

# Easergy MiCOM P439

**Distance Protection and Control Unit**

**P439/EN M/R-b5-A**

Version P439 -311 -419/420/421 -661

**Technical Manual**

**Volume 2 of 2**



**A1****Function Groups**

|       |   |
|-------|---|
| ADAPT | <i>Adaptive protection</i>                  |
| ARC   | <i>Auto-reclosing control</i>               |
| ASC   | <i>Automatic synchronism check</i>          |
| BUOC  | <i>Backup overcurrent-time protection</i>   |
| CBF   | <i>Circuit breaker failure protection</i>   |
| CBM   | <i>Circuit breaker condition monitoring</i> |
| CMD_1 | <i>Single-pole commands</i>                 |
| COMM1 | <i>“Logical” communication interface 1</i>  |
| COMM2 | <i>“Logical” communication interface 2</i>  |
| COMM3 | <i>InterMiCOM interface</i>                 |
| COUNT | <i>Binary counts</i>                        |
| CS    | <i>Cyber Security</i>                       |
| DELTA | <i>Delta-I protection</i>                   |
| DEV01 | <i>External device</i>                      |
| DEV02 | <i>External device</i>                      |
| DEV03 | <i>External device</i>                      |
| DEV04 | <i>External device</i>                      |
| DEV05 | <i>External device</i>                      |
| DEV06 | <i>External device</i>                      |
| DEV07 | <i>External device</i>                      |
| DEV08 | <i>External device</i>                      |
| DEV09 | <i>External device</i>                      |
| DEV10 | <i>External device</i>                      |
| DIST  | <i>Distance protection</i>                  |
| DTOC  | <i>Definite-time overcurrent protection</i> |
| DVICE | <i>Device</i>                               |
| f<>   | <i>Over-/underfrequency protection</i>      |
| FT_DA | <i>Fault data acquisition</i>               |
| FT_RC | <i>Fault recording</i>                      |

|       |   |
|-------|---|
| GF_DA | <i>Ground fault data acquisition</i>                                  |
| GF_RC | <i>Ground fault recording</i>   |
| GFDSS | <i>Ground fault direction determination using steady-state values</i> |
| GFSC  | <i>Ground fault (short-circuit) protection</i>                        |
| GFSIG | <i>Ground fault protection signaling</i>                              |
| GFTRP | <i>Ground fault tripping</i>  |
| GOOSE | <i>Generic Object Orientated Substation Events</i>                    |
| GSCSG | <i>Ground fault (short-circuit) protection signaling</i>              |
| IDMT  | <i>Inverse-time overcurrent protection</i>                            |
| IEC   | <i>IEC 61850 Communication</i>  |
| ILOCK | <i>Interlocking logic</i>   |
| INP   | <i>Binary input</i>   |
| IRIGB | <i>IRIG-B interface</i>   |
| LED   | <i>LED indicators</i>   |
| LIMIT | <i>Limit value monitoring</i>   |
| LOC   | <i>Local control panel</i>  |
| LOG_2 | <i>Programmable Logic</i>   |
| LOGIC | <i>Programmable Logic</i>   |
| MAIN  | <i>Main function</i>  |
| MCMON | <i>Measuring-circuit monitoring</i>                                   |
| MEASI | <i>Measured data input</i>  |
| MEASO | <i>Measured data output</i>   |
| MT_RC | <i>Monitoring signal recording</i>                                    |
| OL_DA | <i>Overload data acquisition</i>                                      |
| OL_RC | <i>Overload recording</i>   |
| OP_RC | <i>Operating data recording</i>                                       |
| OUTP  | <i>Binary and analog output</i>                                       |
| P<>   | <i>Power directional protection</i>                                   |
| PC    | <i>PC link</i>  |
| Pf<   | <i>Underfrequency load shedding</i>                                   |
| PSB   | <i>Power swing blocking</i>   |

|       |   |
|-------|---|
| PSIG  | <i>Protective signaling</i>                                     |
| PSS   | <i>Parameter subset selection</i>                               |
| QV    | <i>Voltage controlled directional reactive power protection</i> |
| SCDD  | <i>Short-circuit direction determination</i>                    |
| SFMON | <i>Self-monitoring</i>  |
| SIG_1 | <i>Single-pole signals</i>                                      |
| SOTF  | <i>Switch on to fault protection</i>                            |
| TGFD  | <i>Transient ground fault direction determination</i>           |
| THERM | <i>Thermal overload protection</i>                              |
| TIMER | <i>Real Timer</i>   |
| TPD1  | <i>Three Position Drive</i>                                     |
| TPD2  | <i>Three Position Drive</i>                                     |
| TPD3  | <i>Three Position Drive</i>                                     |
| TPD4  | <i>Three Position Drive</i>                                     |
| TRMON | <i>Transformer monitoring</i>                                   |
| V<>   | <i>Time-voltage protection</i>                                  |
| VINP  | <i>Virtual Inputs</i>   |



## A2

## Internal Signals

|                            |  |
|----------------------------|--|
| ARC: CB closed             | Vol. 1, Fig. 3-215, (p. 3-280)                                   |
| ARC: Switch to tPmax       | Vol. 1, Fig. 3-224, (p. 3-290)                                   |
| ARC: Test HSR A-B-C int.   | Vol. 1, Fig. 3-219, (p. 3-285)                                   |
| ARC: Trip time elapsed     | Vol. 1, Fig. 3-217, (p. 3-282)                                   |
| ARC: V> for RRC triggered  | Vol. 1, Fig. 3-221, (p. 3-287)                                   |
| ARC: Zone extension HSR    | Vol. 1, Fig. 3-223, (p. 3-289)                                   |
| ARC: Zone extension RC     | Vol. 1, Fig. 3-223, (p. 3-289)                                   |
| ARC: Zone extension TDR    | Vol. 1, Fig. 3-223, (p. 3-289)                                   |
| ASC: AC effect. for DEV01  | Vol. 1, Fig. 3-242, (p. 3-311)                                   |
| ASC: Active                | Vol. 1, Fig. 3-231, (p. 3-298)                                   |
| ASC: Close enable DEV01    | Vol. 1, Fig. 3-242, (p. 3-311)                                   |
| ASC: Close enable w.block  | Vol. 1, Fig. 3-231, (p. 3-298)                                   |
| ASC: Close reject.w.block  | Vol. 1, Fig. 3-231, (p. 3-298)                                   |
| ASC: Gen. close request    | Vol. 1, Fig. 3-232, (p. 3-299)<br>Vol. 1, Fig. 3-233, (p. 3-300) |
| ASC: Manual close request  | Vol. 1, Fig. 3-232, (p. 3-299)<br>Vol. 1, Fig. 3-233, (p. 3-300) |
| ASC: Test                  | Vol. 1, Fig. 3-232, (p. 3-299)<br>Vol. 1, Fig. 3-233, (p. 3-300) |
| BUOC: Bl.Zero-sequ.start.  | Vol. 1, Fig. 3-70, (p. 3-111)                                    |
| BUOC: Block. Starting      | Vol. 1, Fig. 3-70, (p. 3-111)                                    |
| BUOC: IA> triggered        | Vol. 1, Fig. 3-183, (p. 3-248)                                   |
| BUOC: IB> triggered        | Vol. 1, Fig. 3-183, (p. 3-248)                                   |
| BUOC: IC> triggered        | Vol. 1, Fig. 3-183, (p. 3-248)                                   |
| BUOC: Trip A               | Vol. 1, Fig. 3-183, (p. 3-248)                                   |
| BUOC: Trip B               | Vol. 1, Fig. 3-183, (p. 3-248)                                   |
| BUOC: Trip C               | Vol. 1, Fig. 3-183, (p. 3-248)                                   |
| CBF: IN                    | Vol. 1, Fig. 3-380, (p. 3-459)                                   |
| CBM: Internal CB trip      | Vol. 1, Fig. 3-391, (p. 3-469)                                   |
| CBM: internal trip cmd.    | Vol. 1, Fig. 3-390, (p. 3-469)                                   |
| COMM1: Close request DEV01 | Vol. 1, Fig. 3-420, (p. 3-501)                                   |

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|-----------------------------|--|
| COMM1: Communication error  | Vol. 1, Fig. 3-13, (p. 3-21)<br>Vol. 1, Fig. 3-14, (p. 3-22)<br>Vol. 1, Fig. 3-15, (p. 3-23)<br>Vol. 1, Fig. 3-16, (p. 3-24)<br>Vol. 1, Fig. 3-17, (p. 3-25)<br>Vol. 1, Fig. 3-18, (p. 3-26) |
| COMM1: Count 1              | Vol. 1, Fig. 3-439, (p. 3-527)   |
| COMM1: Debounced signal     | Vol. 1, Fig. 3-435, (p. 3-522)   |
| COMM1: Motor rel. mon. trg. | Vol. 1, Fig. 3-429, (p. 3-513)   |
| COMM1: Open request DEV01   | Vol. 1, Fig. 3-420, (p. 3-501)   |
| COMM1: Selected protocol    | Vol. 1, Fig. 3-12, (p. 3-20)   |
| COMM1: Signal S001,log      | Vol. 1, Fig. 3-434, (p. 3-521)   |
| DEV01: Close cmd blocked    | Vol. 1, Fig. 3-423, (p. 3-504)   |
| DEV01: Close request        | Vol. 1, Fig. 3-418, (p. 3-499)   |
| DEV01: Enable SI Close      | Vol. 1, Fig. 3-420, (p. 3-501)   |
| DEV01: Enable SI Open       | Vol. 1, Fig. 3-420, (p. 3-501)   |
| DEV01: End close command    | Vol. 1, Fig. 3-424, (p. 3-506)   |
| DEV01: End open command     | Vol. 1, Fig. 3-424, (p. 3-506)   |
| DEV01: Latching time elaps. | Vol. 1, Fig. 3-418, (p. 3-499)   |
| DEV01: Latching time runn.  | Vol. 1, Fig. 3-418, (p. 3-499)   |
| DEV01: Open cmd blocked     | Vol. 1, Fig. 3-423, (p. 3-504)   |
| DEV01: Open request         | Vol. 1, Fig. 3-418, (p. 3-499)   |
| DEV01: Protect. close cmd.  | Vol. 1, Fig. 3-421, (p. 3-502)   |
| DEV01: Protection trip cmd. | Vol. 1, Fig. 3-421, (p. 3-502)   |
| DEV01: Start runn.time mon. | Vol. 1, Fig. 3-429, (p. 3-513)   |
| DEV01: Switch. device runn. | Vol. 1, Fig. 3-424, (p. 3-506)   |
| DIST:  Z <sub>meas</sub>    | Vol. 1, Fig. 3-142, (p. 3-198)   |
| DIST: 1-pole starting       | Vol. 1, Fig. 3-134, (p. 3-188)   |
| DIST: ARC blocked           | Vol. 1, Fig. 3-165, (p. 3-223)   |
| DIST: BI.Start. I>>         | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DIST: BI.Start. Z<          | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DIST: Dist.decis.Z1 stored  | Vol. 1, Fig. 3-145, (p. 3-201)<br>Vol. 1, Fig. 3-149, (p. 3-206)   |



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| DIST: Dist.decision Z1     | Vol. 1, Fig. 3-145, (p. 3-201)<br>Vol. 1, Fig. 3-149, (p. 3-206) |
| DIST: Dist.decision Z1,ze  | Vol. 1, Fig. 3-145, (p. 3-201)<br>Vol. 1, Fig. 3-149, (p. 3-206) |
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| DIST: Enable V<, Z<, B     | Vol. 1, Fig. 3-128, (p. 3-180)                                   |
| DIST: Enable V<, Z<, C     | Vol. 1, Fig. 3-128, (p. 3-180)                                   |
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| DIST: Enable ZA-G starting | Vol. 1, Fig. 3-130, (p. 3-183)                                   |
| DIST: Enable ZB-C starting | Vol. 1, Fig. 3-130, (p. 3-183)                                   |
| DIST: Enable ZB-G starting | Vol. 1, Fig. 3-130, (p. 3-183)                                   |
| DIST: Enable ZC-A starting | Vol. 1, Fig. 3-130, (p. 3-183)                                   |
| DIST: Enable ZC-G starting | Vol. 1, Fig. 3-130, (p. 3-183)                                   |
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| DIST: I>> triggered        | Vol. 1, Fig. 3-125, (p. 3-177)                                   |
| DIST: I>>> triggered       | Vol. 1, Fig. 3-125, (p. 3-177)                                   |
| DIST: <u>I</u> A-kG        | Vol. 1, Fig. 3-132, (p. 3-185)                                   |
| DIST: IA>(IbI) trigg.      | Vol. 1, Fig. 3-128, (p. 3-180)                                   |
| DIST: IA>> triggered       | Vol. 1, Fig. 3-125, (p. 3-177)                                   |
| DIST: <u>I</u> B-kG        | Vol. 1, Fig. 3-132, (p. 3-185)                                   |
| DIST: IB>(IbI) trigg.      | Vol. 1, Fig. 3-128, (p. 3-180)                                   |
| DIST: IB>> triggered       | Vol. 1, Fig. 3-125, (p. 3-177)                                   |
| DIST: <u>I</u> C-kG        | Vol. 1, Fig. 3-132, (p. 3-185)                                   |
| DIST: IC>(IbI) trigg.      | Vol. 1, Fig. 3-128, (p. 3-180)                                   |
| DIST: IC>> triggered       | Vol. 1, Fig. 3-125, (p. 3-177)                                   |
| DIST: <u>I</u> kG          | Vol. 1, Fig. 3-132, (p. 3-185)                                   |
| DIST: <u>I</u> meas        | Vol. 1, Fig. 3-136, (p. 3-191)                                   |
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| DIST: N1,fw                | Vol. 1, Fig. 3-152, (p. 3-209)                                   |
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| DIST: N3,fw                | Vol. 1, Fig. 3-152, (p. 3-209) |
| DIST: N4,bw                | Vol. 1, Fig. 3-152, (p. 3-209) |
| DIST: N4,fw                | Vol. 1, Fig. 3-152, (p. 3-209) |
| DIST: N5,bw                | Vol. 1, Fig. 3-152, (p. 3-209) |
| DIST: N5,fw                | Vol. 1, Fig. 3-152, (p. 3-209) |
| DIST: N6,bw                | Vol. 1, Fig. 3-152, (p. 3-209) |
| DIST: N6,fw                | Vol. 1, Fig. 3-152, (p. 3-209) |
| DIST: N7,bw                | Vol. 1, Fig. 3-152, (p. 3-209) |
| DIST: N7,fw                | Vol. 1, Fig. 3-152, (p. 3-209) |
| DIST: N8,bw                | Vol. 1, Fig. 3-152, (p. 3-209) |
| DIST: N8,fw                | Vol. 1, Fig. 3-152, (p. 3-209) |
| DIST: N9,bw                | Vol. 1, Fig. 3-152, (p. 3-209) |
| DIST: N9,fw                | Vol. 1, Fig. 3-152, (p. 3-209) |
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| DIST: Select.meas.loop B-C | Vol. 1, Fig. 3-136, (p. 3-191) |
| DIST: Select.meas.loop B-G | Vol. 1, Fig. 3-136, (p. 3-191) |
| DIST: Select.meas.loop C-A | Vol. 1, Fig. 3-136, (p. 3-191) |
| DIST: Select.meas.loop C-G | Vol. 1, Fig. 3-136, (p. 3-191) |
| DIST: Select.meas.loop P-G | Vol. 1, Fig. 3-136, (p. 3-191) |
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| DIST: Start.VNG> triggered | Vol. 1, Fig. 3-126, (p. 3-178) |
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| DIST: Starting G           | Vol. 1, Fig. 3-127, (p. 3-179) |

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|-----------------------------|--|
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| DIST: tIN> elapsed          | Vol. 1, Fig. 3-126, (p. 3-178)   |
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| DIST: Trip zone 1,ze        | Vol. 1, Fig. 3-153, (p. 3-211)<br>Vol. 1, Fig. 3-156, (p. 3-214)<br>Vol. 1, Fig. 3-158, (p. 3-216)<br>Vol. 1, Fig. 3-160, (p. 3-218)<br>Vol. 1, Fig. 3-162, (p. 3-220)<br>Vol. 1, Fig. 3-164, (p. 3-222) |
| DIST: Trip zone 10          | Vol. 1, Fig. 3-153, (p. 3-211)<br>Vol. 1, Fig. 3-156, (p. 3-214)<br>Vol. 1, Fig. 3-158, (p. 3-216)<br>Vol. 1, Fig. 3-160, (p. 3-218)<br>Vol. 1, Fig. 3-162, (p. 3-220)<br>Vol. 1, Fig. 3-164, (p. 3-222) |
| DIST: Trip zone 2           | Vol. 1, Fig. 3-153, (p. 3-211)<br>Vol. 1, Fig. 3-156, (p. 3-214)<br>Vol. 1, Fig. 3-158, (p. 3-216)<br>Vol. 1, Fig. 3-160, (p. 3-218)<br>Vol. 1, Fig. 3-162, (p. 3-220)<br>Vol. 1, Fig. 3-164, (p. 3-222) |
| DIST: Trip zone 4           | Vol. 1, Fig. 3-158, (p. 3-216)<br>Vol. 1, Fig. 3-160, (p. 3-218)<br>Vol. 1, Fig. 3-162, (p. 3-220)   |
| DIST: Trip zone 9           | Vol. 1, Fig. 3-153, (p. 3-211)<br>Vol. 1, Fig. 3-156, (p. 3-214)<br>Vol. 1, Fig. 3-158, (p. 3-216)<br>Vol. 1, Fig. 3-160, (p. 3-218)<br>Vol. 1, Fig. 3-162, (p. 3-220)<br>Vol. 1, Fig. 3-164, (p. 3-222) |
| DIST: tVNG>> elapsed        | Vol. 1, Fig. 3-126, (p. 3-178)   |
| DIST: <u>V</u> A-B (stored) | Vol. 1, Fig. 3-137, (p. 3-192)   |
| DIST: VA< triggered         | Vol. 1, Fig. 3-129, (p. 3-182)   |
| DIST: VB< triggered         | Vol. 1, Fig. 3-129, (p. 3-182)   |

|                              |                                |
|------------------------------|--------------------------------|
| DIST: VC< triggered          | Vol. 1, Fig. 3-129, (p. 3-182) |
| DIST: $\underline{V}_{meas}$ | Vol. 1, Fig. 3-136, (p. 3-191) |
| DIST: VNG>> exceeded         | Vol. 1, Fig. 3-126, (p. 3-178) |
| DIST: Voltage mem. enabled   | Vol. 1, Fig. 3-137, (p. 3-192) |
| DIST: VPP< triggered         | Vol. 1, Fig. 3-129, (p. 3-182) |
| DIST: XF                     | Vol. 1, Fig. 3-146, (p. 3-202) |
| DIST: ZA< start. triggered   | Vol. 1, Fig. 3-133, (p. 3-186) |
| DIST: ZB< start. triggered   | Vol. 1, Fig. 3-133, (p. 3-186) |
| DIST: ZC< start. triggered   | Vol. 1, Fig. 3-133, (p. 3-186) |
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| DIST: $\varphi_{corr}$       | Vol. 1, Fig. 3-137, (p. 3-192) |
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| DIST: $\varphi_X$            | Vol. 1, Fig. 3-138, (p. 3-193) |
| DTOC: Bl.Start. I>           | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DTOC: Bl.Start. I>>          | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DTOC: Bl.Start. I>>>         | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DTOC: Bl.Start. I>>>>        | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DTOC: Bl.Start. Ineg>>>>     | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DTOC: Block. Start. IN>      | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DTOC: Block. Start. IN>>     | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DTOC: Block. Start. IN>>>    | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DTOC: Block. Start. IN>>>>   | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DTOC: Block.Start. Ineg>     | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DTOC: Block.Start. Ineg>>    | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DTOC: Block.Start. Ineg>>>   | Vol. 1, Fig. 3-70, (p. 3-111)  |
| DTOC: $\underline{IN}$       | Vol. 1, Fig. 3-277, (p. 3-348) |
| DTOC: Pulse prolong. runn.   | Vol. 1, Fig. 3-280, (p. 3-352) |
| DTOC: Starting IN            | Vol. 1, Fig. 3-279, (p. 3-350) |
| DTOC: Starting IP            | Vol. 1, Fig. 3-279, (p. 3-350) |
| DTOC: t2 N                   | Vol. 1, Fig. 3-280, (p. 3-352) |
| f<>: fMeas                   | Vol. 1, Fig. 3-71, (p. 3-112)  |
| f<>: No. periods reached     | Vol. 1, Fig. 3-71, (p. 3-112)  |

|                             |  |
|-----------------------------|--|
| f<>: <u>V</u> Meas          | Vol. 1, Fig. 3-71, (p. 3-112)                                    |
| FT_DA: Impedance ZAG, sec.  | Vol. 1, Fig. 3-117, (p. 3-163)                                   |
| FT_DA: Impedance ZBG, sec.  | Vol. 1, Fig. 3-117, (p. 3-163)                                   |
| FT_DA: Impedance ZCG, sec.  | Vol. 1, Fig. 3-117, (p. 3-163)                                   |
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| FT_DA: Output meas. values  | Vol. 1, Fig. 3-114, (p. 3-159)                                   |
| FT_DA: Trigger N            | Vol. 1, Fig. 3-127, (p. 3-179)                                   |
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| FT_RC: Trigger N            | Vol. 1, Fig. 3-127, (p. 3-179)                                   |
| GF_RC: Ground flt.record. n | Vol. 1, Fig. 3-112, (p. 3-155)                                   |
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| GFDSS: Direction LS         | Vol. 1, Fig. 3-308, (p. 3-384)<br>Vol. 1, Fig. 3-314, (p. 3-390) |
| GFDSS: <u>I</u> N filtered  | Vol. 1, Fig. 3-312, (p. 3-388)                                   |
| GFDSS: IN> triggered        | Vol. 1, Fig. 3-312, (p. 3-388)                                   |
| GFDSS: Op. delay IN elapsed | Vol. 1, Fig. 3-312, (p. 3-388)                                   |
| GFDSS: Op.del.Y(N)> elapsed | Vol. 1, Fig. 3-318, (p. 3-394)                                   |
| GFDSS: P                    | Vol. 1, Fig. 3-308, (p. 3-384)<br>Vol. 1, Fig. 3-314, (p. 3-390) |
| GFDSS: Q                    | Vol. 1, Fig. 3-308, (p. 3-384)<br>Vol. 1, Fig. 3-314, (p. 3-390) |
| GFDSS: <u>V</u> NG          | Vol. 1, Fig. 3-307, (p. 3-383)                                   |
| GFDSS: <u>V</u> NG filtered | Vol. 1, Fig. 3-308, (p. 3-384)<br>Vol. 1, Fig. 3-314, (p. 3-390) |
| GFDSS: VNG> triggered       | Vol. 1, Fig. 3-308, (p. 3-384)<br>Vol. 1, Fig. 3-314, (p. 3-390) |
| GFSC: Blocked               | Vol. 1, Fig. 3-246, (p. 3-316)                                   |
| GFSC: Curr.-dep. trip sig.  | Vol. 1, Fig. 3-259, (p. 3-330)                                   |
| GFSC: <u>I</u> N filtered   | Vol. 1, Fig. 3-248, (p. 3-318)                                   |
| GFSC: <u>V</u> NG           | Vol. 1, Fig. 3-247, (p. 3-317)                                   |
| GFSC: <u>V</u> NG filtered  | Vol. 1, Fig. 3-248, (p. 3-318)                                   |
| GFSC: Volt.-dep. trip sig.  | Vol. 1, Fig. 3-254, (p. 3-325)                                   |

|                             |  |
|-----------------------------|--|
| GFSC: Voltage present       | Vol. 1, Fig. 3-247, (p. 3-317)<br>Vol. 1, Fig. 3-248, (p. 3-318)   |
| GSCSG: BI. PSIG weak infeed | Vol. 1, Fig. 3-268, (p. 3-339)   |
| GSCSG: Blocking ARC         | Vol. 1, Fig. 3-271, (p. 3-342)   |
| GSCSG: Frequ.mon. triggered | Vol. 1, Fig. 3-266, (p. 3-337)   |
| GSCSG: Send internal signal | Vol. 1, Fig. 3-268, (p. 3-339)<br>Vol. 1, Fig. 3-269, (p. 3-340)<br>Vol. 1, Fig. 3-272, (p. 3-343)<br>Vol. 1, Fig. 3-273, (p. 3-344)   |
| GSCSG: Transient blocking   | Vol. 1, Fig. 3-267, (p. 3-338)   |
| GSCSG: Trip A               | Vol. 1, Fig. 3-271, (p. 3-342)   |
| GSCSG: Trip B               | Vol. 1, Fig. 3-271, (p. 3-342)   |
| GSCSG: Trip C               | Vol. 1, Fig. 3-271, (p. 3-342)   |
| IDMT: BI.Start.Iref,N>      | Vol. 1, Fig. 3-70, (p. 3-111)  |
| IDMT: BI.Start.Iref,neg>    | Vol. 1, Fig. 3-70, (p. 3-111)  |
| IDMT: BI.Start.Iref,P> Px   | Vol. 1, Fig. 3-70, (p. 3-111)  |
| IDMT: IN                    | Vol. 1, Fig. 3-291, (p. 3-366)   |
| IDMT: Starting A            | Vol. 1, Fig. 3-289, (p. 3-362)   |
| IDMT: Starting B            | Vol. 1, Fig. 3-289, (p. 3-362)   |
| IDMT: Starting C            | Vol. 1, Fig. 3-289, (p. 3-362)   |
| INP: Fct. assignm. U xxx    | Vol. 1, Fig. 3-34, (p. 3-63)<br>Vol. 1, Fig. 3-44, (p. 3-73)<br>Vol. 1, Fig. 3-67, (p. 3-109)<br>Vol. 1, Fig. 3-96, (p. 3-138)<br>Vol. 1, Fig. 3-187, (p. 3-254)<br>Vol. 1, Fig. 3-209, (p. 3-274)<br>Vol. 1, Fig. 3-214, (p. 3-279)<br>Vol. 1, Fig. 3-230, (p. 3-297)<br>Vol. 1, Fig. 3-232, (p. 3-299)<br>Vol. 1, Fig. 3-233, (p. 3-300)<br>Vol. 1, Fig. 3-245, (p. 3-315)<br>Vol. 1, Fig. 3-263, (p. 3-334)<br>Vol. 1, Fig. 3-378, (p. 3-457)<br>Vol. 1, Fig. 3-382, (p. 3-461)<br>Vol. 1, Fig. 3-404, (p. 3-484)<br>Vol. 1, Fig. 3-412, (p. 3-490) |
| INP: Oper. mode U xxx       | Vol. 1, Fig. 3-34, (p. 3-63)   |
| INP: State U xxx            | Vol. 1, Fig. 3-34, (p. 3-63)   |

|                             |  |
|-----------------------------|--|
| LED: Fct.assig. Hxx red     | Vol. 1, Fig. 3-51, (p. 3-89)   |
| LED: Oper. mode H xx        | Vol. 1, Fig. 3-51, (p. 3-89)   |
| LED: State Hxx red          | Vol. 1, Fig. 3-51, (p. 3-89)   |
| LOC: Remote&local control   | Vol. 1, Fig. 3-10, (p. 3-16)   |
| LOC: Return t.select. trg   | Vol. 1, Fig. 3-4, (p. 3-9)   |
| MAIN: 3-pole trip           | Vol. 1, Fig. 3-83, (p. 3-124)  |
| MAIN: Bck.1 sel.functions   | Vol. 1, Fig. 3-73, (p. 3-114)  |
| MAIN: Bck.2 sel.functions   | Vol. 1, Fig. 3-73, (p. 3-114)  |
| MAIN: DEVxx is a C.B.       | Vol. 1, Fig. 3-413, (p. 3-491)   |
| MAIN: Direct motor control  | Vol. 1, Fig. 3-413, (p. 3-491)   |
| MAIN: End command           | Vol. 1, Fig. 3-429, (p. 3-513)   |
| MAIN: Gen. Starting Iref,N  | Vol. 1, Fig. 3-279, (p. 3-350)   |
| MAIN: Meas.r.extd. ext./RC  | Vol. 1, Fig. 3-145, (p. 3-201)<br>Vol. 1, Fig. 3-149, (p. 3-206)                               |
| MAIN: Protection active     | Vol. 1, Fig. 3-67, (p. 3-109)  |
| MAIN: Reset LED             | Vol. 1, Fig. 3-92, (p. 3-134)  |
| MAIN: Time tag              | Vol. 1, Fig. 3-91, (p. 3-130)  |
| MAIN: Trip signal           | Vol. 1, Fig. 3-83, (p. 3-124)  |
| MAIN: Trip signal 1         | Vol. 1, Fig. 3-84, (p. 3-125)  |
| MEASO: Enable               | Vol. 1, Fig. 3-44, (p. 3-73)   |
| MEASO: Output value x       | Vol. 1, Fig. 3-47, (p. 3-78)<br>Vol. 1, Fig. 3-49, (p. 3-84)                                   |
| MEASO: Reset meas.val.outp. | Vol. 1, Fig. 3-45, (p. 3-74)   |
| OUTP: Fct.assignment K xxx  | Vol. 1, Fig. 3-41, (p. 3-71)<br>Vol. 1, Fig. 3-49, (p. 3-84)<br>Vol. 1, Fig. 3-433, (p. 3-519) |
| OUTP: Oper. mode K xxx      | Vol. 1, Fig. 3-41, (p. 3-71)   |
| P<>: P                      | Vol. 1, Fig. 3-358, (p. 3-439)   |
| P<>: P-                     | Vol. 1, Fig. 3-358, (p. 3-439)   |
| P<>: P+                     | Vol. 1, Fig. 3-358, (p. 3-439)   |
| P<>: Q                      | Vol. 1, Fig. 3-358, (p. 3-439)   |
| P<>: Q-                     | Vol. 1, Fig. 3-358, (p. 3-439)   |
| P<>: Q+                     | Vol. 1, Fig. 3-358, (p. 3-439)   |

|                             |  |
|-----------------------------|--|
| PSB: Asyn. power swing      | Vol. 1, Fig. 3-168, (p. 3-226)   |
| PSB: Ready                  | Vol. 1, Fig. 3-167, (p. 3-225)   |
| PSIG: Frequ. monit. trigg.  | Vol. 1, Fig. 3-191, (p. 3-257)   |
| PSIG: Receive weak inf.     | Vol. 1, Fig. 3-209, (p. 3-274)   |
| PSIG: Telecom. faulty int.  | Vol. 1, Fig. 3-207, (p. 3-272)   |
| PSIG: Timer stage elapsed   | Vol. 1, Fig. 3-188, (p. 3-255)   |
| PSIG: Transient blocking    | Vol. 1, Fig. 3-192, (p. 3-257)   |
| PSIG: Trip 1                | Vol. 1, Fig. 3-199, (p. 3-264)<br>Vol. 1, Fig. 3-203, (p. 3-268)   |
| PSIG: Trip 2                | Vol. 1, Fig. 3-208, (p. 3-273)   |
| PSIG: Trip enable           | Vol. 1, Fig. 3-199, (p. 3-264)<br>Vol. 1, Fig. 3-203, (p. 3-268)<br>Vol. 1, Fig. 3-205, (p. 3-270)<br>Vol. 1, Fig. 3-207, (p. 3-272) |
| PSIG: Trip time elapsed     | Vol. 1, Fig. 3-188, (p. 3-255)   |
| PSIG: Trip V<               | Vol. 1, Fig. 3-209, (p. 3-274)   |
| PSIG: Trip V<, A            | Vol. 1, Fig. 3-209, (p. 3-274)   |
| PSIG: Trip V<, B            | Vol. 1, Fig. 3-209, (p. 3-274)   |
| PSIG: Trip V<, C            | Vol. 1, Fig. 3-209, (p. 3-274)   |
| PSIG: V< triggered          | Vol. 1, Fig. 3-209, (p. 3-274)   |
| PSIG: Weak inf. ready       | Vol. 1, Fig. 3-210, (p. 3-275)   |
| QV: Bl.Start. QV            | Vol. 1, Fig. 3-70, (p. 3-111)  |
| SCDD: Bl.Direct. tlref,N>   | Vol. 1, Fig. 3-304, (p. 3-379)   |
| SCDD: Bl.Direct. tlref,P>   | Vol. 1, Fig. 3-298, (p. 3-373)   |
| SCDD: Block. direct. tl>    | Vol. 1, Fig. 3-298, (p. 3-373)   |
| SCDD: Block. direct. tl>>   | Vol. 1, Fig. 3-298, (p. 3-373)   |
| SCDD: Block. Direct. tl>>>  | Vol. 1, Fig. 3-298, (p. 3-373)   |
| SCDD: Block. direct. tIN>   | Vol. 1, Fig. 3-304, (p. 3-379)   |
| SCDD: Block. direct. tIN>>  | Vol. 1, Fig. 3-304, (p. 3-379)   |
| SCDD: Block. Direct. tIN>>> | Vol. 1, Fig. 3-304, (p. 3-379)   |
| SCDD: Block.Direct.tl>>>>   | Vol. 1, Fig. 3-298, (p. 3-373)   |
| SCDD: Block.direct.tIN>>>>  | Vol. 1, Fig. 3-304, (p. 3-379)   |
| SCDD: Determin. N enabled   | Vol. 1, Fig. 3-302, (p. 3-377)   |



|                            |                                |
|----------------------------|--------------------------------|
| SCDD: Determin. P enabled  | Vol. 1, Fig. 3-296, (p. 3-371) |
| SCDD: Enabled              | Vol. 1, Fig. 3-294, (p. 3-369) |
| SCDD: IN                   | Vol. 1, Fig. 3-301, (p. 3-376) |
| SCDD: Phase curr.stage bl. | Vol. 1, Fig. 3-296, (p. 3-371) |
| SCDD: Resid.curr.stage bl. | Vol. 1, Fig. 3-302, (p. 3-377) |
| SCDD: VNG                  | Vol. 1, Fig. 3-300, (p. 3-376) |
| Signal 1 EXT               | Vol. 1, Fig. 3-412, (p. 3-490) |
| Signal 2 EXT               | Vol. 1, Fig. 3-412, (p. 3-490) |
| SOTF: ARC blocked          | Vol. 1, Fig. 3-186, (p. 3-252) |
| SOTF: Line dead trig. en.  | Vol. 1, Fig. 3-184, (p. 3-250) |
| SOTF: Trip time elapsed    | Vol. 1, Fig. 3-186, (p. 3-252) |
| TGFD: Direction BS         | Vol. 1, Fig. 3-324, (p. 3-402) |
| TGFD: Direction LS         | Vol. 1, Fig. 3-324, (p. 3-402) |
| TGFD: Hardware fault       | Vol. 1, Fig. 3-322, (p. 3-400) |
| TGFD: IN,p triggered       | Vol. 1, Fig. 3-324, (p. 3-402) |
| TGFD: Reset signal         | Vol. 1, Fig. 3-326, (p. 3-403) |
| TGFD: <u>V</u> NG          | Vol. 1, Fig. 3-323, (p. 3-401) |
| TGFD: VNG> (f0) triggered  | Vol. 1, Fig. 3-324, (p. 3-402) |
| TGFD: VNG> triggered       | Vol. 1, Fig. 3-324, (p. 3-402) |
| THERM: Block. by CTA error | Vol. 1, Fig. 3-330, (p. 3-408) |
| THERM: With CTA            | Vol. 1, Fig. 3-330, (p. 3-408) |
| V<>: Starting V< A(-B)     | Vol. 1, Fig. 3-339, (p. 3-418) |
| V<>: Starting V< B(-C)     | Vol. 1, Fig. 3-339, (p. 3-418) |
| V<>: Starting V< C(-A)     | Vol. 1, Fig. 3-339, (p. 3-418) |
| V<>: V< A(-B) ready        | Vol. 1, Fig. 3-335, (p. 3-414) |
| V<>: V< B(-C) ready        | Vol. 1, Fig. 3-335, (p. 3-414) |
| V<>: V< C(-A) ready        | Vol. 1, Fig. 3-335, (p. 3-414) |
| V<>: V< ready              | Vol. 1, Fig. 3-335, (p. 3-414) |
| V<>: <u>V</u> neg          | Vol. 1, Fig. 3-343, (p. 3-422) |
| V<>: <u>V</u> NG           | Vol. 1, Fig. 3-346, (p. 3-425) |
| V<>: <u>V</u> pos          | Vol. 1, Fig. 3-343, (p. 3-422) |



## A3 Glossary

### Modules

|    |  |
|----|--|
| A: | Communication module                     |
| B: | Digital bus module                       |
| L: | MMI module                               |
| N  | Transient ground fault evaluation module |
| P: | Processor module                         |
| T: | Transformer module                       |
| V: | Power supply module                      |
| X: | Binary I/O module                        |
| Y: | Analog I/O module                        |

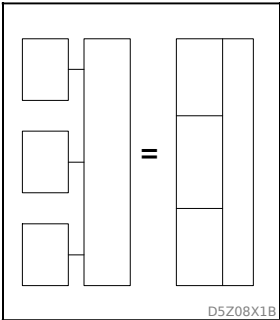
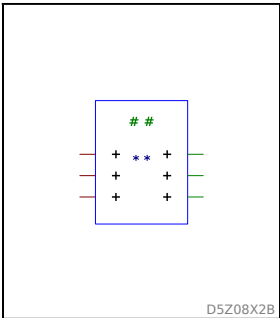
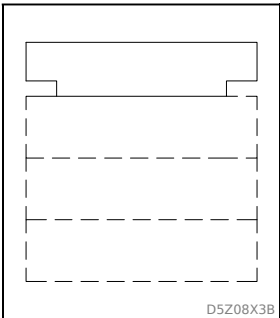
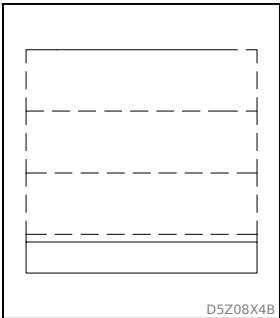
### Symbols

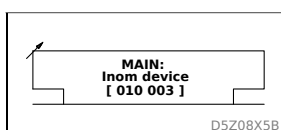
#### *Graphic symbols for block diagrams*

Binary elements in compliance with DIN 40900 part 12, September 1992, IEC 617-12: modified 1991

Analog information processing in compliance with DIN 40900 part 13, January 1981. To document the linking of analog and binary signals, additional symbols have been used, taken from several DIN documents.

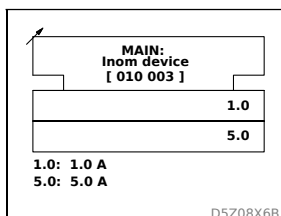
As a rule, direction of the signal flow is from left to right and from top to bottom. Other flow directions are marked by an arrow. Input signals are listed on the left side of the signal flow, output signals on the right side.

| Symbol  | Description   |
|---|---|
|    | <p>To obtain more space for representing a group of related elements, contours of the elements may be joined or cascaded if the following rules are met:</p> <p>There is no functional linkage between elements whose common contour line is oriented in the signal flow direction.</p> <p>Note:</p> <p>This rule does not necessarily apply to configurations with two or more signal flow directions, such as for symbols with a control block and an output block.</p> <p>There exists at least one logical link between elements whose common contour line runs perpendicularly to the signal flow direction.</p> |
|   | <p><b>Components of a symbol</b></p> <p>A symbol consists of a contour or contour combination and one or more qualifiers.</p> <p><b>Description of the example symbol in the left column</b></p> <ul style="list-style-type: none"><li>● Blue line: Contour</li><li>● Dark red lines: Inputs</li><li>● Green lines: Outputs</li><li>● Green hash characters: Preferred location for the general function qualifying symbol</li><li>● Dark blue asterisk characters: Alternative location for the general function qualifying symbol</li></ul>   |
|  | <p><b>Control block</b></p> <p>A control block contains an input function common to several symbols. It is used for the collective setting of several trigger elements, for example.</p>  |
|  | <p><b>Output block</b></p> <p>An output block contains an output function common to several symbols.</p>  |



### Settable control block

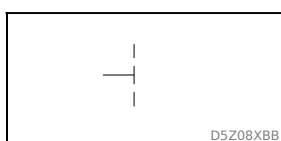
The 6 digits in square brackets represent the address under which the function shown in the text is implemented.



### Settable control block with function blocks

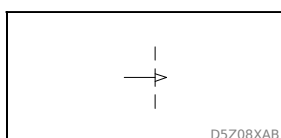
The digits in the function block show the settings that are possible for this function.

The text below the symbol assigns the corresponding unit or meaning to each setting.



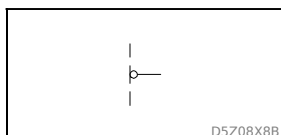
### Static input

Only the state of the binary input variable is effective.



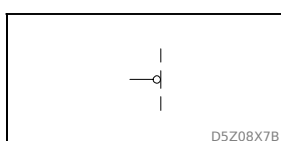
### Dynamic input

Only the transition from value 0 to value 1 is effective.



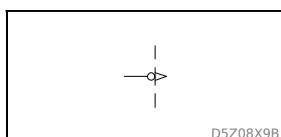
### Negation of an output

The value up to the border line is negated at the output.



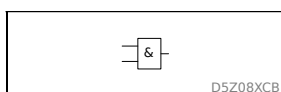
### Negation of an input

The input value is negated before the border line.



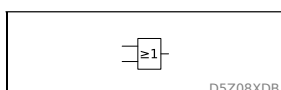
### Dynamic input with negation

Only the transition from value 1 to value 0 is effective.



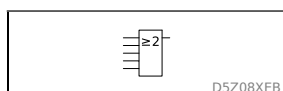
### AND element

The output variable will be 1 only if all input variables are 1.



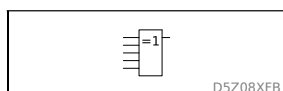
### OR element

The output variable will be 1 only if at least one input variable is 1.



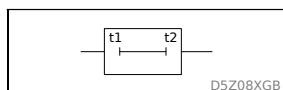
### Threshold element

The output variable will be 1 only if at least two input variables are 1. The number in the symbol may be replaced by any other number.



### (m out of n) element

The output variable will be 1 only if just one input variable is 1. The number in the symbol may be replaced by any other number if the number of inputs is increased or decreased accordingly.

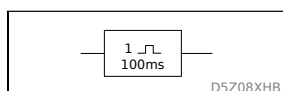


### Delay element

The transition from value 0 to 1 at the output occurs after a time delay of t1 relative to the corresponding transition at the input.

The transition from value 1 to 0 at the output occurs after a time delay of t2 relative to the corresponding transition at the input.

t1 and t2 may be replaced by the actual delay values (in seconds or strobe ticks).

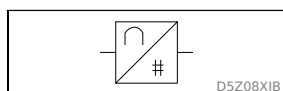


### Monostable flip-flop

The output variable will be 1 only if the input variable changes to 1. The output variable will remain 1 for 100 ms, regardless of the duration of the input value 1 (non-retriggerable).

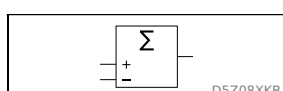
Without a 1 in the function block, the monostable flip-flop is retriggerable.

The time is 100 ms in this example, but it may be changed to any other duration.



### Analog-digital converter

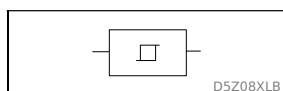
An analog input signal is converted to a binary signal.



### Subtractor

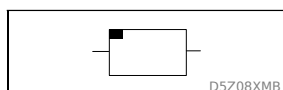
The output variable is the difference between the two input variables.

A **summing element** is obtained by changing the minus sign to a plus sign at the symbol input.



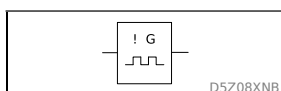
### Schmitt Trigger with binary output signal

The binary output variable will be 1 if the input signal exceeds a specific threshold. The output variable remains 1 until the input signal drops below the threshold again.



### Memory, general

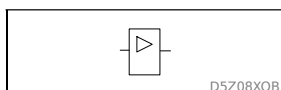
Storage of a binary or analog signal.

**Non-stable flip-flop**

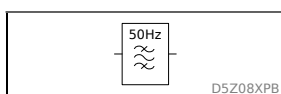
When the input variable changes to 1, a pulse sequence is generated at the output.

The ! to the left of the G indicates that the pulse sequence starts with the input variable transition (synchronized start).

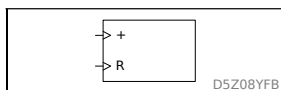
If there is a ! to the right of the G, the pulse sequence ends with the ending of the 1 signal at the input (synchronized stop).

**Amplifier**

The output variable is 1 only if the input variable is also 1.

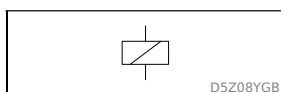
**Band pass filter**

The output only transmits the 50 Hz component of the input signals. All other frequencies (above and below 50 Hz) are attenuated.

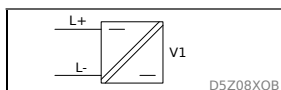
**Counter**

At the + input the input variable transitions from 0 to 1 are counted and stored in the function block.

At the R(eset) input a transition of the input variable from 0 to 1 resets the counter to 0.



**Electromechanical drive** in general, here a relay, for example.

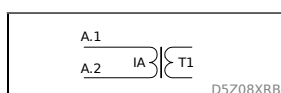
**Signal level converter**

with electrical isolation between input and output.

L+ = pos. voltage input

L- = neg. voltage input

U1 = device identifier



**Input transformer** with phase and item identifiers (according to DIN EN 60445)

**Phase identifiers for current inputs:**

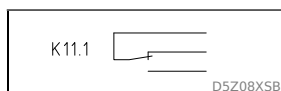
- for A: A1 and A2
- for B: B1 and B2
- for C: C1 and C2
- for N: N1 and N2

**Phase identifiers for voltage inputs**

- via transformer 1:
  - for A: 1U
  - for B: 1V
  - for C: 1W
  - for N: 1N
- via transformer 2:
  - for A: 2U
  - for B: 2V

**Item identifiers**

- for current transformers:
  - for A: T1
  - for B: T2
  - for C: T3
  - for N: T4
- for voltage transformer 1:
  - for A: T5
  - for B: T6
  - for C: T7
  - for N: T8
- for  $V_{G-N}$  transformer: T90
- for voltage transformer 2:
  - for A: T15



**Change-over contact**

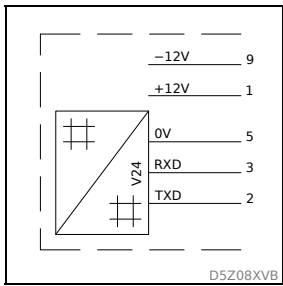
with item identifier



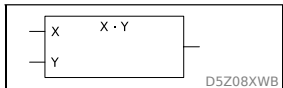
**Special symbol**

Output relay in normally-energized arrangement ("closed-circuit operation").

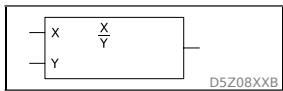




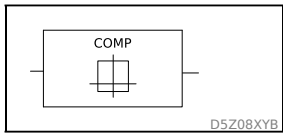
**PC interface**  
with pin connections



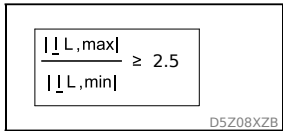
**Multiplier**  
The output variable is the result of the multiplication of the two input variables.



**Divider**  
The output variable is the result of the division of the two input variables.



**Comparator**  
The output variable becomes 1 only if the input variable(s) are equal to the function in the function block.



**Formula block**  
The output variable becomes 1 only if the input variable(s) satisfy the equation in the function block

**Examples of Signal Names**

All settings and signals relevant for protection are shown in the block diagrams of Chapter “Operation” as follows:

| Signal Name  | Description  |
|--|--|
| ♦ FT_RC: Fault recording n<br>305 100                  | Internal signal names are not coded by a data model address. In the block diagrams they are marked with a diamond. The small figure underneath the signal name represents a code that is irrelevant to the user.<br><br>The internal signal names used and their origins are listed in Appendix. |
| DIST: VNG>> triggered<br>[ 036 015 ]                   | Signal names coded by a data model address are represented by their address (shown in square brackets). Their origin is given in Chapters “Setting” and “Information and Control Functions”.   |
| MAIN: General reset USER<br>[ 003 002 ]<br>↗1: Execute | A specific setting to be used later on is shown with its signal name, address, and the setting preceded by the setting arrow.  |

Symbols Used

| Symbol            | Meaning   |
|-------------------|---|
| t                 | Time duration   |
| V                 | Voltage, potential difference   |
| $\underline{V}$   | Complex voltage   |
| I                 | Electrical current  |
| $\underline{I}$   | Complex current   |
| $\underline{Z}$   | Complex impedance   |
| $ \underline{Z} $ | Modulus of complex impedance  |
| f                 | Frequency   |
| δ                 | Temperature in °C   |
| Σ                 | Sum, result   |
| Ω                 | Unit of electrical resistance   |
| α                 | Angle   |
| φ, ϕ              | Phase angle. With subscripts: specific angle between a defined current and a defined voltage. |
| τ                 | Time constant   |
| ΔT                | Temperature difference in K   |

# A4 Telecontrol Interfaces

## A4.1 Telecontrol Interface per EN 60870-5-101 or IEC 870-5-101 (Companion Standard)

This section incorporates Section 8 of EN 60870-5-101 (1996), which includes a general definition of the telecontrol interface for substation control systems.

### A4.1.1 Interoperability

This application-based standard (companion standard) specifies parameter sets and other options from which subsets are to be selected in order to implement specific telecontrol systems. Certain parameters such as the number of bytes (octets) in the COMMON ADDRESS of the ASDU are mutually exclusive. This means that only one value of the defined parameter is allowed per system. Other parameters, such as the listed set of different process information in the command and monitor direction, permit definition of the total number or of subsets that are suitable for the given application. This section combines the parameters given in the previous sections in order to facilitate an appropriate selection for a specific application. If a system is made up of several system components supplied by different manufacturers, then it is necessary for all partners to agree on the selected parameters.

The boxes for the selected parameters should be checked [see *National Preface of EN 60870-5-101*].

*The overall definition of a system may also require individual selection of certain parameters for specific parts of a system such as individual selection of scaling factors for individually addressable measured values.*

#### A4.1.1.1 Network Configuration (Network-Specific Parameters)

|                                     |                                       |                                     |                                     |
|-------------------------------------|---------------------------------------|-------------------------------------|-------------------------------------|
| <input checked="" type="checkbox"/> | Point-to-point configuration          | <input checked="" type="checkbox"/> | Multipoint-party line configuration |
| <input checked="" type="checkbox"/> | Multiple point-to-point configuration | <input type="checkbox"/>            | Multipoint-star configuration       |

**A4.1.1.2****Physical Layer (Network-Specific Parameters)**

(See National Preface of EN 60870-5-101.)

**Transmission Rate (Control Direction)**

(The transmission rates for control direction and monitor direction must be identical.)

| Unbalanced interface V.24/V.28, Standardized   | Unbalanced interface V.24/V.28, Recommended with > 1 200 bit/s | Balanced interface X.24/X.27         |
|--|--|--------------------------------------|
| <input type="checkbox"/> 100 bit/s             | <input checked="" type="checkbox"/> 2400 bit/s                 | <input type="checkbox"/> 2400 bit/s  |
| <input type="checkbox"/> 200 bit/s             | <input checked="" type="checkbox"/> 4800 bit/s                 | <input type="checkbox"/> 4800 bit/s  |
| <input type="checkbox"/> 300 bit/s             | <input checked="" type="checkbox"/> 9600 bit/s                 | <input type="checkbox"/> 9600 bit/s  |
| <input checked="" type="checkbox"/> 600 bit/s  |  | <input type="checkbox"/> 19200 bit/s |
| <input checked="" type="checkbox"/> 1200 bit/s |  | <input type="checkbox"/> 38400 bit/s |
|  |  | <input type="checkbox"/> 56000 bit/s |
|  |  | <input type="checkbox"/> 64000 bit/s |

**Transmission Rate (Monitor Direction)**

(The transmission rates for control direction and monitor direction must be identical.)

| Unbalanced interface V.24/V.28, Standardized   | Unbalanced interface V.24/V.28, Recommended with > 1 200 bit/s | Balanced interface X.24/X.27         |
|--|--|--------------------------------------|
| <input type="checkbox"/> 100 bit/s             | <input checked="" type="checkbox"/> 2400 bit/s                 | <input type="checkbox"/> 2400 bit/s  |
| <input type="checkbox"/> 200 bit/s             | <input checked="" type="checkbox"/> 4800 bit/s                 | <input type="checkbox"/> 4800 bit/s  |
| <input type="checkbox"/> 300 bit/s             | <input checked="" type="checkbox"/> 9600 bit/s                 | <input type="checkbox"/> 9600 bit/s  |
| <input checked="" type="checkbox"/> 600 bit/s  |  | <input type="checkbox"/> 19200 bit/s |
| <input checked="" type="checkbox"/> 1200 bit/s |  | <input type="checkbox"/> 38400 bit/s |
|  |  | <input type="checkbox"/> 56000 bit/s |
|  |  | <input type="checkbox"/> 64000 bit/s |

**A4.1.1.3****Link Layer (Network-Specific Parameters)**

(See National Preface of EN 60870-5-101.)

Frame format FT 1.2, single character 1, and the fixed time-out interval are used exclusively in this companion standard.

|     | Link Transmission Procedure |
|-----|-----------------------------|
| [✓] | Balanced transmission       |
| [✓] | Unbalanced transmission     |

|     | Address Field of the Link                |
|-----|--|
| [✓] | Not present (balanced transmission only) |
| [✓] | One octet                                |
| [✓] | Two octets (balanced transmission only)  |
| [✓] | Structured                               |
| [✓] | Unstructured                             |

|       | Frame Length                        |
|-------|-------------------------------------|
| [240] | Maximum length L (number of octets) |

A4.1.1.4

Application Layer

(See National Preface of EN 60870-5-101.)  
Transmission mode for application data  
Mode 1 (least significant octet first), as defined in clause 4.10 of IEC 870-5-4, is used exclusively in this companion standard.

Common Address of ASDU (System-Specific Parameter)

|                                     |           |                                     |            |
|-------------------------------------|-----------|-------------------------------------|------------|
| <input checked="" type="checkbox"/> | One octet | <input checked="" type="checkbox"/> | Two octets |
|-------------------------------------|-----------|-------------------------------------|------------|

Information Object Address (System-Specific Parameter)

|                                     |              |                                     |              |
|-------------------------------------|--------------|-------------------------------------|--------------|
| <input checked="" type="checkbox"/> | One octet    | <input checked="" type="checkbox"/> | Structured   |
| <input checked="" type="checkbox"/> | Two octets   | <input checked="" type="checkbox"/> | Unstructured |
| <input checked="" type="checkbox"/> | Three octets |                                     |              |

Cause of Transmission (System-Specific Parameter)

|                                     |           |                                     |                                      |
|-------------------------------------|-----------|-------------------------------------|--------------------------------------|
| <input checked="" type="checkbox"/> | One octet | <input checked="" type="checkbox"/> | Two octets (with originator address) |
|-------------------------------------|-----------|-------------------------------------|--------------------------------------|

Selection of Standard ASDUs  
Process Information in Monitor Direction (Station-Specific Parameter)

|     |      |   |   |            |
|-----|------|---|---|------------|
| [✓] | <1>  | = | Single-point information  | M_SP_NA_1  |
| [✓] | <2>  | = | Single-point information with time tag                                  | M_SP_TA_1  |
| [✓] | <3>  | = | Double-point information  | M_DP_NA_1  |
| [✓] | <4>  | = | Double-point information with time tag                                  | M_DP_TA_1  |
| [✓] | <5>  | = | Step position information   | M_ST_NA_1  |
| [✓] | <6>  | = | Step position information with time tag                                 | M_ST_TA_1  |
| [✓] | <7>  | = | Bit string of 32 bit  | M_BO_NA_1  |
| [✓] | <8>  | = | Bit string of 32 bit with time tag                                      | M_BO_TA_1  |
| [✓] | <9>  | = | Measured value, normalized value  | M_ME_NA_1  |
| [✓] | <10> | = | Measured value, normalized value with time tag                          | M_ME_TA_1  |
| [✓] | <11> | = | Measured value, scaled value  | M_ME_NB_1  |
| [✓] | <12> | = | Measured value, scaled value with time tag                              | M_ME_TB_1  |
| [ ] | <13> | = | Measured value, short floating point value                              | M_ME_NC_1  |
| [ ] | <14> | = | Measured value, short floating point value with time tag                | M_ME_TC_1  |
| [✓] | <15> | = | Integrated totals   | M_IT_NA_1  |
| [✓] | <16> | = | Integrated totals with time tag   | M_IT_TA_1  |
| [✓] | <17> | = | Event of protection equipment with time tag                             | M_EP_TA_1  |
| [✓] | <18> | = | Packed start events of protection equipment with time tag               | ME_EP_TB_1 |
| [✓] | <19> | = | Packed output circuit information of protection equipment with time tag | M_EP_TC_1  |
| [ ] | <20> | = | Packed single-point information with status change detection            | M_PS_NA_1  |
| [ ] | <21> | = | Measured value, normalized value without quality descriptor             | M_ME_ND_1  |

### Process Information in Monitor Direction (Station-Specific Parameter)

(Incorrectly identified with control direction in IEC 870-5-101.)

|                                     |      |   |   |           |
|-------------------------------------|------|---|---|-----------|
| <input checked="" type="checkbox"/> | <45> | = | Single command                                | C_SC_NA_1 |
| <input checked="" type="checkbox"/> | <46> | = | Double command                                | C_DC_NA_1 |
| <input checked="" type="checkbox"/> | <47> | = | Regulating step command                       | C_IT_NA_1 |
| <input type="checkbox"/>            | <48> | = | Set point command, normalized value           | C_RC_NA_1 |
| <input type="checkbox"/>            | <49> | = | Set point command, scaled value               | C_SE_NB_1 |
| <input type="checkbox"/>            | <50> | = | Set point command, short floating point value | C_SE_NC_1 |
| <input type="checkbox"/>            | <51> | = | Bit string of 32 bit                          | C_BO_NA_1 |

#### System Information in Monitor Direction (Station-Specific Parameter)

|                                     |      |   |                       |            |
|-------------------------------------|------|---|-----------------------|------------|
| <input checked="" type="checkbox"/> | <70> | = | End of initialization | ME_EI_NA_1 |
|-------------------------------------|------|---|-----------------------|------------|

#### System Information in Control Direction (Station-Specific Parameter)

|                                     |       |   |  |           |
|-------------------------------------|-------|---|--|-----------|
| <input checked="" type="checkbox"/> | <100> | = | Interrogation command  | C_IC_NA_1 |
| <input checked="" type="checkbox"/> | <101> | = | Counter interrogation command  | C_CI_NA_1 |
| <input checked="" type="checkbox"/> | <102> | = | Read command   | C_RD_NA_1 |
| <input checked="" type="checkbox"/> | <103> | = | Clock synchronization command  | C_CS_NA_1 |
| <input checked="" type="checkbox"/> | <104> | = | Test command   | C_TS_NB_1 |
| <input type="checkbox"/>            | <105> | = | Reset process command  | C_RP_NC_1 |
| <input type="checkbox"/>            | <106> | = | Delay acquisition command<br>(See National Preface of EN 60870-5-101.) | C_CD_NA_1 |

#### Parameter in Control Direction (Station-Specific Parameter)

|                                     |       |   |   |           |
|-------------------------------------|-------|---|---|-----------|
| <input checked="" type="checkbox"/> | <110> | = | Parameter of measured value, normalized value           | P_ME_NA_1 |
| <input checked="" type="checkbox"/> | <111> | = | Parameter of measured value, scaled value               | P_ME_NB_1 |
| <input type="checkbox"/>            | <112> | = | Parameter of measured value, short floating point value | P_ME_NC_1 |
| <input type="checkbox"/>            | <113> | = | Parameter activation                                    | P_AC_NA_1 |

#### File Transfer (Station-Specific Parameter)



|     |       |   |  |           |
|-----|-------|---|--|-----------|
| [ ] | <120> | = | File ready   | F_FR_NA_1 |
| [ ] | <121> | = | Section ready  | F_SR_NA_1 |
| [ ] | <122> | = | Call directory, select file, call file, call section | F_SC_NA_1 |
| [ ] | <123> | = | Last section, last segment                           | F_LS_NA_1 |
| [ ] | <124> | = | Ack file, ack section                                | F_AF_NA_1 |
| [ ] | <125> | = | Segment  | F_SG_NA_1 |
| [ ] | <126> | = | Directory  | F_DR_TA_1 |

**A4.1.1.5****Basic Application Functions**

(See National Preface of EN 60870-5-101.)

**Station Initialization (Station-Specific Parameter)**

|                                     |                       |
|-------------------------------------|-----------------------|
| <input checked="" type="checkbox"/> | Remote initialization |
|-------------------------------------|-----------------------|

**General Interrogation (System- or Station-Specific Parameter)**

|   |  |  |
|---|--|--|
| <input checked="" type="checkbox"/> Global  |  |  |
| <input checked="" type="checkbox"/> Group 1 | <input checked="" type="checkbox"/> Group 7  | <input checked="" type="checkbox"/> Group 13 |
| <input checked="" type="checkbox"/> Group 2 | <input checked="" type="checkbox"/> Group 8  | <input checked="" type="checkbox"/> Group 14 |
| <input checked="" type="checkbox"/> Group 3 | <input checked="" type="checkbox"/> Group 9  | <input checked="" type="checkbox"/> Group 15 |
| <input checked="" type="checkbox"/> Group 4 | <input checked="" type="checkbox"/> Group 10 | <input checked="" type="checkbox"/> Group 16 |
| <input checked="" type="checkbox"/> Group 5 | <input checked="" type="checkbox"/> Group 11 |  |
| <input checked="" type="checkbox"/> Group 6 | <input checked="" type="checkbox"/> Group 12 |  |

Addresses per group have to be defined.

**Clock Synchronization (Station-Specific Parameter)**

|                                     |                       |
|-------------------------------------|-----------------------|
| <input checked="" type="checkbox"/> | Clock synchronization |
|-------------------------------------|-----------------------|

**Command Transmission (Object-Specific Parameter)**

|                                     |                                       |                          |                                      |
|-------------------------------------|---------------------------------------|--------------------------|--------------------------------------|
| <input checked="" type="checkbox"/> | Direct command transmission           | <input type="checkbox"/> | Select and execute command           |
| <input type="checkbox"/>            | Direct set point command transmission | <input type="checkbox"/> | Select and execute set point command |
|                                     |                                       | <input type="checkbox"/> | C_SE ACTTERM used                    |

|                                     |  |
|-------------------------------------|--|
| <input checked="" type="checkbox"/> | No additional definition   |
| <input type="checkbox"/>            | Short pulse duration (Execution duration determined by a system parameter in the outstation) |
| <input type="checkbox"/>            | Long pulse duration (Execution duration determined by a system parameter in the outstation)  |
| <input type="checkbox"/>            | Persistent output  |

**Transmission of Integrated Totals (Station- or Object-Specific Parameter)**

|                                     |                              |                                     |                         |
|-------------------------------------|------------------------------|-------------------------------------|-------------------------|
| <input type="checkbox"/>            | Counter request              | <input checked="" type="checkbox"/> | General request counter |
| <input checked="" type="checkbox"/> | Counter freeze without reset | <input checked="" type="checkbox"/> | Request counter group 1 |
| <input type="checkbox"/>            | Counter freeze with reset    | <input checked="" type="checkbox"/> | Request counter group 2 |
| <input type="checkbox"/>            | Counter reset                | <input checked="" type="checkbox"/> | Request counter group 3 |
|                                     |                              | <input checked="" type="checkbox"/> | Request counter group 4 |

Addresses per group have to be specified

#### Parameter Loading (Object-Specific Parameter)

|                                     |   |
|-------------------------------------|---|
| <input checked="" type="checkbox"/> | Threshold value                               |
| <input type="checkbox"/>            | Smoothing value                               |
| <input type="checkbox"/>            | Low limit for transmission of measured value  |
| <input type="checkbox"/>            | High limit for transmission of measured value |

#### Parameter Activation (Object-Specific Parameter)

|                          |   |
|--------------------------|---|
| <input type="checkbox"/> | Act/deact of persistent cyclic or periodic transmission of the addressed object |
|--------------------------|---|

#### File Transfer (Station-Specific Parameter)

|                          |                                    |           |
|--------------------------|------------------------------------|-----------|
| <input type="checkbox"/> | File transfer in monitor direction | F_FR_NA_1 |
| <input type="checkbox"/> | File transfer in control direction | F_FR_NA_1 |

## A4.2 Communication Interface per IEC 60870-5-103

This section incorporates Section 8 of IEC 60870-5-103, including definitions applicable to the P439.

### A4.2.1 Interoperability

#### A4.2.1.1 Physical Layer

##### A4.2.1.1.1 Electrical Interface

|                                     |                                 |
|-------------------------------------|---------------------------------|
| <input checked="" type="checkbox"/> | EIA RS 485                      |
| <input checked="" type="checkbox"/> | No. of loads: 32 for one device |

Note: EIA RS 485 defines the loads in such a way that 32 of such loads can be operated on one line. For detailed information see EIA RS 485, Section 3.

#### A4.2.1.1.2 Optical Interface

|                                     |                    |
|-------------------------------------|--------------------|
| <input checked="" type="checkbox"/> | Glass fiber        |
| <input checked="" type="checkbox"/> | Plastic fiber      |
| <input checked="" type="checkbox"/> | F-SMA connector    |
| <input type="checkbox"/>            | BFOC/2.5 connector |

#### A4.2.1.1.3 Transmission Rate

|                                     |             |
|-------------------------------------|-------------|
| <input checked="" type="checkbox"/> | 9600 bit/s  |
| <input checked="" type="checkbox"/> | 19200 bit/s |

#### A4.2.1.2 Link Layer

There are no selection options for the link layer.

#### A4.2.1.3 Application Layer

##### A4.2.1.3.1 Transmission Mode for Application Data

Mode 1 (least significant octet first) as defined in clause 4.10 of IEC 60870-5-4 is used exclusively in this companion standard.

##### A4.2.1.3.2 Common Address of ASDU

|                                     |   |
|-------------------------------------|---|
| <input checked="" type="checkbox"/> | One COMMON ADDRESS of ASDU (identical to the station address) |
| <input type="checkbox"/>            | More than one COMMON ADDRESS of ASDU                          |

##### A4.2.1.3.3 Selection of Standard Information Numbers in Monitor Direction

#### **System Functions in Monitor Direction**

|                                     | INF | Description                  |
|-------------------------------------|-----|------------------------------|
| <input checked="" type="checkbox"/> | <0> | End of general interrogation |
| <input checked="" type="checkbox"/> | <0> | Time synchronization         |
| <input checked="" type="checkbox"/> | <2> | Reset FCB                    |
| <input checked="" type="checkbox"/> | <3> | Reset CU                     |
| <input checked="" type="checkbox"/> | <4> | Start / restart              |
| <input type="checkbox"/>            | <5> | Power on                     |

**Status Indications in Monitor Direction**

|                                     | INF  | Description                   | P439 Designations<br>(Address) Description |
|-------------------------------------|------|-------------------------------|--|
| <input checked="" type="checkbox"/> | <16> | Auto-recloser active          | (015 064) ARC: Enabled                     |
| <input checked="" type="checkbox"/> | <17> | Teleprotection active         | (015 008) PSIG: Enabled                    |
| <input checked="" type="checkbox"/> | <18> | Protection active             | (003 030) MAIN: Device on-line             |
| <input checked="" type="checkbox"/> | <19> | LED reset                     | (021 010) MAIN: Reset indicat. USER        |
| <input checked="" type="checkbox"/> | <20> | Blocking of monitor direction | (037 075) COMM1: Sig./meas.val.block.      |
| <input checked="" type="checkbox"/> | <21> | Test mode                     | (037 071) MAIN: Test mode                  |
| <input type="checkbox"/>            | <22> | Local parameter setting       |  |
| <input checked="" type="checkbox"/> | <23> | Characteristic 1              | (036 090) PSS: PS 1 active                 |
| <input checked="" type="checkbox"/> | <24> | Characteristic 2              | (036 091) PSS: PS 2 active                 |
| <input checked="" type="checkbox"/> | <25> | Characteristic 3              | (036 092) PSS: PS 3 active                 |
| <input checked="" type="checkbox"/> | <26> | Characteristic 4              | (036 093) PSS: PS 4 active                 |
| <input checked="" type="checkbox"/> | <27> | Auxiliary input 1             | (034 000) LOGIC: Input 01 EXT              |
| <input checked="" type="checkbox"/> | <28> | Auxiliary input 2             | (034 001) LOGIC: Input 02 EXT              |
| <input checked="" type="checkbox"/> | <29> | Auxiliary input 3             | (034 002) LOGIC: Input 03 EXT              |
| <input checked="" type="checkbox"/> | <30> | Auxiliary input 4             | (034 003) LOGIC: Input 04 EXT              |

**Monitoring Signals (Supervision Indications) in Monitor Direction**

|     | INF  | Description  | P439 Designations<br>(Address) Description |
|-----|------|--|--|
| [✓] | <32> | Measurand supervision I  | (040 087) MCMON: Meas. circ. I faulty      |
| [✓] | <33> | Measurand supervision V  | (038 023) MCMON: Meas. circ. V faulty      |
| [✓] | <35> | Phase sequence supervision   | (038 049) MCMON: Phase sequ. V faulty      |
| [✓] | <36> | Trip circuit supervision<br>(The message content is<br>formed from the OR operation<br>of the individual signals.) | (041 200) SFMON: Relay Kxx faulty          |
| [ ] | <37> | I>> back-up operation  | (037 021) BUOC: Active                     |
| [✓] | <38> | VT fuse failure  | (004 061) MAIN: M.c.b. trip V EXT          |
| [✓] | <39> | Teleprotection disturbed   | (036 060) PSIG: Telecom. faulty            |
| [✓] | <46> | Group warning  | (036 100) SFMON: Warning (relay)           |
| [✓] | <47> | Group alarm  | (004 065) MAIN: Blocked/faulty             |

**Earth Fault Indications in Monitor Direction**

|     | INF  | Description                      | P439 Designations<br>(Address) Description |
|-----|------|----------------------------------|--|
| [✓] | <48> | Earth fault A                    | (041 054) MAIN: Ground fault A             |
| [✓] | <49> | Earth fault B                    | (041 055) MAIN: Ground fault B             |
| [✓] | <50> | Earth fault C                    | (041 056) MAIN: Ground fault C             |
| [✓] | <51> | Earth fault forward, i.e. line   | (041 088) MAIN: Gnd. fault forw./LS        |
| [✓] | <52> | Earth fault reverse, i.e. busbar | (041 089) MAIN: Gnd. fault backw./BS       |

**Fault Indications in Monitor Direction**

|                                     | INF  | Description                       | P439 Designations<br>(Address) Description |
|-------------------------------------|------|-----------------------------------|--|
| <input checked="" type="checkbox"/> | <64> | Start / pick-up A                 | (036 001) MAIN: Starting A                 |
| <input checked="" type="checkbox"/> | <65> | Start / pick-up B                 | (036 002) MAIN: Starting B                 |
| <input checked="" type="checkbox"/> | <66> | Start / pick-up C                 | (036 003) MAIN: Starting C                 |
| <input checked="" type="checkbox"/> | <67> | Start / pick-up N                 | (036 004) MAIN: Starting GF                |
| <input checked="" type="checkbox"/> | <68> | General trip                      | (036 071) MAIN: Gen. trip command 1        |
| <input type="checkbox"/>            | <69> | Trip A                            |  |
| <input type="checkbox"/>            | <70> | Trip B                            |  |
| <input type="checkbox"/>            | <71> | Trip C                            |  |
| <input checked="" type="checkbox"/> | <72> | Trip I>> (back-up operation)      | (036 014) BUOC: Trip signal                |
| <input checked="" type="checkbox"/> | <73> | Fault location X in ohms          | (004 029) FT_DA: Fault react., prim.       |
| <input checked="" type="checkbox"/> | <74> | Fault forward/line                | (036 018) DIST: Fault forward / LS         |
| <input checked="" type="checkbox"/> | <75> | Fault reverse/busbar              | (036 019) DIST: Fault backward / BS        |
| <input checked="" type="checkbox"/> | <76> | Teleprotection signal transmitted | (036 035) PSIG: Send (signal)              |
| <input checked="" type="checkbox"/> | <77> | Teleprotection signal received    | (037 029) PSIG: Receive (signal)           |
| <input checked="" type="checkbox"/> | <78> | Zone 1                            | (036 026) DIST: t1 elapsed                 |
| <input checked="" type="checkbox"/> | <79> | Zone 2                            | (036 027) DIST: t2 elapsed                 |
| <input checked="" type="checkbox"/> | <80> | Zone 3                            | (036 028) DIST: t3 elapsed                 |
| <input checked="" type="checkbox"/> | <81> | Zone 4                            | (036 029) DIST: t4 elapsed                 |
| <input checked="" type="checkbox"/> | <82> | Zone 5                            | (036 030) DIST: t5 elapsed                 |
| <input checked="" type="checkbox"/> | <83> | Zone 6                            | (036 031) DIST: t6 elapsed                 |
| <input checked="" type="checkbox"/> | <84> | General starting                  | (036 000) MAIN: General starting           |
| <input checked="" type="checkbox"/> | <85> | Breaker failure                   | (036 017) CBF: CB failure                  |
| <input type="checkbox"/>            | <86> | Trip measuring system A           |  |
| <input type="checkbox"/>            | <87> | Trip measuring system B           |  |
| <input type="checkbox"/>            | <88> | Trip measuring system C           |  |
| <input type="checkbox"/>            | <89> | Trip measuring system N           |  |
| <input type="checkbox"/>            | <90> | Trip I>                           |  |
| <input type="checkbox"/>            | <91> | Trip I>>                          |  |

|     | INF  | Description | P439 Designations<br>(Address) Description |
|-----|------|-------------|--|
| [ ] | <92> | Trip IN>    |  |
| [ ] | <93> | Trip IN>>   |  |

### **Auto-Reclosure Indications in Monitor Direction**

|     | INF   | Description             | P439 Designations<br>(Address) Description |
|-----|-------|-------------------------|--|
| [✓] | <128> | CB 'on' by AR           | (037 007) ARC: (Re)close signal HSR        |
| [✓] | <129> | CB 'on' by long-time AR | (037 006) ARC: (Re)close signal TDR        |
| [✓] | <130> | AR blocked              | (037 008) ARC: Not ready                   |

### **Measurands in Monitor Direction**

|     | INF   | Description  | P439 Designations<br>(Address) Description   |
|-----|-------|--|--|
| [✓] | <144> | Measurand I<br>(only with setting<br>COMM1: Transm.enab.cycl<br>.dat to ASDU 3.1 per IEC)                                  | (006 041) MAIN: Current B p.u.   |
| [✓] | <145> | Measurands I, V<br>(only with setting<br>COMM1: Transm.enab.cycl<br>.dat to ASDU 3.2 per IEC)                              | (006 041) MAIN: Current B p.u.<br>(005 045) MAIN: Voltage A-B p.u.   |
| [✓] | <146> | Measurands I, V, P, Q<br>(only with setting<br>COMM1: Transm.enab.cycl<br>.dat to ASDU 3.3 per IEC)                        | (006 041) MAIN: Current B p.u.<br>(005 045) MAIN: Voltage A-B p.u.<br>(004 051) MAIN: Active power P p.u.<br>(004 053) MAIN: Reac. power Q p.u.  |
| [✓] | <147> | Measurands $I_N$ , $V_{EN}$<br>(only with setting<br>COMM1: Transm.enab.cycl<br>.dat to ASDU 3.4 per IEC)                  | (005 011) MAIN: Current $\Sigma(IP)$ p.u.<br>(005 013) MAIN: Volt. $\Sigma(VPG)/\sqrt{3}$ p.u.   |
| [✓] | <148> | Measurands $I_{A,B,C}$ , $V_{A,B,C}$ , P, Q, f<br>(only with setting<br>COMM1: Transm.enab.cycl<br>.dat to ASDU 9 per IEC) | (005 041) MAIN: Current A p.u.<br>(006 041) MAIN: Current B p.u.<br>(007 041) MAIN: Current C p.u.<br>(005 043) MAIN: Voltage A-G p.u.<br>(006 043) MAIN: Voltage B-G p.u.<br>(007 043) MAIN: Voltage C-G p.u.<br>(004 051) MAIN: Active power P p.u.<br>(004 053) MAIN: Reac. power Q p.u.<br>(004 040) MAIN: Frequency f |



**Generic Functions in Monitor Direction**

|     | INF   | Description   |
|-----|-------|---|
| [ ] | <240> | Read headings of all defined groups                   |
| [ ] | <241> | Read values or attributes of all entries of one group |
| [ ] | <243> | Read directory of a single entry                      |
| [ ] | <244> | Read value or attribute of a single entry             |
| [ ] | <245> | General interrogation of generic data                 |
| [ ] | <249> | Write entry with confirmation                         |
| [ ] | <250> | Write entry with execution                            |
| [ ] | <251> | Write entry abort                                     |

A4.2.1.3.4                      Selection of Standard Information Numbers in Control Direction

**System Functions in Control Direction**

|     | INF | Description                         |
|-----|-----|-------------------------------------|
| [✓] | <0> | Initiation of general interrogation |
| [✓] | <0> | Time synchronization                |

**General Commands in Control Direction**

|     | INF  | Description  | P439 Designations<br>(Address) Description |
|-----|------|--|--|
| [✓] | <16> | Auto-recloser on/off   | (015 064) ARC: Enabled                     |
| [✓] | <17> | Teleprotection on/off  | (015 008) PSIG: Enabled                    |
| [✓] | <18> | Protection on/off  | (003 030) MAIN: Device on-line             |
| [✓] | <19> | LED reset  | (021 010) MAIN: Reset indicat. USER        |
| [✓] | <23> | Activate characteristic 1<br>(Switches<br>PSS: Param.subs.sel.<br>USER to <i>Parameter subset</i><br>1.) | (003 060) PSS: Param.subs.sel. USER        |
| [✓] | <24> | Activate characteristic 2<br>(Switches<br>PSS: Param.subs.sel.<br>USER to <i>Parameter subset</i><br>2.) | (003 060) PSS: Param.subs.sel. USER        |
| [✓] | <25> | Activate characteristic 3<br>(Switches<br>PSS: Param.subs.sel.<br>USER to <i>Parameter subset</i><br>3.) | (003 060) PSS: Param.subs.sel. USER        |
| [✓] | <26> | Activate characteristic 4<br>(Switches<br>PSS: Param.subs.sel.<br>USER to <i>Parameter subset</i><br>4.) | (003 060) PSS: Param.subs.sel. USER        |

**Generic Functions in Control Direction**

|     | INF   | Description   |
|-----|-------|---|
| [ ] | <240> | Read headings of all defined groups                   |
| [ ] | <241> | Read values or attributes of all entries of one group |
| [ ] | <243> | Read directory of a single entry                      |
| [ ] | <244> | Read value or attribute of a single entry             |
| [ ] | <245> | General interrogation of generic data                 |
| [ ] | <248> | Write entry   |
| [ ] | <249> | Write entry with confirmation                         |
| [ ] | <250> | Write entry with execution                            |
| [ ] | <251> | Write entry abort                                     |

## A4.2.1.3.5 Basic Application Functions

|                                     |                               |
|-------------------------------------|-------------------------------|
| <input checked="" type="checkbox"/> | Test mode                     |
| <input checked="" type="checkbox"/> | Blocking of monitor direction |
| <input checked="" type="checkbox"/> | Disturbance data              |
| <input type="checkbox"/>            | Generic services              |
| <input checked="" type="checkbox"/> | Private data                  |

## A4.2.1.3.6 Miscellaneous

Measured values are transmitted both with ASDU 3 and ASDU 9. As defined in Sec. 7.2.6.8, the maximum MVAL can be either 1.2 or 2.4 times the rated value. In ASDU 3 and ASDU 9, different ratings may not be used; in other words, there is only one choice for each measurand.

| Measured value   | Max. MVAL = nom. value multiplied by |    |                                     |
|------------------|--------------------------------------|----|-------------------------------------|
|                  | 1.2                                  | or | 2.4                                 |
| Current A        | <input type="checkbox"/>             |    | <input checked="" type="checkbox"/> |
| Current B        | <input type="checkbox"/>             |    | <input checked="" type="checkbox"/> |
| Current C        | <input type="checkbox"/>             |    | <input checked="" type="checkbox"/> |
| Voltage A-G      | <input type="checkbox"/>             |    | <input checked="" type="checkbox"/> |
| Voltage B-G      | <input type="checkbox"/>             |    | <input checked="" type="checkbox"/> |
| Voltage C-G      | <input type="checkbox"/>             |    | <input checked="" type="checkbox"/> |
| Enabled power P  | <input type="checkbox"/>             |    | <input checked="" type="checkbox"/> |
| Reactive power Q | <input type="checkbox"/>             |    | <input checked="" type="checkbox"/> |
| Frequency f      | <input type="checkbox"/>             |    | <input checked="" type="checkbox"/> |
| Voltage A-B      | <input type="checkbox"/>             |    | <input checked="" type="checkbox"/> |

## A5 List of Bay Types

### A5.1 Key to the List of Bay Types

#### Supported Bay Types

*In general, the selection of a bay type (via MAIN: Type of bay) is accepted by the P439 only if all of the following requirements are fulfilled:*

- The selected ID number is known by the P439, i. e. is either available as a pre-defined standard bay type, or matches a bay type definition that has been loaded as a customized bay type into the P439 memory in file transfer mode.
- A binary I/O module has been fitted to slot 6 (40 TE case) or 12 (84 TE case).
- The hardware (in particular the set of all binary I/O modules and power supply) has got a sufficient number of inputs and outputs as required by the selected bay type.
- None of the inputs/outputs required by the selected bay type has been previously assigned to a non-control function.

*In case of the setting MAIN: Auto-assignment I/O = Yes, the following two constraints must be noted:*

- The activation of a new bay type overwrites all DEVxx / SIG\_1 / CMD\_1 assignments to I/O elements that have been previously made (for the previous bay type definition).
- If the automatic I/O assignment fails because some required inputs and outputs have been assigned to a non-control function, or because the number of I/O elements available is not sufficient, then the previously selected bay type remains active and an error message "Signal from device: Hardware module not fitted (0x8063)" is reported in the "kommprot.txt" log file.

#### Sorting the Bay Types

The bay types are sorted by the criteria listed below. These criteria are encoded in the first three characters of the bay type code (example: **A11.100.R01**) given in brackets after the Bay Type No. (example: **2**). Sorting is first by "Type of bay" in the order given below, then within each group by the second and third character in ascending order.

- Type of bay
  - A – Feeder bays
  - L – Bus sectionalizer bay
  - Q –Bus coupler bay
  - K – Bus coupler and sectionalizer bay
  - M – Busbar measurement bay
  - E – Busbar grounding bay
  - X – Other bay type
- Number of busbars
  - 1 – Single busbar
  - 2 – Double busbar
  - 9 – Without busbar / other configurations
- Equipment
  - 1 – Bays with switch truck or withdrawable switchgear assembly
  - 2 – Bays with two circuit breakers or switch disconnectors on switch trucks or withdrawable switchgear assembly
  - 3 – Bays with stationary switchgear units
  - 5 – Bays with stationary switchgear units and three-position disconnector
  - 9 – Other bay types

#### Key

**Bay Type No.:** This number indicates the value to be set at MAIN: Type of bay (Menu branch *Par/Conf*) in order to configure the unit for the selected bay type.

#### Special Designations for External Devices:

- *Mot.relay*: Motor relay
- *Shunt wd.*: Shunt winding

#### Table “Assignment of Binary Inputs and Output Relays”:

Column “*Switchgear unit*”: This column begins with the designation for the external device (switchgear unit). The function group follows in brackets. The function group encompasses all setting options for monitoring the switchgear unit and its signals. “Open” and “Close(d)” indicate the signal message or control direction of the switchgear unit.

Column “*Binary Input*”: The “Open” or “Closed” signal should be connected to the binary input U xxxx. The connection points of the binary input U xxxx are shown in the terminal connection diagrams.

Column “*Output relay*”: The “Open” or “Close” control of the switchgear unit is effected via output relay K xxxx. The connection points of the output relay K xxxx are shown in the terminal connection diagrams.

#### Table “Bay Interlock Equations for Operation without Station Interlocking”:

*The interlock equations are stored at substation control level, not at unit level.*

**Symbols used in the Boolean interlock equations:**

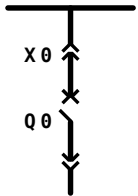
- **/**: Negation
- **0**: Switchgear unit "Open"
- **1**: Switchgear unit "Closed"
- **X**: Switchgear unit in intermediate position
- **FctBI1**: Function block 1, configuration at MAIN: Inp.asg. fct.block.1  
(menu branch *Par/Func/Cont*)
- **FctBI2**: Function block 1, configuration at MAIN: Inp.asg. fct.block.2  
(menu branch *Par/Func/Cont*)

## A5.2 Predefined Bay Types

### A5.2.1 Feeder Bays

#### A5.2.1.1 Bay type No. 2: Feeder bay with circuit breaker, single busbar

A11.100.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |

Tab. A5-1: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

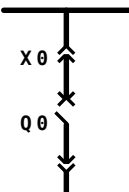
Tab. A5-2: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

Tab. A5-3: Bay Interlock Equations for Operation with Station Interlocking



**A5.2.1.2 Bay type No. 3: Feeder bay with circuit breaker, single busbar**  
A11.100.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |

**Tab. A5-4: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

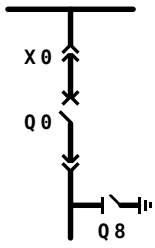
**Tab. A5-5: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-6: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.3****Bay type No. 546: Feeder bay with circuit breaker, single busbar, direct motor control**

A11.101.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-7: Assignment of Binary Inputs and Output Relays**

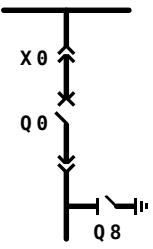
| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                   |

**Tab. A5-8: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                   |

**Tab. A5-9: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.4 Bay type No. 4: Feeder bay with circuit breaker, single busbar**  
A11.101.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-10: Assignment of Binary Inputs and Output Relays**

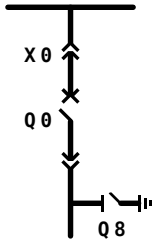
| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-11: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-12: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.5 Bay type No. 5: Feeder bay with circuit breaker, single busbar**  
A11.101.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-13: Assignment of Binary Inputs and Output Relays**

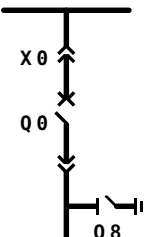
| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                   |

**Tab. A5-14: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                   |

**Tab. A5-15: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.6 Bay type No. 6: Feeder bay with circuit breaker, single busbar**  
A11.101.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |

**Tab. A5-16: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                   |

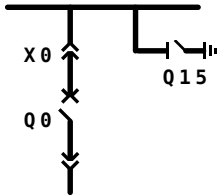
**Tab. A5-17: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                   |

**Tab. A5-18: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.7****Bay type No. 523: Feeder bay with circuit breaker, single busbar**

A11.108.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q15 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-19: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

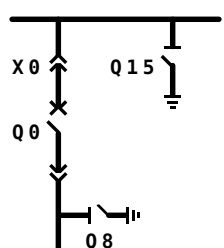
**Tab. A5-20: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-21: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.8****Bay type No. 549: Feeder bay with circuit breaker, single busbar, direct motor control**

A11.109.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| X0 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)                          | Open     | U B01        | /            |   |
|                                      | Close(d) | U B02        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-22: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X0=0)$  |
| X0              | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0) \ \& \ (Q15=0)$                                   |

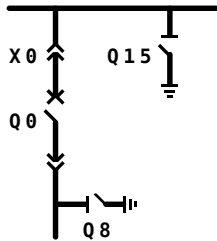
**Tab. A5-23: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X0=0)$  |
| X0              | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0) \ \& \ (Q15=0)$                                   |

**Tab. A5-24: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.9****Bay type No. 244: Feeder bay with circuit breaker, single busbar**

A11.109.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q15 (DEV07)     | Open     | U C01        | /            |   |
|                 | Close(d) | U C02        | /            |   |

**Tab. A5-25: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

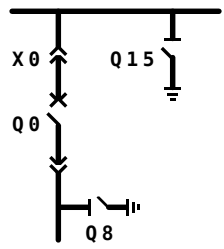
**Tab. A5-26: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-27: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.10 Bay type No. 544: Feeder bay with circuit breaker, single busbar**  
A11.109.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-28: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ \neg(\text{FctBl1}=1) \ \& \ \neg(\text{FctBl2}=1)$ |
| Q8              | Close(d)    | $(X0=0)$  |
| X0              | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0) \ \& \ (Q15=0)$   |

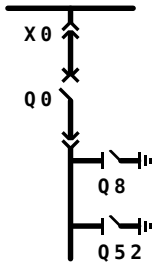
**Tab. A5-29: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ \neg(\text{FctBl1}=1) \ \& \ \neg(\text{FctBl2}=1)$ |
| Q8              | Close(d)    | $(X0=0)$  |
| X0              | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0) \ \& \ (Q15=0)$   |

**Tab. A5-30: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.11****Bay type No. 567: Feeder bay with circuit breaker, single busbar**

A11.132.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q52 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-31: Assignment of Binary Inputs and Output Relays**

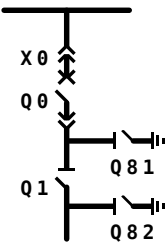
| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |

**Tab. A5-32: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |

**Tab. A5-33: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.12 Bay type No. 521: Feeder bay with circuit breaker, single busbar**  
A11.134.R02.1

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q1 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q81 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q82 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-34: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(Q1=X) \ \& \ (Q82=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$  |

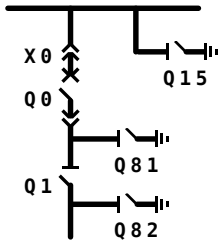
**Tab. A5-35: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(Q1=X) \ \& \ (Q82=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$  |

**Tab. A5-36: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.13****Bay type No. 519: Feeder bay with circuit breaker, single busbar**

A11.135.R02.1

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q1 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q81 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q82 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |
| Q15 (DEV06)     | Open     | U B05        | /            |   |
|                 | Close(d) | U B06        | /            |   |

**Tab. A5-37: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(Q1=X) \ \& \ (Q15=0) \ \& \ (Q82=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |

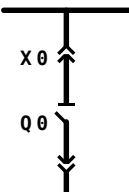
**Tab. A5-38: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(Q1=X) \ \& \ (Q15=0) \ \& \ (Q82=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |

**Tab. A5-39: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.14****Bay type No. 7: Feeder bay with switch disconnecter, single busbar**

A11.200.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |

**Tab. A5-40: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

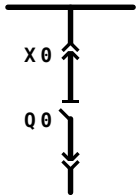
**Tab. A5-41: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-42: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.15****Bay type No. 8: Feeder bay with switch disconnecter, single busbar**

A11.200.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |

**Tab. A5-43: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

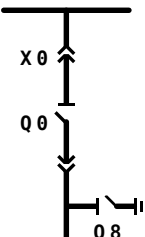
**Tab. A5-44: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-45: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.16****Bay type No. 9: Feeder bay with switch disconnecter, single busbar**

A11.201.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-46: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

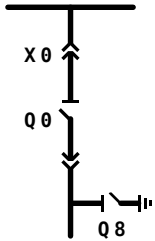
**Tab. A5-47: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-48: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.17****Bay type No. 10: Feeder bay with switch disconnecter, single busbar**

A11.201.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-49: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                   |

**Tab. A5-50: Bay Interlock Equations for Operation without Station Interlocking**

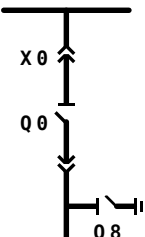
| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                   |

**Tab. A5-51: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.18****Bay type No. 11: Feeder bay with switch disconnecter, single busbar**

A11.201.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |

**Tab. A5-52: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

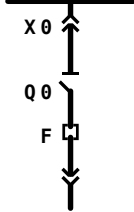
**Tab. A5-53: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-54: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.19****Bay type No. 12: Feeder bay with switch disconnecter / fuse unit, single busbar**

A11.400.R01

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)                 | Open     | U A03        | /            |   |
|                            | Close(d) | U A04        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-55: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |

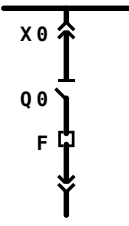
**Tab. A5-56: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |

**Tab. A5-57: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.20****Bay type No. 13: Feeder bay with switch disconnecter / fuse unit, single busbar**

A11.400.R02

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-58: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

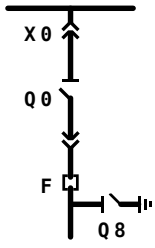
**Tab. A5-59: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-60: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.21****Bay type No. 14: Feeder bay with switch disconnecter / fuse unit, single busbar**

A11.401.R01

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)                 | Open     | U A03        | /            |   |
|                            | Close(d) | U A04        | /            |   |
| Q8 (DEV03)                 | Open     | U A05        | /            |   |
|                            | Close(d) | U A06        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-61: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

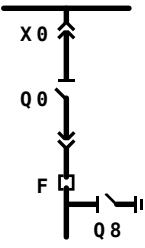
**Tab. A5-62: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-63: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.22****Bay type No. 15: Feeder bay with switch disconnecter / fuse unit, single busbar**

A11.401.R02

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)                 | Open     | U A05        | /            |   |
|                            | Close(d) | U A06        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-64: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                   |

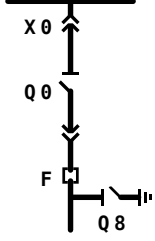
**Tab. A5-65: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                   |

**Tab. A5-66: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.23****Bay type No. 16: Feeder bay with switch disconnecter / fuse unit, single busbar**

A11.401.R03

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)                 | Open     | U A05        | K A05        |   |
|                            | Close(d) | U A06        | K A06        |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-67: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                   |

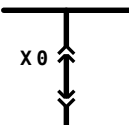
**Tab. A5-68: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                       |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                   |

**Tab. A5-69: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.24****Bay type No. 17: Feeder bay with other switchgear unit, single busbar**

A11.900.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| X0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |

**Tab. A5-70: Assignment of Binary Inputs and Output Relays**

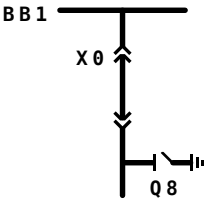
| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-71: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-72: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.25****Bay type No. 504: Feeder bay with other switchgear unit, single busbar**  
A11.901.R00

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-73: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

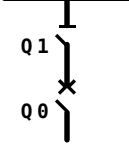
**Tab. A5-74: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-75: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.26 Bay type No. 541: Feeder bay with circuit breaker, single busbar**  
A13.104.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |

**Tab. A5-76: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(\text{FctBI1}=\text{I}) \ \& \ \neg(\text{FctBI2}=\text{I})$ |

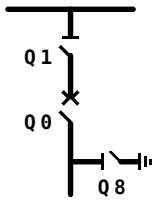
**Tab. A5-77: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(\text{FctBI1}=\text{I}) \ \& \ \neg(\text{FctBI2}=\text{I})$ |

**Tab. A5-78: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.27****Bay type No. 18: Feeder bay with circuit breaker, single busbar, direct motor control**

A13.105.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-79: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

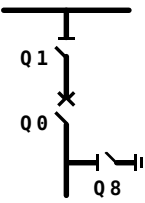
**Tab. A5-80: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

**Tab. A5-81: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.28****Bay type No. 19: Feeder bay with circuit breaker, single busbar**

A13.105.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-82: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |

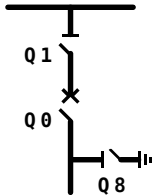
**Tab. A5-83: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |

**Tab. A5-84: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.29****Bay type No. 20: Feeder bay with circuit breaker, single busbar**

A13.105.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-85: Assignment of Binary Inputs and Output Relays**

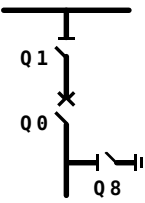
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-86: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-87: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.30 Bay type No. 21: Feeder bay with circuit breaker, single busbar**  
A13.105.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |

**Tab. A5-88: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

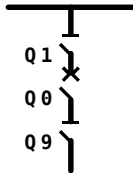
**Tab. A5-89: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

**Tab. A5-90: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.31****Bay type No. 557: Feeder bay with circuit breaker, single busbar**

A13.106.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q9 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |

**Tab. A5-91: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

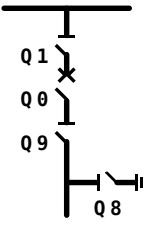
**Tab. A5-92: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-93: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.32****Bay type No. 22: Feeder bay with circuit breaker, single busbar, direct motor control**

A13.107.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q9 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-94: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-95: Bay Interlock Equations for Operation without Station Interlocking**

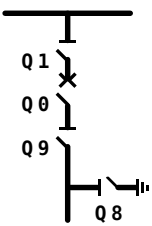
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-96: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.33****Bay type No. 23: Feeder bay with circuit breaker, single busbar**

A13.107.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q9 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-97: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

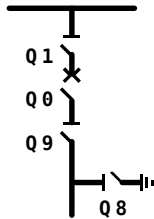
**Tab. A5-98: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

**Tab. A5-99: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.34****Bay type No. 24: Feeder bay with circuit breaker, single busbar**

A13.107.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q9 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-100: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

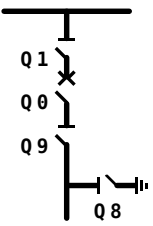
**Tab. A5-101: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-102: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.35****Bay type No. 25: Feeder bay with circuit breaker, single busbar**

A13.107.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q9 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-103: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

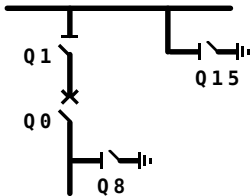
**Tab. A5-104: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-105: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.36****Bay type No. 508: Feeder bay with circuit breaker, single busbar**

A13.111.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-106: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ (Q15=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0) \ \& \ (Q15=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$  |

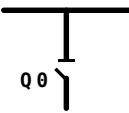
**Tab. A5-107: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ (Q15=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0) \ \& \ (Q15=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$  |

**Tab. A5-108: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.37****Bay type No. 26: Feeder bay with switch disconnecter, single busbar**

A13.200.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |

**Tab. A5-109: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

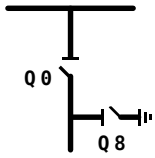
**Tab. A5-110: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-111: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.38****Bay type No. 27: Feeder bay with switch disconnecter, single busbar, direct motor control**

A13.201.M02

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-112: Assignment of Binary Inputs and Output Relays**

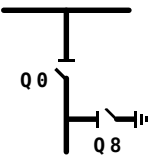
| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q8              | Close(d)    | $(Q0=0)$                                       |

**Tab. A5-113: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q8              | Close(d)    | $(Q0=0)$                                       |

**Tab. A5-114: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.39 Bay type No. 28: Feeder bay with switch disconnecter, single busbar**  
A13.201.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |

**Tab. A5-115: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBl1=l) \ \& \ /(FctBl2=l)$ |

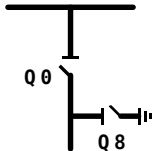
**Tab. A5-116: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBl1=l) \ \& \ /(FctBl2=l)$ |

**Tab. A5-117: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.40****Bay type No. 29: Feeder bay with switch disconnecter, single busbar**

A13.201.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |

**Tab. A5-118: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q8              | Close(d)    | $(Q0=0)$                                       |

**Tab. A5-119: Bay Interlock Equations for Operation without Station Interlocking**

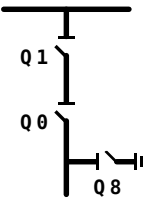
| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q8              | Close(d)    | $(Q0=0)$                                       |

**Tab. A5-120: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.41****Bay type No. 30: Feeder bay with switch disconnecter, single busbar, direct motor control**

A13.205.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-121: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

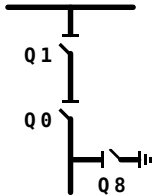
**Tab. A5-122: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

**Tab. A5-123: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.42****Bay type No. 31: Feeder bay with switch disconnecter, single busbar**

A13.205.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-124: Assignment of Binary Inputs and Output Relays**

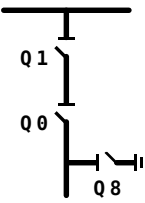
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-125: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-126: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.43****Bay type No. 32: Feeder bay with switch disconnecter, single busbar**  
A13.205.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-127: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

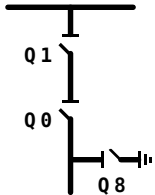
**Tab. A5-128: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-129: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.44****Bay type No. 33: Feeder bay with switch disconnecter, single busbar**

A13.205.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |

**Tab. A5-130: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

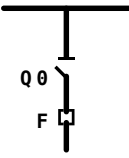
**Tab. A5-131: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

**Tab. A5-132: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.45****Bay type No. 34: Feeder bay with switch disconnecter / fuse unit, single busbar**

A13.400.R01

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-133: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-134: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-135: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.46****Bay type No. 35: Feeder bay with switch disconnecter / fuse unit, single busbar, direct motor control**

A13.401.M02

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|--|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |  |
|                                      | Close(d) | U A02        | K A02        |  |
| Q8 (DEV02)                           | Open     | U A03        | K A03        |  |
|                                      | Close(d) | U A04        | K A04        |  |
| F (SIG_1: Signal S011 EXT)           |          | U B05        | /            |  |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |  |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |  |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |  |

**Tab. A5-136: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q8              | Close(d)    | $(Q0=0)$                                       |

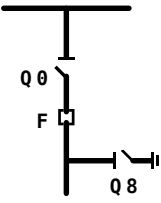
**Tab. A5-137: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q8              | Close(d)    | $(Q0=0)$                                       |

**Tab. A5-138: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.47****Bay type No. 36: Feeder bay with switch disconnecter / fuse unit, single busbar**

A13.401.R01

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)                 | Open     | U A03        | /            |   |
|                            | Close(d) | U A04        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-139: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBl1=l) \ \& \ /(FctBl2=l)$ |

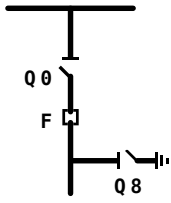
**Tab. A5-140: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBl1=l) \ \& \ /(FctBl2=l)$ |

**Tab. A5-141: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.48****Bay type No. 37: Feeder bay with switch disconnecter / fuse unit, single busbar**

A13.401.R02

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-142: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q8              | Close(d)    | $(Q0=0)$                                       |

**Tab. A5-143: Bay Interlock Equations for Operation without Station Interlocking**

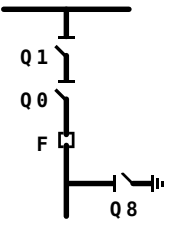
| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q8              | Close(d)    | $(Q0=0)$                                       |

**Tab. A5-144: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.49****Bay type No. 38: Feeder bay with switch disconnecter / fuse unit, single busbar, direct motor control**

A13.405.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| F (SIG_1: Signal S011 EXT)           |          | U B05        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-145: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

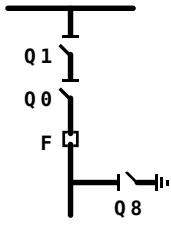
**Tab. A5-146: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

**Tab. A5-147: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.50****Bay type No. 39: Feeder bay with switch disconnecter / fuse unit, single busbar**

A13.405.R01

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                 | Open     | U A03        | /            |   |
|                            | Close(d) | U A04        | /            |   |
| Q8 (DEV03)                 | Open     | U A05        | /            |   |
|                            | Close(d) | U A06        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-148: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

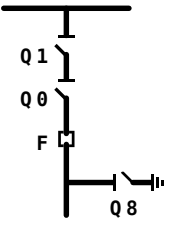
**Tab. A5-149: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-150: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.51****Bay type No. 40: Feeder bay with switch disconnecter / fuse unit, single busbar**

A13.405.R02

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)                 | Open     | U A05        | /            |   |
|                            | Close(d) | U A06        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-151: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

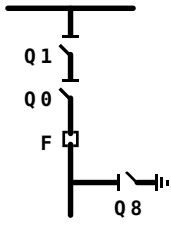
**Tab. A5-152: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-153: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.52****Bay type No. 41: Feeder bay with switch disconnecter / fuse unit, single busbar**

A13.405.R03

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)                 | Open     | U A05        | K A05        |   |
|                            | Close(d) | U A06        | K A06        |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-154: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

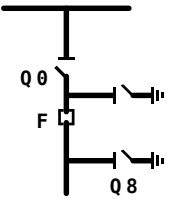
**Tab. A5-155: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

**Tab. A5-156: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.53****Bay type No. 503: Feeder bay with switch disconnecter / fuse unit, single busbar**

A13.432.R02

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-157: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBl1=l) \ \& \ /(FctBl2=l)$ |
| Q8              | Close(d)    | $(Q0=0)$                                       |

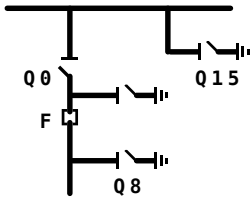
**Tab. A5-158: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                             |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q8=0) \ \& \ /(FctBl1=l) \ \& \ /(FctBl2=l)$ |
| Q8              | Close(d)    | $(Q0=0)$                                       |

**Tab. A5-159: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.54****Bay type No. 507: Feeder bay with switch disconnecter / fuse unit, single busbar**

A13.433.R02

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| Q15 (DEV03)                | Open     | U A05        | /            |   |
|                            | Close(d) | U A06        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-160: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                |
|-----------------|-------------|---|
| Q0              | Close(d)    | $(Q8=0) \& (Q15=0) \& /(FctBl1=I) \& /(FctBl2=I)$ |
| Q8              | Close(d)    | $(Q0=0)$  |

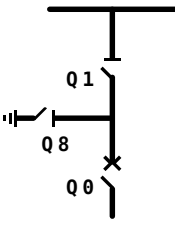
**Tab. A5-161: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                |
|-----------------|-------------|---|
| Q0              | Close(d)    | $(Q8=0) \& (Q15=0) \& /(FctBl1=I) \& /(FctBl2=I)$ |
| Q8              | Close(d)    | $(Q0=0)$  |

**Tab. A5-162: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.55****Bay type No. 220: Feeder bay with circuit breaker, single busbar, direct motor control**

A15.105.M02

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)                           | Open     | U A05        | /            |   |
|                                      | Close(d) | U A06        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-163: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

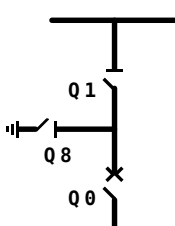
**Tab. A5-164: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-165: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.56****Bay type No. 42: Feeder bay with circuit breaker, single busbar, direct motor control**

A15.105.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-166: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Open        | $(Q8=0)$  |
|                 | Close(d)    | $/(Q1=X) \ \& \ (Q8=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q1              | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$  |
| Q8              | Open        | $(Q0=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$  |

**Tab. A5-167: Bay Interlock Equations for Operation without Station Interlocking**

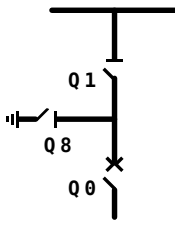


| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=I)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$     |

**Tab. A5-168: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.57****Bay type No. 43: Feeder bay with circuit breaker, single busbar**

A15.105.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-169: Assignment of Binary Inputs and Output Relays**

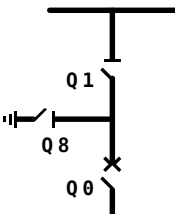
| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Open        | $(Q8=0)$  |
|                 | Close(d)    | $/(Q1=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-170: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Open        | $(Q8=0)$  |
|                 | Close(d)    | $/(Q1=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-171: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.58 Bay type No. 221: Feeder bay with circuit breaker, single busbar**  
A15.105.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-172: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

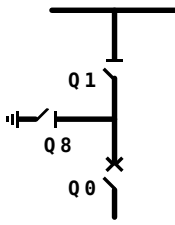
**Tab. A5-173: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-174: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.59****Bay type No. 44: Feeder bay with circuit breaker, single busbar**

A15.105.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |

**Tab. A5-175: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=1)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$     |

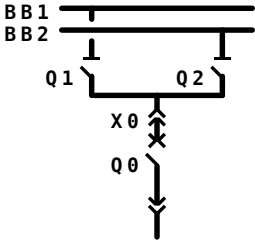
**Tab. A5-176: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ (Q8=0) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q8              | Open        | $(Q0=1)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$     |

**Tab. A5-177: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.60****Bay type No. 45: Feeder bay with circuit breaker, double busbar, direct motor control**

A21.104.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-178: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

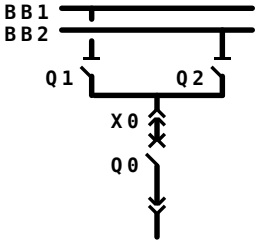
**Tab. A5-179: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

**Tab. A5-180: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.61****Bay type No. 46: Feeder bay with circuit breaker, double busbar**

A21.104.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-181: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

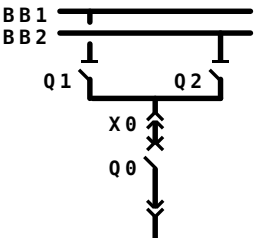
**Tab. A5-182: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

**Tab. A5-183: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.62****Bay type No. 47: Feeder bay with circuit breaker, double busbar**

A21.104.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-184: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

**Tab. A5-185: Bay Interlock Equations for Operation without Station Interlocking**

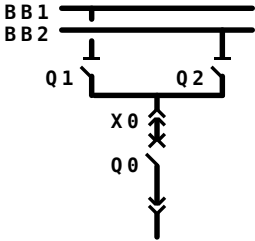
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-186: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.63****Bay type No. 48: Feeder bay with circuit breaker, double busbar**

A21.104.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-187: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

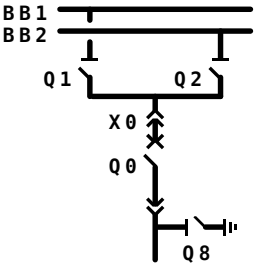
**Tab. A5-188: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

**Tab. A5-189: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.64****Bay type No. 49: Feeder bay with circuit breaker, double busbar, direct motor control**

A21.105.M05

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)                           | Open     | U B03        | K B03        |   |
|                                      | Close(d) | U B04        | K B04        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-190: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

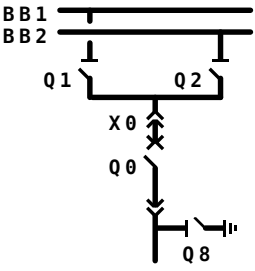
**Tab. A5-191: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

**Tab. A5-192: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.65****Bay type No. 50: Feeder bay with circuit breaker, double busbar**

A21.105.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-193: Assignment of Binary Inputs and Output Relays**

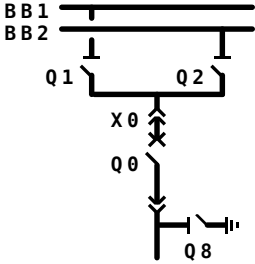
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-194: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-195: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.66 Bay type No. 51: Feeder bay with circuit breaker, double busbar**  
A21.105.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-196: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

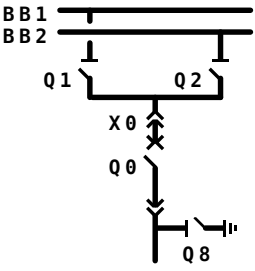
**Tab. A5-197: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-198: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.67****Bay type No. 52: Feeder bay with circuit breaker, double busbar**

A21.105.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-199: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

**Tab. A5-200: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

**Tab. A5-201: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.68****Bay type No. 53: Feeder bay with circuit breaker, double busbar**

A21.105.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q0 (DEV01)      | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| Q1 (DEV02)      | Open     | U A03        | K A03        |  |
|                 | Close(d) | U A04        | K A04        |  |
| Q2 (DEV03)      | Open     | U A05        | K A05        |  |
|                 | Close(d) | U A06        | K A06        |  |
| X0 (DEV04)      | Open     | U B01        | K B01        |  |
|                 | Close(d) | U B02        | K B02        |  |
| Q8 (DEV05)      | Open     | U B03        | K B03        |  |
|                 | Close(d) | U B04        | K B04        |  |

**Tab. A5-202: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

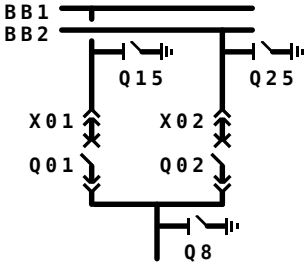
**Tab. A5-203: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge \neg(X0=X) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0) \wedge (Q1=0) \wedge (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q1=0) \wedge (Q2=0) \wedge (Q8=0)$   |

Tab. A5-204: Bay Interlock Equations for Operation with Station Interlocking



**A5.2.1.69 Bay type No. 526: Feeder bay with circuit breaker, double busbar**  
A21.125.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q01 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q02 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X02 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |
| Q15 (DEV06)     | Open     | U B05        | /            |   |
|                 | Close(d) | U B06        | /            |   |
| Q25 (DEV07)     | Open     | U C01        | /            |   |
|                 | Close(d) | U C02        | /            |   |

**Tab. A5-205: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(X01=X) \wedge \neg(X02=X) \wedge (Q15=0) \wedge (Q25=0) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |
| Q02             | Close(d)    | $\neg(X01=X) \wedge \neg(X02=X) \wedge (Q15=0) \wedge (Q25=0) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |

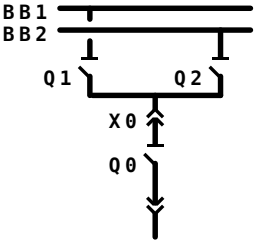
**Tab. A5-206: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(X01=X) \wedge \neg(X02=X) \wedge (Q15=0) \wedge (Q25=0) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |
| Q02             | Close(d)    | $\neg(X01=X) \wedge \neg(X02=X) \wedge (Q15=0) \wedge (Q25=0) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |

**Tab. A5-207: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.70****Bay type No. 54: Feeder bay with switch disconnecter, double busbar, direct motor control**

A21.204.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-208: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

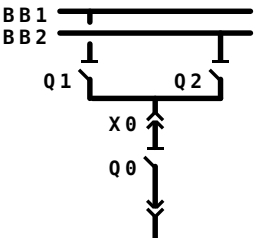
**Tab. A5-209: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

**Tab. A5-210: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.71****Bay type No. 55: Feeder bay with switch disconnecter, double busbar**

A21.204.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-211: Assignment of Binary Inputs and Output Relays**

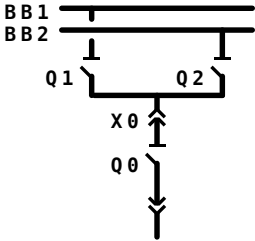
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge \neg(X0=X) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |

**Tab. A5-212: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge \neg(X0=X) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |

**Tab. A5-213: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.72 Bay type No. 56: Feeder bay with switch disconnecter, double busbar**  
A21.204.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-214: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

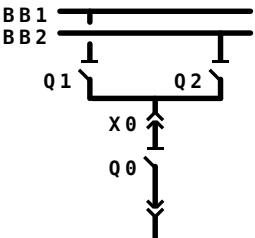
**Tab. A5-215: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-216: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.73****Bay type No. 57: Feeder bay with switch disconnecter, double busbar**

A21.204.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-217: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

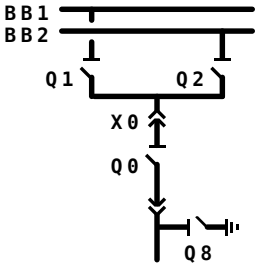
**Tab. A5-218: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

**Tab. A5-219: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.74****Bay type No. 58: Feeder bay with switch disconnecter, double busbar, direct motor control**

A21.205.M05

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)                           | Open     | U B03        | K B03        |   |
|                                      | Close(d) | U B04        | K B04        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-220: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

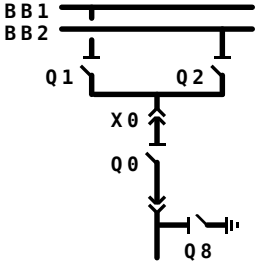
**Tab. A5-221: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

**Tab. A5-222: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.75 Bay type No. 59: Feeder bay with switch disconnecter, double busbar**  
A21.205.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-223: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

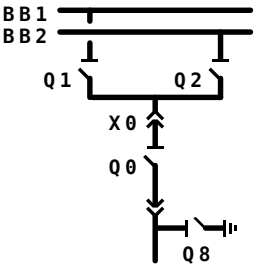
**Tab. A5-224: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-225: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.76****Bay type No. 60: Feeder bay with switch disconnecter, double busbar**

A21.205.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-226: Assignment of Binary Inputs and Output Relays**

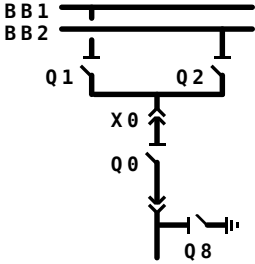
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

**Tab. A5-227: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-228: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.77 Bay type No. 61: Feeder bay with switch disconnecter, double busbar**  
A21.205.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-229: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

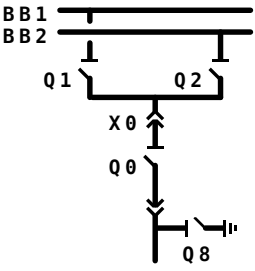
**Tab. A5-230: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

**Tab. A5-231: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.78****Bay type No. 62: Feeder bay with switch disconnecter, double busbar**

A21.205.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)      | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |

**Tab. A5-232: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

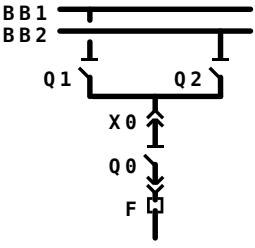
**Tab. A5-233: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

**Tab. A5-234: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.79****Bay type No. 63: Feeder bay with switch disconnecter / fuse unit, double busbar, direct motor control**

A21.404.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| F (SIG_1: Signal S011 EXT)           |          | U B05        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-235: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

**Tab. A5-236: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

**Tab. A5-237: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.80****Bay type No. 64: Feeder bay with switch disconnecter / fuse unit, double busbar**

A21.404.R01

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|--|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |  |
|                            | Close(d) | U A02        | K A02        |  |
| Q1 (DEV02)                 | Open     | U A03        | /            |  |
|                            | Close(d) | U A04        | /            |  |
| Q2 (DEV03)                 | Open     | U A05        | /            |  |
|                            | Close(d) | U A06        | /            |  |
| X0 (DEV04)                 | Open     | U B01        | /            |  |
|                            | Close(d) | U B02        | /            |  |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |  |

**Tab. A5-238: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-239: Bay Interlock Equations for Operation without Station Interlocking**

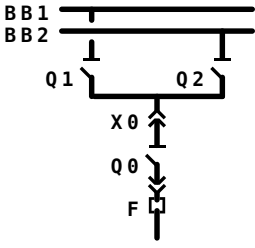
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-240: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.81****Bay type No. 65: Feeder bay with switch disconnecter / fuse unit, double busbar**

A21.404.R03

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                 | Open     | U A05        | K A05        |   |
|                            | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                 | Open     | U B01        | /            |   |
|                            | Close(d) | U B02        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-241: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

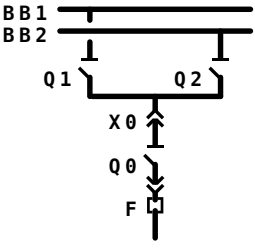
**Tab. A5-242: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-243: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.82****Bay type No. 66: Feeder bay with switch disconnecter / fuse unit, double busbar**

A21.404.R04

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                 | Open     | U A05        | K A05        |   |
|                            | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                 | Open     | U B01        | K B01        |   |
|                            | Close(d) | U B02        | K B02        |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-244: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

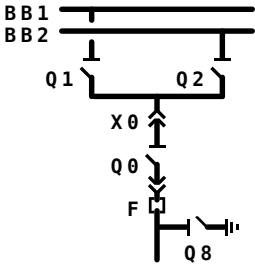
**Tab. A5-245: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

**Tab. A5-246: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.83****Bay type No. 67: Feeder bay with switch disconnecter / fuse unit, double busbar, direct motor control**

A21.405.M05

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)                           | Open     | U B03        | K B03        |   |
|                                      | Close(d) | U B04        | K B04        |   |
| F (SIG_1: Signal S011 EXT)           |          | U B05        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-247: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

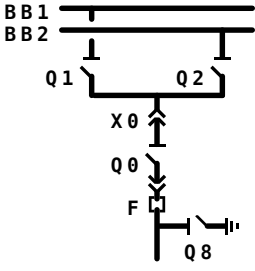
**Tab. A5-248: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

**Tab. A5-249: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.84****Bay type No. 68: Feeder bay with switch disconnecter / fuse unit, double busbar**

A21.405.R01

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                 | Open     | U A03        | /            |   |
|                            | Close(d) | U A04        | /            |   |
| Q2 (DEV03)                 | Open     | U A05        | /            |   |
|                            | Close(d) | U A06        | /            |   |
| X0 (DEV04)                 | Open     | U B01        | /            |   |
|                            | Close(d) | U B02        | /            |   |
| Q8 (DEV05)                 | Open     | U B03        | /            |   |
|                            | Close(d) | U B04        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-250: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

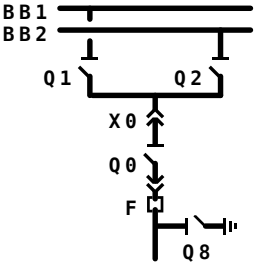
**Tab. A5-251: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-252: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.85****Bay type No. 69: Feeder bay with switch disconnecter / fuse unit, double busbar**

A21.405.R03

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                 | Open     | U A05        | K A05        |   |
|                            | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                 | Open     | U B01        | /            |   |
|                            | Close(d) | U B02        | /            |   |
| Q8 (DEV05)                 | Open     | U B03        | /            |   |
|                            | Close(d) | U B04        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-253: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

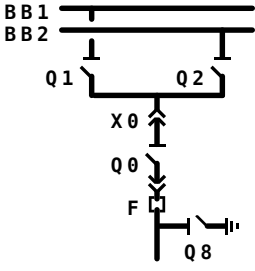
**Tab. A5-254: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-255: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.86****Bay type No. 70: Feeder bay with switch disconnecter / fuse unit, double busbar**

A21.405.R04

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                 | Open     | U A05        | K A05        |   |
|                            | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                 | Open     | U B01        | K B01        |   |
|                            | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)                 | Open     | U B03        | /            |   |
|                            | Close(d) | U B04        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-256: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

**Tab. A5-257: Bay Interlock Equations for Operation without Station Interlocking**

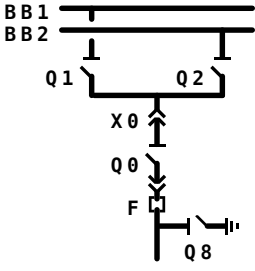
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge \neg(X0=X) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0) \wedge (Q1=0) \wedge (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q1=0) \wedge (Q2=0) \wedge (Q8=0)$   |

Tab. A5-258: Bay Interlock Equations for Operation with Station Interlocking



**A5.2.1.87****Bay type No. 71: Feeder bay with switch disconnecter / fuse unit, double busbar**

A21.405.R05

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                 | Open     | U A05        | K A05        |   |
|                            | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                 | Open     | U B01        | K B01        |   |
|                            | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)                 | Open     | U B03        | K B03        |   |
|                            | Close(d) | U B04        | K B04        |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-259: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

**Tab. A5-260: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(X0=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q8              | Close(d)    | $(X0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |

**Tab. A5-261: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.88****Bay type No. 72: Feeder bay with circuit breaker, double busbar**

A22.101.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q01 (DEV01)     | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| Q02 (DEV02)     | Open     | U A03        | K A03        |  |
|                 | Close(d) | U A04        | K A04        |  |
| X01 (DEV03)     | Open     | U A05        | /            |  |
|                 | Close(d) | U A06        | /            |  |
| X02 (DEV04)     | Open     | U B01        | /            |  |
|                 | Close(d) | U B02        | /            |  |
| Q8 (DEV05)      | Open     | U B03        | /            |  |
|                 | Close(d) | U B04        | /            |  |

**Tab. A5-262: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

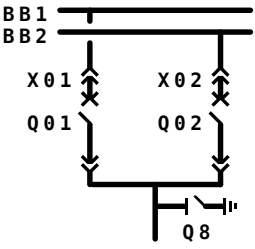
**Tab. A5-263: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $/(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $/(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-264: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.89****Bay type No. 73: Feeder bay with circuit breaker, double busbar**

A22.101.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q01 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q02 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X02 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-265: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| X01             | Open        | $(Q01=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q8=0)$   |
| X02             | Open        | $(Q02=0)$   |
|                 | Close(d)    | $(Q02=0) \ \& \ (Q8=0)$   |

**Tab. A5-266: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q02             | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X01             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q8=0)$  |
| X02             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0) \ \& \ (Q8=0)$  |

**Tab. A5-267: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.90****Bay type No. 74: Feeder bay with circuit breaker, double busbar**

A22.101.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q01 (DEV01)     | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| Q02 (DEV02)     | Open     | U A03        | K A03        |  |
|                 | Close(d) | U A04        | K A04        |  |
| X01 (DEV03)     | Open     | U A05        | K A05        |  |
|                 | Close(d) | U A06        | K A06        |  |
| X02 (DEV04)     | Open     | U B01        | K B01        |  |
|                 | Close(d) | U B02        | K B02        |  |
| Q8 (DEV05)      | Open     | U B03        | K B03        |  |
|                 | Close(d) | U B04        | K B04        |  |

**Tab. A5-268: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q8              | Close(d)    | $(X01=0) \ \& \ (X02=0)$  |
| X01             | Open        | $(Q01=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q8=0)$   |
| X02             | Open        | $(Q02=0)$   |
|                 | Close(d)    | $(Q02=0) \ \& \ (Q8=0)$   |

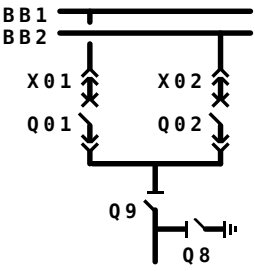
**Tab. A5-269: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q02             | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X01=0) \ \& \ (X02=0)$   |
| X01             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q8=0)$  |
| X02             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0) \ \& \ (Q8=0)$  |

**Tab. A5-270: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.91****Bay type No. 75: Feeder bay with circuit breaker, double busbar**

A22.103.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q01 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q02 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X02 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q9 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |
| Q8 (DEV06)      | Open     | U B05        | /            |   |
|                 | Close(d) | U B06        | /            |   |

**Tab. A5-271: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

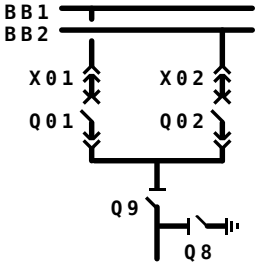
**Tab. A5-272: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q01             | Close(d)    | $/(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $/(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-273: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.92 Bay type No. 76: Feeder bay with circuit breaker, double busbar**  
A22.103.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q01 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q02 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X02 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q9 (DEV05)      | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |
| Q8 (DEV06)      | Open     | U B05        | /            |   |
|                 | Close(d) | U B06        | /            |   |

**Tab. A5-274: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q9              | Open        | $(Q01=0) \ \& \ (Q02=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q02=0) \ \& \ (Q8=0)$   |

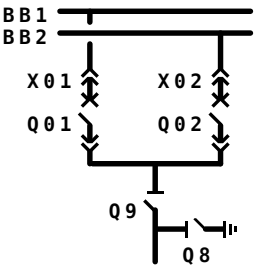
**Tab. A5-275: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q01             | Close(d)    | $/(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $/(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q9              | Open        | $(Q01=0) \ \& \ (Q02=0)$  |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q02=0) \ \& \ (Q8=0)$  |

**Tab. A5-276: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.93****Bay type No. 77: Feeder bay with circuit breaker, double busbar**

A22.103.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q01 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q02 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X02 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q9 (DEV05)      | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |
| Q8 (DEV06)      | Open     | U B05        | /            |   |
|                 | Close(d) | U B06        | /            |   |

**Tab. A5-277: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q9              | Open        | $(Q01=0) \ \& \ (Q02=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q02=0) \ \& \ (Q8=0)$   |
| X01             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0)$  |
| X02             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0)$  |

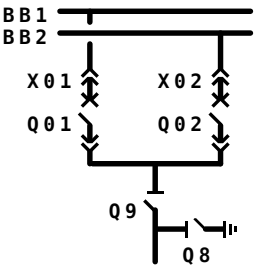
**Tab. A5-278: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(Q9=X) \ \& \ \neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q02             | Close(d)    | $\neg(Q9=X) \ \& \ \neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q9              | Open        | $(Q01=0) \ \& \ (Q02=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q02=0) \ \& \ (Q8=0)$   |
| X01             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0)$  |
| X02             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0)$  |

**Tab. A5-279: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.94****Bay type No. 78: Feeder bay with circuit breaker, double busbar**

A22.103.R06

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q01 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q02 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X02 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q9 (DEV05)      | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |
| Q8 (DEV06)      | Open     | U B05        | K B05        |   |
|                 | Close(d) | U B06        | K B06        |   |

**Tab. A5-280: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q01=0) \ \& \ (Q02=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q02=0) \ \& \ (Q8=0)$   |
| X01             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0)$  |
| X02             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0)$  |

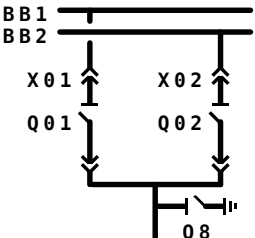
**Tab. A5-281: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(Q9=X) \ \& \ \neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q02             | Close(d)    | $\neg(Q9=X) \ \& \ \neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q01=0) \ \& \ (Q02=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q02=0) \ \& \ (Q8=0)$   |
| X01             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0)$  |
| X02             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0)$  |

**Tab. A5-282: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.95****Bay type No. 79: Feeder bay with switch disconnecter, double busbar**

A22.201.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q01 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q02 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X02 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-283: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-284: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $/(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $/(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-285: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.96****Bay type No. 80: Feeder bay with switch disconnecter, double busbar**

A22.201.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q01 (DEV01)     | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| Q02 (DEV02)     | Open     | U A03        | K A03        |  |
|                 | Close(d) | U A04        | K A04        |  |
| X01 (DEV03)     | Open     | U A05        | K A05        |  |
|                 | Close(d) | U A06        | K A06        |  |
| X02 (DEV04)     | Open     | U B01        | K B01        |  |
|                 | Close(d) | U B02        | K B02        |  |
| Q8 (DEV05)      | Open     | U B03        | /            |  |
|                 | Close(d) | U B04        | /            |  |

**Tab. A5-286: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| X01             | Open        | $(Q01=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q8=0)$   |
| X02             | Open        | $(Q02=0)$   |
|                 | Close(d)    | $(Q02=0) \ \& \ (Q8=0)$   |

**Tab. A5-287: Bay Interlock Equations for Operation without Station Interlocking**

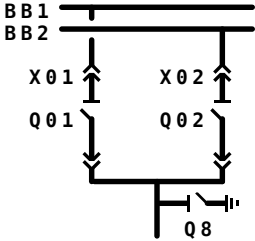
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q02             | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| X01             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q8=0)$  |
| X02             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0) \ \& \ (Q8=0)$  |

**Tab. A5-288: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.97****Bay type No. 81: Feeder bay with switch disconnecter, double busbar**

A22.201.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q01 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q02 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X02 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)      | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |

**Tab. A5-289: Assignment of Binary Inputs and Output Relays**

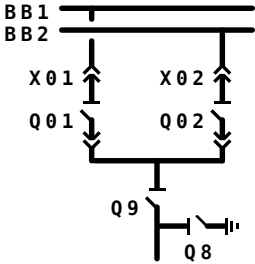
| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q8              | Close(d)    | $(X01=0) \ \& \ (X02=0)$  |
| X01             | Open        | $(Q01=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q8=0)$   |
| X02             | Open        | $(Q02=0)$   |
|                 | Close(d)    | $(Q02=0) \ \& \ (Q8=0)$   |

**Tab. A5-290: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q02             | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q8              | Close(d)    | $(X01=0) \ \& \ (X02=0)$   |
| X01             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q8=0)$  |
| X02             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0) \ \& \ (Q8=0)$  |

**Tab. A5-291: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.98 Bay type No. 82: Feeder bay with switch disconnecter, double busbar**  
A22.203.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q01 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q02 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X02 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q9 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |
| Q8 (DEV06)      | Open     | U B05        | /            |   |
|                 | Close(d) | U B06        | /            |   |

**Tab. A5-292: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

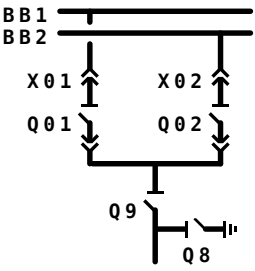
**Tab. A5-293: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q01             | Close(d)    | $/(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $/(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-294: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.99****Bay type No. 83: Feeder bay with switch disconnecter, double busbar**

A22.203.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q01 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q02 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X02 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q9 (DEV05)      | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |
| Q8 (DEV06)      | Open     | U B05        | /            |   |
|                 | Close(d) | U B06        | /            |   |

**Tab. A5-295: Assignment of Binary Inputs and Output Relays**

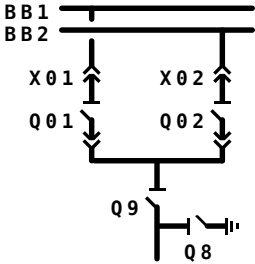
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q9              | Open        | $(Q01=0) \ \& \ (Q02=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q02=0) \ \& \ (Q8=0)$   |

**Tab. A5-296: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q01             | Close(d)    | $/(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $/(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q9              | Open        | $(Q01=0) \ \& \ (Q02=0)$  |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q02=0) \ \& \ (Q8=0)$  |

**Tab. A5-297: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.100 Bay type No. 84: Feeder bay with switch disconnecter, double busbar**  
A22.203.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q01 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q02 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X02 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q9 (DEV05)      | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |
| Q8 (DEV06)      | Open     | U B05        | /            |   |
|                 | Close(d) | U B06        | /            |   |

**Tab. A5-298: Assignment of Binary Inputs and Output Relays**

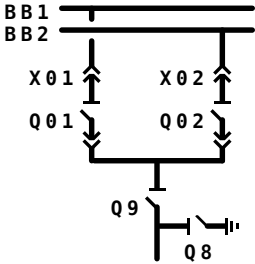
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q9              | Open        | $(Q01=0) \ \& \ (Q02=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q02=0) \ \& \ (Q8=0)$   |
| X01             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0)$  |
| X02             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0)$  |

**Tab. A5-299: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(Q9=X) \ \& \ \neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q02             | Close(d)    | $\neg(Q9=X) \ \& \ \neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q9              | Open        | $(Q01=0) \ \& \ (Q02=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q02=0) \ \& \ (Q8=0)$   |
| X01             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0)$  |
| X02             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0)$  |

**Tab. A5-300: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.101 Bay type No. 85: Feeder bay with switch disconnecter, double busbar**  
A22.203.R06

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q01 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q02 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X02 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q9 (DEV05)      | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |
| Q8 (DEV06)      | Open     | U B05        | K B05        |   |
|                 | Close(d) | U B06        | K B06        |   |

**Tab. A5-301: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $(Q02=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q02             | Close(d)    | $(Q01=0) \ \& \ /(Q9=X) \ \& \ /(X01=X) \ \& \ /(X02=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q01=0) \ \& \ (Q02=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q02=0) \ \& \ (Q8=0)$   |
| X01             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0)$  |
| X02             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0)$  |

**Tab. A5-302: Bay Interlock Equations for Operation without Station Interlocking**

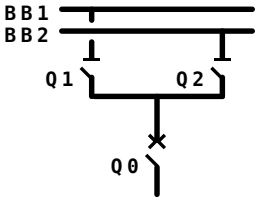
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(Q9=X) \ \& \ \neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q02             | Close(d)    | $\neg(Q9=X) \ \& \ \neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q01=0) \ \& \ (Q02=0)$   |
|                 | Close(d)    | $(Q01=0) \ \& \ (Q02=0) \ \& \ (Q8=0)$   |
| X01             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0)$  |
| X02             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0)$  |

**Tab. A5-303: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.102****Bay type No. 86: Feeder bay with circuit breaker, double busbar, direct motor control**

A23.104.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-304: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

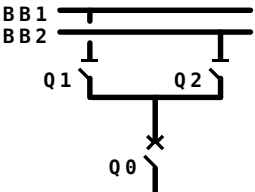
**Tab. A5-305: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-306: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.103****Bay type No. 87: Feeder bay with circuit breaker, double busbar**

A23.104.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-307: Assignment of Binary Inputs and Output Relays**

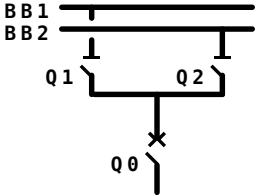
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-308: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-309: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.104 Bay type No. 88: Feeder bay with circuit breaker, double busbar**  
A23.104.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |

**Tab. A5-310: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

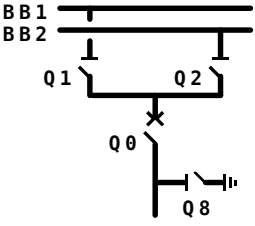
**Tab. A5-311: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-312: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.105****Bay type No. 89: Feeder bay with circuit breaker, double busbar, direct motor control**

A23.105.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-313: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

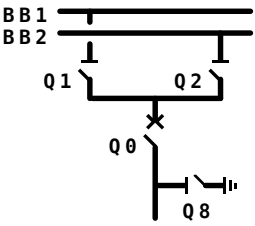
**Tab. A5-314: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

**Tab. A5-315: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.106****Bay type No. 90: Feeder bay with circuit breaker, double busbar**

A23.105.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-316: Assignment of Binary Inputs and Output Relays**

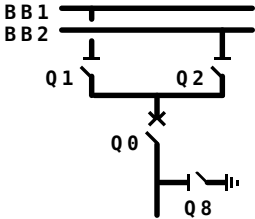
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge (Q8=0) \wedge \neg(\text{FctBI1}=I) \wedge \neg(\text{FctBI2}=I)$ |

**Tab. A5-317: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge (Q8=0) \wedge \neg(\text{FctBI1}=I) \wedge \neg(\text{FctBI2}=I)$ |

**Tab. A5-318: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.107 Bay type No. 91: Feeder bay with circuit breaker, double busbar**  
A23.105.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-319: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |

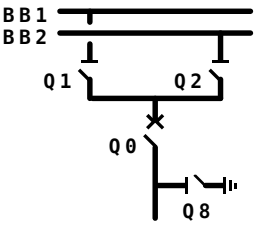
**Tab. A5-320: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |

**Tab. A5-321: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.108****Bay type No. 92: Feeder bay with circuit breaker, double busbar**

A23.105.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-322: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge (Q8=0) \wedge \neg(\text{FctBI1}=I) \wedge \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0) \wedge (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q2=0) \wedge (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \wedge (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q1=0) \wedge (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \wedge (Q1=0) \wedge (Q2=0)$   |

**Tab. A5-323: Bay Interlock Equations for Operation without Station Interlocking**

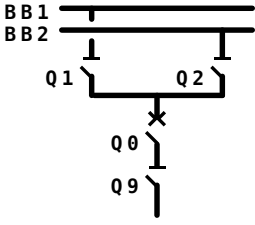
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge (Q8=0) \wedge \neg(\text{FctBI1}=I) \wedge \neg(\text{FctBI2}=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \wedge (Q1=0) \wedge (Q2=0)$   |

**Tab. A5-324: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.109****Bay type No. 93: Feeder bay with circuit breaker, double busbar, direct motor control**

A23.106.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q9 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-325: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

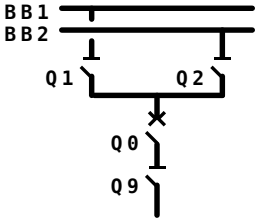
**Tab. A5-326: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-327: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.110****Bay type No. 94: Feeder bay with circuit breaker, double busbar**

A23.106.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q9 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-328: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

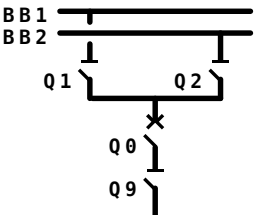
**Tab. A5-329: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-330: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.111****Bay type No. 95: Feeder bay with circuit breaker, double busbar**

A23.106.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q9 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-331: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

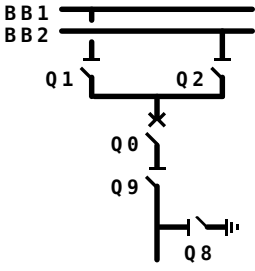
**Tab. A5-332: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-333: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.112****Bay type No. 96: Feeder bay with circuit breaker, double busbar, direct motor control**

A23.107.M05

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q9 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)                           | Open     | U B03        | K B03        |   |
|                                      | Close(d) | U B04        | K B04        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-334: Assignment of Binary Inputs and Output Relays**

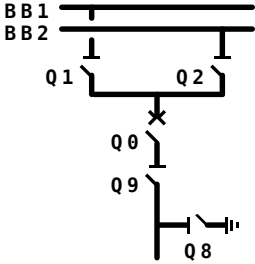
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-335: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge \neg(Q9=X) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q8=0)$   |

Tab. A5-336: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.1.113 Bay type No. 97: Feeder bay with circuit breaker, double busbar**  
A23.107.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q9 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-337: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

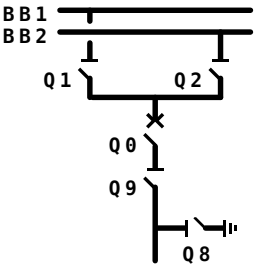
**Tab. A5-338: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

**Tab. A5-339: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.114****Bay type No. 98: Feeder bay with circuit breaker, double busbar**

A23.107.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q9 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-340: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-341: Bay Interlock Equations for Operation without Station Interlocking**

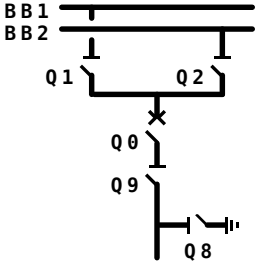
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-342: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.115****Bay type No. 99: Feeder bay with circuit breaker, double busbar**

A23.107.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q9 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)      | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |

**Tab. A5-343: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

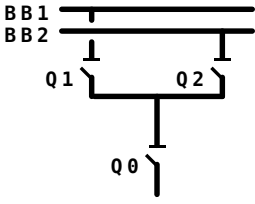
**Tab. A5-344: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge \neg(Q9=X) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q8=0)$   |

Tab. A5-345: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.1.116****Bay type No. 100: Feeder bay with switch disconnecter, double busbar, direct motor control**

A23.204.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-346: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

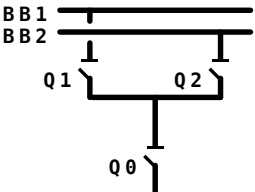
**Tab. A5-347: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-348: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.117****Bay type No. 101: Feeder bay with switch disconnecter, double busbar**

A23.204.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-349: Assignment of Binary Inputs and Output Relays**

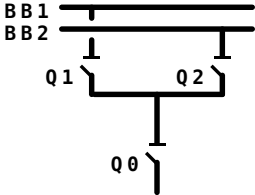
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-350: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-351: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.118 Bay type No. 102: Feeder bay with switch disconnecter, double busbar**  
A23.204.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |

**Tab. A5-352: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

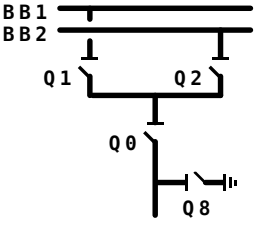
**Tab. A5-353: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

**Tab. A5-354: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.119****Bay type No. 103: Feeder bay with switch disconnecter, double busbar, direct motor control**

A23.205.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-355: Assignment of Binary Inputs and Output Relays**

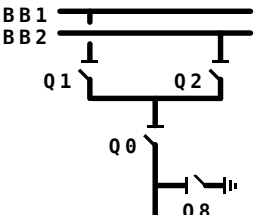
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

**Tab. A5-356: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

**Tab. A5-357: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.120****Bay type No. 104: Feeder bay with switch disconnecter, double busbar**  
A23.205.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-358: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge (Q8=0) \wedge \neg(\text{FctBI1}=I) \wedge \neg(\text{FctBI2}=I)$ |

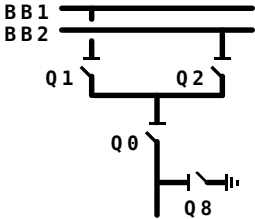
**Tab. A5-359: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge (Q8=0) \wedge \neg(\text{FctBI1}=I) \wedge \neg(\text{FctBI2}=I)$ |

**Tab. A5-360: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.121 Bay type No. 105: Feeder bay with switch disconnecter, double busbar**  
A23.205.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-361: Assignment of Binary Inputs and Output Relays**

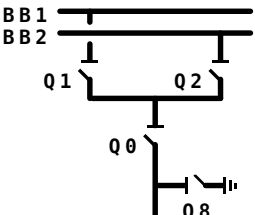
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |

**Tab. A5-362: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |

**Tab. A5-363: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.122****Bay type No. 106: Feeder bay with switch disconnecter, double busbar**  
A23.205.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-364: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

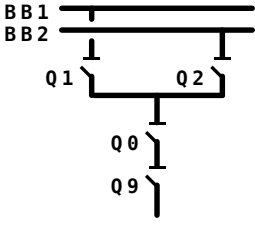
**Tab. A5-365: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

**Tab. A5-366: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.123****Bay type No. 107: Feeder bay with switch disconnecter, double busbar, direct motor control**

A23.206.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q9 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-367: Assignment of Binary Inputs and Output Relays**

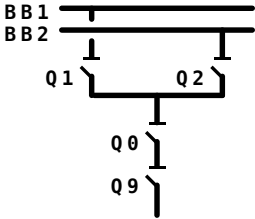
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-368: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge \neg(Q9=X) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

Tab. A5-369: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.1.124 Bay type No. 108: Feeder bay with switch disconnecter, double busbar**  
A23.206.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q9 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-370: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

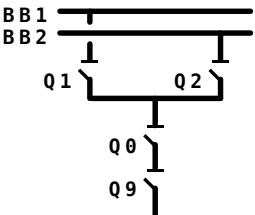
**Tab. A5-371: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

**Tab. A5-372: Bay Interlock Equations for Operation with Station Interlocking**

## A5.2.1.125

**Bay type No. 109: Feeder bay with switch disconnecter, double busbar**  
 A23.206.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q9 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

Tab. A5-373: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

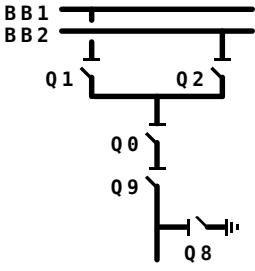
Tab. A5-374: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

Tab. A5-375: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.1.126****Bay type No. 110: Feeder bay with switch disconnecter, double busbar, direct motor control**

A23.207.M05

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q9 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)                           | Open     | U B03        | K B03        |   |
|                                      | Close(d) | U B04        | K B04        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-376: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

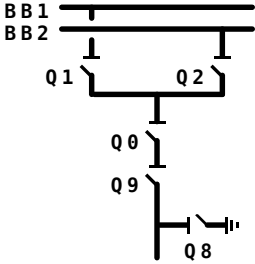
**Tab. A5-377: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge \neg(Q9=X) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q8=0)$   |

Tab. A5-378: Bay Interlock Equations for Operation with Station Interlocking



**A5.2.1.127 Bay type No. 111: Feeder bay with switch disconnecter, double busbar**  
A23.207.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q9 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-379: Assignment of Binary Inputs and Output Relays**

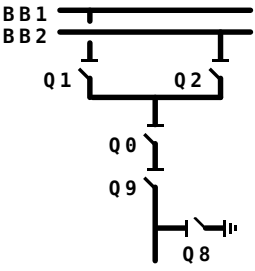
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

**Tab. A5-380: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

**Tab. A5-381: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.128****Bay type No. 112: Feeder bay with switch disconnecter, double busbar**  
A23.207.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q9 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-382: Assignment of Binary Inputs and Output Relays**

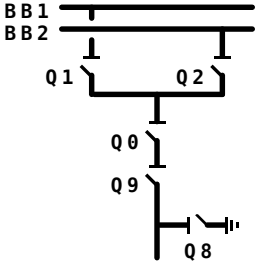
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-383: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-384: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.129 Bay type No. 113: Feeder bay with switch disconnecter, double busbar**  
A23.207.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q9 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q8 (DEV05)      | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |

**Tab. A5-385: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(Q9=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

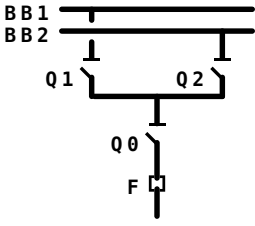
**Tab. A5-386: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge \neg(Q9=X) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(Q9=0)$   |
| Q9              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q8=0)$   |

Tab. A5-387: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.1.130****Bay type No. 114: Feeder bay with switch disconnecter / fuse unit, double busbar, direct motor control**

A23.404.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| F (SIG_1: Signal S011 EXT)           |          | U B05        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-388: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

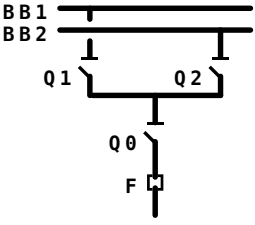
**Tab. A5-389: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-390: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.131****Bay type No. 115: Feeder bay with switch disconnecter / fuse unit, double busbar**

A23.404.R01

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                 | Open     | U A03        | /            |   |
|                            | Close(d) | U A04        | /            |   |
| Q2 (DEV03)                 | Open     | U A05        | /            |   |
|                            | Close(d) | U A06        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-391: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-392: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-393: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.132****Bay type No. 116: Feeder bay with switch disconnecter / fuse unit, double busbar**

A23.404.R03

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|--|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |  |
|                            | Close(d) | U A02        | K A02        |  |
| Q1 (DEV02)                 | Open     | U A03        | K A03        |  |
|                            | Close(d) | U A04        | K A04        |  |
| Q2 (DEV03)                 | Open     | U A05        | K A05        |  |
|                            | Close(d) | U A06        | K A06        |  |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |  |

**Tab. A5-394: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0)$   |

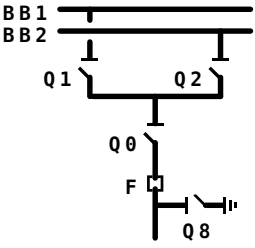
**Tab. A5-395: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-396: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.133****Bay type No. 117: Feeder bay with switch disconnecter / fuse unit, double busbar, direct motor control**

A23.405.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| F (SIG_1: Signal S011 EXT)           |          | U B05        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-397: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

**Tab. A5-398: Bay Interlock Equations for Operation without Station Interlocking**

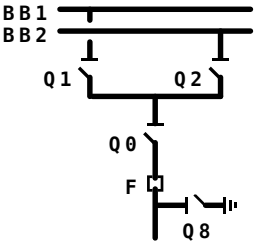


| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |

**Tab. A5-399: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.134****Bay type No. 118: Feeder bay with switch disconnecter / fuse unit, double busbar**

A23.405.R01

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                 | Open     | U A03        | /            |   |
|                            | Close(d) | U A04        | /            |   |
| Q2 (DEV03)                 | Open     | U A05        | /            |   |
|                            | Close(d) | U A06        | /            |   |
| Q8 (DEV04)                 | Open     | U B01        | /            |   |
|                            | Close(d) | U B02        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-400: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-401: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-402: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.135****Bay type No. 119: Feeder bay with switch disconnecter / fuse unit, double busbar**

A23.405.R03

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|--|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |  |
|                            | Close(d) | U A02        | K A02        |  |
| Q1 (DEV02)                 | Open     | U A03        | K A03        |  |
|                            | Close(d) | U A04        | K A04        |  |
| Q2 (DEV03)                 | Open     | U A05        | K A05        |  |
|                            | Close(d) | U A06        | K A06        |  |
| Q8 (DEV04)                 | Open     | U B01        | /            |  |
|                            | Close(d) | U B02        | /            |  |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |  |

**Tab. A5-403: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |

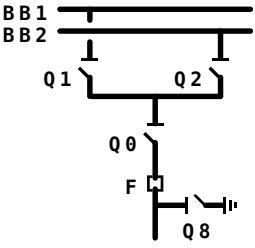
**Tab. A5-404: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |

**Tab. A5-405: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.136****Bay type No. 120: Feeder bay with switch disconnecter / fuse unit, double busbar**

A23.405.R04

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                 | Open     | U A05        | K A05        |   |
|                            | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)                 | Open     | U B01        | K B01        |   |
|                            | Close(d) | U B02        | K B02        |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-406: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge (Q8=0) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \wedge (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q2=0) \wedge (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \wedge (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q1=0) \wedge (Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \wedge (Q1=0) \wedge (Q2=0)$   |

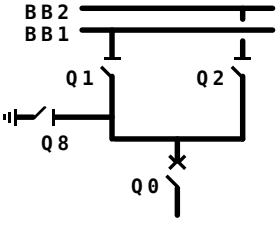
**Tab. A5-407: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge (Q8=0) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |
| Q8              | Close(d)    | $(Q0=0) \wedge (Q1=0) \wedge (Q2=0)$   |

**Tab. A5-408: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.137****Bay type No. 222: Feeder bay with circuit breaker, double busbar, direct motor control**

A25.105.M03.1

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)                           | Open     | U B01        | /            |   |
|                                      | Close(d) | U B02        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-409: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |

**Tab. A5-410: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q1=X) \ \& \ /(Q2=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |

**Tab. A5-411: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.138****Bay type No. 223: Feeder bay with circuit breaker, double busbar, direct motor control**

A25.105.M03.2

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|--|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |  |
|                                      | Close(d) | U A02        | K A02        |  |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |  |
|                                      | Close(d) | U A04        | K A04        |  |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |  |
|                                      | Close(d) | U A06        | K A06        |  |
| Q8 (DEV04)                           | Open     | U B01        | /            |  |
|                                      | Close(d) | U B02        | /            |  |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |  |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |  |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |  |

**Tab. A5-412: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |

**Tab. A5-413: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q1=X) \ \& \ /(Q2=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |

**Tab. A5-414: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.139****Bay type No. 121: Feeder bay with circuit breaker, double busbar, direct motor control**

A25.105.M04.1

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|--|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |  |
|                                      | Close(d) | U A02        | K A02        |  |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |  |
|                                      | Close(d) | U A04        | K A04        |  |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |  |
|                                      | Close(d) | U A06        | K A06        |  |
| Q8 (DEV04)                           | Open     | U B01        | K B01        |  |
|                                      | Close(d) | U B02        | K B02        |  |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |  |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |  |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |  |

**Tab. A5-415: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$         |

**Tab. A5-416: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q1=X) \ \& \ /(Q2=X) \ \& \ (Q8=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$   |

**Tab. A5-417: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.140****Bay type No. 122: Feeder bay with circuit breaker, double busbar, direct motor control**

A25.105.M04.2

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|--|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |  |
|                                      | Close(d) | U A02        | K A02        |  |
| Q1 (DEV02)                           | Open     | U A03        | K A03        |  |
|                                      | Close(d) | U A04        | K A04        |  |
| Q2 (DEV03)                           | Open     | U A05        | K A05        |  |
|                                      | Close(d) | U A06        | K A06        |  |
| Q8 (DEV04)                           | Open     | U B01        | K B01        |  |
|                                      | Close(d) | U B02        | K B02        |  |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |  |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |  |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |  |

**Tab. A5-418: Assignment of Binary Inputs and Output Relays**

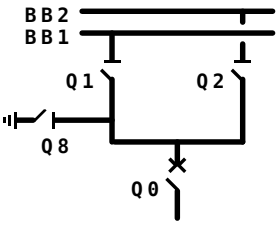
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ \neg(FctBI1=I) \ \& \ (FctBI2=I)$             |

**Tab. A5-419: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q1=X) \ \& \ /(Q2=X) \ \& \ (Q8=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$   |

**Tab. A5-420: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.141 Bay type No. 123: Feeder bay with circuit breaker, double busbar**  
A25.105.R01.1

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-421: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge (Q8=0) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |

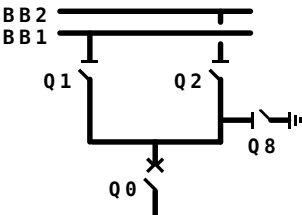
**Tab. A5-422: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge (Q8=0) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |

**Tab. A5-423: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.142****Bay type No. 124: Feeder bay with circuit breaker, double busbar**

A25.105.R01.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q2 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-424: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

**Tab. A5-425: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

**Tab. A5-426: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.143 Bay type No. 224: Feeder bay with circuit breaker, double busbar**  
A25.105.R03.1

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q0 (DEV01)      | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| Q1 (DEV02)      | Open     | U A03        | K A03        |  |
|                 | Close(d) | U A04        | K A04        |  |
| Q2 (DEV03)      | Open     | U A05        | K A05        |  |
|                 | Close(d) | U A06        | K A06        |  |
| Q8 (DEV04)      | Open     | U B01        | /            |  |
|                 | Close(d) | U B02        | /            |  |

**Tab. A5-427: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q1=X) \ \& \ /(Q2=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |

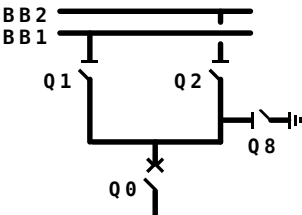
**Tab. A5-428: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q1=X) \ \& \ /(Q2=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |

**Tab. A5-429: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.144****Bay type No. 225: Feeder bay with circuit breaker, double busbar**

A25.105.R03.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-430: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge (Q8=0) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \wedge (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q2=0) \wedge (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \wedge (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q1=0) \wedge (Q8=0)$   |

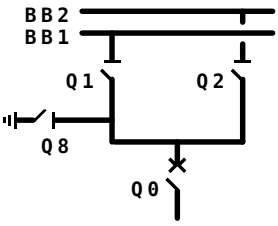
**Tab. A5-431: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge (Q8=0) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |

**Tab. A5-432: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.1.145 Bay type No. 125: Feeder bay with circuit breaker, double busbar**  
A25.105.R04.1

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-433: Assignment of Binary Inputs and Output Relays**

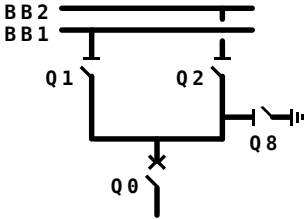
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$         |

**Tab. A5-434: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q1=X) \ \& \ /(Q2=X) \ \& \ (Q8=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$   |

**Tab. A5-435: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.146 Bay type No. 126: Feeder bay with circuit breaker, double busbar**  
A25.105.R04.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-436: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q1=X) \ \& \ /(Q2=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q8=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$   |

**Tab. A5-437: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q1=X) \ \& \ /(Q2=X) \ \& \ (Q8=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q1              | Close(d)    | $(Q8=0)$   |
| Q2              | Close(d)    | $(Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$   |

**Tab. A5-438: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.147 Bay type No. 127: Feeder bay with circuit breaker, double busbar**  
A25.128.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q0 (DEV01)      | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| Q1 (DEV02)      | Open     | U A03        | /            |  |
|                 | Close(d) | U A04        | /            |  |
| Q2 (DEV03)      | Open     | U A05        | /            |  |
|                 | Close(d) | U A06        | /            |  |
| Q81 (DEV04)     | Open     | U B01        | /            |  |
|                 | Close(d) | U B02        | /            |  |
| Q82 (DEV05)     | Open     | U B03        | /            |  |
|                 | Close(d) | U B04        | /            |  |

**Tab. A5-439: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q81=0) \ \& \ (Q82=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q81=0) \ \& \ (Q82=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |

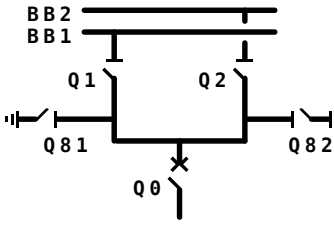
**Tab. A5-440: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q81=0) \ \& \ (Q82=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q81=0) \ \& \ (Q82=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |

**Tab. A5-441: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.1.148****Bay type No. 128: Feeder bay with circuit breaker, double busbar**

A25.128.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q81 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q82 (DEV05)     | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |

**Tab. A5-442: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q81=0) \ \& \ (Q82=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q81=0) \ \& \ (Q82=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q1              | Open        | $(Q0=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q2=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q2              | Open        | $(Q0=0) \ \& \ (Q1=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q81             | Open        | $(Q0=I) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$                         |
| Q82             | Open        | $(Q0=I) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$                         |

**Tab. A5-443: Bay Interlock Equations for Operation without Station Interlocking**

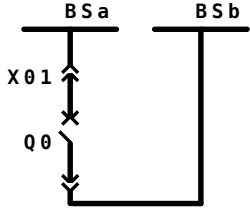
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q81=0) \ \& \ (Q82=0)$   |
|                 | Close(d)    | $\neg(Q1=X) \ \& \ \neg(Q2=X) \ \& \ (Q81=0) \ \& \ (Q82=0) \ \& \ \neg(\text{FctBl1}=1) \ \& \ \neg(\text{FctBl2}=1)$ |
| Q1              | Close(d)    | $(Q81=0) \ \& \ (Q82=0)$   |
| Q2              | Close(d)    | $(Q81=0) \ \& \ (Q82=0)$   |
| Q81             | Open        | $(Q0=1) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ \neg(\text{FctBl1}=1) \ \& \ \neg(\text{FctBl2}=1)$                         |
| Q82             | Open        | $(Q0=1) \ \& \ (Q1=0) \ \& \ (Q2=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q1=0) \ \& \ (Q2=0) \ \& \ \neg(\text{FctBl1}=1) \ \& \ \neg(\text{FctBl2}=1)$                         |

**Tab. A5-444: Bay Interlock Equations for Operation with Station Interlocking**

## A5.2.2 Bus Sectionalizer Bays

### A5.2.2.1 Bay type No. 133: Bus sectionalizer bay with circuit breaker, single busbar

L11.100.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |

Tab. A5-445: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

Tab. A5-446: Bay Interlock Equations for Operation without Station Interlocking

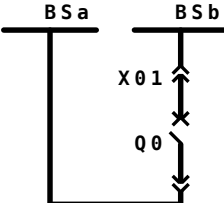
| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

Tab. A5-447: Bay Interlock Equations for Operation with Station Interlocking



### A5.2.2.2 Bay type No. 553: Bus sectionalizer bay with circuit breaker, single busbar

L11.100.R01.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |

Tab. A5-448: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

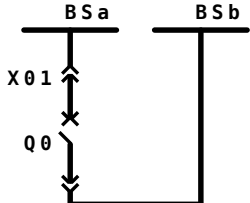
Tab. A5-449: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

Tab. A5-450: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.2.3****Bay type No. 134: Bus sectionalizer bay with circuit breaker, single busbar**

L11.100.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |

**Tab. A5-451: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| X01             | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0)$  |

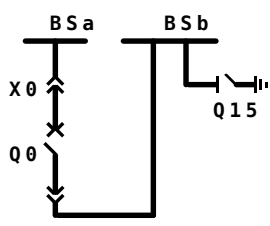
**Tab. A5-452: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| X01             | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0)$  |

**Tab. A5-453: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.4****Bay type No. 528: Bus sectionalizer bay with circuit breaker, single busbar**

L11.102.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q15 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-454: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |

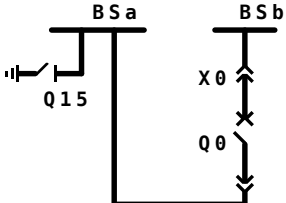
**Tab. A5-455: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |

**Tab. A5-456: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.5****Bay type No. 542: Bus sectionalizer bay with circuit breaker, single busbar**

L11.102.R01.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q15 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-457: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $/(X0=X) \ \& \ (Q15=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

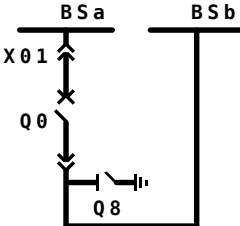
**Tab. A5-458: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $/(X0=X) \ \& \ (Q15=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-459: Bay Interlock Equations for Operation with Station Interlocking**

### A5.2.2.6 Bay type No. 135: Bus sectionalizer bay with circuit breaker, single busbar

L11.104.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

Tab. A5-460: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

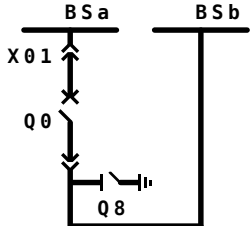
Tab. A5-461: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

Tab. A5-462: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.2.7****Bay type No. 136: Bus sectionalizer bay with circuit breaker, single busbar**

L11.104.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-463: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(FctBl1=l) \ \& \ \neg(FctBl2=l)$ |
| X01             | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                    |

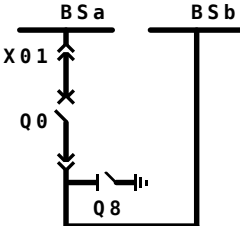
**Tab. A5-464: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(FctBl1=l) \ \& \ \neg(FctBl2=l)$ |
| X01             | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                    |

**Tab. A5-465: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.8****Bay type No. 137: Bus sectionalizer bay with circuit breaker, single busbar**

L11.104.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q8 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |

**Tab. A5-466: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X01=0) \ \& \ (Q8=I)$                                   |
| X01             | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                    |

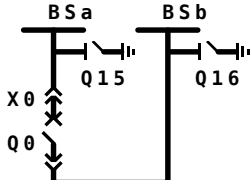
**Tab. A5-467: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X01=0)$   |
| X01             | Open        | $(Q0=0)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$                                    |

**Tab. A5-468: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.9****Bay type No. 547: Bus sectionalizer bay with circuit breaker, single busbar, direct motor control**

L11.112.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q15 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q16 (DEV04)                          | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-469: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q15             | Close(d)    | $(Q15=I)$  |
| Q16             | Close(d)    | $(Q16=I)$  |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0) \ \& \ (Q16=0)$   |

**Tab. A5-470: Bay Interlock Equations for Operation without Station Interlocking**

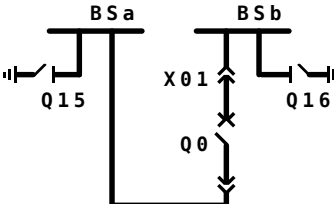
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0) \ \& \ (Q16=0)$   |

**Tab. A5-471: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.2.10****Bay type No. 564: Bus sectionalizer bay with circuit breaker, single busbar**

L11.112.R01.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q15 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q16 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-472: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |

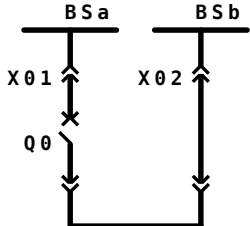
**Tab. A5-473: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation  |
|-----------------|-------------|---|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |

**Tab. A5-474: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.11****Bay type No. 138: Bus sectionalizer bay with circuit breaker, single busbar**

L11.116.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| X02 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-475: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

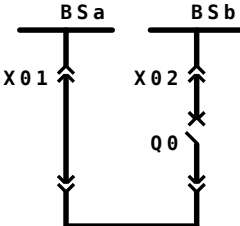
**Tab. A5-476: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-477: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.12****Bay type No. 545: Bus sectionalizer bay with circuit breaker, single busbar**

L11.116.R01.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| X02 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-478: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

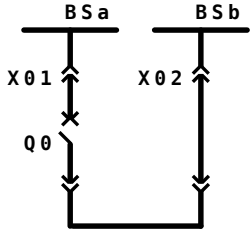
**Tab. A5-479: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

**Tab. A5-480: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.13****Bay type No. 139: Bus sectionalizer bay with circuit breaker, single busbar**

L11.116.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X02 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |

**Tab. A5-481: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X01             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X02             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

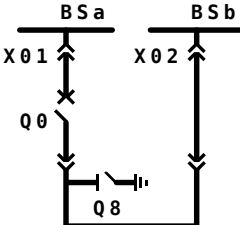
**Tab. A5-482: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X01             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X02             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-483: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.14****Bay type No. 548: Bus sectionalizer bay with circuit breaker, single busbar, direct motor control**

L11.120.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| X02 (DEV04)                          | Open     | U B01        | /            |   |
|                                      | Close(d) | U B02        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-484: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X01=0) \ \& \ (X02=0)$   |
| X01             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

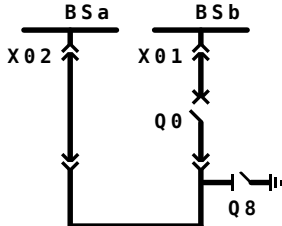
**Tab. A5-485: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X01=0) \ \& \ (X02=0)$   |
| X01             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-486: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.15****Bay type No. 552: Bus sectionalizer bay with circuit breaker, single busbar, direct motor control**

L11.120.M03.2

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| X02 (DEV04)                          | Open     | U B01        | /            |   |
|                                      | Close(d) | U B02        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-487: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X01=0) \ \& \ (X02=0)$   |
| X01             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

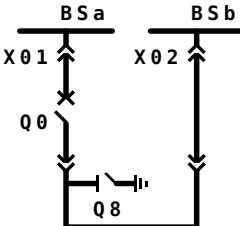
**Tab. A5-488: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X01=0) \ \& \ (X02=0)$   |
| X01             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-489: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.16****Bay type No. 140: Bus sectionalizer bay with circuit breaker, single busbar**

L11.120.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| X02 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-490: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

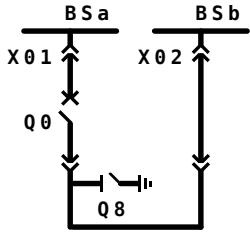
**Tab. A5-491: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-492: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.17****Bay type No. 141: Bus sectionalizer bay with circuit breaker, single busbar**

L11.120.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X02 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-493: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X01             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| X02             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-494: Bay Interlock Equations for Operation without Station Interlocking**

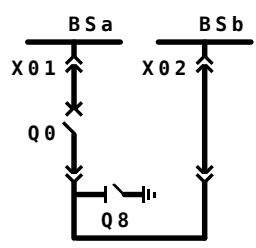
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X01             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| X02             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-495: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.2.18****Bay type No. 543: Bus sectionalizer bay with circuit breaker, single busbar**

L11.120.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X02 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q8 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-496: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X01=0) \ \& \ (X02=0)$   |
| X01             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-497: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X01=0) \ \& \ (X02=0)$   |
| X01             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-498: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.19****Bay type No. 142: Bus sectionalizer bay with circuit breaker, single busbar**

L11.120.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q0 (DEV01)      | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| X01 (DEV02)     | Open     | U A03        | K A03        |  |
|                 | Close(d) | U A04        | K A04        |  |
| X02 (DEV03)     | Open     | U A05        | K A05        |  |
|                 | Close(d) | U A06        | K A06        |  |
| Q8 (DEV04)      | Open     | U B01        | K B01        |  |
|                 | Close(d) | U B02        | K B02        |  |

**Tab. A5-499: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X01=0) \ \& \ (X02=0)$   |
| X01             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| X02             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

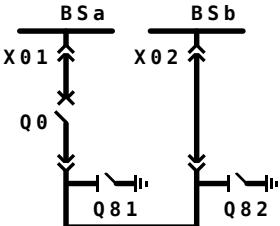
**Tab. A5-500: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q8              | Close(d)    | $(X01=0) \ \& \ (X02=0)$   |
| X01             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| X02             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-501: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.20****Bay type No. 558: Bus sectionalizer bay with circuit breaker, single busbar**

L11.128.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| X02 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q81 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q82 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-502: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

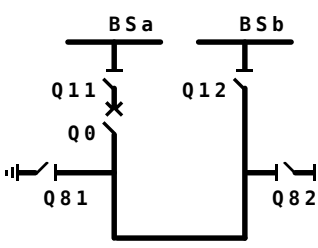
**Tab. A5-503: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-504: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.21****Bay type No. 143: Bus sectionalizer bay with circuit breaker, single busbar, direct motor control**

L13.113.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q12 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q81 (DEV04)                          | Open     | U B01        | /            |   |
|                                      | Close(d) | U B02        | /            |   |
| Q82 (DEV05)                          | Open     | U B03        | /            |   |
|                                      | Close(d) | U B04        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-505: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q81=0) \ \& \ (Q82=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |

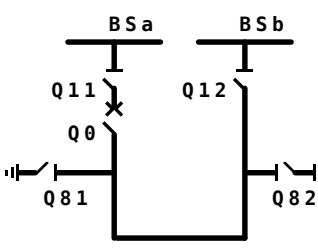
**Tab. A5-506: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q81=0) \ \& \ (Q82=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |

**Tab. A5-507: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.22****Bay type No. 144: Bus sectionalizer bay with circuit breaker, single busbar, direct motor control**

L13.113.M05

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q12 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q81 (DEV04)                          | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Q82 (DEV05)                          | Open     | U B03        | K B03        |   |
|                                      | Close(d) | U B04        | K B04        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-508: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q81=0) \ \& \ (Q82=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q81             | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |
| Q82             | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |

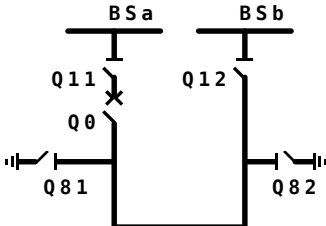
**Tab. A5-509: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q81=0) \ \& \ (Q82=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q81             | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |
| Q82             | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |

**Tab. A5-510: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.23****Bay type No. 145: Bus sectionalizer bay with circuit breaker, single busbar**

L13.113.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q12 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q81 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q82 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-511: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \wedge \neg(Q12=X) \wedge (Q81=0) \wedge (Q82=0) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |

**Tab. A5-512: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \wedge \neg(Q12=X) \wedge (Q81=0) \wedge (Q82=0) \wedge \neg(FctBI1=I) \wedge \neg(FctBI2=I)$ |

**Tab. A5-513: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.2.24****Bay type No. 146: Bus sectionalizer bay with circuit breaker, single busbar**

L13.113.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q0 (DEV01)      | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| Q11 (DEV02)     | Open     | U A03        | K A03        |  |
|                 | Close(d) | U A04        | K A04        |  |
| Q12 (DEV03)     | Open     | U A05        | K A05        |  |
|                 | Close(d) | U A06        | K A06        |  |
| Q81 (DEV04)     | Open     | U B01        | /            |  |
|                 | Close(d) | U B02        | /            |  |
| Q82 (DEV05)     | Open     | U B03        | /            |  |
|                 | Close(d) | U B04        | /            |  |

**Tab. A5-514: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \wedge \neg(Q12=X) \wedge (Q81=0) \wedge (Q82=0) \wedge \neg(FctBl1=I) \wedge \neg(FctBl2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q81=0) \wedge (Q82=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q81=0) \wedge (Q82=0)$   |

**Tab. A5-515: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \wedge \neg(Q12=X) \wedge (Q81=0) \wedge (Q82=0) \wedge \neg(FctBl1=I) \wedge \neg(FctBl2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q81=0) \wedge (Q82=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q81=0) \wedge (Q82=0)$   |

**Tab. A5-516: Bay Interlock Equations for Operation with Station Interlocking**

## A5.2.2.25

**Bay type No. 517: Bus sectionalizer bay with circuit breaker, single busbar**

L13.113.R03.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q0 (DEV01)      | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| Q11 (DEV02)     | Open     | U A03        | K A03        |  |
|                 | Close(d) | U A04        | K A04        |  |
| Q12 (DEV03)     | Open     | U A05        | /            |  |
|                 | Close(d) | U A06        | /            |  |
| Q81 (DEV04)     | Open     | U B01        | K B01        |  |
|                 | Close(d) | U B02        | K B02        |  |
| Q82 (DEV05)     | Open     | U B03        | /            |  |
|                 | Close(d) | U B04        | /            |  |

**Tab. A5-517: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q81=0) \ \& \ (Q82=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q81             | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |

**Tab. A5-518: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q81=0) \ \& \ (Q82=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q81             | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |

**Tab. A5-519: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.26****Bay type No. 147: Bus sectionalizer bay with circuit breaker, single busbar**

L13.113.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q0 (DEV01)      | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| Q11 (DEV02)     | Open     | U A03        | K A03        |  |
|                 | Close(d) | U A04        | K A04        |  |
| Q12 (DEV03)     | Open     | U A05        | K A05        |  |
|                 | Close(d) | U A06        | K A06        |  |
| Q81 (DEV04)     | Open     | U B01        | K B01        |  |
|                 | Close(d) | U B02        | K B02        |  |
| Q82 (DEV05)     | Open     | U B03        | K B03        |  |
|                 | Close(d) | U B04        | K B04        |  |

**Tab. A5-520: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q81=0) \ \& \ (Q82=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q81             | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |
| Q82             | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |

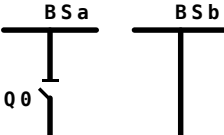
**Tab. A5-521: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q81=0) \ \& \ (Q82=0) \ \& \ \neg(\text{FctBl1}=I) \ \& \ \neg(\text{FctBl2}=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q81=0) \ \& \ (Q82=0)$   |
| Q81             | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |
| Q82             | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |

**Tab. A5-522: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.27****Bay type No. 148: Bus sectionalizer bay with switch disconnecter, single busbar**

L13.200.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |

**Tab. A5-523: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

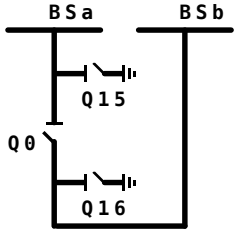
**Tab. A5-524: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-525: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.28****Bay type No. 149: Bus sectionalizer bay with switch disconnecter, single busbar**

L13.202.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q15 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q16 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-526: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation                                 |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q15=0) \& (Q16=0) \& /(FctBI1=I) \& /(FctBI2=I)$ |

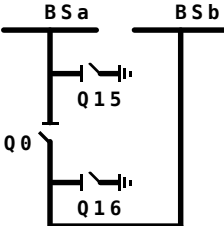
**Tab. A5-527: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation                                 |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q15=0) \& (Q16=0) \& /(FctBI1=I) \& /(FctBI2=I)$ |

**Tab. A5-528: Bay Interlock Equations for Operation with Station Interlocking**

### A5.2.2.29 Bay type No. 150: Bus sectionalizer bay with switch disconnecter, single busbar

L13.202.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q15 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q16 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |

Tab. A5-529: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation                                 |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q15=0) \& (Q16=0) \& /(FctBI1=I) \& /(FctBI2=I)$ |
| Q15             | Close(d)    | $(Q0=0) \& (Q15=I)$                                |
| Q16             | Close(d)    | $(Q0=0) \& (Q16=I)$                                |

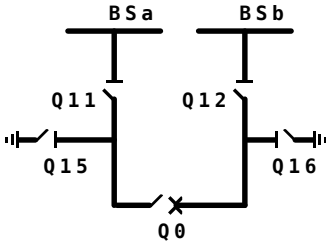
Tab. A5-530: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation                                 |
|-----------------|-------------|--|
| Q0              | Close(d)    | $(Q15=0) \& (Q16=0) \& /(FctBI1=I) \& /(FctBI2=I)$ |
| Q15             | Close(d)    | $(Q0=0)$   |
| Q16             | Close(d)    | $(Q0=0)$   |

Tab. A5-531: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.2.30****Bay type No. 226: Bus sectionalizer bay with circuit breaker, single busbar, direct motor control**

L15.113.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q12 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)                          | Open     | U B01        | /            |   |
|                                      | Close(d) | U B02        | /            |   |
| Q16 (DEV05)                          | Open     | U B03        | /            |   |
|                                      | Close(d) | U B04        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-532: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \& (Q16=0)$   |
|                 | Close(d)    | $/(Q11=X) \& /(Q12=X) \& (Q15=0) \& (Q16=0) \& /(FctBI1=I) \& /(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q16=0)$  |

**Tab. A5-533: Bay Interlock Equations for Operation without Station Interlocking**



| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q16=0)$   |
|                 | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q16=0)$  |

**Tab. A5-534: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.31****Bay type No. 151: Bus sectionalizer bay with circuit breaker, single busbar, direct motor control**

L15.113.M05

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|--|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |  |
|                                      | Close(d) | U A02        | K A02        |  |
| Q11 (DEV02)                          | Open     | U A03        | K A03        |  |
|                                      | Close(d) | U A04        | K A04        |  |
| Q12 (DEV03)                          | Open     | U A05        | K A05        |  |
|                                      | Close(d) | U A06        | K A06        |  |
| Q15 (DEV04)                          | Open     | U B01        | K B01        |  |
|                                      | Close(d) | U B02        | K B02        |  |
| Q16 (DEV05)                          | Open     | U B03        | K B03        |  |
|                                      | Close(d) | U B04        | K B04        |  |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |  |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |  |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |  |

**Tab. A5-535: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q16=0)$   |
|                 | Close(d)    | $/(Q11=X) \ \& \ /(Q12=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q16=0)$  |
| Q15             | Open        | $(Q0=I) \ \& \ (Q12=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=I) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I) \ \& \ (Q15=I)$    |
| Q16             | Open        | $(Q0=I) \ \& \ (Q11=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q12=0) \ \& \ (Q11=I) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I) \ \& \ (Q16=I)$    |

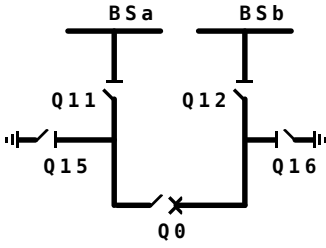
**Tab. A5-536: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q16=0)$   |
|                 | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q16=0)$  |
| Q15             | Open        | $(Q0=1) \ \& \ (Q12=1)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=1) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$                         |
| Q16             | Open        | $(Q0=1) \ \& \ (Q11=1)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q12=0) \ \& \ (Q11=1) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$                         |

**Tab. A5-537: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.32****Bay type No. 152: Bus sectionalizer bay with circuit breaker, single busbar**

L15.113.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q12 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q15 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q16 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-538: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q16=0)$   |
|                 | Close(d)    | $/(Q11=X) \ \& \ /(Q12=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

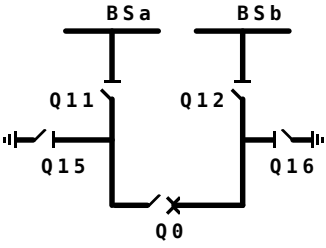
**Tab. A5-539: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q16=0)$   |
|                 | Close(d)    | $/(Q11=X) \ \& \ /(Q12=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-540: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.33****Bay type No. 227: Bus sectionalizer bay with circuit breaker, single busbar**

L15.113.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q12 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q16 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-541: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q16=0)$   |
|                 | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q16=0)$  |

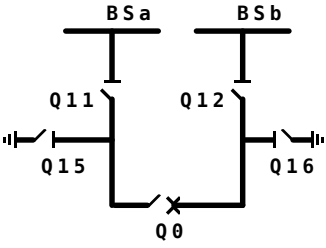
**Tab. A5-542: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q16=0)$   |
|                 | Close(d)    | $/(Q11=X) \ \& \ /(Q12=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q16=0)$  |

**Tab. A5-543: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.34****Bay type No. 153: Bus sectionalizer bay with circuit breaker, single busbar**

L15.113.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q12 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q16 (DEV05)     | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |

**Tab. A5-544: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q16=0)$   |
|                 | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q16=0)$  |
| Q15             | Open        | $(Q0=I) \ \& \ (Q12=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=I) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I) \ \& \ (Q15=I)$          |
| Q16             | Open        | $(Q0=I) \ \& \ (Q11=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q12=0) \ \& \ (Q11=I) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I) \ \& \ (Q16=I)$          |

**Tab. A5-545: Bay Interlock Equations for Operation without Station Interlocking**

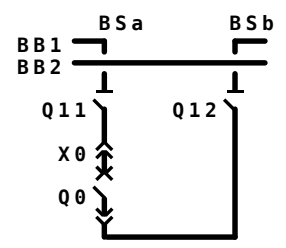
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \& (Q16=0)$   |
|                 | Close(d)    | $/(Q11=X) \& /(Q12=X) \& (Q15=0) \& (Q16=0) \& /(FctBI1=I) \& /(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q16=0)$  |
| Q15             | Open        | $(Q0=I) \& (Q12=I)$  |
|                 | Close(d)    | $(Q0=0) \& (Q11=0) \& (Q12=I) \& /(FctBI1=I) \& /(FctBI2=I)$               |
| Q16             | Open        | $(Q0=I) \& (Q11=I)$  |
|                 | Close(d)    | $(Q0=0) \& (Q12=0) \& (Q11=I) \& /(FctBI1=I) \& /(FctBI2=I)$               |

**Tab. A5-546: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.2.35****Bay type No. 154: Bus sectionalizer bay with circuit breaker, double busbar, direct motor control**

L21.101.M04.1

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q12 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-547: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |

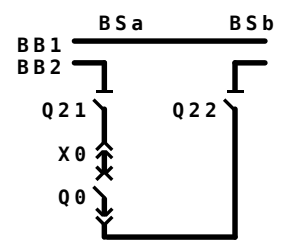
**Tab. A5-548: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |

**Tab. A5-549: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.36****Bay type No. 155: Bus sectionalizer bay with circuit breaker, double busbar, direct motor control**

L21.101.M04.2

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q21 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q22 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-550: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q21=0) \ \& \ (Q22=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q21=0) \ \& \ (Q22=0)$   |

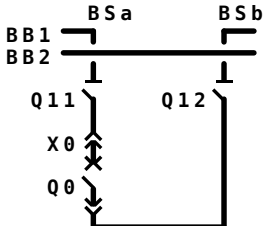
**Tab. A5-551: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q21=0) \ \& \ (Q22=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q21=0) \ \& \ (Q22=0)$   |

**Tab. A5-552: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.37****Bay type No. 156: Bus sectionalizer bay with circuit breaker, double busbar**

L21.101.R01.1

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q12 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-553: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

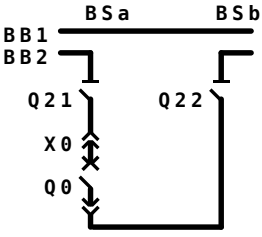
**Tab. A5-554: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-555: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.38****Bay type No. 157: Bus sectionalizer bay with circuit breaker, double busbar**

L21.101.R01.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q21 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q22 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-556: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

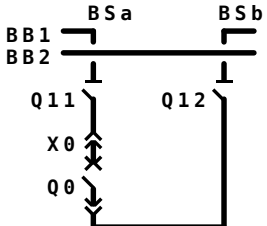
**Tab. A5-557: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-558: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.39****Bay type No. 158: Bus sectionalizer bay with circuit breaker, double busbar**

L21.101.R03.1

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q12 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-559: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-560: Bay Interlock Equations for Operation without Station Interlocking**

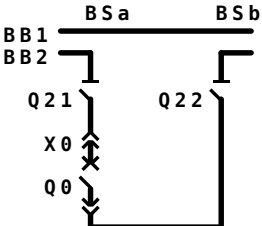
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-561: Bay Interlock Equations for Operation with Station Interlocking**

## A5.2.2.40

**Bay type No. 159: Bus sectionalizer bay with circuit breaker, double busbar**

L21.101.R03.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q21 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q22 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-562: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-563: Bay Interlock Equations for Operation without Station Interlocking**

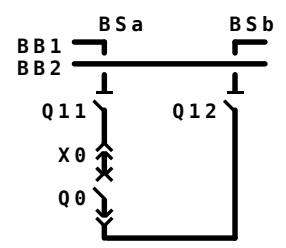
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-564: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.2.41****Bay type No. 160: Bus sectionalizer bay with circuit breaker, double busbar**

L21.101.R04.1

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q12 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-565: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |

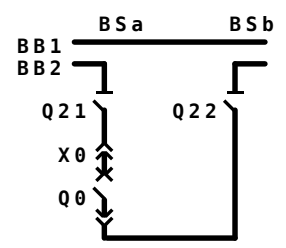
**Tab. A5-566: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=0)$   |

**Tab. A5-567: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.42****Bay type No. 161: Bus sectionalizer bay with circuit breaker, double busbar**

L21.101.R04.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q21 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q22 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-568: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q21=0) \ \& \ (Q22=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q21=0) \ \& \ (Q22=0)$   |

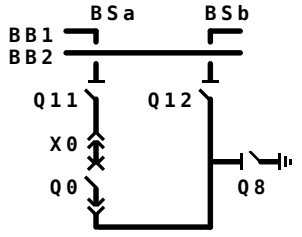
**Tab. A5-569: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q21=0) \ \& \ (Q22=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q21=0) \ \& \ (Q22=0)$   |

**Tab. A5-570: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.43****Bay type No. 513: Bus sectionalizer bay with circuit breaker, double busbar**

L21.109.R03.1

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q12 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-571: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \wedge \neg(Q12=X) \wedge \neg(X0=X) \wedge (Q8=0) \wedge \neg(\text{FctBI1}=I) \wedge \neg(\text{FctBI2}=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q8=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q8=0)$   |

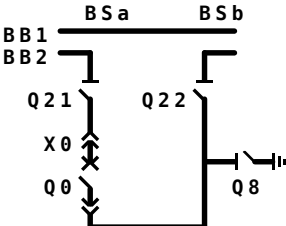
**Tab. A5-572: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q11=X) \wedge \neg(Q12=X) \wedge \neg(X0=X) \wedge (Q8=0) \wedge \neg(\text{FctBI1}=I) \wedge \neg(\text{FctBI2}=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q8=0)$   |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q8=0)$   |

**Tab. A5-573: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.44****Bay type No. 514: Bus sectionalizer bay with circuit breaker, double busbar**

L21.109.R03.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q21 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q22 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q8 (DEV05)      | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-574: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(X0=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-575: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(X0=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-576: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.45****Bay type No. 162: Bus sectionalizer bay with circuit breaker, double busbar**

L23.101.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q01 (DEV01)     | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| Q02 (DEV02)     | Open     | U A03        | K A03        |  |
|                 | Close(d) | U A04        | K A04        |  |
| Q11 (DEV03)     | Open     | U A05        | /            |  |
|                 | Close(d) | U A06        | /            |  |
| Q12 (DEV04)     | Open     | U B01        | /            |  |
|                 | Close(d) | U B02        | /            |  |
| Q21 (DEV05)     | Open     | U B03        | /            |  |
|                 | Close(d) | U B04        | /            |  |
| Q22 (DEV06)     | Open     | U B05        | /            |  |
|                 | Close(d) | U B06        | /            |  |

**Tab. A5-577: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q02             | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-578: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q02             | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-579: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.46****Bay type No. 163: Bus sectionalizer bay with circuit breaker, double busbar**

L23.101.R06

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q01 (DEV01)     | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| Q02 (DEV02)     | Open     | U A03        | K A03        |  |
|                 | Close(d) | U A04        | K A04        |  |
| Q11 (DEV03)     | Open     | U A05        | K A05        |  |
|                 | Close(d) | U A06        | K A06        |  |
| Q12 (DEV04)     | Open     | U B01        | K B01        |  |
|                 | Close(d) | U B02        | K B02        |  |
| Q21 (DEV05)     | Open     | U B03        | K B03        |  |
|                 | Close(d) | U B04        | K B04        |  |
| Q22 (DEV06)     | Open     | U B05        | K B05        |  |
|                 | Close(d) | U B06        | K B06        |  |

**Tab. A5-580: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q02             | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q11             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0)$  |
| Q12             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0)$  |
| Q21             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0)$  |
| Q22             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0)$  |

**Tab. A5-581: Bay Interlock Equations for Operation without Station Interlocking**

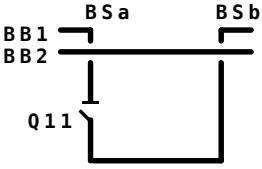


| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q01             | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q02             | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q11             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0)$  |
| Q12             | Open        | $(Q01=0)$  |
|                 | Close(d)    | $(Q01=0)$  |
| Q21             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0)$  |
| Q22             | Open        | $(Q02=0)$  |
|                 | Close(d)    | $(Q02=0)$  |

**Tab. A5-582: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.47****Bay type No. 554: Bus sectionalizer bay with other switchgear unit, double busbar, direct motor control**

L23.901.M01.1

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q11 (DEV01)                          | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-583: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

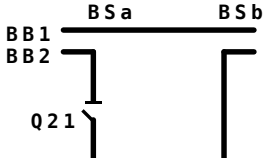
**Tab. A5-584: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-585: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.48****Bay type No. 555: Bus sectionalizer bay with other switchgear unit, double busbar, direct motor control**

L23.901.M01.2

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q21 (DEV01)                          | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-586: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

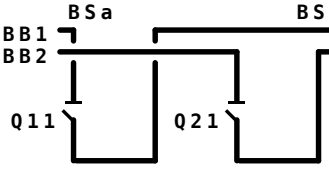
**Tab. A5-587: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-588: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.49****Bay type No. 164: Bus sectionalizer bay with other switchgear unit, double busbar**

L23.901.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q11 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q21 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |

**Tab. A5-589: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q11             | Open        | $(Q11=0)$          |
|                 | Close(d)    | $(Q11=1)$          |
| Q21             | Open        | $(Q21=0)$          |
|                 | Close(d)    | $(Q21=1)$          |

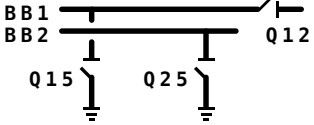
**Tab. A5-590: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-591: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.50****Bay type No. 242: Bus sectionalizer bay with other switchgear unit, double busbar, direct motor control**

L23.903.M01.3

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q12 (DEV01)                          | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q15 (DEV02)                          | Open     | U A03        | /            |   |
|                                      | Close(d) | U A04        | /            |   |
| Q25 (DEV03)                          | Open     | U A05        | /            |   |
|                                      | Close(d) | U A06        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-592: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q12             | Open        | $(Q12=0)$          |
|                 | Close(d)    | $(Q12=1)$          |

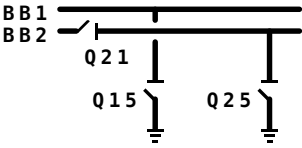
**Tab. A5-593: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-594: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.51****Bay type No. 243: Bus sectionalizer bay with other switchgear unit, double busbar, direct motor control**

L23.903.M01.4

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q21 (DEV01)                          | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q15 (DEV02)                          | Open     | U A03        | /            |   |
|                                      | Close(d) | U A04        | /            |   |
| Q25 (DEV03)                          | Open     | U A05        | /            |   |
|                                      | Close(d) | U A06        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-595: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q21             | Open        | $(Q21=0)$          |
|                 | Close(d)    | $(Q21=1)$          |

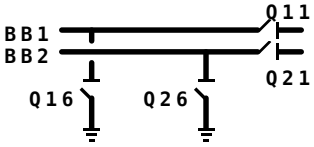
**Tab. A5-596: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-597: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.52****Bay type No. 511: Bus sectionalizer bay with other switchgear unit, double busbar, direct motor control**

L23.903.M02

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q11 (DEV01)                          | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q21 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q16 (DEV03)                          | Open     | U A05        | /            |   |
|                                      | Close(d) | U A06        | /            |   |
| Q26 (DEV04)                          | Open     | U B01        | /            |   |
|                                      | Close(d) | U B02        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-598: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q11             | Open        | $(Q11=0)$          |
|                 | Close(d)    | $(Q11=1)$          |
| Q21             | Open        | $(Q21=0)$          |
|                 | Close(d)    | $(Q21=1)$          |

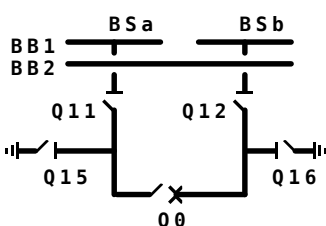
**Tab. A5-599: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-600: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.53****Bay type No. 228: Bus sectionalizer bay with circuit breaker, double busbar, direct motor control**

L25.113.M03.1

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q12 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)                          | Open     | U B01        | /            |   |
|                                      | Close(d) | U B02        | /            |   |
| Q16 (DEV05)                          | Open     | U B03        | /            |   |
|                                      | Close(d) | U B04        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-601: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \& (Q16=0)$   |
|                 | Close(d)    | $/(Q11=X) \& /(Q12=X) \& (Q15=0) \& (Q16=0) \& /(FctBI1=I) \& /(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q16=0)$  |

**Tab. A5-602: Bay Interlock Equations for Operation without Station Interlocking**



| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q16=0)$   |
|                 | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q16=0)$  |

**Tab. A5-603: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.54****Bay type No. 229: Bus sectionalizer bay with circuit breaker, double busbar, direct motor control**

L25.113.M03.2

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|--|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |  |
|                                      | Close(d) | U A02        | K A02        |  |
| Q21 (DEV02)                          | Open     | U A03        | K A03        |  |
|                                      | Close(d) | U A04        | K A04        |  |
| Q22 (DEV03)                          | Open     | U A05        | K A05        |  |
|                                      | Close(d) | U A06        | K A06        |  |
| Q25 (DEV04)                          | Open     | U B01        | /            |  |
|                                      | Close(d) | U B02        | /            |  |
| Q26 (DEV05)                          | Open     | U B03        | /            |  |
|                                      | Close(d) | U B04        | /            |  |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |  |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |  |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |  |

**Tab. A5-604: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q25=0) \ \& \ (Q26=0)$   |
|                 | Close(d)    | $/(Q21=X) \ \& \ /(Q22=X) \ \& \ (Q25=0) \ \& \ (Q26=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q26=0)$  |

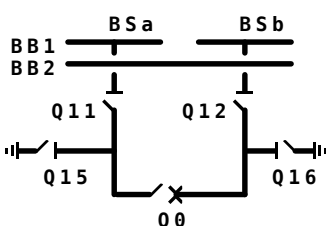
**Tab. A5-605: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q25=0) \ \& \ (Q26=0)$   |
|                 | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ (Q25=0) \ \& \ (Q26=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q26=0)$  |

**Tab. A5-606: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.55****Bay type No. 165: Bus sectionalizer bay with circuit breaker, double busbar, direct motor control**

L25.113.M05.1

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q12 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)                          | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Q16 (DEV05)                          | Open     | U B03        | K B03        |   |
|                                      | Close(d) | U B04        | K B04        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-607: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \& (Q16=0)$   |
|                 | Close(d)    | $/(Q11=X) \& /(Q12=X) \& (Q15=0) \& (Q16=0) \& /(FctBl1=I) \& /(FctBl2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q16=0)$  |
| Q15             | Open        | $(Q0=I) \& (Q12=I)$  |
|                 | Close(d)    | $(Q0=0) \& (Q11=0) \& (Q12=I) \& /(FctBl1=I) \& /(FctBl2=I) \& (Q15=I)$    |
| Q16             | Open        | $(Q0=I) \& (Q11=I)$  |
|                 | Close(d)    | $(Q0=0) \& (Q12=0) \& (Q11=I) \& /(FctBl1=I) \& /(FctBl2=I) \& (Q16=I)$    |

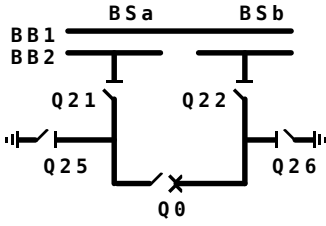
**Tab. A5-608: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q16=0)$   |
|                 | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q16=0)$  |
| Q15             | Open        | $(Q0=1) \ \& \ (Q12=1)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=1) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$                         |
| Q16             | Open        | $(Q0=1) \ \& \ (Q11=1)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q12=0) \ \& \ (Q11=1) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$                         |

**Tab. A5-609: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.56****Bay type No. 166: Bus sectionalizer bay with circuit breaker, double busbar, direct motor control**

L25.113.M05.2

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q21 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q22 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q25 (DEV04)                          | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Q26 (DEV05)                          | Open     | U B03        | K B03        |   |
|                                      | Close(d) | U B04        | K B04        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-610: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q25=0) \ \& \ (Q26=0)$   |
|                 | Close(d)    | $/(Q21=X) \ \& \ /(Q22=X) \ \& \ (Q25=0) \ \& \ (Q26=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q26=0)$  |
| Q25             | Open        | $(Q0=I) \ \& \ (Q22=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q21=0) \ \& \ (Q22=I) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I) \ \& \ (Q25=I)$    |
| Q26             | Open        | $(Q0=I) \ \& \ (Q21=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q22=0) \ \& \ (Q21=I) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I) \ \& \ (Q26=I)$    |

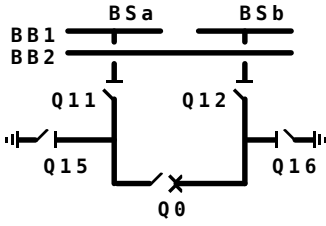
**Tab. A5-611: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q25=0) \ \& \ (Q26=0)$   |
|                 | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ (Q25=0) \ \& \ (Q26=0) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q26=0)$  |
| Q25             | Open        | $(Q0=1) \ \& \ (Q22=1)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q21=0) \ \& \ (Q22=1) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$                         |
| Q26             | Open        | $(Q0=1) \ \& \ (Q21=1)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q22=0) \ \& \ (Q21=1) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$                         |

**Tab. A5-612: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.57****Bay type No. 167: Bus sectionalizer bay with circuit breaker, double busbar**

L25.113.R01.1

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q12 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q15 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q16 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-613: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \& (Q16=0)$   |
|                 | Close(d)    | $/(Q11=X) \& /(Q12=X) \& (Q15=0) \& (Q16=0) \& /(FctBI1=I) \& /(FctBI2=I)$ |

**Tab. A5-614: Bay Interlock Equations for Operation without Station Interlocking**

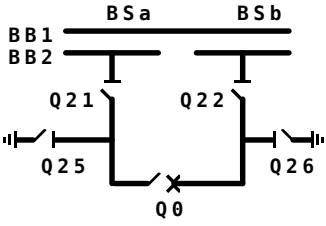
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \& (Q16=0)$   |
|                 | Close(d)    | $/(Q11=X) \& /(Q12=X) \& (Q15=0) \& (Q16=0) \& /(FctBI1=I) \& /(FctBI2=I)$ |

**Tab. A5-615: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.2.58****Bay type No. 168: Bus sectionalizer bay with circuit breaker, double busbar**

L25.113.R01.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q21 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q22 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q25 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q26 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-616: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q25=0) \ \& \ (Q26=0)$   |
|                 | Close(d)    | $/(Q21=X) \ \& \ /(Q22=X) \ \& \ (Q25=0) \ \& \ (Q26=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-617: Bay Interlock Equations for Operation without Station Interlocking**

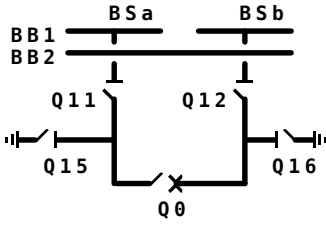
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q25=0) \ \& \ (Q26=0)$   |
|                 | Close(d)    | $/(Q21=X) \ \& \ /(Q22=X) \ \& \ (Q25=0) \ \& \ (Q26=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-618: Bay Interlock Equations for Operation with Station Interlocking**

## A5.2.2.59

**Bay type No. 230: Bus sectionalizer bay with circuit breaker, double busbar**

L25.113.R03.1

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q12 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q16 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-619: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q16=0)$   |
|                 | Close(d)    | $/(Q11=X) \ \& \ /(Q12=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q16=0)$  |

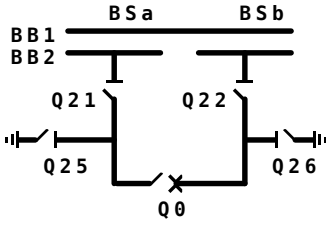
**Tab. A5-620: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q16=0)$   |
|                 | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ \neg(FctBl1=l) \ \& \ \neg(FctBl2=l)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q16=0)$  |

**Tab. A5-621: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.60****Bay type No. 231: Bus sectionalizer bay with circuit breaker, double busbar**

L25.113.R03.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q21 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q22 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q25 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q26 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-622: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q25=0) \ \& \ (Q26=0)$   |
|                 | Close(d)    | $/(Q21=X) \ \& \ /(Q22=X) \ \& \ (Q25=0) \ \& \ (Q26=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q26=0)$  |

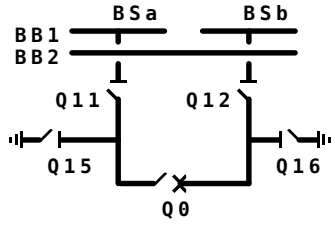
**Tab. A5-623: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q25=0) \ \& \ (Q26=0)$   |
|                 | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ (Q25=0) \ \& \ (Q26=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q26=0)$  |

**Tab. A5-624: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.61****Bay type No. 169: Bus sectionalizer bay with circuit breaker, double busbar**

L25.113.R05.1

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q11 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q12 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q16 (DEV05)     | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |

**Tab. A5-625: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \& (Q16=0)$   |
|                 | Close(d)    | $/(Q11=X) \& /(Q12=X) \& (Q15=0) \& (Q16=0) \& /(FctBI1=I) \& /(FctBI2=I)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q16=0)$  |
| Q15             | Open        | $(Q0=I) \& (Q12=I)$  |
|                 | Close(d)    | $(Q0=0) \& (Q11=0) \& (Q12=I) \& /(FctBI1=I) \& /(FctBI2=I) \& (Q15=I)$    |
| Q16             | Open        | $(Q0=I) \& (Q11=I)$  |
|                 | Close(d)    | $(Q0=0) \& (Q12=0) \& (Q11=I) \& /(FctBI1=I) \& /(FctBI2=I) \& (Q16=I)$    |

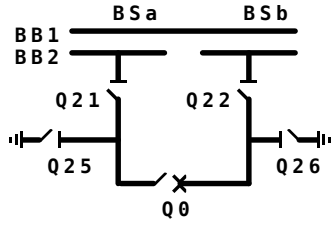
**Tab. A5-626: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q16=0)$   |
|                 | Close(d)    | $\neg(Q11=X) \ \& \ \neg(Q12=X) \ \& \ (Q15=0) \ \& \ (Q16=0) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$ |
| Q11             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q12             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q16=0)$  |
| Q15             | Open        | $(Q0=1) \ \& \ (Q12=1)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q11=0) \ \& \ (Q12=1) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$                         |
| Q16             | Open        | $(Q0=1) \ \& \ (Q11=1)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q12=0) \ \& \ (Q11=1) \ \& \ \neg(\text{FctBI1}=1) \ \& \ \neg(\text{FctBI2}=1)$                         |

**Tab. A5-627: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.2.62****Bay type No. 170: Bus sectionalizer bay with circuit breaker, double busbar**

L25.113.R05.2

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q21 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q22 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q25 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q26 (DEV05)     | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |

**Tab. A5-628: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q25=0) \ \& \ (Q26=0)$   |
|                 | Close(d)    | $/(Q21=X) \ \& \ /(Q22=X) \ \& \ (Q25=0) \ \& \ (Q26=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q26=0)$  |
| Q25             | Open        | $(Q0=I) \ \& \ (Q22=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q21=0) \ \& \ (Q22=I) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I) \ \& \ (Q25=I)$    |
| Q26             | Open        | $(Q0=I) \ \& \ (Q21=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q22=0) \ \& \ (Q21=I) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I) \ \& \ (Q26=I)$    |

**Tab. A5-629: Bay Interlock Equations for Operation without Station Interlocking**

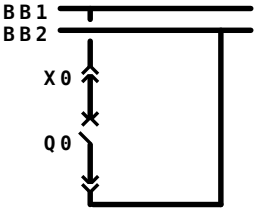


| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q25=0) \ \& \ (Q26=0)$   |
|                 | Close(d)    | $\neg(Q21=X) \ \& \ \neg(Q22=X) \ \& \ (Q25=0) \ \& \ (Q26=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q21             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |
| Q22             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q26=0)$  |
| Q25             | Open        | $(Q0=I) \ \& \ (Q22=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q21=0) \ \& \ (Q22=I) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$                         |
| Q26             | Open        | $(Q0=I) \ \& \ (Q21=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q22=0) \ \& \ (Q21=I) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$                         |

**Tab. A5-630: Bay Interlock Equations for Operation with Station Interlocking**

### A5.2.3 Bus Coupler Bays

#### A5.2.3.1 Bay type No. 505: Bus coupler bay with circuit breaker, double busbar Q21.100.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |

Tab. A5-631: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation                              |
|-----------------|-------------|---|
| Q0              | Close(d)    | $/(X0=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

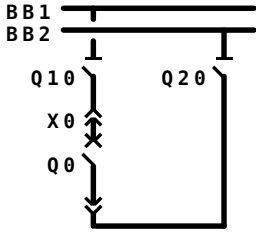
Tab. A5-632: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation                              |
|-----------------|-------------|---|
| Q0              | Close(d)    | $/(X0=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

Tab. A5-633: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.3.2****Bay type No. 197: Bus coupler bay with circuit breaker, double busbar, direct motor control**

Q21.101.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-634: Assignment of Binary Inputs and Output Relays**

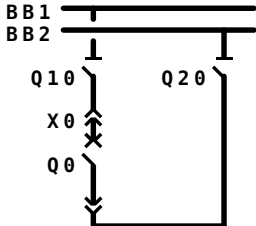
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=0)$   |

**Tab. A5-635: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=0)$   |

**Tab. A5-636: Bay Interlock Equations for Operation with Station Interlocking**

### A5.2.3.3 Bay type No. 198: Bus coupler bay with circuit breaker, double busbar Q21.101.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q20 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-637: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

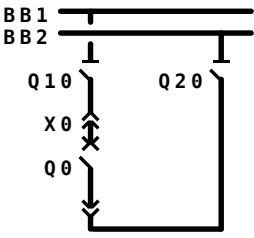
**Tab. A5-638: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-639: Bay Interlock Equations for Operation with Station Interlocking**

## A5.2.3.4

**Bay type No. 199: Bus coupler bay with circuit breaker, double busbar**  
 Q21.101.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-640: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

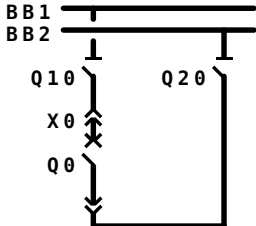
**Tab. A5-641: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-642: Bay Interlock Equations for Operation with Station Interlocking**

### A5.2.3.5 Bay type No. 200: Bus coupler bay with circuit breaker, double busbar

Q21.101.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-643: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=0)$   |

**Tab. A5-644: Bay Interlock Equations for Operation without Station Interlocking**

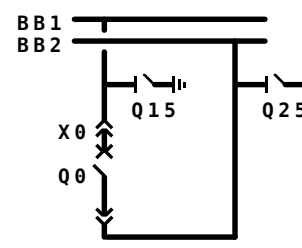
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=0)$   |

**Tab. A5-645: Bay Interlock Equations for Operation with Station Interlocking**



### A5.2.3.6 Bay type No. 556: Bus coupler bay with circuit breaker, double busbar, direct motor control

Q21.112.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q15 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q25 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

Tab. A5-646: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ (Q25=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q15             | Close(d)    | $(Q15=I)$  |
| Q25             | Close(d)    | $(Q25=I)$  |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

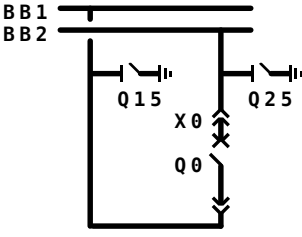
Tab. A5-647: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ (Q25=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

Tab. A5-648: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.3.7****Bay type No. 565: Bus coupler bay with circuit breaker, double busbar, direct motor control**

Q21.112.M04.2

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q15 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q25 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| X0 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-649: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ (Q25=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q15             | Close(d)    | $(Q15=I)$  |
| Q25             | Close(d)    | $(Q25=I)$  |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-650: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ (Q15=0) \ \& \ (Q25=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| X0              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-651: Bay Interlock Equations for Operation with Station Interlocking**

### A5.2.3.8 Bay type No. 201: Bus coupler bay with circuit breaker, double busbar Q21.117.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q0 (DEV01)      | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| Q10 (DEV02)     | Open     | U A03        | /            |  |
|                 | Close(d) | U A04        | /            |  |
| Q20 (DEV03)     | Open     | U A05        | /            |  |
|                 | Close(d) | U A06        | /            |  |
| Q11 (DEV04)     | Open     | U B01        | /            |  |
|                 | Close(d) | U B02        | /            |  |
| Q21 (DEV05)     | Open     | U B03        | /            |  |
|                 | Close(d) | U B04        | /            |  |
| X0 (DEV06)      | Open     | U B05        | /            |  |
|                 | Close(d) | U B06        | /            |  |

**Tab. A5-652: Assignment of Binary Inputs and Output Relays**

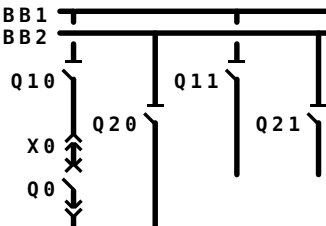
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-653: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-654: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.9****Bay type No. 202: Bus coupler bay with circuit breaker, double busbar**  
Q21.117.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q11 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q21 (DEV05)     | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |
| X0 (DEV06)      | Open     | U B05        | /            |   |
|                 | Close(d) | U B06        | /            |   |

**Tab. A5-655: Assignment of Binary Inputs and Output Relays**

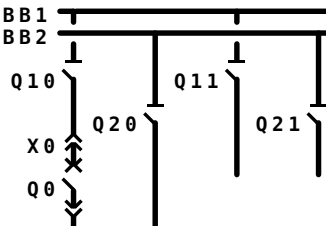
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-656: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-657: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.10****Bay type No. 203: Bus coupler bay with circuit breaker, double busbar**  
Q21.117.R06

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q11 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q21 (DEV05)     | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |
| X0 (DEV06)      | Open     | U B05        | K B05        |   |
|                 | Close(d) | U B06        | K B06        |   |

**Tab. A5-658: Assignment of Binary Inputs and Output Relays**

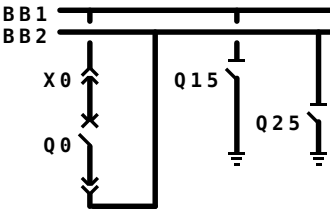
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=0)$   |

**Tab. A5-659: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(X0=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| X0              | Open        | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=0)$   |

**Tab. A5-660: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.11****Bay type No. 245: Bus coupler bay with circuit breaker, double busbar**  
Q21.132.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q15 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q25 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-661: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

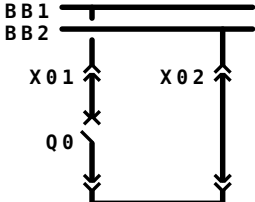
**Tab. A5-662: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X0=X) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

**Tab. A5-663: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.3.12 Bay type No. 563: Bus coupler bay with circuit breaker, double busbar**  
Q21.133.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| X01 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| X02 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-664: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-665: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(X01=X) \ \& \ \neg(X02=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-666: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.13****Bay type No. 204: Bus coupler bay with circuit breaker, double busbar, direct motor control**

Q23.101.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|--|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |  |
|                                      | Close(d) | U A02        | K A02        |  |
| Q10 (DEV02)                          | Open     | U A03        | K A03        |  |
|                                      | Close(d) | U A04        | K A04        |  |
| Q20 (DEV03)                          | Open     | U A05        | K A05        |  |
|                                      | Close(d) | U A06        | K A06        |  |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |  |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |  |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |  |

**Tab. A5-667: Assignment of Binary Inputs and Output Relays**

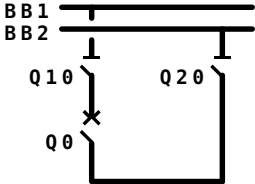
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-668: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-669: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.14 Bay type No. 205: Bus coupler bay with circuit breaker, double busbar**  
Q23.101.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q20 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |

**Tab. A5-670: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-671: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-672: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.15****Bay type No. 206: Bus coupler bay with circuit breaker, double busbar**  
Q23.101.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|--|
| Q0 (DEV01)      | Open     | U A01        | K A01        |  |
|                 | Close(d) | U A02        | K A02        |  |
| Q10 (DEV02)     | Open     | U A03        | K A03        |  |
|                 | Close(d) | U A04        | K A04        |  |
| Q20 (DEV03)     | Open     | U A05        | K A05        |  |
|                 | Close(d) | U A06        | K A06        |  |

**Tab. A5-673: Assignment of Binary Inputs and Output Relays**

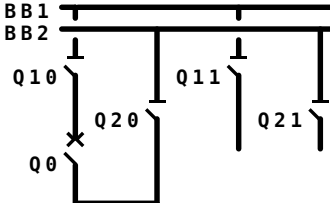
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-674: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-675: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.16 Bay type No. 207: Bus coupler bay with circuit breaker, double busbar**  
Q23.117.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q20 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q11 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q21 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-676: Assignment of Binary Inputs and Output Relays**

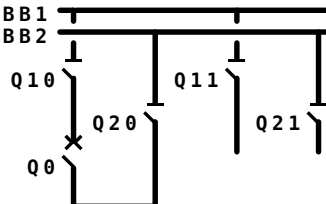
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-677: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |

**Tab. A5-678: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.17****Bay type No. 208: Bus coupler bay with circuit breaker, double busbar**  
Q23.117.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q11 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q21 (DEV05)     | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |

**Tab. A5-679: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

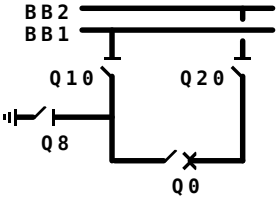
**Tab. A5-680: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0)$   |

**Tab. A5-681: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.18****Bay type No. 236: Bus coupler bay with circuit breaker, double busbar, direct motor control**

Q25.105.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)                           | Open     | U B01        | /            |   |
|                                      | Close(d) | U B02        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-682: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-683: Bay Interlock Equations for Operation without Station Interlocking**

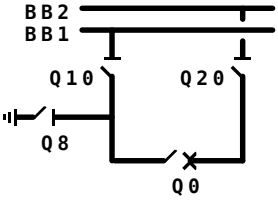
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q8=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0) \ \& \ (Q8=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-684: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.3.19****Bay type No. 209: Bus coupler bay with circuit breaker, double busbar, direct motor control**

Q25.105.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-685: Assignment of Binary Inputs and Output Relays**

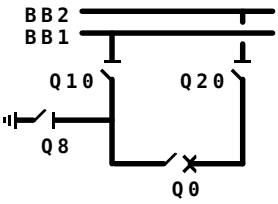
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$       |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q20=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=I) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I) \ \& \ (Q8=I)$ |

**Tab. A5-686: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ (Q8=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0) \ \& \ (Q8=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q20=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=I) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$         |

**Tab. A5-687: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.20****Bay type No. 210: Bus coupler bay with circuit breaker, double busbar**  
Q25.105.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q20 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-688: Assignment of Binary Inputs and Output Relays**

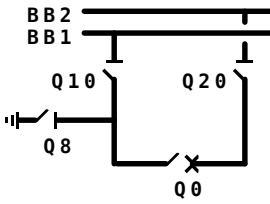
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-689: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-690: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.21****Bay type No. 237: Bus coupler bay with circuit breaker, double busbar**  
Q25.105.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-691: Assignment of Binary Inputs and Output Relays**

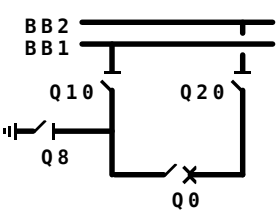
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-692: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ (Q8=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-693: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.22****Bay type No. 211: Bus coupler bay with circuit breaker, double busbar**  
Q25.105.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-694: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$       |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q20=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=I) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I) \ \& \ (Q8=I)$ |

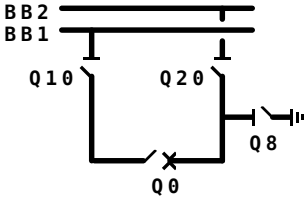
**Tab. A5-695: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q20=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=I) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$   |

**Tab. A5-696: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.23****Bay type No. 238: Bus coupler bay with circuit breaker, double busbar, direct motor control**

Q25.109.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)                           | Open     | U B01        | /            |   |
|                                      | Close(d) | U B02        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-697: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-698: Bay Interlock Equations for Operation without Station Interlocking**

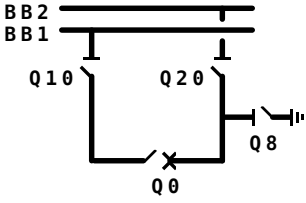
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q8=0) \ \& \ /(FctBl1=I) \ \& \ /(FctBl2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-699: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.3.24****Bay type No. 212: Bus coupler bay with circuit breaker, double busbar, direct motor control**

Q25.109.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)                           | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-700: Assignment of Binary Inputs and Output Relays**

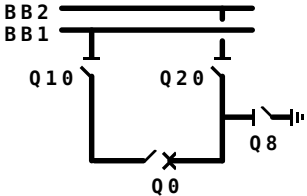
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$             |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q10=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q20=0) \ \& \ (Q10=I) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I) \ \& \ (Q8=I)$ |

**Tab. A5-701: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q10=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q20=0) \ \& \ (Q10=I) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$   |

**Tab. A5-702: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.25 Bay type No. 213: Bus coupler bay with circuit breaker, double busbar**  
Q25.109.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q20 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-703: Assignment of Binary Inputs and Output Relays**

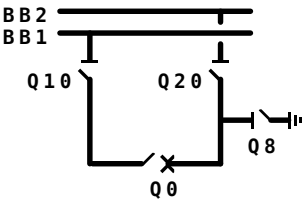
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-704: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |

**Tab. A5-705: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.26****Bay type No. 239: Bus coupler bay with circuit breaker, double busbar**  
Q25.109.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-706: Assignment of Binary Inputs and Output Relays**

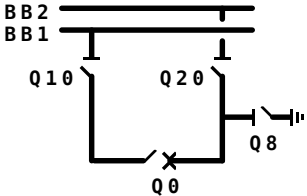
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-707: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |

**Tab. A5-708: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.27****Bay type No. 214: Bus coupler bay with circuit breaker, double busbar**  
Q25.109.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q8 (DEV04)      | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-709: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ (Q8=0) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I)$       |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q10=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q20=0) \ \& \ (Q10=I) \ \& \ \neg(FctBI1=I) \ \& \ \neg(FctBI2=I) \ \& \ (Q8=I)$ |

**Tab. A5-710: Bay Interlock Equations for Operation without Station Interlocking**

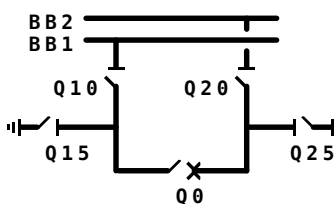
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q8=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q8=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q8=0)$   |
| Q8              | Open        | $(Q0=I) \ \& \ (Q10=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q20=0) \ \& \ (Q10=I) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$   |

**Tab. A5-711: Bay Interlock Equations for Operation with Station Interlocking**

### A5.2.3.28

**Bay type No. 240: Bus coupler bay with circuit breaker, double busbar, direct motor control**

025.113.M03

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)                          | Open     | U B01        | /            |   |
|                                      | Close(d) | U B02        | /            |   |
| Q25 (DEV05)                          | Open     | U B03        | /            |   |
|                                      | Close(d) | U B04        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-712: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q25=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q15=0) \ \& \ (Q25=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |

**Tab. A5-713: Bay Interlock Equations for Operation without Station Interlocking**

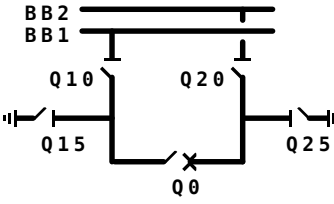
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q25=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q15=0) \ \& \ (Q25=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |

**Tab. A5-714: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.3.29****Bay type No. 215: Bus coupler bay with circuit breaker, double busbar, direct motor control**

Q25.113.M05

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q0 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)                          | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Q25 (DEV05)                          | Open     | U B03        | K B03        |   |
|                                      | Close(d) | U B04        | K B04        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-715: Assignment of Binary Inputs and Output Relays**

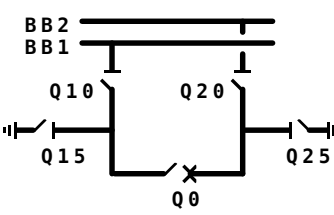
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q25=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q15=0) \ \& \ (Q25=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q15             | Open        | $(Q0=I) \ \& \ (Q20=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=I) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I) \ \& \ (Q15=I)$    |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |
| Q25             | Open        | $(Q0=I) \ \& \ (Q10=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q20=0) \ \& \ (Q10=I) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I) \ \& \ (Q25=I)$    |

**Tab. A5-716: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \& (Q25=0)$   |
|                 | Close(d)    | $/(Q10=X) \& /(Q20=X) \& (Q15=0) \& (Q25=0) \& /(FctBI1=I) \& /(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q15=0)$  |
| Q15             | Open        | $(Q0=I) \& (Q20=I)$  |
|                 | Close(d)    | $(Q0=0) \& (Q10=0) \& (Q20=I) \& /(FctBI1=I) \& /(FctBI2=I)$               |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q25=0)$  |
| Q25             | Open        | $(Q0=I) \& (Q10=I)$  |
|                 | Close(d)    | $(Q0=0) \& (Q20=0) \& (Q10=I) \& /(FctBI1=I) \& /(FctBI2=I)$               |

**Tab. A5-717: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.30 Bay type No. 216: Bus coupler bay with circuit breaker, double busbar**  
Q25.113.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |
| Q20 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q15 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q25 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-718: Assignment of Binary Inputs and Output Relays**

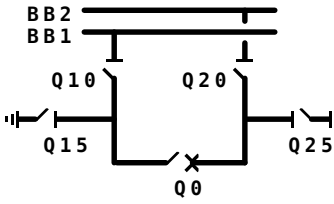
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q25=0)$   |
|                 | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ (Q15=0) \ \& \ (Q25=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

**Tab. A5-719: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q25=0)$   |
|                 | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ (Q15=0) \ \& \ (Q25=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |

**Tab. A5-720: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.31****Bay type No. 241: Bus coupler bay with circuit breaker, double busbar**  
Q25.113.R03

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q25 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |

**Tab. A5-721: Assignment of Binary Inputs and Output Relays**

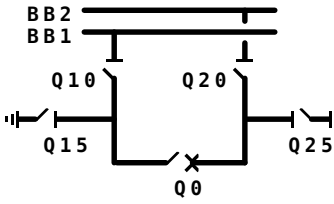
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q25=0)$   |
|                 | Close(d)    | $/(Q10=X) \ \& \ /(Q20=X) \ \& \ (Q15=0) \ \& \ (Q25=0) \ \& \ /(FctBI1=I) \ \& \ /(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |

**Tab. A5-722: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q25=0)$   |
|                 | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ (Q15=0) \ \& \ (Q25=0) \ \& \ \neg(FctBl1=I) \ \& \ \neg(FctBl2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |

**Tab. A5-723: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.3.32****Bay type No. 217: Bus coupler bay with circuit breaker, double busbar**  
Q25.113.R05

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q10 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q15 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q25 (DEV05)     | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |

**Tab. A5-724: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \& (Q25=0)$   |
|                 | Close(d)    | $/(Q10=X) \& /(Q20=X) \& (Q15=0) \& (Q25=0) \& /(FctBI1=I) \& /(FctBI2=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q15=0)$  |
| Q15             | Open        | $(Q0=I) \& (Q20=I)$  |
|                 | Close(d)    | $(Q0=0) \& (Q10=0) \& (Q20=I) \& /(FctBI1=I) \& /(FctBI2=I) \& (Q15=I)$    |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \& (Q25=0)$  |
| Q25             | Open        | $(Q0=I) \& (Q10=I)$  |
|                 | Close(d)    | $(Q0=0) \& (Q20=0) \& (Q10=I) \& /(FctBI1=I) \& /(FctBI2=I) \& (Q25=I)$    |

**Tab. A5-725: Bay Interlock Equations for Operation without Station Interlocking**

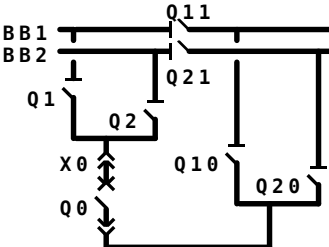
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Open        | $(Q15=0) \ \& \ (Q25=0)$   |
|                 | Close(d)    | $\neg(Q10=X) \ \& \ \neg(Q20=X) \ \& \ (Q15=0) \ \& \ (Q25=0) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$ |
| Q10             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q15=0)$  |
| Q15             | Open        | $(Q0=I) \ \& \ (Q20=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0) \ \& \ (Q20=I) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$                         |
| Q20             | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q25=0)$  |
| Q25             | Open        | $(Q0=I) \ \& \ (Q10=I)$  |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q20=0) \ \& \ (Q10=I) \ \& \ \neg(\text{FctBI1}=I) \ \& \ \neg(\text{FctBI2}=I)$                         |

**Tab. A5-726: Bay Interlock Equations for Operation with Station Interlocking**

## A5.2.4 Bus Coupler and Sectionalizer Bays

### A5.2.4.1 Bay type No. 218: Bus coupler and sectionalizer bay with circuit breaker, double busbar

K29.101.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | /            |   |
|                 | Close(d) | U A02        | /            |   |
| Q10 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q20 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q11 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |
| Q21 (DEV05)     | Open     | U B03        | /            |   |
|                 | Close(d) | U B04        | /            |   |
| X0 (DEV06)      | Open     | U B05        | /            |   |
|                 | Close(d) | U B06        | /            |   |
| Q1 (DEV07)      | Open     | U C01        | /            |   |
|                 | Close(d) | U C02        | /            |   |
| Q2 (DEV08)      | Open     | U C03        | /            |   |
|                 | Close(d) | U C04        | /            |   |

Tab. A5-727: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation      |
|-----------------|-------------|-------------------------|
| Q10             | Open        | $(Q0=0)$                |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q20=0)$ |
| Q20             | Open        | $(Q0=0)$                |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0)$ |

Tab. A5-728: Bay Interlock Equations for Operation without Station Interlocking

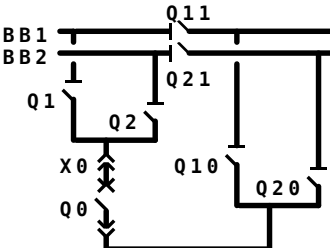


| Switchgear unit | Control O/C | Interlock equation      |
|-----------------|-------------|-------------------------|
| Q10             | Open        | $(Q0=0)$                |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q20=0)$ |
| Q20             | Open        | $(Q0=0)$                |
|                 | Close(d)    | $(Q0=0) \ \& \ (Q10=0)$ |

**Tab. A5-729: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.4.2****Bay type No. 219: Bus coupler and sectionalizer bay with circuit breaker, double busbar**

K29.101.R06

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q1 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q2 (DEV03)      | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q11 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |
| Q21 (DEV05)     | Open     | U B03        | K B03        |   |
|                 | Close(d) | U B04        | K B04        |   |
| X0 (DEV06)      | Open     | U B05        | K B05        |   |
|                 | Close(d) | U B06        | K B06        |   |
| Q10 (DEV07)     | Open     | U C01        | /            |   |
|                 | Close(d) | U C02        | /            |   |
| Q20 (DEV08)     | Open     | U C03        | /            |   |
|                 | Close(d) | U C04        | /            |   |

**Tab. A5-730: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge \neg(X0=X) \wedge \neg(Q10=X) \wedge \neg(Q20=X) \wedge \neg(\text{FctBI1}=I) \wedge \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q2=0)$   |
| Q11             | Open        | $(Q0=I) \wedge (Q1=I) \wedge (Q10=I) \wedge (X0=I)$  |
|                 | Close(d)    | $(Q0=I) \wedge (Q1=I) \wedge (Q10=I) \wedge (X0=I)$  |
| Q2              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q1=0)$   |
| Q21             | Open        | $(Q0=I) \wedge (Q2=I) \wedge (Q20=I) \wedge (X0=I)$  |
|                 | Close(d)    | $(Q0=I) \wedge (Q2=I) \wedge (Q20=I) \wedge (X0=I)$  |
| X0              | Open        | $(Q0=0) \wedge (Q1=0) \wedge (Q2=0) \wedge (Q10=0) \wedge (Q20=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q1=0) \wedge (Q2=0) \wedge (Q10=0) \wedge (Q20=0)$   |

**Tab. A5-731: Bay Interlock Equations for Operation without Station Interlocking**

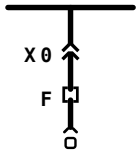
| Switchgear unit | Control O/C | Interlock equation   |
|-----------------|-------------|--|
| Q0              | Close(d)    | $\neg(Q1=X) \wedge \neg(Q2=X) \wedge \neg(X0=X) \wedge \neg(Q10=X) \wedge \neg(Q20=X) \wedge \neg(\text{FctBI1}=I) \wedge \neg(\text{FctBI2}=I)$ |
| Q1              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q2=0)$   |
| Q11             | Open        | $(Q0=I) \wedge (Q1=I) \wedge (Q10=I) \wedge (X0=I)$  |
|                 | Close(d)    | $(Q0=I) \wedge (Q1=I) \wedge (Q10=I) \wedge (X0=I)$  |
| Q2              | Open        | $(Q0=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q1=0)$   |
| Q21             | Open        | $(Q0=I) \wedge (Q2=I) \wedge (Q20=I) \wedge (X0=I)$  |
|                 | Close(d)    | $(Q0=I) \wedge (Q2=I) \wedge (Q20=I) \wedge (X0=I)$  |
| X0              | Open        | $(Q0=0) \wedge (Q1=0) \wedge (Q2=0) \wedge (Q10=0) \wedge (Q20=0)$   |
|                 | Close(d)    | $(Q0=0) \wedge (Q1=0) \wedge (Q2=0) \wedge (Q10=0) \wedge (Q20=0)$   |

**Tab. A5-732: Bay Interlock Equations for Operation with Station Interlocking**

## A5.2.5 Busbar Measurement Bays

### A5.2.5.1 Bay type No. 171: Busbar measurement bay with fuse unit, single busbar

M11.300.R00

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| X0 (DEV01)                 | Open     | U A01        | /            |   |
|                            | Close(d) | U A02        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

Tab. A5-733: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

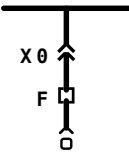
Tab. A5-734: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-735: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.5.2****Bay type No. 172: Busbar measurement bay with fuse unit, single busbar**

M11.300.R01

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| X0 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-736: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

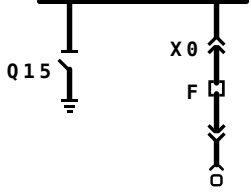
**Tab. A5-737: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-738: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.3****Bay type No. 540: Busbar measurement bay with fuse unit, single busbar**

M11.304.R02

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q15 (DEV01)                | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| X0 (DEV02)                 | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

**Tab. A5-739: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | (Q15=I)            |

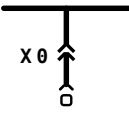
**Tab. A5-740: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-741: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.4****Bay type No. 173: Busbar measurement bay with other switchgear unit, single busbar**

M11.900.R00

| Switchgear unit |          | Binary input | Output relay |   |
|-----------------|----------|--------------|--------------|---|
| X0 (DEV01)      | Open     | U A01        | /            |  |
|                 | Close(d) | U A02        | /            |   |

**Tab. A5-742: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

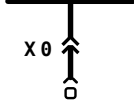
**Tab. A5-743: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-744: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.5****Bay type No. 174: Busbar measurement bay with other switchgear unit, single busbar**

M11.900.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| X0 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |

**Tab. A5-745: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-746: Bay Interlock Equations for Operation without Station Interlocking**

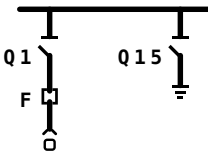
| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-747: Bay Interlock Equations for Operation with Station Interlocking**



### A5.2.5.6 Bay type No. 175: Busbar measurement bay with fuse unit, single busbar, direct motor control

M13.312.M02

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q1 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q15 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| F (SIG_1: Signal S011 EXT)           |          | U B05        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

Tab. A5-748: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | (Q15=I)            |

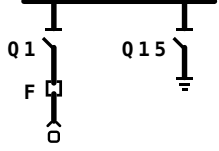
Tab. A5-749: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-750: Bay Interlock Equations for Operation with Station Interlocking

### A5.2.5.7 Bay type No. 176: Busbar measurement bay with fuse unit, single busbar

M13.312.R01

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q1 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q15 (DEV02)                | Open     | U A03        | /            |   |
|                            | Close(d) | U A04        | /            |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

Tab. A5-751: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

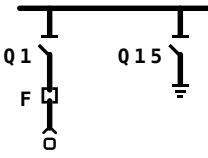
Tab. A5-752: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-753: Bay Interlock Equations for Operation with Station Interlocking

### A5.2.5.8 Bay type No. 177: Busbar measurement bay with fuse unit, single busbar

M13.312.R02

| Switchgear unit            |          | Binary input | Output relay |  |
|----------------------------|----------|--------------|--------------|---|
| Q1 (DEV01)                 | Open     | U A01        | K A01        |   |
|                            | Close(d) | U A02        | K A02        |   |
| Q15 (DEV02)                | Open     | U A03        | K A03        |   |
|                            | Close(d) | U A04        | K A04        |   |
| F (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |

Tab. A5-754: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | $(Q15=I)$          |

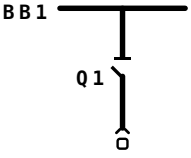
Tab. A5-755: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-756: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.5.9****Bay type No. 506: Busbar measurement bay with other switchgear unit, single busbar**

M13.902.R00

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q1 (DEV01)      | Open     | U A01        | /            |   |
|                 | Close(d) | U A02        | /            |   |

**Tab. A5-757: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

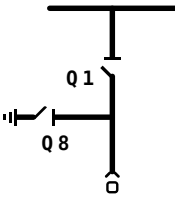
**Tab. A5-758: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-759: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.10****Bay type No. 232: Busbar measurement bay with other switchgear unit, single busbar, direct motor control**

M15.903.M01

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q1 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)                           | Open     | U A03        | /            |   |
|                                      | Close(d) | U A04        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-760: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | (Q8=0)             |

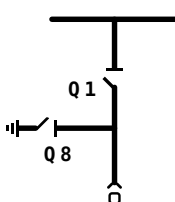
**Tab. A5-761: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | (Q8=0)             |

**Tab. A5-762: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.11****Bay type No. 178: Busbar measurement bay with other switchgear unit, single busbar, direct motor control**

M15.903.M02

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q1 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-763: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | $(Q8=0)$           |
| Q8              | Close(d)    | $(Q1=0)$           |

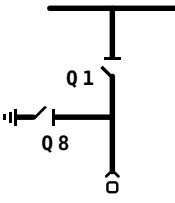
**Tab. A5-764: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | $(Q8=0)$           |
| Q8              | Close(d)    | $(Q1=0)$           |

**Tab. A5-765: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.12****Bay type No. 233: Busbar measurement bay with other switchgear unit, single busbar**

M15.903.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q1 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)      | Open     | U A03        | /            |   |
|                 | Close(d) | U A04        | /            |   |

**Tab. A5-766: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | (Q8=0)             |

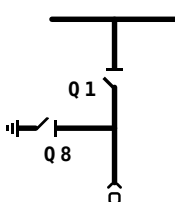
**Tab. A5-767: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | (Q8=0)             |

**Tab. A5-768: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.13****Bay type No. 179: Busbar measurement bay with other switchgear unit, single busbar**

M15.903.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q1 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q8 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |

**Tab. A5-769: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | $(Q8=0)$           |
| Q8              | Close(d)    | $(Q1=0)$           |

**Tab. A5-770: Bay Interlock Equations for Operation without Station Interlocking**

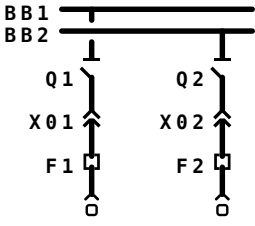
| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | $(Q8=0)$           |
| Q8              | Close(d)    | $(Q1=0)$           |

**Tab. A5-771: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.5.14****Bay type No. 180: Busbar measurement bay with fuse unit, double busbar**

M21.302.R02

| Switchgear unit             |          | Binary input | Output relay |  |
|-----------------------------|----------|--------------|--------------|---|
| Q1 (DEV01)                  | Open     | U A01        | K A01        |   |
|                             | Close(d) | U A02        | K A02        |   |
| Q2 (DEV02)                  | Open     | U A03        | K A03        |   |
|                             | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)                 | Open     | U A05        | /            |   |
|                             | Close(d) | U A06        | /            |   |
| X02 (DEV04)                 | Open     | U B01        | /            |   |
|                             | Close(d) | U B02        | /            |   |
| F1 (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |
| F2 (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |

**Tab. A5-772: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-773: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-774: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.15****Bay type No. 181: Busbar measurement bay with fuse unit, double busbar**

M21.302.R04

| Switchgear unit             |          | Binary input | Output relay |  |
|-----------------------------|----------|--------------|--------------|--|
| Q1 (DEV01)                  | Open     | U A01        | K A01        |  |
|                             | Close(d) | U A02        | K A02        |  |
| Q2 (DEV02)                  | Open     | U A03        | K A03        |  |
|                             | Close(d) | U A04        | K A04        |  |
| X01 (DEV03)                 | Open     | U A05        | K A05        |  |
|                             | Close(d) | U A06        | K A06        |  |
| X02 (DEV04)                 | Open     | U B01        | K B01        |  |
|                             | Close(d) | U B02        | K B02        |  |
| F1 (SIG_1: Signal S011 EXT) |          | U B05        | /            |  |
| F2 (SIG_1: Signal S012 EXT) |          | U B06        | /            |  |

**Tab. A5-775: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| X01             | Open        | $(Q1=0)$           |
|                 | Close(d)    | $(Q1=0)$           |
| X02             | Open        | $(Q2=0)$           |
|                 | Close(d)    | $(Q2=0)$           |

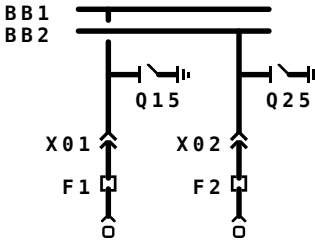
**Tab. A5-776: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| X01             | Open        | $(Q1=0)$           |
|                 | Close(d)    | $(Q1=0)$           |
| X02             | Open        | $(Q2=0)$           |
|                 | Close(d)    | $(Q2=0)$           |

**Tab. A5-777: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.16****Bay type No. 182: Busbar measurement bay with fuse unit, double busbar**

M21.312.R02

| Switchgear unit             |          | Binary input | Output relay |  |
|-----------------------------|----------|--------------|--------------|---|
| Q15 (DEV01)                 | Open     | U A01        | K A01        |   |
|                             | Close(d) | U A02        | K A02        |   |
| Q25 (DEV02)                 | Open     | U A03        | K A03        |   |
|                             | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)                 | Open     | U A05        | /            |   |
|                             | Close(d) | U A06        | /            |   |
| X02 (DEV04)                 | Open     | U B01        | /            |   |
|                             | Close(d) | U B02        | /            |   |
| F1 (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |
| F2 (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |

**Tab. A5-778: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | (Q15=I)            |
| Q25             | Close(d)    | (Q25=I)            |

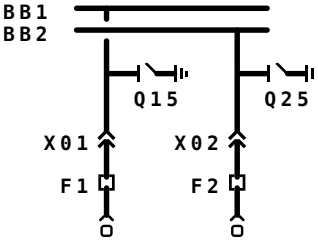
**Tab. A5-779: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-780: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.17****Bay type No. 183: Busbar measurement bay with fuse unit, double busbar**

M21.312.R04

| Switchgear unit             |          | Binary input | Output relay |  |
|-----------------------------|----------|--------------|--------------|---|
| Q15 (DEV01)                 | Open     | U A01        | K A01        |   |
|                             | Close(d) | U A02        | K A02        |   |
| Q25 (DEV02)                 | Open     | U A03        | K A03        |   |
|                             | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)                 | Open     | U A05        | K A05        |   |
|                             | Close(d) | U A06        | K A06        |   |
| X02 (DEV04)                 | Open     | U B01        | K B01        |   |
|                             | Close(d) | U B02        | K B02        |   |
| F1 (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |
| F2 (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |

**Tab. A5-781: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | (Q15=I)            |
| Q25             | Close(d)    | (Q25=I)            |

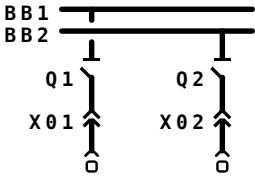
**Tab. A5-782: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-783: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.18****Bay type No. 184: Busbar measurement bay with other switchgear unit, double busbar**

M21.902.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q1 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q2 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X02 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-784: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

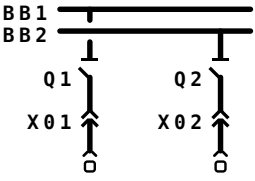
**Tab. A5-785: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-786: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.19****Bay type No. 185: Busbar measurement bay with other switchgear unit, double busbar**

M21.902.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q1 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q2 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X02 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-787: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| X01             | Open        | $(Q1=0)$           |
|                 | Close(d)    | $(Q1=0)$           |
| X02             | Open        | $(Q2=0)$           |
|                 | Close(d)    | $(Q2=0)$           |

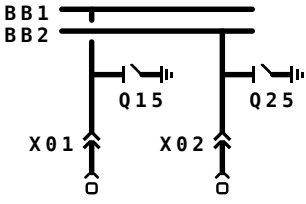
**Tab. A5-788: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| X01             | Open        | $(Q1=0)$           |
|                 | Close(d)    | $(Q1=0)$           |
| X02             | Open        | $(Q2=0)$           |
|                 | Close(d)    | $(Q2=0)$           |

**Tab. A5-789: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.20****Bay type No. 186: Busbar measurement bay with other switchgear unit, double busbar**

M21.912.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q15 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q25 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| X02 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-790: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | (Q15=I)            |
| Q25             | Close(d)    | (Q25=I)            |

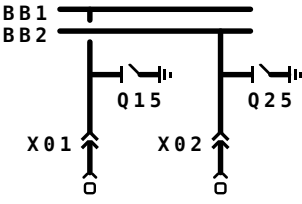
**Tab. A5-791: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-792: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.21****Bay type No. 187: Busbar measurement bay with other switchgear unit, double busbar**

M21.912.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q15 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q25 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| X01 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| X02 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-793: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | $(Q15=I)$          |
| Q25             | Close(d)    | $(Q25=I)$          |

**Tab. A5-794: Bay Interlock Equations for Operation without Station Interlocking**

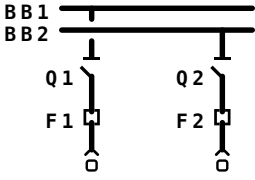
| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-795: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.5.22****Bay type No. 188: Busbar measurement bay with fuse unit, double busbar**

M23.302.R02

| Switchgear unit             |          | Binary input | Output relay |  |
|-----------------------------|----------|--------------|--------------|---|
| Q1 (DEV01)                  | Open     | U A01        | K A01        |   |
|                             | Close(d) | U A02        | K A02        |   |
| Q2 (DEV02)                  | Open     | U A03        | K A03        |   |
|                             | Close(d) | U A04        | K A04        |   |
| F1 (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |
| F2 (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |

**Tab. A5-796: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

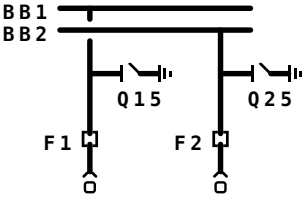
**Tab. A5-797: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-798: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.23****Bay type No. 189: Busbar measurement bay with fuse unit, double busbar**

M23.312.R02

| Switchgear unit             |          | Binary input | Output relay |  |
|-----------------------------|----------|--------------|--------------|---|
| Q15 (DEV01)                 | Open     | U A01        | K A01        |   |
|                             | Close(d) | U A02        | K A02        |   |
| Q25 (DEV02)                 | Open     | U A03        | K A03        |   |
|                             | Close(d) | U A04        | K A04        |   |
| F1 (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |
| F2 (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |

**Tab. A5-799: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | (Q15=I)            |
| Q25             | Close(d)    | (Q25=I)            |

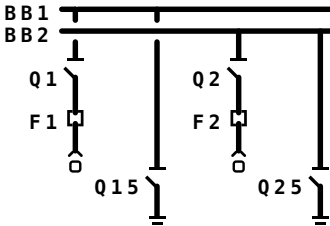
**Tab. A5-800: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-801: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.24****Bay type No. 190: Busbar measurement bay with fuse unit, double busbar, direct motor control**

M23.328.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q1 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q2 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q15 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q25 (DEV04)                          | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| F2 (SIG_1: Signal S010 EXT)          |          | U B04        | /            |   |
| F1 (SIG_1: Signal S011 EXT)          |          | U B05        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-802: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | (Q15=I)            |
| Q25             | Close(d)    | (Q25=I)            |

**Tab. A5-803: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-804: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.25****Bay type No. 191: Busbar measurement bay with fuse unit, double busbar**

M23.328.R02

| Switchgear unit             |          | Binary input | Output relay |  |
|-----------------------------|----------|--------------|--------------|--|
| Q1 (DEV01)                  | Open     | U A01        | K A01        |  |
|                             | Close(d) | U A02        | K A02        |  |
| Q2 (DEV02)                  | Open     | U A03        | K A03        |  |
|                             | Close(d) | U A04        | K A04        |  |
| Q15 (DEV03)                 | Open     | U A05        | /            |  |
|                             | Close(d) | U A06        | /            |  |
| Q25 (DEV04)                 | Open     | U B01        | /            |  |
|                             | Close(d) | U B02        | /            |  |
| F1 (SIG_1: Signal S011 EXT) |          | U B05        | /            |  |
| F2 (SIG_1: Signal S012 EXT) |          | U B06        | /            |  |

**Tab. A5-805: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

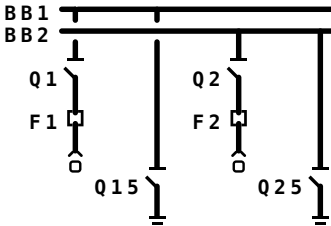
**Tab. A5-806: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-807: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.26****Bay type No. 192: Busbar measurement bay with fuse unit, double busbar**

M23.328.R04

| Switchgear unit             |          | Binary input | Output relay |  |
|-----------------------------|----------|--------------|--------------|---|
| Q1 (DEV01)                  | Open     | U A01        | K A01        |   |
|                             | Close(d) | U A02        | K A02        |   |
| Q2 (DEV02)                  | Open     | U A03        | K A03        |   |
|                             | Close(d) | U A04        | K A04        |   |
| Q15 (DEV03)                 | Open     | U A05        | K A05        |   |
|                             | Close(d) | U A06        | K A06        |   |
| Q25 (DEV04)                 | Open     | U B01        | K B01        |   |
|                             | Close(d) | U B02        | K B02        |   |
| F1 (SIG_1: Signal S011 EXT) |          | U B05        | /            |   |
| F2 (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |

**Tab. A5-808: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | (Q15=I)            |
| Q25             | Close(d)    | (Q25=I)            |

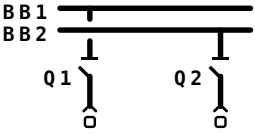
**Tab. A5-809: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-810: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.27****Bay type No. 193: Busbar measurement bay with other switchgear unit, double busbar**

M23.902.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q1 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q2 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |

**Tab. A5-811: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

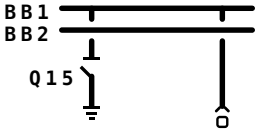
**Tab. A5-812: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-813: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.28****Bay type No. 559: Busbar measurement bay with other switchgear unit, double busbar**

M23.904.R00

| Switchgear unit |          | Binary input | Output relay |   |
|-----------------|----------|--------------|--------------|---|
| Q15 (DEV01)     | Open     | U A01        | /            |  |
|                 | Close(d) | U A02        | /            |   |

**Tab. A5-814: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

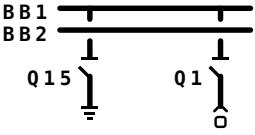
**Tab. A5-815: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-816: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.29****Bay type No. 509: Busbar measurement bay with other switchgear unit, double busbar, direct motor control**

M23.906.M01

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q1 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q15 (DEV02)                          | Open     | U A03        | /            |   |
|                                      | Close(d) | U A04        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-817: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-818: Bay Interlock Equations for Operation without Station Interlocking**

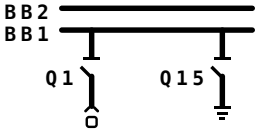
| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-819: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.5.30****Bay type No. 529: Busbar measurement bay with other switchgear unit, double busbar, direct motor control**

M23.906.M02

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q1 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q15 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-820: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | (Q15=I)            |

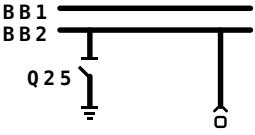
**Tab. A5-821: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-822: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.31****Bay type No. 560: Busbar measurement bay with other switchgear unit, double busbar**

M23.908.R00

| Switchgear unit |          | Binary input | Output relay |   |
|-----------------|----------|--------------|--------------|---|
| Q25 (DEV01)     | Open     | U A01        | /            |  |
|                 | Close(d) | U A02        | /            |   |

**Tab. A5-823: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

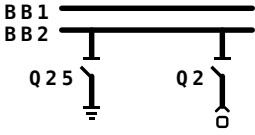
**Tab. A5-824: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-825: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.32****Bay type No. 510: Busbar measurement bay with other switchgear unit, double busbar, direct motor control**

M23.910.M01

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q2 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q25 (DEV02)                          | Open     | U A03        | /            |   |
|                                      | Close(d) | U A04        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-826: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

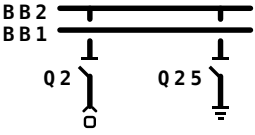
**Tab. A5-827: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-828: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.33****Bay type No. 530: Busbar measurement bay with other switchgear unit, double busbar, direct motor control**

M23.910.M02

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q2 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q25 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-829: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q25             | Close(d)    | (Q25=I)            |

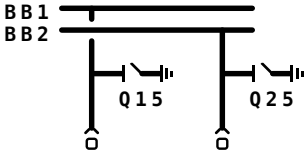
**Tab. A5-830: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-831: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.34****Bay type No. 194: Busbar measurement bay with other switchgear unit, double busbar**

M23.912.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q15 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q25 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |

**Tab. A5-832: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | (Q15=I)            |
| Q25             | Close(d)    | (Q25=I)            |

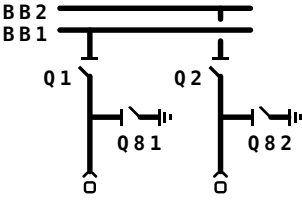
**Tab. A5-833: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-834: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.35****Bay type No. 234: Busbar measurement bay with other switchgear unit, double busbar, direct motor control**

M25.903.M02

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q1 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q2 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q81 (DEV03)                          | Open     | U A05        | /            |   |
|                                      | Close(d) | U A06        | /            |   |
| Q82 (DEV04)                          | Open     | U B01        | /            |   |
|                                      | Close(d) | U B02        | /            |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-835: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | $(Q81=0)$          |
| Q2              | Close(d)    | $(Q82=0)$          |

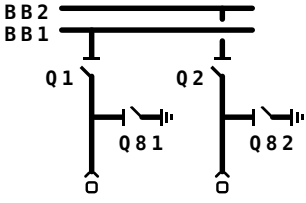
**Tab. A5-836: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | $(Q81=0)$          |
| Q2              | Close(d)    | $(Q82=0)$          |

**Tab. A5-837: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.36****Bay type No. 195: Busbar measurement bay with other switchgear unit, double busbar, direct motor control**

M25.903.M04

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q1 (DEV01)                           | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q2 (DEV02)                           | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Q81 (DEV03)                          | Open     | U A05        | K A05        |   |
|                                      | Close(d) | U A06        | K A06        |   |
| Q82 (DEV04)                          | Open     | U B01        | K B01        |   |
|                                      | Close(d) | U B02        | K B02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-838: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | $(Q81=0)$          |
| Q2              | Close(d)    | $(Q82=0)$          |
| Q81             | Close(d)    | $(Q1=0)$           |
| Q82             | Close(d)    | $(Q2=0)$           |

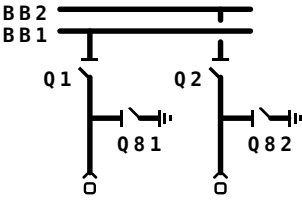
**Tab. A5-839: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | $(Q81=0)$          |
| Q2              | Close(d)    | $(Q82=0)$          |
| Q81             | Close(d)    | $(Q1=0)$           |
| Q82             | Close(d)    | $(Q2=0)$           |

**Tab. A5-840: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.5.37****Bay type No. 235: Busbar measurement bay with other switchgear unit, double busbar**

M25.903.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q1 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q2 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q81 (DEV03)     | Open     | U A05        | /            |   |
|                 | Close(d) | U A06        | /            |   |
| Q82 (DEV04)     | Open     | U B01        | /            |   |
|                 | Close(d) | U B02        | /            |   |

**Tab. A5-841: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | $(Q81=0)$          |
| Q2              | Close(d)    | $(Q82=0)$          |

**Tab. A5-842: Bay Interlock Equations for Operation without Station Interlocking**

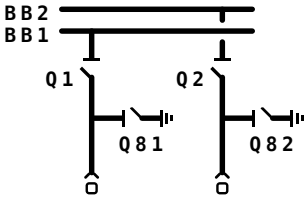
| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | $(Q81=0)$          |
| Q2              | Close(d)    | $(Q82=0)$          |

**Tab. A5-843: Bay Interlock Equations for Operation with Station Interlocking**



**A5.2.5.38****Bay type No. 196: Busbar measurement bay with other switchgear unit, double busbar**

M25.903.R04

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q1 (DEV01)      | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q2 (DEV02)      | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |
| Q81 (DEV03)     | Open     | U A05        | K A05        |   |
|                 | Close(d) | U A06        | K A06        |   |
| Q82 (DEV04)     | Open     | U B01        | K B01        |   |
|                 | Close(d) | U B02        | K B02        |   |

**Tab. A5-844: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | $(Q81=0)$          |
| Q2              | Close(d)    | $(Q82=0)$          |
| Q81             | Close(d)    | $(Q1=0)$           |
| Q82             | Close(d)    | $(Q2=0)$           |

**Tab. A5-845: Bay Interlock Equations for Operation without Station Interlocking**

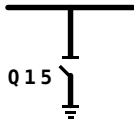
| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q1              | Close(d)    | $(Q81=0)$          |
| Q2              | Close(d)    | $(Q82=0)$          |
| Q81             | Close(d)    | $(Q1=0)$           |
| Q82             | Close(d)    | $(Q2=0)$           |

**Tab. A5-846: Bay Interlock Equations for Operation with Station Interlocking**

## A5.2.6 Busbar Grounding Bays

### A5.2.6.1 Bay type No. 129: Busbar grounding bay with other switchgear unit, single busbar, direct motor control

E13.901.M01

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q15 (DEV01)                          | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

Tab. A5-847: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | (Q15=I)            |

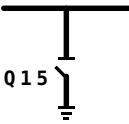
Tab. A5-848: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-849: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.6.2****Bay type No. 130: Busbar grounding bay with other switchgear unit, single busbar**

E13.901.R01

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q15 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |

**Tab. A5-850: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | (Q15=I)            |

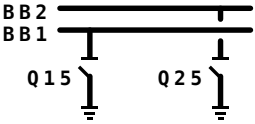
**Tab. A5-851: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-852: Bay Interlock Equations for Operation with Station Interlocking**

**A5.2.6.3****Bay type No. 131: Busbar grounding bay with other switchgear unit, double busbar, direct motor control**

E23.903.M02

| Switchgear unit                      |          | Binary input | Output relay |  |
|--------------------------------------|----------|--------------|--------------|---|
| Q15 (DEV01)                          | Open     | U A01        | K A01        |   |
|                                      | Close(d) | U A02        | K A02        |   |
| Q25 (DEV02)                          | Open     | U A03        | K A03        |   |
|                                      | Close(d) | U A04        | K A04        |   |
| Motor relay (SIG_1: Signal S012 EXT) |          | U B06        | /            |   |
| Shunt winding (CMD_1: Command C011)  |          | /            | K B05        |   |
| Motor relay (CMD_1: Command C012)    |          | /            | K B06        |   |

**Tab. A5-853: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | (Q15=I)            |
| Q25             | Close(d)    | (Q25=I)            |

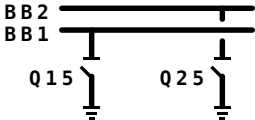
**Tab. A5-854: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-855: Bay Interlock Equations for Operation with Station Interlocking**

#### A5.2.6.4 Bay type No. 132: Busbar grounding bay with other switchgear unit, double busbar

E23.903.R02

| Switchgear unit |          | Binary input | Output relay |  |
|-----------------|----------|--------------|--------------|---|
| Q15 (DEV01)     | Open     | U A01        | K A01        |   |
|                 | Close(d) | U A02        | K A02        |   |
| Q25 (DEV02)     | Open     | U A03        | K A03        |   |
|                 | Close(d) | U A04        | K A04        |   |

Tab. A5-856: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
| Q15             | Close(d)    | $(Q15=I)$          |
| Q25             | Close(d)    | $(Q25=I)$          |

Tab. A5-857: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-858: Bay Interlock Equations for Operation with Station Interlocking

A5.2.7 Other Bay Types

A5.2.7.1 Bay type No. 1: Other bay type with other switchgear unit, without busbar  
X99.901.R00

| Switchgear unit | Binary input | Output relay |  |
|-----------------|--------------|--------------|--|
| —               |              |              |  |

Tab. A5-859: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-860: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-861: Bay Interlock Equations for Operation with Station Interlocking

### A5.2.7.2 Bay type No. 980: Other bay type with other switchgear unit, without busbar

X99.902.R06.2

| Switchgear unit               | Binary input | Output relay |   |
|-------------------------------|--------------|--------------|---|
| S001 (SIG_1: Signal S001 EXT) | U A01        | /            | <div>I</div> <div><div>1<input type="checkbox"/></div><div>2<input type="checkbox"/></div><div>3<input type="checkbox"/></div><div>4<input type="checkbox"/></div><div>5<input type="checkbox"/></div><div>6<input type="checkbox"/></div><div>7</div><div>8</div><div>9</div><div>10</div><div>11</div><div>12</div></div> <div><div>13</div><div>14</div><div>15</div><div>16</div><div>17</div><div>18</div><div>19</div><div>20</div></div> <div>O</div> <div><div>1<input type="checkbox"/></div><div>2<input type="checkbox"/></div><div>3<input type="checkbox"/></div><div>4<input type="checkbox"/></div><div>5<input type="checkbox"/></div><div>6<input type="checkbox"/></div><div>7</div><div>8</div><div>9</div><div>10</div><div>11</div><div>12</div></div> |
| S002 (SIG_1: Signal S002 EXT) | U A02        | /            |   |
| S003 (SIG_1: Signal S003 EXT) | U A03        | /            |   |
| S004 (SIG_1: Signal S004 EXT) | U A04        | /            |   |
| S005 (SIG_1: Signal S005 EXT) | U A05        | /            |   |
| S006 (SIG_1: Signal S006 EXT) | U A06        | /            |   |
| C001 (CMD_1: Command C001)    | /            | K A01        |   |
| C002 (CMD_1: Command C002)    | /            | K A02        |   |
| C003 (CMD_1: Command C003)    | /            | K A03        |   |
| C004 (CMD_1: Command C004)    | /            | K A04        |   |
| C005 (CMD_1: Command C005)    | /            | K A05        |   |
| C006 (CMD_1: Command C006)    | /            | K A06        |   |

Tab. A5-862: Assignment of Binary Inputs and Output Relays

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-863: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-864: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.7.3****Bay type No. 981: Other bay type with other switchgear unit, without busbar**

X99.903.R12.2

| Switchgear unit               | Binary input | Output relay |  |
|-------------------------------|--------------|--------------|--|
| S001 (SIG_1: Signal S001 EXT) | U A01        | /            | <div> <div>I</div> <div> <div>1 <input type="checkbox"/></div> <div>2 <input type="checkbox"/></div> <div>3 <input type="checkbox"/></div> <div>4 <input type="checkbox"/></div> <div>5 <input type="checkbox"/></div> <div>6 <input type="checkbox"/></div> <div>7 <input type="checkbox"/></div> <div>8 <input type="checkbox"/></div> <div>9 <input type="checkbox"/></div> <div>10 <input type="checkbox"/></div> <div>11 <input type="checkbox"/></div> <div>12 <input type="checkbox"/></div> </div> <div> <div>13</div> <div>14</div> <div>15</div> <div>16</div> <div>17</div> <div>18</div> <div>19</div> <div>20</div> </div> <div> <div>O</div> <div> <div>1 <input type="checkbox"/></div> <div>2 <input type="checkbox"/></div> <div>3 <input type="checkbox"/></div> <div>4 <input type="checkbox"/></div> <div>5 <input type="checkbox"/></div> <div>6 <input type="checkbox"/></div> <div>7 <input type="checkbox"/></div> <div>8 <input type="checkbox"/></div> <div>9 <input type="checkbox"/></div> <div>10 <input type="checkbox"/></div> <div>11 <input type="checkbox"/></div> <div>12 <input type="checkbox"/></div> </div> </div> </div> |
| S002 (SIG_1: Signal S002 EXT) | U A02        | /            |  |
| S003 (SIG_1: Signal S003 EXT) | U A03        | /            |  |
| S004 (SIG_1: Signal S004 EXT) | U A04        | /            |  |
| S005 (SIG_1: Signal S005 EXT) | U A05        | /            |  |
| S006 (SIG_1: Signal S006 EXT) | U A06        | /            |  |
| S007 (SIG_1: Signal S007 EXT) | U B01        | /            |  |
| S008 (SIG_1: Signal S008 EXT) | U B02        | /            |  |
| S009 (SIG_1: Signal S009 EXT) | U B03        | /            |  |
| S010 (SIG_1: Signal S010 EXT) | U B04        | /            |  |
| S011 (SIG_1: Signal S011 EXT) | U B05        | /            |  |
| S012 (SIG_1: Signal S012 EXT) | U B06        | /            |  |
| C001 (CMD_1: Command C001)    | /            | K A01        |  |
| C002 (CMD_1: Command C002)    | /            | K A02        |  |
| C003 (CMD_1: Command C003)    | /            | K A03        |  |
| C004 (CMD_1: Command C004)    | /            | K A04        |  |
| C005 (CMD_1: Command C005)    | /            | K A05        |  |
| C006 (CMD_1: Command C006)    | /            | K A06        |  |
| C007 (CMD_1: Command C007)    | /            | K B01        |  |
| C008 (CMD_1: Command C008)    | /            | K B02        |  |
| C009 (CMD_1: Command C009)    | /            | K B03        |  |
| C010 (CMD_1: Command C010)    | /            | K B04        |  |
| C011 (CMD_1: Command C011)    | /            | K B05        |  |
| C012 (CMD_1: Command C012)    | /            | K B06        |  |

**Tab. A5-865: Assignment of Binary Inputs and Output Relays**



| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-866: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-867: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.7.4****Bay type No. 982: Other bay type with other switchgear unit, without busbar**

X99.904.R06.2

| Switchgear unit               | Binary input | Output relay |  |
|-------------------------------|--------------|--------------|--|
| S001 (SIG_1: Signal S001 EXT) | U A01        | /            | <div> <div>I</div> <div> <div>1 <input type="checkbox"/></div> <div>2 <input type="checkbox"/></div> <div>3 <input type="checkbox"/></div> <div>4 <input type="checkbox"/></div> <div>5 <input type="checkbox"/></div> <div>6 <input type="checkbox"/></div> <div>7 <input type="checkbox"/></div> <div>8 <input type="checkbox"/></div> <div>9 <input type="checkbox"/></div> <div>10 <input type="checkbox"/></div> <div>11 <input type="checkbox"/></div> <div>12 <input type="checkbox"/></div> </div> <div> <div>13 <input type="checkbox"/></div> <div>14 <input type="checkbox"/></div> <div>15 <input type="checkbox"/></div> <div>16 <input type="checkbox"/></div> <div>17 <input type="checkbox"/></div> <div>18 <input type="checkbox"/></div> <div>19 <input type="checkbox"/></div> <div>20 <input type="checkbox"/></div> </div> <div> <div>O</div> <div> <div>1 <input type="checkbox"/></div> <div>2 <input type="checkbox"/></div> <div>3 <input type="checkbox"/></div> <div>4 <input type="checkbox"/></div> <div>5 <input type="checkbox"/></div> <div>6 <input type="checkbox"/></div> <div>7 <input type="checkbox"/></div> <div>8 <input type="checkbox"/></div> <div>9 <input type="checkbox"/></div> <div>10 <input type="checkbox"/></div> <div>11 <input type="checkbox"/></div> <div>12 <input type="checkbox"/></div> </div> </div> </div> |
| S002 (SIG_1: Signal S002 EXT) | U A02        | /            |  |
| S003 (SIG_1: Signal S003 EXT) | U A03        | /            |  |
| S004 (SIG_1: Signal S004 EXT) | U A04        | /            |  |
| S005 (SIG_1: Signal S005 EXT) | U A05        | /            |  |
| S006 (SIG_1: Signal S006 EXT) | U A06        | /            |  |
| S007 (SIG_1: Signal S007 EXT) | U C01        | /            |  |
| S008 (SIG_1: Signal S008 EXT) | U C02        | /            |  |
| S009 (SIG_1: Signal S009 EXT) | U C03        | /            |  |
| S010 (SIG_1: Signal S010 EXT) | U C04        | /            |  |
| S011 (SIG_1: Signal S011 EXT) | U C05        | /            |  |
| S012 (SIG_1: Signal S012 EXT) | U C06        | /            |  |
| S013 (SIG_1: Signal S013 EXT) | U C07        | /            |  |
| S014 (SIG_1: Signal S014 EXT) | U C08        | /            |  |
| C001 (CMD_1: Command C001)    | /            | K A01        |  |
| C002 (CMD_1: Command C002)    | /            | K A02        |  |
| C003 (CMD_1: Command C003)    | /            | K A03        |  |
| C004 (CMD_1: Command C004)    | /            | K A04        |  |
| C005 (CMD_1: Command C005)    | /            | K A05        |  |
| C006 (CMD_1: Command C006)    | /            | K A06        |  |

**Tab. A5-868: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-869: Bay Interlock Equations for Operation without Station Interlocking

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

Tab. A5-870: Bay Interlock Equations for Operation with Station Interlocking

**A5.2.7.5****Bay type No. 983: Other bay type with other switchgear unit, without busbar**

X99.905.R12.2

| Switchgear unit               | Binary input | Output relay |  |
|-------------------------------|--------------|--------------|--|
| S001 (SIG_1: Signal S001 EXT) | U A01        | /            | <div> <div>I</div> <div> <div>1 <input type="checkbox"/></div> <div>2 <input type="checkbox"/></div> <div>3 <input type="checkbox"/></div> <div>4 <input type="checkbox"/></div> <div>5 <input type="checkbox"/></div> <div>6 <input type="checkbox"/></div> <div>7 <input type="checkbox"/></div> <div>8 <input type="checkbox"/></div> <div>9 <input type="checkbox"/></div> <div>10 <input type="checkbox"/></div> <div>11 <input type="checkbox"/></div> <div>12 <input type="checkbox"/></div> </div> <div> <div>13 <input type="checkbox"/></div> <div>14 <input type="checkbox"/></div> <div>15 <input type="checkbox"/></div> <div>16 <input type="checkbox"/></div> <div>17 <input type="checkbox"/></div> <div>18 <input type="checkbox"/></div> <div>19 <input type="checkbox"/></div> <div>20 <input type="checkbox"/></div> </div> <div> <div>O</div> <div> <div>1 <input type="checkbox"/></div> <div>2 <input type="checkbox"/></div> <div>3 <input type="checkbox"/></div> <div>4 <input type="checkbox"/></div> <div>5 <input type="checkbox"/></div> <div>6 <input type="checkbox"/></div> <div>7 <input type="checkbox"/></div> <div>8 <input type="checkbox"/></div> <div>9 <input type="checkbox"/></div> <div>10 <input type="checkbox"/></div> <div>11 <input type="checkbox"/></div> <div>12 <input type="checkbox"/></div> </div> </div> </div> |
| S002 (SIG_1: Signal S002 EXT) | U A02        | /            |  |
| S003 (SIG_1: Signal S003 EXT) | U A03        | /            |  |
| S004 (SIG_1: Signal S004 EXT) | U A04        | /            |  |
| S005 (SIG_1: Signal S005 EXT) | U A05        | /            |  |
| S006 (SIG_1: Signal S006 EXT) | U A06        | /            |  |
| S007 (SIG_1: Signal S007 EXT) | U B01        | /            |  |
| S008 (SIG_1: Signal S008 EXT) | U B02        | /            |  |
| S009 (SIG_1: Signal S009 EXT) | U B03        | /            |  |
| S010 (SIG_1: Signal S010 EXT) | U B04        | /            |  |
| S011 (SIG_1: Signal S011 EXT) | U B05        | /            |  |
| S012 (SIG_1: Signal S012 EXT) | U B06        | /            |  |
| S013 (SIG_1: Signal S013 EXT) | U C01        | /            |  |
| S014 (SIG_1: Signal S014 EXT) | U C02        | /            |  |
| S015 (SIG_1: Signal S015 EXT) | U C03        | /            |  |
| S016 (SIG_1: Signal S016 EXT) | U C04        | /            |  |
| S017 (SIG_1: Signal S017 EXT) | U C05        | /            |  |
| S018 (SIG_1: Signal S018 EXT) | U C06        | /            |  |
| S019 (SIG_1: Signal S019 EXT) | U C07        | /            |  |
| S020 (SIG_1: Signal S020 EXT) | U C08        | /            |  |

| Switchgear unit            | Binary input | Output relay |  |
|----------------------------|--------------|--------------|--|
| C001 (CMD_1: Command C001) | /            | K A01        |  |
| C002 (CMD_1: Command C002) | /            | K A02        |  |
| C003 (CMD_1: Command C003) | /            | K A03        |  |
| C004 (CMD_1: Command C004) | /            | K A04        |  |
| C005 (CMD_1: Command C005) | /            | K A05        |  |
| C006 (CMD_1: Command C006) | /            | K A06        |  |
| C007 (CMD_1: Command C007) | /            | K B01        |  |
| C008 (CMD_1: Command C008) | /            | K B02        |  |
| C009 (CMD_1: Command C009) | /            | K B03        |  |
| C010 (CMD_1: Command C010) | /            | K B04        |  |
| C011 (CMD_1: Command C011) | /            | K B05        |  |
| C012 (CMD_1: Command C012) | /            | K B06        |  |

**Tab. A5-871: Assignment of Binary Inputs and Output Relays**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-872: Bay Interlock Equations for Operation without Station Interlocking**

| Switchgear unit | Control O/C | Interlock equation |
|-----------------|-------------|--------------------|
|                 |             | —                  |

**Tab. A5-873: Bay Interlock Equations for Operation with Station Interlocking**



## A6 Version History

### A6.1 Version History - MiCOM P30

**A6.1.1 P439 -301 -40x -601 ... -310 -4xx -653-701**

**A6.1.1.1 P439 -301 -401/402 -601**

Release: 2001-06-25

Initial product release

**A6.1.1.2 P439 -301 -401/402 -601-703**

Release: 2002-05-27

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

DIST

Bug fixing:

- The reach of the circle part of underimpedance starting in backward- (reverse) direction was only 25% of the set reach.

PSIG

Bug fixing:

- During a transient blocking the send signal was not interrupted.

f<>

Bug fixing:

- Assigning of the measurement loop for frequency measurement was incorrectly implemented.
- When a phase-to-ground voltage measurement loop was selected ( $V_{AG}$ ,  $V_{BG}$ ,  $V_{CG}$ ) the internal  $V_{<}$  blocking value was 1.73 times greater than the value set at (018 200) f<>: Undervolt. block.  $V_{<}$ .

SIG\_1

Bug fixing:

- When the VDEW addition to the IEC 60870-5-103 protocol was used single-pole signals in the data byte were signaled with the "0" (end) or "1" (start) value.

**A6.1.1.3****P439 -301 -401/402 -601-705**

Release: 2002-12-10

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## DVICE

## Bug fixing:

- By mistake the (038 046) MAIN: Prot. ext. disabled signal was stored in the checksum-protected area of the NVRAM. With the 84 TE case variant with ring terminal connection, this led to a storage area violation during a startup and therefore to a cold restart.



**A6.1.1.4****P439 -302 -403/404 -602**

Release: 2003–07–09

*Hardware*

As an alternative slot 4 can now be equipped with the 5-pole voltage transformer module T (for the Automatic Synchronism Check function).

A new communication module A, providing the InterMiCOM protective interface COMM3 (InterMiCOM), is available now as an ordering option.

As an alternative to the conventional transformer modules for analog input signals there is now a new CT/VT-board with NCIT available. Details are available on request.

Binary signal inputs with a higher switching threshold are now available. Installation is only recommended if the application specifically requires such binary signal inputs.

*Diagram*

The new connection diagrams include the InterMiCOM communication interface (function group COMM3) and the fifth VT input.

- P439 -403 (for 40 TE case, with pin-terminal connection)
- P439 -404 (for 84 TE case, with ring-terminal connection)

*Software***COMM1**

The COURIER protocol has now been implemented.

Advanced communications software was designed to cope with communication problems with ESC field units.

The fault location (004 029) FT\_DA: Fault react., prim. (Function Type 80h, Information Number 49h), will no longer be sent spontaneously, if its value is *Not measured*.

With the fault values transmission the scaling factor for the primary value of channel VNG was corrected by a factor of  $1/\sqrt{3}$ .

Bug fixing:

- IEC-60850-5-103: The trip signal of back-up overcurrent (BUOC) was transmitted with ASDU 1 (instead of ASDU 2).
- IEC 60870-5-103: For the reclose commands of high-speed and time-delayed reclosing (Function Type 80h, Information Numbers 80h and 81h), the status changes "On" to "Off" were signaled spontaneously and were transmitted as part of the response to a general scan.

|       |  |
|-------|--|
| MAIN  | <p>In addition to the standard procedure to determine energy output a second procedure is now available. The selection of the procedure depends on the given load ratio and is made by setting (010 138) MAIN: Op. mode energy cnt..</p> <p>Time switching to setting "Daylight saving time" (003 095) MAIN: Time switching is now stored so that it will remain valid after a warm restart.</p> <p>New input signals allow direct transfer tripping without use of protective signaling scheme logic (function group PSIG).</p> <p>The BUOC trip signal now forms part of the configuration list of the general trip commands. (Please note that this trip signal forms a fixed part of general trip command 1 and may only be assigned to general trip command 2.)</p> <p>The determination of the faulty phase during a ground fault in Petersen coil compensated power systems is improved to avoid incorrect signaling at the end of the ground fault.</p> <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● In the selection table for MAIN: Fct. assign. fault (021 031) output relays K14x, K16x and K18x were missing.</li> </ul> |
| ASC   | <p>Function Automatic Synchronism Check (ASC) has been added: The voltage and synchronism conditions are checked before an automatic or manual closing occurs.</p> <p>The transformer module T with a fifth VT is required to provide a reference voltage.</p>   |
| MCMON | <p>Reference voltage monitoring is now included in the measuring-circuit monitoring function with the signals</p> <ul style="list-style-type: none"> <li>● (038 100) MCMON: FF, Vref triggered</li> <li>● (040 078) MCMON: M.circ. V, Vref flty.</li> </ul> <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● The m.c.b. trip signal was stored without the 300 ms pick-up delay in the monitoring signal memory. This caused false entries in case of switching-off of the auxiliary supply, if at the same time the auxiliary voltage of the binary signal input was also switched-off (input operated as "active low").</li> <li>● The <math>V_{neg}</math> comparator for monitoring the voltage measuring circuits was not initialized if the operating mode at MCMON: Op. mode volt. mon. was set to <i>Vneg with curr. enab</i> as long as the load current was below 5% <math>I_{nom}</math>.</li> </ul>   |
| PSB   | <p>The power swing blocking function has been added: Detection of power swing to either block distance protection (= Power Swing Blocking) or to deliberately trip (= Out-of-Step Tripping).</p>   |

|                |  |
|----------------|--|
| FT_DA          | <p>The measuring window for fault data acquisition is determined by the distance element for fault durations shorter than 55 ms.</p> <p>The output of the primary short-circuit reactance (004 029) FT_DA: Fault react., prim. is now made in the same way as the fault location.</p> <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● The fault location output is now correctly given according to the setting (010 032) FT_DA: Outp. flt.locat. PSx.</li> <li>● Fault locations of numerical values &gt;655.35% were falsely displayed as small values.</li> </ul> |
| DIST           | <p>The directional element was further improved in order to cope with transient errors seen with synthetic test signals for faults close to the directional line.</p>  |
| IDMT           | <p>The direction characteristic for short circuit direction measurement based on negative-sequence current and voltage is now corrected.</p> <p>The direction characteristic for short circuit direction measurement based on negative-sequence current and voltage is now corrected.</p>  |
| TGFD           | <p>The setting range for the parameter at TGFD: IN,p&gt; (016 042) has been extended to <math>0.03 I_{nom}</math>.</p> <p>The pick-up delay of the measuring circuit monitoring signal at SFMON: TGFD mon. triggered (093 094) is now increased from 5 s to 65 s.</p>  |
| PSIG, ARC, ASC | <p>The functionality of equal-priority enabling or disabling a function via any device interface is modified now in that way, that the functions are enabled by default.</p>   |
| PSIG           | <p>Improvement of the weak-infeed logic.</p>   |
| DTOC           | <p>The DTOC ground fault protection was enhanced by a hold-time logic so that intermittent ground faults can be detected. The ground fault elements can now be operated directionalized.</p> <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● The English display text at (035 040) DTOC: tIN&gt;&gt;&gt;&gt; elapsed has been corrected.</li> </ul>  |
| f<>            | <p>Measurements of minimum frequency during an underfrequency situation and maximum frequency during an overfrequency situation have been added.</p>   |
| DEVxx          | <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● The SIN byte was not supported in the transmission per IEC 60850-5-103 / VDEW mode.</li> </ul>   |

|       |   |
|-------|---|
| LOC   | <p>Customized binary signal panels can now be created.</p> <p>A customized Bay Panel can be sub-divided into up to eight images.</p> <p>The selection table for the Operation Panel was extended.</p> <p>Bug fixing:</p> <ul style="list-style-type: none"><li>● The signals M037 to M040 can now be configured as image variables.</li></ul> |
| COMM3 | <p>New function group COMM3 (InterMiCOM protection interface) permits end-end channel-aided schemes to be configured, without the need of discrete carrier equipment.</p>   |
| MEASO | <p>Scaling of the BCD coded output of measurands now allows the setting of an output values range. This feature is required if signed event measurands are assigned to the BCD output (like fault location or short-circuit reactance,...).</p>   |
| LOGIC | <p>Bug fixing:</p> <ul style="list-style-type: none"><li>● The time dependent logic outputs – (042 033) LOGIC: Output 1 (t) to (042 095) LOGIC: Output 32 (t) – were reset for a short period during parameter subset selection.</li></ul>  |
| CMD_1 | <p>Single commands, created with the bay editor from the PC Access Software <b>MiCOM S1</b>, can now also be configured to output relays on the output module X(60) in slot 10 (with 40 TE cases) or slot 18 (with 84 TE cases).</p>  |
| SIG_1 | <p>Bug fixing:</p> <ul style="list-style-type: none"><li>● A concurrent use of signals M001 and M033 was not possible.</li></ul>  |

**A6.1.1.5 P439 -302 -403/404 -602-706**

Release: 2003–12–11

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## COMM1

Bug fixing:

- DNP3: Multiple telegrams are prevented.
- The protocol per IEC 60850-5-101 incorrectly transmitted negative operating values.

## COMM1, COMM2, PC

Bug fixing:

- Change of the type characteristic for the measured operating values in the IEC 60870-5-103 communication protocol from F2 to F8 hex.

## MAIN

Bug fixing:

- When a warm restart occurred, the primary nominal voltages  $V$  and  $V_{\text{ref}}$  were initialized with their default values.
- The setting for the close command pulse time was ignored; the close command pulse time was fixed permanently at 50 ms.

## PSIG, ARC, ASC

Bug fixing:

- If only the input function “Enable EXT” was configured while using a binary signal input, then this input function is enabled by the rising edge and disabled by the falling edge of the input signal. However, this input function was disabled if the supply voltage was interrupted (off-on) or a warm restart occurred whilst an input function signal was present.

## SOTF

Bug fixing:

- A transient undervoltage starting could occur with the switching on of a feeder, which led to an overreaction when the function SOTF was applied, with the operating mode set to *Trip with starting*.

## MCMON

## Bug fixing:

- Negative-sequence voltage monitoring was blocked by the general starting. This led to the following functional sequence:  
Negative-sequence voltage monitoring detected a measuring circuit failure and switched to backup overcurrent-time protection. If this protection then started, a general starting resulted which, in turn, led to the measuring circuit monitoring function being blocked. As a result the backup overcurrent-time protection function was reset and distance protection started which then instantly tripped.  
This error did not influence M.C.B. trip input signal identification and fuse failure monitoring.

## LOC

## Bug fixing:

- Selecting (user defined) switchgear units without device designation is now made possible.

**A6.1.1.6****P439 -302 -403/404 -602-707**

Release: 2004–12–15

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## COMM1

Bug fixing:

- IEC 60870-5-101: Support of the 7-byte time tag length has been corrected: (003 198) COMM1: Time tag length = 7 Byte

## GFDSS

Processing of the function GFDSS now occurs with a higher priority in order to obtain reduced reaction times with less fluctuation. This is a response to the increased application of ground fault direction signaling as a tripping condition.

Bug fixing:

- The cause for faulty or unstable directional decisions with the operate delay  $t_{VNG>}$  set below 60 ms has been removed.
- The operate delays LS and BS are now accurate, even with set values > 65 s.

## TGFD

Bug fixing:

- As of version P439-602 the setting range for the current stage (016 042) TGFD: IN,p> has been extended to  $0.03 I_{nom}$ . With such a sensitive setting of the current stage it could occur that the self-monitoring function was triggered (with alarm signal (093 095) SFMON: Module N DAC faulty being issued) as the permitted tolerance for the monitored quantity is too large for such a sensitive setting.

## f&lt;&gt;

Bug fixing:

- Signals of this function group were not issued spontaneously.
- The cause for imprecise frequency measurements, when 6 cycles were selected for the evaluation time, has now been eliminated.

## P&lt;&gt;

Bug fixing:

- Starting signals were not direction-dependent.

## COUNT

Bug fixing:

- Count value acquisition could not be enabled correctly.

**A6.1.1.7****P439 -302 -403/404 -602-708**

Release: 2006-01-27

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## COMM1

Function type F0 hex switching commands (according to VDEW recommendation) are now accepted.

## ASC

Bug fixing:

- The internal timer clock was corrupted during the ASC operative time. This led to implausible time tags added to binary signals, which in turn made fault records difficult to interpret. Protection functions were in no way affected.
- The offset angle ASC: Phi offset PSx) was taken into account but by a factor of 10 less than required (for instance when set to 90° an internal value of only 9° was taken into account).



**A6.1.1.8****P439 -303 -405/406 -610**

Release: 2006–02–09

**This is a preliminary IEC 61850 version which is project-specific and only available on request!**

*Hardware*

The new hardware variants now offer, per ordering option, additional operating thresholds for the binary signal inputs:

- >73 V (67% of VA,nom = 110 V) (Order ext. No. 463)
- >146 V (67% of VA,nom = 220 V) (Order ext. No. 464)

Installation of the standard variant is generally recommended if the application does not specifically require such binary signal inputs with higher operating thresholds.

The new Ethernet module for communication per IEC 61850 is now available and may be fitted to slot 2 as an alternative to communication module A.

*Diagram*

The new connection diagrams now include the Ethernet module communication interface.

- P439 -405 (for 40 TE case, with pin-terminal connection)
- P439 -406 (for 84 TE case, with ring-terminal connection)

*Software***LOC**

Extensive expansion of the parameter selection (080 110) LOC: Assignment read key.

Instead of selecting only one assigned protocol by pressing the READ key there are now up to 16 different addresses assigned which can be selected by pressing the READ key more than once in succession (menu jump function).

**COMM1**

Time stamping of status signals from external devices has been adapted to the DNP3 protocol.

Bug fixing:

- With the Courier protocol, a change of a communication parameter will no longer lead to a sporadic warm restart of the device.

**COMM1/COMM2**

With the IEC 60870-5-103 protocol, the selection of measured operating values has been extended for the cyclic ILS telegram.

**COMM2**

It is now possible to select by setting (103 203) COMM2: Positive ackn. fault whether a fault read out at COMM2 is to be acknowledged positively and consequently deleted from the fault overview at the COMM2/PC interface or not.

**IEC**

Initial implementation of the IEC 61850 communication protocol.

**GSSE**

In conjunction with the IEC 61850 communication protocol a communication procedure has been implemented that is compatible with previous UCA2 GOOSE for the exchange of binary information within an Ethernet network section.

**GOOSE** In conjunction with the IEC 61850 communication protocol the IEC-GOOSE communication procedure for the exchange of binary information within an Ethernet network section has been implemented.

**MAIN** Parameters, which could previously only be set in the “General Functions” branch of the menu tree, have been transferred to the parameter subsets.

- MAIN: Neutr.pt. treat. PSx
- MAIN: Phase prio. 2pG PSx
- MAIN: Transfer for 1p PSx
- MAIN: Op. mode rush r. PSx
- MAIN: I> lift rush r. PSx
- MAIN: Rush I2fn/Ifn PSx

With this improvement it is now possible to consider operational changes in the system's neutral grounding by selecting the appropriate parameter subset.

The primary source for synchronizing the date and time can now be selected. Available are COMM1, COMM2/PC, IRIG-B or a binary input for minute signal pulses. A backup source may additionally be selected.

- (103 210) MAIN: Prim.Source TimeSync
- (103 211) MAIN: BackupSourceTimeSync

For bay control function signals detected via binary signal inputs and conditioned with debouncing it is now possible to select whether the time tag for the signal is to be issued after debouncing (or when the first pulse edge is detected). The setting (221 083) MAIN: TimeTagAfterDebounce is provided for this purpose.

The parameter (010 049) MAIN: Rotary field was renamed to (010 049) MAIN: Phase sequence. In addition the parameter selection for *clockwise* and *anticlockwise* was also changed to A-B-C and A-C-B.

The CB close time (e.g. time from close command to closing of CB contacts) can now be set at (000 032) MAIN: tCB,close. This time duration may be applied in the function ASC for the new functionality “switch on at point of synchronism”.

The following per unit measured operating values have been added:

- (004 070) MAIN: Frequency f p.u.
- (005 072) MAIN: Angle VPG/IN p.u.
- (005 073) MAIN: Load angle phi A p.u.
- (005 074) MAIN: Load angle phi B p.u.
- (005 075) MAIN: Load angle phi C p.u.
- (005 076) MAIN: Angle phi N p.u.

## SFMON

The configuration table of the user defined alarm condition has been extended by the instantaneous and timed outputs 30...32(t) of the programmable LOGIC:

- (098 053) SFMON: Output 30 ~ (042 090) LOGIC: Output 30
- (098 054) SFMON: Output 30 (t) ~ (042 091) LOGIC: Output 30 (t)
- (098 055) SFMON: Output 31 ~ (042 092) LOGIC: Output 31
- (098 056) SFMON: Output 31 (t) ~ (042 093) LOGIC: Output 31 (t)
- (098 057) SFMON: Output 32 ~ (042 094) LOGIC: Output 32
- (098 058) SFMON: Output 32 (t) ~ (042 095) LOGIC: Output 32 (t)

These logic outputs are included in the warning signals by setting SFMON: Fct. assign. warning and they are also recorded in the monitoring signal memory.

These signals can be used to create an alarm signal under complex application conditions. This signaling has no influence on the device's operation (i.e. no warm restart or blocking).

A number of device bugs previously led to a blocking with the second entry to the monitoring signal memory (i. e. if the recurring fault was already stored in the monitoring signal memory – see Chapter “Troubleshooting” in the Technical Manual). This reaction was modified in such a manner that device blocking will only occur if a renewed appearance of the same device fault lies within a set “memory retention time” (021 018) SFMON: Mon.sig. retention. This makes it possible to tolerate sporadic faults, resulting from control actions, without having to clear the monitoring signal memory in the interim.

The significance of the time stamp was modified to accommodate this new feature. The time stamp now represents the last appearance of the fault.

The following alarm signals relate to the communication module that supports the protocol per IEC 60870-5-103 only:

- (093 070) SFMON: Module A DPR faulty
- (093 071) SFMON: Module A RAM faulty

This communication module cannot be fitted to the P439 and the signals have therefore been removed.

## FT\_RC

The duration of the disturbance record is limited to 1 minute so as to avoid a record of an endless disturbance.

The signal (036 050) ARC: Blocking EXT is now stored in the fault recording (previously only the resulting signal (004 069) ARC: Blocked was recorded).

The signal (002 002) FT\_RC: Record.trig active has been implemented, which shows that a fault-recording trigger is present.

## MEASI

Open-circuit monitoring of the 20 mA input and the “PT 100” input has been improved.

|       |  |
|-------|--|
| DIST  | <p>The ground fault starting condition has been made settable by an “OR”-linked or an “AND”-linked condition of the <math>I_{N&gt;}</math> and <math>V_{NG&gt;}</math> thresholds, if the system star point is low-impedance grounded (setting at (001 249) MAIN: Earth-Starting PSx).</p> <p>The enable logic for the sensitive double earth fault detection has been enhanced such that now the base point current must be enabled in one of the two phases for which the undervoltage condition is met.</p> <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● Correction of the angle error which appeared when the system frequency deviated from the nominal frequency <math>f_{nom} = 60</math> Hz and had an incorrect value differing by a factor of 5/6.</li> </ul> |
| MCMON | Fuse failure detection is blocked now during “CB open” conditions.   |
| IDMT  | The residual current stage has been enhanced by a minimum trip time and a minimum trip current threshold.  |
| ASC   | <p>New functionality “Switch on at point of synchronism”: In slightly asynchronous networks the reclose command can be controlled in such a way that it will be issued at the exact point of synchronism.</p> <p>The close command conditions can now be set individually for ARC and manual closing.</p> <p>The reference voltage <math>V_{ref}</math> and the voltage from the corresponding measuring loop are stored as event data.</p> <p>Selecting the CB assignment to an external device has been adapted to the maximum possible number of external devices.</p>  |
| GFDSS | <p>“Admittance processing” was added to the function GFDSS.</p> <p>The setting parameters for the function GFDSS are now included in the parameter subsets and can be changed, according to operating conditions, by selecting the appropriate parameter subset. It is also possible to individually enable this function in each parameter subset.</p>  |
| TGFD  | <p>The setting parameters for the function TGFD are now included in the parameter subsets and can be changed, according to operating conditions, by selecting the appropriate parameter subset. It is also possible to individually enable this function in each parameter subset.</p> <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● When function group TGFD was enabled, TGFD decisions were issued that had previously been stored.</li> </ul>  |

|     |  |
|-----|--|
| V<> | <p>The over-/undervoltage function may now be optionally operated with an enable threshold based on the minimum current monitor for the undervoltage stages (<math>V_{&lt;}</math>, <math>V_{&lt;&lt;}</math>, <math>V_{pos&lt;}</math>, <math>V_{pos&lt;&lt;}</math>).</p> <p>The undervoltage stages are blocked if during active monitoring the set threshold of at least one phase is not exceeded by the phase currents. There are two new setting parameters to activate the operating mode for minimum current monitoring and to set the enable threshold:</p> <ul style="list-style-type: none"><li>● V&lt;&gt;: Op. mode V&lt; mon. PSx (001 162)</li><li>● V&lt;&gt;: I enable V&lt; PSx (001 155)</li></ul> |
| P<> | <p>The underpower stages P&lt;/&lt;&lt; und Q&lt;/&lt;&lt; were added to the function. Further starting signals were added which will only trigger when power values have been determined <i>and</i> the power direction is detected to correspond with the setting.</p>   |
| CBM | <p>Function group circuit breaker monitoring (CBM) has been added.</p>   |
| CBF | <p>The complete revision of the circuit breaker failure protection function now includes a current breaking-off criterion.</p>   |

**A6.1.1.9****P439 -303 -405/406 -611**

Release: 2006-02-09

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

The basic software for the device has been adapted to support a detachable HMI.

*IEC*

A settable VLAN identifier has been implemented.

The IEC data model has been extended and harmonized.

The settable IED name now precedes the LD name.

Bug notice: With versions P439-610 and -611 it is not possible to enter GOOSE events into the interlocking logic.

Bug fixing:

- A fault could occur when the device was overloaded with too many switching commands.

**A6.1.1.10****P439 -303 -405/406 -612**

Release: 2006–12–06

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## COMM1

The upgraded communications software 3.18 is now implemented. Various small bugs have been fixed in communication protocols per IEC 60870-5-101 and MODBUS.

## IEC

Bug fixing:

- If communication was interrupted during control access via the Ethernet interface using the operating program MiCOM S1, renewed control access was only possible after a warm restart of the P439.
- If a “Select” or “Operate” command for an external device, in which the interlock bit had been set, was sent from a client to the protection and control unit it could occur that such a command was rejected.
- Previously a break in the client-server communications link could occur after approximately 49 days for about 20 minutes. GOOSE and GSSE are not affected.

## GOOSE

For the exchange of binary information in an Ethernet network section the IEC 61850 communication procedure (IEC-GOOSE) has been implemented.

**A6.1.1.11****P439 -304 -407/408 -613**

Release: 2007-01-19

*Hardware*

As an ordering option for the 40 TE and 84 TE model versions there is now a variant available with a detachable HMI. The detachable HMI is always supplied with a case width of 40 TE. The freely configurable LED indicators H4 to H16 on the detachable HMI are provided as multi-color LEDs.

The ordering option Ethernet module with 100 Mbit/s glass fiber and ST connector has replaced the ordering option Ethernet module with 10 Mbit/s glass fiber and ST connector.

*Diagram*

The updated connection diagrams now include the interfaces to connect the detachable HMI.

- P439-407 (for 40 TE case, with pin-terminal connection)
- P439-408 (for 84 TE case, with ring-terminal connection)

*Software*

## DVICE, LOC

Because of the ordering option “detachable HMI” these additional Device Identification parameters are now available:

- (002 131) DVICE: SW version DHMI
- (002 132) DVICE: SW version DHMI DM
- (221 099) LOC: Local HMI exists

## COMM1

When the protocols per IEC 60870-5-101 or IEC 60870-5-103 are used, the message (221 100) COMM1: Buffer overrun is issued when an internal buffer overrun of the spontaneous control function signals has occurred.



## IEC

Implementation of active monitoring of the communications data links to logged-on clients with the parameter (104 062) IEC: TCP keep-alive timer. This active monitoring now replaces previous passive monitoring by parameter (104 050) IEC: Inactivity timer.

Implementation of an automatic switchover to daylight saving time, activated by parameter (104 219) IEC: Switch.dayl.sav.time. Switchover times for the automatic switch to daylight saving time are governed by the following settings:

- (104 220) IEC: Dayl.sav.time start
- (104 221) IEC: Dayl.sav.time st. d
- (104 222) IEC: Dayl.sav.time st. m
- (104 223) IEC: Dayl.sav.t.st.0:00 +
- (104 225) IEC: Dayl.sav.time end
- (104 226) IEC: Dayl.sav.time end d
- (104 227) IEC: Dayl.sav.time end m
- (104 228) IEC: Dayl.sav.t.end 0:00+

A second SNTP server may now be applied for time synchronization. Should no answer be transmitted by the first SNTP server the next request is automatically transferred to the second SNTP server (backup function).

- (104 202) IEC: SNTP server 1 IP
- (104 210) IEC: SNTP server 2 IP

Instead of setting a router address and target network, so as to establish a communication link to a client situated exterior to the local network, now only the setting of the gateway address is required via (104 011) IEC: Gateway address.

Now “unbuffered reports” are available for all logical nodes.

## GOOSE

VLAN priority for GOOSE is set via (106 007) GOOSE: VLAN Priority.

The dataset reference for GOOSE is displayed via the measured value (106 008) GOOSE: DataSet Reference.

The number of addressable external devices was increased from 16 to 32.

The parameter GOOSE: DataSet Cfg.Revision (106 005) was renamed to GOOSE: DataSet Cfg.Revision (106 009) and all parameters

GOOSE: Ext.Devxx interm.pos (xx=1 to 16) are now available as GOOSE: Ext.Devyy interm.pos (yy=01 to 32).

## LED

The operating mode for the LED indicators has been extended by the operating mode LED flashing.

Configuration, operating mode and physical state of the permanently configured LED indicators H1 and H17 are now displayed via configuration parameters and physical state signals.

The freely configurable LED indicators H4 to H16 may now be assigned two signals, each with a different color (red or green). If both assigned signals are active the resulting LED color will be “amber”.

|           |   |
|-----------|---|
| MAIN      | <p>The parameter (221 098) MAIN: Time tag has replaced the previous parameter (221 083) MAIN: TimeTagAfterDebounce. In addition there is a third operating mode available for selection.</p> <p>Bug fixing:</p> <ul style="list-style-type: none"><li>● When binary input functions are de-configured (...EXT) so as to enable or disable function groups their internal state was initialized to the correct default value only with physical inputs. With logical communication interfaces (LOGIC, COMM3, GOOSE, GSSE) it was possible that the last valid state value was retained.</li></ul>  |
| ASC       | <p>Bug fixing:</p> <ul style="list-style-type: none"><li>● If the automatic synchronism check was disabled while the (037 086) ASC: Close rejection signal was still present then this signal was not reset.</li></ul>  |
| LOC, MAIN | <p>Respective binary signal inputs (if previously unavailable) are assigned to all default reset functions. These binary input functions are now available in the configuration list for the two newly implemented group resetting functions as well as the extended functional assignment for the CLEAR key ('C'):</p> <ul style="list-style-type: none"><li>● (005 248) MAIN: Fct.assign. reset 1</li><li>● (005 249) MAIN: Fct.assign. reset 2</li><li>● (005 251) LOC: Assignment reset key</li></ul> <p>Two menu jump lists may now be configured. These menu jump lists make it possible to select individual menu points (i.e. set values, counters, triggering functions, event logs) in a freely definable sequence.</p> <ul style="list-style-type: none"><li>● (030 238) LOC: Fct. menu jmp list 1</li><li>● (030 239) LOC: Fct. menu jmp list 2</li></ul> |
| DTOC      | <p>Bug fixing:</p> <ul style="list-style-type: none"><li>● Because of an assigning error the incorrect signals "DTOC startings" were issued instead of "DTOC blockings EXT", which occurred through the communication interfaces (IEC, COMM1 with IEC 60870-5-101 / -103, MODBUS, DNP) and with fault recording.</li></ul>  |
| PSB       | <p>Bug fixing:</p> <ul style="list-style-type: none"><li>● The measurement of Delta Z was not always carried out correctly when the positive-sequence impedance moved into the power swing polygon "from left to right".</li><li>● The maximum blocking time is now re-started again with each entry into the power swing polygon.</li></ul>  |
| CBF       | <p>The parameter (011 067) CBF: tCBF has been removed. This time-delay is no longer required by the new circuit breaker failure function which includes the undercurrent criterion.</p>   |

**A6.1.1.12                      P439 -303 -405/406 -612-711**

Release: 2007–02–13

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## IEC

Further measures were implemented to improve communications stability even during short network interruptions.

**A6.1.1.13                      P439 -304 -407/408 -613-712**

Release: 2007–03–07

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## IEC

Further measures were implemented to improve communications stability even during short network interruptions.

## LOC

The time periods for the reset time for backlighting of the LCD display and the return time were not issued correctly.

## MAIN

Bug fixing:

- Multiple blockings did not operate properly.

**A6.1.1.14****P439 -304 -407/408 -613-713**

Release: 2007-05-22

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## LOC

Bug fixing:

- A device warm restart occurred, 20 seconds after the DHMI was removed.

**A6.1.1.15****P439 -304 -407/408 -613-714**

Release: 2007-06-13

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## IEC

Implementation of the communication protocol has been extended:

The implementation of this version of the IEC 61850 protocol of the P439 has been certified by the KEMA.

**A6.1.1.16****P439 -304 -407/408 -614**

Release: 2007–09–18

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## DVICE

Parameter DVICE: AFS Order No. (001 000) is to be used instead of (000 001) DVICE: Order No.. This new device identification parameter may be edited so that details on hardware additions can be registered with the device on site.

## COMM1

Transmission of measured operating values is now carried out with 32 bit values. (Counters and overflow values are transmitted together; the frame format is backwards compatible).

## IEC

IEC: Deadband value (104 051) was divided into several individual settings:

- (104 229) IEC: Update Measurements
- (104 230) IEC: Dead band IP
- (104 231) IEC: Dead band IN
- (104 232) IEC: Dead band VPP
- (104 233) IEC: Dead band VPG
- (104 234) IEC: Dead band f
- (104 235) IEC: Dead band P
- (104 236) IEC: Dead band phi
- (104 237) IEC: Dead band Z
- (104 238) IEC: Dead band min/max
- (104 239) IEC: Dead band ASC
- (104 240) IEC: Dead band temp.
- (104 241) IEC: Dead band 20mA

The analog measured values from the PT 100 input and the 20 mA input have been added to the data model.

The power factor value has been added to the list of cyclic measured values.

## INP

Further reset commands were added to the function assignment of binary signal inputs:

- (006 054) COMM3: Reset No.tlgerr EXT
- (006 076) MEASI: Rst. temp. Tmax EXT
- (006 074) ASC: Reset counters EXT
- (006 075) f<>: Reset meas. vals EXT

|                  |   |
|------------------|---|
| MAIN             | <p>The MAIN: Meas. direction P,Q (006 096) setting now allows sign inversion for the display of the following measured operating values:</p> <ul style="list-style-type: none"> <li>● MAIN: Active power P prim. (004 050)</li> <li>● MAIN: Reac. power Q prim. (004 052)</li> <li>● MAIN: Active power P p.u. (004 051)</li> <li>● MAIN: Reac. power Q p.u. (004 053)</li> </ul> <p>This parameter setting does not influence the remaining measured operating values. It must be noted that by inverting the sign only the display of measured operating values is effected, but all of the protection functions continue to use non-inverted measured operating values.</p> <p>The following logic state signals are issued depending on the respective control point position:</p> <ul style="list-style-type: none"> <li>● MAIN: Cmd. fr. comm.interf (221 101)</li> <li>● MAIN: Command from HMI (221 102)</li> <li>● MAIN: Cmd. fr. electr.ctrl (221 103)</li> </ul> |
| MCMON            | <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● Monitoring of <math>V_{ref}</math> did not function when the processor board P 9651428 was fitted.</li> </ul>   |
| FT_DA            | <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● When the primary short circuit impedance was calculated, the set secondary nominal voltage was not taken into account (the calculation was always carried out with the value for <math>V_{nom} = 100\text{ V}</math>).</li> </ul>   |
| OUTP, LED, LOGIC | <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● The (037 200) DIST: Impedance in zone 6 signal was added to the selection tables.</li> </ul>  |
| BUOC             | <p>The setting range for the overcurrent stages has been extended:</p> <ul style="list-style-type: none"> <li>● (010 058) BUOC: <math>I &gt; PSx = 0.10 \dots 1.00 \dots 20.00 I_{nom}</math></li> <li>● (010 064) BUOC: <math>IN &gt; PSx = 0.10 \dots 0.20 \dots 20.00 I_{nom}</math></li> </ul>  |
| ASC              | <p>The default values for which the voltage thresholds determine that “<i>voltage is present</i>” (<math>V &gt;</math>) or “<i>voltage is not present</i>” (<math>V &lt;</math>) have been set to more realistic values:</p> <ul style="list-style-type: none"> <li>● (026 017) ASC: AR <math>V &gt;</math> volt.check <math>PSx = 0.80 V_{nom}/\sqrt{3}</math></li> <li>● (018 017) ASC: AR <math>V &lt;</math> volt.check <math>PSx = 0.20 V_{nom}/\sqrt{3}</math></li> </ul>   |
| TGFD             | <p>Self-monitoring has been enhanced. Transient faults now do not lead to a continuous blocking of the TGFD module or to an entry into the monitoring signal memory.</p>  |

## P&lt;&gt;

## Bug fixing:

- The setting parameters P<> were not converted when the settings for Inom or the dynamic range had been changed. A new calculation was only carried out after a warm restart.
- Dependent on the setting (large operate value + large hysteresis) an overflow error could occur with the underpower stages P</<< and Q</<< so that the hysteresis could not be adhered to correctly.

## LIMIT

Reference voltage monitoring was added to the Limit Value Monitoring function.

## DEVxx

The state signals are now stored in the operating data memory:

- (218 000) DEV01: Open cmd. received (...etc for DEV02,...)
- (218 001) DEV01: Close cmd. received (...etc for DEV02,...)

Supporting of 3 position disconnecter / earthing switch.

The function type may now again be set in the range from 1 to 254. It must be observed that setting type numbers may not be applied from the range of standardized or reserved signals according to IEC 60870-5-103 for distance protection devices (80 to 8F hex = 128 to 143 dec) in order to avoid conflict situations with commands and signals within the protection's extent.

The setting parameters required only with communication protocols per IEC 60870-5 are now only available if such a protocol is used. The following settings are visible only when (003 215) COMM1: Basic IEC870-5 enabl has been set to Yes (example shown for DEV01):

- (210 034) DEV01: Funct. type, signal
- (210 035) DEV01: Inform. No., signal
- (210 032) DEV01: Funct. type, command
- (210 033) DEV01: Inform. No., command
- (221 002) MAIN: SI active USER
- (210 025) DEV01: Open w/o stat.interl
- (210 026) DEV01: Close w/o stat. int.
- (210 039) DEV01: Fct.assig.BlwSI open
- (210 040) DEV01: Fct.assig.BlwSI clos

**A6.1.1.17****P439 -304 -407/408 -614-715**

Release: 2007–10–22

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## IEC

## Bug fixing:

- A communications fault occurred, if the K200 relay was not wired correctly in bays with motor controlling.
- Freezing of operation measurements reports after  $65536 \times 2$ seconds (36.4 hours).

## MAIN

## Bug fixing:

- The CB status signals were not monitored. The following signals were not updated:
  - (031 040) MAIN: CB open 3p
  - (031 042) MAIN: CB closed 3p
  - (031 041) MAIN: CB pos.sig. unplaus.This fault was also present with the CBM and CBF functions.

## CBF

The signal CBF: CB failure (036 017) is now available again.



**A6.1.1.18                      P439 -304 -407/408 -614-716**

Release: 2007–11–16

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## IEC

The CBF data model has been enhanced to meet the current state offered by the Px3x platform.

**A6.1.1.19                      P439 -304 -407/408 -615**

Release: 2008–03–10

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## IEC

Bug fixing:

- With the fault values transmission the nominal current setting was ignored (all values were referenced to  $I_{nom} = 1 \text{ A}$ ).

**A6.1.1.20****P439 -304 -407/408 -616**

Release: 2009–03–26

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## LOC

New parameter for the hold-time of the measured values display.

- (031 072) LOC: Hold-t. meas.v.displ

Range: 1 to 60 seconds.

The default value is *blocked*, so that the behavior is backward-compatible (i.e. the new functionality is deactivated).

Functionality: On the Bay Panel, one can select the previous or next configured measured value by pressing the “Up” or “Down” key, respectively. This works exactly like before. The new feature is that always after the set time the display automatically steps forward to the next value. If the parameter is set to *blocked*, the selected measured value is always displayed.

Bug fixing:

- The Password Display mode was not supported during a startup.
- The detachable HMI did not support the character set 3.

## COMM1

Communications protocol IEC 60870-5-103: When checking during test operations it is now possible to trigger signals (SIG) and contact positions (DEV) from the control part (previously only possible from the protection part).

Bug fixing:

- Communications protocol DNP3: Contact positions were transmitted twice.
- MODBUS protocol: The analog channel with the reference voltage value was not transmitted.

## COMMx

Bug fixing:

- The time-tags with entries into various recording memories could differ, in particular when the parameter subset was changed.

## LED

By default (unchanged) the H4 LED indicator is assigned to MAIN: Gen. trip signal (036 251), but its operating mode is now set at (085 008) LED: Operating mode H 4 to *ES reset (fault)* by default.

|       |   |
|-------|---|
| MAIN  | <p>New addresses with a 32 bit measured value display have been added for the 4 energy measured values:</p> <ul style="list-style-type: none"> <li>● (008 065) MAIN: Act.energy outp.prim <ul style="list-style-type: none"> <li>◦ 0 ... 6,553,500.00 MWh</li> </ul> </li> <li>● (008 066) MAIN: Act.energy inp. prim <ul style="list-style-type: none"> <li>◦ 0 ... 6,553,500.00 MWh</li> </ul> </li> <li>● (008 067) MAIN: React.en. outp. prim <ul style="list-style-type: none"> <li>◦ 0 ... 6,553,500.00 Mvar h</li> </ul> </li> <li>● (008 068) MAIN: React. en. inp. prim <ul style="list-style-type: none"> <li>◦ 0 ... 6,553,500.00 Mvar h</li> </ul> </li> </ul> <p>The designation text for signal (036 051) has been changed from MAIN: CB closed sig. EXT to MAIN: CB closed 3p EXT without changes in its functionality.</p> <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● The manual close command from the local control panel did not function.</li> </ul> |
| FT_DA | <p>The fault location may now be determined, based solely on a ground starting condition (without a general starting). For this the P439 determines all three phase-to-ground loop impedances and then provides the fault location based on the reactance of the measurement loop with the lowest impedance value.</p> <p>A first version of this feature was already present with software version P439 -616. With the present software version P439 -630 this feature was again revised such that the determination of impedances and the fault location is triggered 100 ms after a ground starting condition has occurred, independent of the set value for timer stage <math>t_{IN&gt;}</math>.</p>  |
| SFMON | <p>The (093 094) SFMON: TGFD mon. triggered signal can now be selected at (021 030) SFMON: Fct. assign. warning but it does not automatically issue an alarm signal on its own.</p>   |
| MCMON | <p>During a starting of the backup overcurrent-time protection (BUOC) monitoring of the negative-sequence voltage is now suspended. This will prevent the measuring-circuit monitoring function from dropping out and distance protection from becoming active again when the measured value falls below the threshold <math>V_{neg&gt;}</math> because of a short-circuit occurring in the primary system.</p>   |
| DIST  | <p>The monitoring speed and accuracy of the tripping time in isolated neutral and resonant grounding systems has been improved.</p> <p>The designation text at (035 073) DIST: Trip sig. Zone 2-6 was corrected to DIST: Trip sig. zone 2-8.</p> <p>The following parameters have been given new default values:</p> <ul style="list-style-type: none"> <li>● DIST: Zfw,PG PSx — 0 <math>\Omega</math></li> <li>● DIST: Zfw,PP PSx — 0 <math>\Omega</math></li> <li>● DIST: kze,PG HSR PSx — 1.50</li> <li>● DIST: kze,PP HSR PSx — 1.50</li> <li>● DIST: kze,PG TDR PSx — 1.50</li> <li>● DIST: kze,PP TDR PSx — 1.50</li> </ul>   |

|                 |  |
|-----------------|--|
| ASC             | When the operating mode is set to <i>Vref &amp; Z1</i> but not <i>V</i> the significance of “Z1” is extended so that with a trip from distance zone 1 OR a PSIG trip the condition is met. This then makes reclosing possible if the primary fault was on the protected line.  |
| PSIG            | The following parameter has a new default value: <ul style="list-style-type: none"> <li>● PSIG: Echo on receive PSx — <i>Without</i></li> </ul>  |
| ARC             | Operative time 2 (ARC: Operative time 2 PSx) is now featured by the P439. In relation with the maximum dead time ARC: Dead time max PSx (which is also available now), it will now be possible to set a dead time according to ASC requirements which will prevent predictable unsuccessful reclosure commands.<br>Bug fixing: <ul style="list-style-type: none"> <li>● Up to now the zone extension factors (kze) from the high-speed reclosure (HSR) were always used, even with a time-delayed reclosure (TDR).</li> </ul>                                    |
| DTOC            | Bug fixing: <ul style="list-style-type: none"> <li>● Up to now blocking of the tIN timer stage (by setting (072 027) DTOC: tIN&gt; PSx to <i>Blocked</i>) also resulted in the blocking of the direction determination by the residual current stages tIN&gt;&gt;, tIN&gt;&gt;&gt; and tIN&gt;&gt;&gt;.</li> </ul>   |
| P<>             | Bug fixing: <ul style="list-style-type: none"> <li>● In certain situations an overflow could occur with very large values for P&lt;, Q&lt;.</li> </ul>   |
| DEV01 ... DEV10 | User-defined names can now be used as device identifiers. In the parameter DEVxx: Designat. ext. dev., the new option <i>Device Name User</i> is available. Then the text for the device's name, entered by the user at each of the DEVxx: DEV-Name User parameters, will be used as the device's designation. (The maximum length is 4 characters, as with the fixed identifiers. Any longer text entered is truncated to 4 characters internally.) The following parameters are new:<br>(218 101) DEV01: DEV-Name User<br>to<br>(218 110) DEV10: DEV-Name User |

**A6.1.1.21****P439 -304 -407/408 -616-719**

Release: 2009-07-20

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## LOC

## Bug fixing:

- Resetting LED indicators during the selection of an external device from the local control panel would shut-off the flashing state of the selected external device's designation.
- Process cycle times were often extended to approximately 100 to 150 ms when the device was operated without a local control panel (HMI) being attached.
- When LED indicators were reset externally, some characters on the LC display could be shown incorrectly or not at all.

## IEC

## Bug fixing:

- After some 15000 close/open commands, the client aborted communication.
- Commands are now rejected with signal "Command already in execution", and the position of the circuit breaker contacts is transmitted correctly to the control system.
- After an abort command with a wrong frame format the state of external devices was no longer transmitted.

## GOOSE

## Bug fixing:

- In case of a problem with the network it could occur that a single GOOSE message was lost.
- The internal counters "sqNum" and "stNum" were not initialized correctly (after GOOSE activation).

**A6.1.1.22****P439 -305 -409/410 -630**

Release: 2009–09–10

*Hardware*

Additional binary input/output modules are now available:

- X(6I 6H) fitted with 6 binary signal inputs and 6 output relays with heavy duty contacts,
- X(6I 3O) fitted with 6 binary signal inputs and 3 output relays,
- X(4H) fitted with 4 heavy duty contacts.

*Diagram*

The updated terminal connection diagrams include the terminal connection diagrams for the new binary I/O modules:

- P439 -409 (for 40TE pin-terminal connection)
- P439 -410 (for 84TE ring-terminal connection)

*Software*

## LOC

The names of busbars and BB-sections can now be edited by the user.

One has to select *BB-User Name* for „Designation busbar #“ or *BB\_Sect.User Name* for „Designat. bus sect.#“, respectively. Then the user name is entered as text value of the respective parameter “Busbar#-NameUser”/“BB Sect.#-NameUser”. The maximum length is 3characters, longer texts will be internally truncated.

Parameters:

- LOC: Busbar1-NameUser (218 191)
- LOC: Busbar2-NameUser (218 192)
- LOC: Busbar3-NameUser (218 193)
- LOC: BB Sect.1-NameUser (218 195)
- LOC: BB Sect.2-NameUser (218 196)

## INP

The setting INP: Filter (010 220) is now available for conformity with standard IEC 60255-22-7, class A.

## LED

By default (unchanged) the H4 LED indicator is assigned to MAIN: Gen. trip signal (036 251), but its operating mode is now set at (085 008) LED: Operating mode H 4 to *ES reset (fault)* by default.

## IEC, GOOSE

Phase 2 of the IEC 61850 communications protocol has been implemented.

|       |  |
|-------|--|
| IEC   | <p>Added to the communication protocol IEC 61850 are:</p> <ul style="list-style-type: none"> <li>● MmuPriMMXU1/PhV.neut Voltage VNG prim.</li> <li>● MmuPriMMXU1/PhV.res Volt. <math>\Sigma(VPG)/3</math> prim.</li> <li>● MmuPriMMXU1/A.res Current <math>\Sigma IP</math> prim.</li> <li>● MmuSecMMXU1./PhV.neut Voltage VNG p.u.</li> <li>● MmuSecMMXU1/PhV.res Volt. <math>\Sigma(VPG)/3</math> p.u.</li> <li>● MmuSecMMXU1/A.neut Current IN p.u.</li> <li>● MmuSecMXU1/A.res Current <math>\Sigma IP</math> p.u.</li> </ul>  |
| COMM1 | <p>These new addresses were added:</p> <ul style="list-style-type: none"> <li>● (221 105) COMM1: Sel. pos. dev.test <ul style="list-style-type: none"> <li>◦ <i>Not assigned</i></li> <li>◦ <i>DEVxx</i></li> </ul> </li> <li>● (221 106) COMM1: Test position dev. <ul style="list-style-type: none"> <li>◦ <i>don't execute</i></li> <li>◦ <i>execute open</i></li> <li>◦ <i>execute close</i></li> <li>◦ <i>execute intermed.</i></li> </ul> </li> </ul>  |
| FT_DA | <p>The fault location may now be determined, based solely on a ground starting condition (without a general starting). For this the P439 determines all three phase-to-ground loop impedances and then provides the fault location based on the reactance of the measurement loop with the lowest impedance value.</p> <p>A first version of this feature was already present with software version P439 -616. With the present software version P439 -630 this feature was again revised such that the determination of impedances and the fault location is triggered 100 ms after a ground starting condition has occurred, independent of the set value for timer stage <math>t_{IN}</math>.</p> |
| MCMON | <p>The "Fuse Failure" monitoring function can be blocked by a binary input function at MCMON: Blocking FF,V EXT (002 182). Further blocking conditions can be flexibly defined by applying this signal, e.g. with the help of the LOGIC function.</p> <p>The following new signals are now available:</p> <ul style="list-style-type: none"> <li>● (007 213) MCMON: M.circ. Vref faulty</li> <li>● (007 214) MCMON: M.circ. VNG faulty</li> </ul> <p>This permits blocking of only the associated voltage timer stages in V&lt;&gt;, without blocking the entire V&lt;&gt; function group.</p>   |

**MAIN** The following measured operating data for delayed/stored phase current values have been added:

- MAIN: IA prim,demand (006 226)
- MAIN: IB prim,demand (006 227)
- MAIN: IC prim,demand (006 228)
- MAIN: IA prim,demand stor. (006 223)
- MAIN: IB prim,demand stor. (006 224)
- MAIN: IC prim,demand stor. (006 225)
- MAIN: IA p.u.,demand (006 235)
- MAIN: IB p.u.,demand (006 236)
- MAIN: IC p.u.,demand (006 237)
- MAIN: IA p.u.,demand stor. (006 232)
- MAIN: IB p.u.,demand stor. (006 233)
- MAIN: IC p.u.,demand stor. (006 234)

The Logic state signal at MAIN: M.c.b. trip VNG EXT (002 183) shows if an M.C.B. trip is present for the external  $V_{NG}$  measuring circuit. This parameter is active only when the setting "Measured" was selected for  $V_{NG}$  determination. An M.C.B. trip  $V_{NG}$  leads to the signal: MCMON: M.circ. VNG faulty (007 214).

Measured operating values are now also calculated during a general starting condition and no longer set to "not measured".

This new signal is now available:

- MAIN: Trip signal 1, 3p (037 253)

New logic state signals for clock synchronization:

The parameter: MAIN: Time synchronized (009 109) shows whether an external clock synchronization had been carried out. This signal is reset after 10 minutes.

Bug fixing:

- Error in handling of the 5 A range in the data for the processor board. Data from the EEPROM were included, even if their checksum was invalid, when data from the second range were entered.

**PSIG** The former parameter (036 048) PSIG: Receive EXT is now featured as two signals:

- (036 048) PSIG: Receive (A) EXT
- (006 037) PSIG: Receive (B) EXT

By setting PSIG: 3 ended line prot PSx it is determined whether both signals are linked in an "AND" or an "OR" gate to form the (006 036) PSIG: Receive combined signal.

Bug fixing:

- The Open signal was missing in the *Reverse interlocking* operating mode.

**BUOC** The BUOC function is now available for all neutral point groundings. (The dependence on the neutral point setting has been eliminated.) However the stage IN> (BUOC: IN> PSx) may now be set to *Blocked*.



|       |   |
|-------|---|
| ASC   | <p>Among the operating modes for the voltage-checking feature there is now an "Exclusive OR" / "XOR" condition available:</p> <ul style="list-style-type: none"> <li>● (018 029) ASC: AR Op.mode v-chk.PSx = <math>N V \&amp; V_{ref} \text{ or } V \&amp; \bar{n} V_{ref}</math></li> <li>● (000 060) ASC: MC op.mode v-chk.PSx = <math>N V \&amp; V_{ref} \text{ or } V \&amp; \bar{n} V_{ref}</math></li> </ul> <p>The meaning of abbreviation "<math>N V \&amp; V_{ref} \text{ or } V \&amp; \bar{n} V_{ref}</math>" is "[ (NOT V) AND Vref] OR [V AND (NOT Vref)]".</p>  |
| ARC   | <p>When ARC: Mon. PSIG recv. PSx is set to Yes then all receive signals are counted during the operative and dead time periods and the maximum dead time period is started when the result counted is unequal to 1.</p>   |
| COUNT | <p>There are now these additional count values 2, 3 and 4 available, i.e. a total of four counters:</p> <ul style="list-style-type: none"> <li>● (217 080) COUNT: Count 2</li> <li>● (217 081) COUNT: Count 3</li> <li>● (217 082) COUNT: Count 4</li> <li>● (217 085) COUNT: Set counter 2 EXT</li> <li>● (217 086) COUNT: Set counter 3 EXT</li> <li>● (217 087) COUNT: Set counter 4 EXT</li> </ul> <p>This new parameter has been introduced:</p> <ul style="list-style-type: none"> <li>● (221 096) COUNT: Iec61850 pulsQty</li> </ul> <p>It is used to set the scaling factor for the count value's transmission via IEC 61850. According to the standard the resulting value is calculated as:</p> <p>Value transmitted = updated value · pulsQty</p> <p>This parameter has been eliminated:</p> <ul style="list-style-type: none"> <li>● (217 160) COUNT: Debounce t. count. 1</li> </ul>   |
| ILOCK | <p>As the interlock conditions are also transmitted together with reporting in the newly implemented phase 2 of the IEC 61850 communication protocol (see above), it is now a requirement that these interlock conditions are cyclically checked and not, as before, only with the request for a switching operation. Therefore this new parameter has been introduced:</p> <ul style="list-style-type: none"> <li>● (221 104) ILOCK: Cycle t interl.chec</li> </ul> <p>The cycle time (range from 100 ms to 10 s) is set here, after which a check of the interlock conditions is carried out. As additional processor capacity must be provided for each of these checks it must be ensured that a favorable compromise is found for the cycle time setting value. On the one hand it is desirable to select a cycle time value which is as short as possible so that changes in the interlock conditions are updated without any notable delays, but on the other hand this cycle time value should not be so short that the P439 system will be under too much strain. As the P439 CPU load is dependent on the total number of function groups having been configured it is not possible to suggest a generally acceptable cycle time value.</p> |

**A6.1.1.23****P439 -304 -407/408 -616-720**

Release: 2009–09–18

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## IEC

Bug fixing:

- The cause of the “Undefined opcode” message that appeared during a switch command was resolved.

**A6.1.1.24****P439 -304 -407/408 -617**

Release: 2010–07–07

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## COMM1

The measured operating data (004 221) MEASI: Temperature p.u. is now available as an additional selection option for (003 175) COMM1: Cycl. data ILS tel..

## CBF

The parameter designation for (022 160) CBF: I> was changed to (022 160) CBF: I<.

P<>

The operate values setting range for the sensitive range as well as the high range have been modified so that they match. Therefore the following parameters all have the same setting range 0.010  $S_{nom}$  to 2.000  $S_{nom}$  (step size 0.001  $S_{nom}$ ):

- P<>: P> high range PSx
- P<>: P> sens. range PSx
- P<>: P>> high range PSx
- P<>: P>> sens. range PSx
- P<>: Q> high range PSx
- P<>: Q> sens. range PSx
- P<>: Q>> high range PSx
- P<>: Q>> sens. range PSx
- P<>: P< high range PSx
- P<>: P< sens. range PSx
- P<>: P<< high range PSx
- P<>: P<< sens. range PSx
- P<>: Q< high range PSx
- P<>: Q< sens. range PSx
- P<>: Q<< high range PSx
- P<>: Q<< sens. range PSx

**A6.1.1.25****P439 -304 -407/408 -618**

Release: 2011-01-07

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## IEC

In order to guarantee full compatibility with PACiS the neutral-point displacement voltage (calculated and measured) as well as the residual current (calculated and measured) were assigned to the node MMXU so that the node MSQI would then include only the positive-sequence and negative-sequence values.

## PC

The following parameter has been removed: PC: Name of manufacturer (003 183).

Note: Compatibility even with older versions of the operating program continues to be guaranteed.

## COMM1

The data point (003 178) COMM1: -103 prot. variant may now be used to select between the -103 protocol variants *Private* and *Compatible*. The protocol variant *Compatible* corresponds to the VDEW implementation.

Note: As before this setting is hidden unless an IEC 60870-5 protocol is enabled.

The data point (003 214) COMM1: MODBUS prot. variant may now be used to select between the MODBUS protocol variants *Private* and *Compatible*. The protocol variant *Compatible* corresponds to the MODBUS implementation in the MiCOM Px20 and Px40 protection devices. The protocol variant *Private* corresponds to the first implementation of the MODBUS protocol.

Note: As before this setting is hidden unless the MODBUS protocol is enabled.

## COMM1, COMM2

The menu points (003 161) COMM1: Name of manufacturer and (103 161) COMM2: Name of manufacturer can no longer be set by using a selection list but, for reasons of compatibility, they may now be defined as free text. The default is *SE* but, in individual cases, it may become necessary to enter texts differing from the default.

Notes:

- These parameters can only be set using the operating program and it is not possible to set them locally using the integrated local control panel (HMI). The maximum text length is 8 characters and designations exceeding this will be truncated.
- The parameter COMM1: Name of manufacturer is hidden unless an IEC 60870-5 protocol is enabled.

## DIST

The calculation of the short circuit impedance angle is now always carried out using the filtered fundamental fault voltage value.

**A6.1.1.26****P439 -305 -409/410 -631**

Release: 2011-01-07

*Hardware*

No changes.

*Diagram*

No changes.

*Software***PC**

The following parameter has been removed: PC: Name of manufacturer (003 183).

Note: Compatibility even with older versions of the operating program continues to be guaranteed.

**IEC**

In order to guarantee full compatibility with PACiS the neutral-point displacement voltage (calculated and measured) as well as the residual current (calculated and measured) were assigned to the node MMXU so that the node MSQI would then include only the positive-sequence and negative-sequence values.

**COMM1**

The data point (003 178) COMM1: -103 prot. variant may now be used to select between the -103 protocol variants *Private* and *Compatible*. The protocol variant *Compatible* corresponds to the VDEW implementation.

Note: As before this setting is hidden unless an IEC 60870-5 protocol is enabled.

The data point (003 214) COMM1: MODBUS prot. variant may now be used to select between the MODBUS protocol variants *Private* and *Compatible*. The protocol variant *Compatible* corresponds to the MODBUS implementation in the MiCOM Px20 and Px40 protection devices. The protocol variant *Private* corresponds to the first implementation of the MODBUS protocol.

Note: As before this setting is hidden unless the MODBUS protocol is enabled.

**COMM1, COMM2**

The menu points (003 161) COMM1: Name of manufacturer and (103 161) COMM2: Name of manufacturer can no longer be set by using a selection list but, for reasons of compatibility, they may now be defined as free text. The default is *SE* but, in individual cases, it may become necessary to enter texts differing from the default.

**Notes:**

- These parameters can only be set using the operating program and it is not possible to set them locally using the integrated local control panel (HMI). The maximum text length is 8 characters and designations exceeding this will be truncated.
- The parameter COMM1: Name of manufacturer is hidden unless an IEC 60870-5 protocol is enabled.

|       |  |
|-------|--|
| MAIN  | <p>The values range for the 3 power measured values has been expanded:</p> <ul style="list-style-type: none"><li>● (005 025) MAIN: Appar. power S prim.<ul style="list-style-type: none"><li>◦ -3,199.9 – 3,200 MVA</li></ul></li><li>● (004 050) MAIN: Active power P prim.<ul style="list-style-type: none"><li>◦ -3,199.9 – 3,200 MW</li></ul></li><li>● (004 052) MAIN: Reac. power Q prim.<ul style="list-style-type: none"><li>◦ -3,199.9 – 3,200 Mvar</li></ul></li></ul> |
| DTOC  | <p>The setting range of the characteristic angle DTOC: Angle phiG PSx (004 092, 004 247, 004 248, 004 249) has been extended to <math>-90^{\circ}</math>...<math>+90^{\circ}</math> so that capacitive ground fault currents in systems with current-limited grounding and in isolated systems may now be taken into account.</p>  |
| DEVxx | <p>The sequence for the configuration parameters in the menu tree (218 101, ...) DEVxx: DEV-Name User for DEV04 was different from that for DEV01, DEV02 and DEV03. This has now been harmonized. (The actual functionality remains unchanged.)</p>  |

**A6.1.1.27 P439 -304 -407/408 -618-727**

Release: 2012-02-01

*Hardware*

No changes.

*Diagram*

No changes.

*Software***IEC****Bug fixing:**

- If single-pole signals of function group SIG\_1 were active during device startup, this could lead to an aborted initialization of the Ethernet communication module.
- During the process of connection with clients that use the "IntegrityPeriod" option, sporadically the MMS communication of the Ethernet communication module would crash without an internal monitoring response to re-establish the functionality. (GOOSE messaging and other communication tasks were not affected.)
- Upon receiving a "Cancel" command while a switchgear device is selected, a positive acknowledgement response ("Ack OK") is sent. Previously, a "Negative ack" was sent.
- If clients did connect to the device immediately after completion of Ethernet communication module startup, this could lead to the temporary erroneous reporting of default values for the external device status (DEVxx) and of the single-pole signals (SIG\_1).
- If a close command could not be performed because of a rejection from the sync-check function, the command termination message is now sent with the correct "Block by Synchrocheck" (11) acknowledgement code number. Previously, code (16) "Timeout" was sent instead.
- Reports of events could get lost if too many state changes occurred in a short period of time, especially during secondary injection testing.

**GOOSE**

The GOOSE Time Allowed to Live (TAL) supervision is enhanced with respect to simultaneous state changes of multiple GOOSE messages.

**PC, COMM2****Bug fixing:**

- If clients did connect to the device immediately after startup of the Ethernet communication module, the initialization of the second internal communication interface could remain incomplete. As a consequence, access by the operating program via the COMM2 interface or by tunneling was not possible in this case.

**A6.1.1.28****P439 -306 -411/412 -631-726**

Release: 2012-02-01

*Hardware*

The P439 is now fitted with an improved power supply module.

Note that the voltage range has changed for DC input:

- For the DC / AC variant, the range is
  - now 60 ... 250 VDC / 100 ... 230 VAC
  - (previously 48 ... 250 VDC / 100 ... 230 VAC).
- For the DC-only variant, the range is
  - now 24 ... 60 VDC
  - (previously 24 VDC).

A new communication module ("REB" = *"Redundant Ethernet Board"*) is now available as an ordering option.

This module can be used for redundant communication via IEC 61850 and may be fitted to slot 2, as an alternative to the other communication modules. The following communication protocols are supported:

- SHP (Self-Healing Protocol).
- RSTP (Rapid Spanning Tree Protocol).
- DHP (Dual-Homing Protocol).

A detailed description of the module and the appropriate network connections is available as a separate document (*"Redundant Ethernet Board, Application Guide"*).

*Diagram*

The diagrams now include the new "REB" module.

- P439 -411: case 40 TE, pin-terminal connection
- P439 -412: case 84 TE, ring-terminal connection



## Software

### IEC

The Originator Category information is now extensively supported for control commands.

#### Bug fixing:

- If single-pole signals of function group SIG\_1 were active during device startup, this could lead to an aborted initialization of the Ethernet communication module.
- During the process of connection with clients that use the "IntegrityPeriod" option, sporadically the MMS communication of the Ethernet communication module would crash without an internal monitoring response to re-establish the functionality. (GOOSE messaging and other communication tasks were not affected.)
- Upon receiving a "Cancel" command while a switchgear device is selected, a positive acknowledgement response ("Ack OK") is sent. Previously, a "Negative ack" was sent.
- If clients did connect to the device immediately after completion of Ethernet communication module startup, this could lead to the temporary erroneous reporting of default values for the external device status (DEVxx) and of the single-pole signals (SIG\_1).
- If a close command could not be performed because of a rejection from the sync-check function, the command termination message is now sent with the correct "Block by Synchrocheck" (11) acknowledgement code number. Previously, code (16) "Timeout" was sent instead.
- Reports of events could get lost if too many state changes occurred in a short period of time, especially during secondary injection testing.
- Events that occurred after a communication link had been interrupted and before this interruption had been detected by the server, were not sent as "Buffered reports" after the connection was re-established.

### GOOSE

The GOOSE Time Allowed to Live (TAL) supervision is enhanced with respect to simultaneous state changes of multiple GOOSE messages.

### PC, COMM2

#### Bug fixing:

- If clients did connect to the device immediately after startup of the Ethernet communication module, the initialization of the second internal communication interface could remain incomplete. As a consequence, access by the operating program via the COMM2 interface or by tunneling was not possible in this case.

**A6.1.1.29****P439 -307 -411/412 -632**

Release: 2012-11-12

*Hardware*

The P439 is now fitted with an improved communication module for the InterMiCOM protocol.

**Note:** This new module is not supported by previous firmware due to differences in uploading the firmware to the controller from the main processor during service bootup.

*Diagram*

No changes.

*Software***MAIN**

In the case of direct motor control by motor relay K200 monitoring has been modified.

With previous P439 software versions, the direction control contacts would open in the following case: The K200 contacts have not opened until the end of the command to the motor when the set monitoring time-delay had expired (monitoring via binary signal input -U 706, signal SIG\_1: Signal S012 EXT as the standard setting). This reaction by the P439 (the previously permanent feature) would result in interrupting the motor control command circuit and thereby preventing an undefined switch position. However, this would involve the danger of contact burn.

By setting the new selection parameter (221 111) MAIN: Cmd.end f.K200 fail. it is now possible to select whether the previous reaction (setting = Yes) or a new behavior (setting = No) is effected.

In this new implementation option, the P439 issues respective fault signals when the monitoring time delay has expired and the direction control contacts will remain closed. (Note: This new feature bears the danger of an undefined switch position!)

For this new implementation option, the following new logic state signals have been added:

- (221 108) MAIN: K200 fail. cmd. end - This signal is issued if the K200 contacts have not opened after the set monitoring time-delay has elapsed.
- (221 109) MAIN: K200 fail. cmd.start - This signal is issued if the K200 contacts have not closed after the set monitoring time-delay has elapsed.
- (221 110) MAIN: DEV op.time exceeded - This fault signal is issued (as a group signal) when no positive position signal (status signal) has been received from the external device after a command has been issued and the set running time-delay has elapsed.

For further processing each of these new fault signals may be configured to selection parameters from the function groups LED (assignment to LED indicators), OUP (assignment to output relays), LOGIC (processing by the programmable logic function), COMMx / IEC / GOOSE (signaling via the control system) or they may be mapped to the signal panel as an alarm signal.

Acknowledging from the local control panel HMI is done by pressing the CLEAR (C) key.

- MAIN, DEVxx      The following new configuration parameters allow for defining monitoring timers for the switchgear units:
- (210 007) DEV01: StartCmdTime superv.  
 (210 057) DEV02: StartCmdTime superv.  
 ...  
 (211 207) DEV10: StartCmdTime superv.  
 (settable in the range 0.1 s ... 10.0 s, default: *blocked*)
- After sending an Open / Close command, the corresponding timer starts. If the switchgear unit has not reached its intermediate position after this time has elapsed then the command is deactivated.
- In case of a switchgear unit for which it is (almost) impossible to detect the intermediate position it is recommended to switch off this monitoring by setting the parameter to *blocked*.
- If the monitoring is active then an exceeded timer is flagged by the new logic state signal (221 112) MAIN: Startcmdtime exceed..
- Bug fixing:
- In the previous software version (-631 -726) with set operating mode DEV01: Oper. mode cmd. = *Time control*, it could happen that an open or close command was transmitted for a long time (approx. 100 s), even if the circuit breaker had already reached the requested position.
- PC, COMM1, COMM2      For the configuration of the parameters
- (003 185) PC: Cycl. data ILS tel.,
  - (003 175) COMM1: Cycl. data ILS tel. and
  - (103 175) COMM2: Cycl. data ILS tel.,
- the following measured variables are available now (in addition to those available in previous software versions):
- (004 054) MAIN: Active power factor
  - (005 026) MAIN: Appar. power S p.u.
  - (005 056) MAIN: Current IP,min p.u.
  - (004 191) GFDSS: Admitt. Y(N) p.u.
  - (004 192) GFDSS: Conduct. G(N) p.u.
  - (004 193) GFDSS: Suscept. B(N) p.u.

## IEC

## Bug fixing:

- The timestamp of the position reports of switchgear units (*CSWI\$ST\$Pos \$t*) has been corrected, so that always the time of the last change of position is transmitted.
- After a connection has been re-established, it could happen that not all *Buffered Reports* were re-sent.
- It could happen that the P439 stopped sending integrity reports for 24 hours.
- Checking the interlock conditions could lead to an unexpected warm restart.
- It could happen that a sequence of answer telegrams was not transmitted in chronological order (but in reverse, i.e. anti-chronological, order).
- In operating mode DEVxx: Oper. mode cmd. = *Time control* it could happen that an open or close command was transmitted for a long time (ca. 100 s), even if the circuit breaker had already reached the requested position.

**A6.1.1.30****P439 -308 -413/414 -650**

Release: 2013–03–01

*Hardware*

The P439 is now fitted with an improved processor module.

*Diagram*

The updated terminal connection diagrams include the optional additional I/O module interfaces:

- P439 -413 (for 40TE pin-terminal connection)
- P439 -414 (for 84TE ring-terminal connection)

*Software*

New MiCOM P30 platform software.

Many parameter labels have been modified so that they harmonize with other MiCOM P30 devices.

## DVICE

Instead of one parameter for the software version (previously: (002 120) DVICE: Software version) the version numbers -6xx and -7xx are now separately stored in two new parameters:

- (010 167) DVICE: Software version 6XX
- (010 168) DVICE: Software version 7XX

Minor version index 7xx is now starting from 700 with each new major version 6xx.

## PC, DVICE

It is now possible to upload new firmware into the device via the TCP/IP protocol. For this purpose there are several new network settings that are not identical to the ones already existing within function group IEC:

- (111 004) PC: IP address
  - (111 005) PC: IP address 1
  - (111 006) PC: IP address 2
  - (111 006) PC: IP address 3
- (111 008) PC: Subnet mask
  - (111 009) PC: Subnet mask 1
  - (111 010) PC: Subnet mask 2
  - (111 011) PC: Subnet mask 3
- (111 016) PC: IP address mode
- (111 017) PC: IP Enable config.

For testing purposes, information parameters store the updated network settings for this firmware uploading network.

- (111 000) DVICE: IP address
- (111 001) DVICE: Subnet mask
- (111 003) DVICE: MAC address

## PC

The default value of (003 081) PC: Baud rate has been changed to *115.2 kBaud*.

|       |  |
|-------|--|
| COMM1 | In the communication protocol per IEC 60870-5-103 positive command acknowledgement can now be set to use either single-character E5 (as previous versions) or a short message FT 1.5.  |
| IEC   | The number of clients for a report has been increased: An unbuffered report (urcbA ... urcbP) can be allocated to max. 8 clients (previously: 1), and a buffered report (brcbA ... brcbH) can be allocated to max. 4 clients (previously: 1).  |
| DIST  | <p>The calculation of the short circuit impedance angle is now always carried out using the filtered fundamental fault voltage value.</p> <p>Reactance reach of polygonal zones is now separately settable for phase-phase and phase-ground loops. This could be used to compensate mutual/ zero-sequence coupling effects. E.g. for zone 1:</p> <ul style="list-style-type: none"> <li>● (012 001) DIST: X1,PG (polygon) PSx</li> <li>● (002 076) DIST: X1,PP (polygon) PSx</li> </ul> <p>Note: When converting setting files, Xn,PP is set to default values and must be adjusted manually.</p> <p>Zone 1 extension can now be applied to either 'R and X' or to 'X' reach only.</p> <ul style="list-style-type: none"> <li>● (010 186) DIST: kze (polygon) PSx</li> </ul> <p>Signaling is accomplished by "any overcurrent start":</p> <ul style="list-style-type: none"> <li>● (011 139) DIST: Starting I&gt;&gt;</li> </ul> <p>The sensitive range has been combined with the high range.</p> |
| OP_RC | The operating data recording buffer size has been enlarged. It now can store up to 1000 events.  |

## MAIN

DTOC, IDMT and DIST with settable inrush stabilization per parameter subset: Stabilization selectable per stage (Phase; E/F and I2 stages): MAIN: Funct.Rush restr.PSx (017 093, 017 064, 017 082, 017 083).

Settable maximum timer, for which inrush stabilization should be effective: Blocked (w/o timer) or settable from 0.01 to 10s. (019 001, 019 002, 019 003, 019 004) MAIN: t lift rush rstr.PSx.

The value range of (015 067) MAIN: Close cmd.pulse time has been increased to *0.100 ... 10.000 s*.

The previously available parameters (003 039) MAIN: Warm restart und (000 085) MAIN: Cold restart have been relabeled MAIN: Soft Warm restart and MAIN: Soft Cold restart, respectively. They still trigger a restart of the device, but now the hardware tests are not carried out anymore during the startup phase. (This way the restart needs less time.)

For a restart including hardware tests, the following new parameters can now be used:

- (010 166) MAIN: Warm restart
- (009 254) MAIN: Cold restart

The previous selection of sensitive or maximum dynamic range for current measurements has been removed (address (031 082) MAIN: Dynamic range I). The P439 now continuously measures currents in both ranges and functions use adaptively the appropriate sampled values. Where previously 2 separate parameters were used to provide appropriate setting ranges, the sensitive range setting parameter is now removed and the high range setting parameter provides the overall setting range.

Old:

- (010 068) DIST: I> (IbI) high r. PS1
- (010 119) DIST: I> (IbI) sens. r.PS1

New:

- (010 068) DIST: I> (IbI) PSx

There is a pole-selective monitoring of the CB status signals available now (in addition to the previously existing 3p monitoring).

New input signals:

- (031 029) MAIN: CB closed A EXT
- (031 030) MAIN: CB closed B EXT
- (031 031) MAIN: CB closed C EXT

New logic state signals:

- (031 032) MAIN: CB open A
- (031 033) MAIN: CB open B
- (031 034) MAIN: CB open C
- (031 035) MAIN: CB closed A
- (031 036) MAIN: CB closed B
- (031 037) MAIN: CB closed C

Note: The plausibility check operates with pole-selective monitoring only.

There is a phase-selective current flow monitoring available now, identical to but independent of that in function group CBF.

- (010 223) MAIN: Current flow A
- (010 224) MAIN: Current flow B
- (010 225) MAIN: Current flow C

The setting for the neutral-point treatment of the system, MAIN: Neutr.pt. treat. PSx, is only used with the ASC, so that it is now visible only if the function group ASC is configured. Moreover, the set of select options has been restricted to those which are relevant for the application.

#### FT\_DA

The following measured fault data values have been introduced:

- (010 198) FT\_DA: Fault type
- (010 217) FT\_DA: Flt.volt. PG/PP prim
- (010 199) FT\_DA: Fault current P prim
- (010 216) FT\_DA: Fault curr. N prim.

The parameters for the load data have been removed:

- (004 037) FT\_DA: Load imped.post-flt.
- (004 038) FT\_DA: Load angle post-flt.
- (004 039) FT\_DA: Resid.curr. post-flt

The fault location may now be determined, based solely on a ground starting condition (without a general starting). For this the P439 determines all three phase-to-ground loop impedances and then provides the fault location based on the reactance of the measurement loop with the lowest impedance value.

#### FT\_RC

The maximum value of (003 079) FT\_RC: Post-fault time and (003 075) FT\_RC: Max. recording time has been increased to *750 periods*.

Fault recording is now providing its own independent current trigger:

- (017 065) FT\_RC: I>

A further analog channel is available, which can be used to record the calculated frequency:

- (035 169) FT\_RC: Rec. analog chann.10

Note: This setting shares a common selection table with P437, where "Current IN,par" could be selected. As this current is not available with P43x, such setting has the same effect as "Without".

Note: Inadvertently, recording channel 9 can no longer be set to "Without", but is fixed to "Vref" (if such VT input is available, otherwise this setting is invisible).

#### MCMON

The minimum current thresholds that enable negative sequence current and voltage monitoring functions are now settable:

- (010 183) MCMON: Imin curr. monitor.  
(previously fix preset to  $0.125 I_{nom}$ )
- (010 184) MCMON: Imin Vneg monitoring  
(previously fix preset to  $0.050 I_{nom}$ )

Pick-up thresholds and the time delay setting of fuse failure monitoring have been made invisible, hence can no longer be changed by user.

Note: When converting an old setting file, these settings are retained in the new settings file, but are not visible. It is recommended to set them to default values prior to conversion.



|      |  |
|------|--|
| BUOC | <p>The BUOC neutral OC stage is now available for all neutral point groundings. The dependence on the neutral point setting has been removed. However the stage IN&gt; may now be set to 'Blocked'. (010 064 BUOC: IN&gt; PSx)</p> <p>A dedicated signal is now available for indicating that IN&gt; element has started:</p> <ul style="list-style-type: none"> <li>● (010 185) BUOC: Zero-sequ. starting</li> </ul>  |
| SOTF | <p>The parameters (011 060) SOTF: Man. close timer PSx and (011 061) SOTF: Operating mode PSx have been moved to the parameter sets.</p> <p>The “switch on to fault” function (SOTF) has been completely updated. This mainly includes the dead line monitoring feature with permanent activation of the function while the line is not energized, and dedicated overcurrent stages.</p> <p>In operating mode <i>Trip with overreach</i>, SOTF provides now the trip time for extended zone 1:</p> <ul style="list-style-type: none"> <li>● (010 218) SOTF: Tripping time PSx</li> </ul>   |
| PSB  | <p>The Power Swing Blocking function has been revised. In particular, the <math>\Delta S</math> operating mode has been removed, and PSB blocking has been enhanced.</p> <p>The following additional features are now available:</p> <ul style="list-style-type: none"> <li>● By setting, not only distance zones but also undervoltage stages can be blocked by PSB.</li> <li>● An overall timer is implemented, which starts when apparent impedance enters the detection polygon for the first time. The overall timer gets reset, if the apparent impedance does not re-enter the detection polygon within the set hold time. If the overall timer elapses, PSB gets blocked for a settable time. <ul style="list-style-type: none"> <li>◦ (010 179) PSB: Max. blocking time</li> <li>◦ (011 142) PSB: Hold time</li> <li>◦ (011 143) PSB: Blocking time int.</li> </ul> </li> <li>● The description text of the following address has been changed to be more self-explaining: <ul style="list-style-type: none"> <li>◦ Old: (014 055) PSB: Max. blocking time</li> <li>◦ New: (014 055) PSB: Max. PS cycle dur.</li> </ul> </li> </ul> |
| PSIG | <p>The PSIG trip signal is now also raised in case of reverse interlocking application (trip condition: fault impedance in extended zone 1, no blocking signal received and tripping time elapsed).</p>  |
| ARC  | <p>The autoreclosing cycle now could also get started from a set LOGIC condition, e.g. in case of a ground fault forward condition in isolated/compensated power systems.</p> <ul style="list-style-type: none"> <li>● (015 033) ARC: Fct.assgn. tLOGIC</li> </ul>   |
| GFSC | <p>The sensitive directional ground fault protection function has been completely updated.</p>   |

|       |   |
|-------|---|
| GSCSG | The sensitive directional ground fault protection signaling function (GSCSG) has been completely updated. As an additional feature, weak-infeed logic gets blocked if either the GFSC IN> threshold has picked up (GFSC: IN> triggered) or the transient blocking timer is running.   |
| IDMT  | The inverse definite minimum overcurrent protection function has been completely updated, most addresses for settings and signals are changed. Moreover, the directional operation of the function has been dropped.  |
| THERM | With the new parameter THERM: Retain replica PSx (009 019, 009 030, 009 032, 009 039) it can now be configured whether the thermal replica is retained in the non-volatile section of the device's memory so that it will still be available after an interruption of the supply voltage.   |
| V<>   | Stages $V_{>>>}$ , $V_{<<<}$ , $V_{ref>>>}$ and $V_{ref<<<}$ have been added, including a separate timer for each of these new stages.<br>For all three phase stages the 3p logic OR and AND results are signaled.  |
| P<>   | Directional power protection now operates based on sensitive current measurements. As a consequence, only one threshold setting is needed per stage.<br>Setting ranges have been harmonized: <ul style="list-style-type: none"> <li>● P,Q &lt;/&gt;&gt;: 0.01 ... 1.50 <math>S_{nom}</math></li> <li>● P,Q &lt;/&lt;&lt;: 0.01 ... 0.50 <math>S_{nom}</math></li> </ul>   |
| CBF   | It is now possible to also use the residual current (measured or calculated) as an additional criterion for "circuit breaker open".<br>The following setting parameters are new: <ul style="list-style-type: none"> <li>● (022 184) CBF: Evaluation IN</li> <li>● (022 180) CBF: IN&lt;</li> </ul> The signal (038 235) CBF: Current flow N = Yes flags that the residual current $I_E$ is greater than the setting CBF: IN<. |
| LIMIT | The following group signals have been added: <ul style="list-style-type: none"> <li>● (221 232) LIMIT: tIPxx triggered</li> <li>● (221 233) LIMIT: tVPGxx triggered</li> <li>● (221 234) LIMIT: tVPPxx triggered</li> <li>● (221 235) LIMIT: tVNGxx triggered</li> <li>● (221 237) LIMIT: tVrefxx triggered</li> </ul>  |
| LOGIC | The number of logic binary inputs has been extended to 40.  |

|                       |  |
|-----------------------|--|
| LOG_2                 | <p>There is a new function group LOG_2 (Programmable Logic 2). It is identical to the previously available function group LOGIC, but it offers only four logical equations. These, however, have long-term timers, settable from 0 to 60000 s (= 16 hours, 40 minutes).</p>  |
| Control (DEVxx, MAIN) | <p>It is possible to download multiple customized bay types without cold restart. Selection parameter has been changed in that way, that any of the downloaded baytypes could be selected through its ID number:</p> <ul style="list-style-type: none"><li>● (220 000) MAIN: Type of bay</li></ul> <p>A new alarm signal for switchgear operating time exceeded is implemented:</p> <ul style="list-style-type: none"><li>● (221 110) MAIN: DEV op.time exceeded</li></ul> <p>This signal will be raised if the command does not reset successfully by switchgear position indication or external run-back signal within set operating time.</p> |
| COUNT                 | <p>The setting values of the cycle time for the count transmission - (217 007) COUNT: Cycle t.count transm - has been modified:</p> <p>Previously, this was a numerical parameter, the setting values could be in the range 0 to 60 [minutes]. Now there is an option table assigned to this parameter, which offers a variety of time values.</p>   |

**A6.1.1.31 P439 -308 -413/414 -650-701**

Release: 2013-06-21

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

Remark: This software version replaces (and corrects) software version -650. The bugs fixed with this version did not appear in any software version other than -650.

## DVICE

Bug fixing:

- The MAC address could not be set, and the download of the firmware via Ethernet was not possible.
- It could happen that no configuration could be loaded via the operating program.

**A6.1.1.32 P439 -306 -411/412 -618-728**

Release: 2013-07-19

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## COMM1

Bug fixing:

- After activation and subsequent deactivation of the signal and measurement blocking (COMM1: Sig./meas. block EXT) it was no longer possible to control switchgear units via IEC 60870-5-103 (master) protocol.

**A6.1.1.33****P439 -308 -413/414 -650-702**

Release: 2013–10–10

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## OUTP

Bug fixing:

- Output relay K608 did not operate correctly.

**A6.1.1.34****P439 -308 -413/414 -651**

Release: 2014-01-14

*Hardware*

No changes.

*Diagram*

No changes.

*Software***LED**There is a new operating mode *ES Alarmunit*:

If this is set, the LED starts flashing with the first signal edge of the assigned signal.

If this is acknowledged (i.e. the LED is reset), although the assigned signal is still active, then the LED changes to continuous light, and if the signal disappears later on, then the LED goes off.

If the flashing LED is acknowledged (i.e. the LED is reset) and the assigned signal is no longer present, the LED immediately goes off.

**MAIN**

A signal for the indication of chatter suppression start has been implemented:

MAIN: Chatt.suppr. started (221 121)

The MAIN: Fct.assig.trip cmd.1 (021 001) is now provided with a dedicated reduced selection table. This prevents the configuration of signals that are already linked in fixed logic such as *DIST: Trip signal*. This in turn avoids jeopardizing fixed logic and thereby avoids an unwanted 3-pole trip or non-selective trip of extended zone 1.

Operation of chatter suppression is now signaled:

- (221 121) MAIN: Chatt.suppr. started

**SFMON**

Bug fixing:

- Monitoring signals resulting from GFSC (measurement monitoring) and GSCSG (mismatch of operation mode when using a common channel with PSIG) were missing in the previous P439 data model and have now been added:
  - (098 013) SFMON: Meas. circuits GFSC
  - (098 019) SFMON: Op.mode PSIG inval.

|                       |   |
|-----------------------|---|
| PSIG                  | <p>The condition for signaling transmission channel failure can now be set to match the application requirements:</p> <ul style="list-style-type: none"> <li>● PSIG: Blk.f.telcom.flt PSx (012 246) <ul style="list-style-type: none"> <li>= <i>Ch. (A)OR(B) faulty</i> for 2- or 3-ended line protection</li> <li>= <i>Ch. (A)AND(B) faulty</i> for 2-ended line protection with redundant channels</li> </ul> </li> </ul> <p>The send signal PSIG: Send (signal) (036 035) is now raised even in 3-channel applications along with any of the phase selective send signals, because it is transmitted in the protocol according to IEC -103 as compatible spontaneous message.</p> <p>For unambiguous signaling an additional send signal is implemented which is used along with a 1-channel transmission:</p> <ul style="list-style-type: none"> <li>● PSIG: Send (012 243)</li> </ul>  |
| Control (DEVxx, MAIN) | <p>There is a new setting parameter, MAIN: Ext.cmd.term. w/o PI (221 115), to configure whether an “external termination” of the switching command is also done based on position indication, or if only an external termination signal is accepted.</p>  |
| DEVxx                 | <p>In addition to the direct motor control principle based on fixed logic (K200), a new setting parameter has been implemented:</p> <ul style="list-style-type: none"> <li>● (202 014) CMD_1: CMD_DC3 config. — with check back signal</li> </ul> <p>An operating counter and a settable limit threshold with related alarm signal has been implemented for each DEVxx:</p> <ul style="list-style-type: none"> <li>● (210 043) DEV01: Operation counter ... (210 143) DEV03: Operation counter</li> <li>● (218 211) DEV01: Oper.count.limit ... (218 213) DEV03: Oper.count.limit</li> <li>● (219 081) DEV01: Warning op.count. ... (219 083) DEV03: Warning op.count.</li> </ul> <p>There are two new setting parameters available for each device, which can be used for blocking any open / close operation of the switchgear unit. These parameters are not affected by interlocking conditions.</p> <ul style="list-style-type: none"> <li>● (218 120) DEV01: Block cmd open ... (218 129) DEV10: Block cmd open</li> <li>● (218 160) DEV01: Block cmd close ... (218 169) DEV10: Block cmd close</li> </ul> |
| SIG_1                 | <p>The number of SIG_1 input signals has been extended to 64. However, this requires that two hardware modules of type X(24I) are fitted.</p>   |

MAIN, CMD\_1, SIG\_1 The direct motor control of switchgear devices has been enhanced. Instead of using an external contactor (K200) internal high-break output can now be used. It requires adjustments to the switching and monitoring timings, for which a dedicated single command and a single signal are provided.

Settings:

- (202 014) CMD\_1: CMD\_DC3 config.
- (202 010) CMD\_1: Design. CMD\_DC3
- (233 007) SIG\_1: SIG\_DC3 config.
- (233 000) SIG\_1: Designat. SIG\_DC3
- (221 240) MAIN: DC op. delay t1
- (221 242) MAIN: DC2/3 release delay
- (221 115) MAIN: Ext.cmd.term. w/o PI

Signals:

- (202 011) CMD\_1: CMD\_DC3
- (233 004) SIG\_1: SIG\_DC3 EXT
- (233 005) SIG\_1: Logic SIG\_DC3

LOGIC The number of logic outputs (equations) has been extended to 128.

COUNT The 4 counters have been equipped with individual debounce timers and limit monitoring.



**A6.1.1.35 P439 -308 -413/414 -651-701**

Release: 2014-03-19

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## OUTP

Bug fixing:

- States of output relays are now stored after power off/on cycle.

## LED

Bug fixing:

- LED states are now stored after power off/on cycle.

## MAIN

Bug fixing:

- Measured energy values are now stored after power off/on cycle.

## CBM

Bug fixing:

- CBM measured values are now stored after power off/on cycle.

## IEC

Bug fixing:

- Upon cold restart the MCL configuration of the Ethernet board is now deleted.
- Modelling of XSWI SwTyp EnumTyp has been aligned to IEC 61850-7-4 standard.

**A6.1.1.36****P439 -308 -413/414 -651-702**

Release: 2014-04-15

*Hardware*

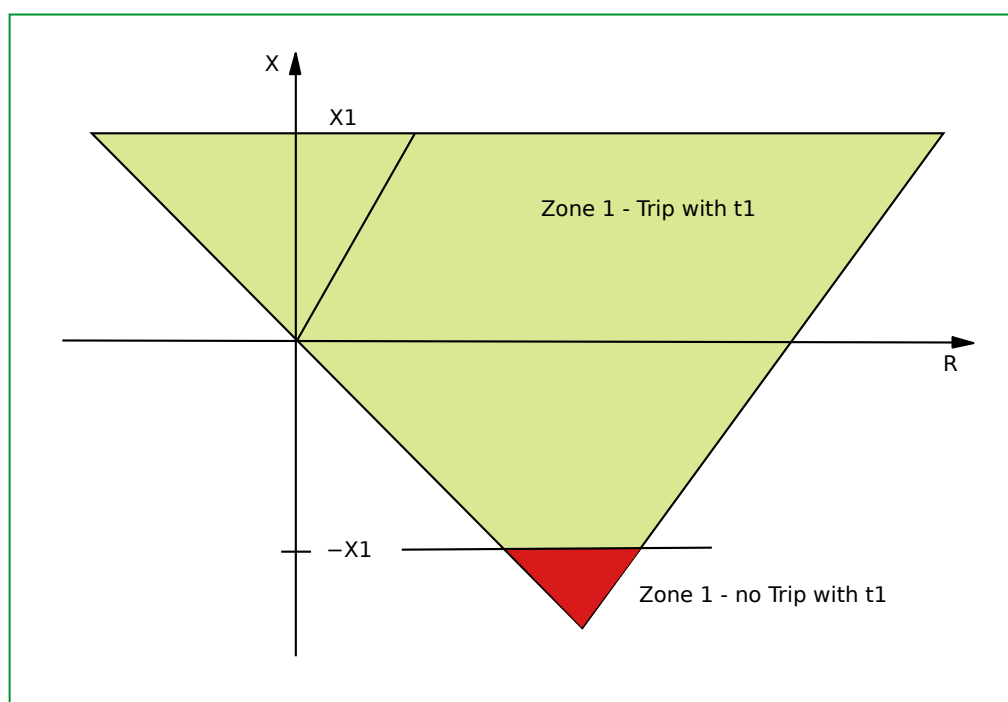
No changes.

*Diagram*

No changes.

*Software***DIST****Bug fixing:**

- With (010 048) MAIN: Neutr.pt. treat. PSx set to *Isol./res.w.start.PG* or *Isol./res.w/o st. PG*, the reach of the underimpedance fault detection in the C-A measuring loop was limited to only a quarter of the set value. This has now been corrected.
- As of software version -650, the tripping characteristic had been erroneously limited to the reactance range  $\pm|X|$ . Using a zone 1 in forward direction with a reach of  $X_1$  as an example, then no tripping occurred for impedances in the 4<sup>th</sup> quadrant with  $X < -X_1$  (shaded area in the following sketch). This has now been corrected.

**INP**

Bug notice: The visibility of the operating mode settings for the U1002 or U1003 binary signal inputs at INP: Oper. mode U 1002 (152 167) or INP: Oper. mode U 1003 (152 170) depends on whether the output relays K1002 or K1003 are fitted or not. Therefore, these settings are visible even if only the X(60) module is fitted in slot 10 (40 TE case).

This does not impact the device function.

**A6.1.1.37 P439 -309 -413/414/415 -651-703**

Release: 2014-06-11

*Hardware*

An additional 40 TE case variant with a combination of pin- and ring-terminal connection can now be ordered (transformer module: for ring-terminal connection; other modules: for pin-terminal connection).

*Diagram*

The updated terminal connection diagram describes the new case variant:

- P439 -413 (for 40TE pin-terminal connection)
- P439 -414 (for 84TE ring-terminal connection)
- P439 -415 (for 40 TE case, transformer module: with ring-terminal connection; other modules: with pin-terminal connection)

*Software*

## Device

## Bug fixing:

- If MAIN: Funct.Rush restr.PSx was used and PSS: Param.subs.sel. USER was transferred to the P439 (or selected via local control panel) a wrong calculation of the checksum of the NVRAM was performed, which led to a storage area violation and therefore to a cold restart.  
This affected all software versions as of P439 -650.

## COMM3

## Bug fixing:

- The InterMiCOM test signal now works when executing (120 053) COMM3: Send signal, test.

## PSIG

## Bug fixing:

- The PSIG test function (i.e. executing (015 009) PSIG: Test telecom. USER) now also works with operating mode PSIG: Operating mode PSx = DC loop operat. mode.

**A6.1.1.38****P439 -310 -416/418/419 -652**

Release: 2015–05–12

*Hardware*

The Redundancy Ethernet Board (REB) can now be ordered with an additional redundancy protocol: PRP (Parallel Redundancy Protocol) is available now as an alternative to RSTP, SHP or DHP.

As an additional order option, a binary module of type X(6I/8O) can now be fitted in slot 8 of the 40 TE case.

*Diagram*

The updated terminal connection diagrams include the optional additional I/O module interfaces:

- P439 -416 (for 40 TE pin-terminal connection)
- P439 -418 (for 40 TE case, transformer module: with ring-terminal connection; other modules: with pin-terminal connection)
- P439 -419 (for 84 TE ring-terminal connection)

*Software*

## IEC

Bug fixing:

- Disabling the protection via binary input ((003 026) MAIN: Disable protect. EXT = Yes) could have interrupted the IEC 61850 communication permanently. This has now been corrected.

## GOOSE

The number of GOOSE inputs has been extended to 128:

Extension of available GOOSE inputs from 32× 1-pole/32× 2-pole to 128 GOOSE inputs configurable in the IED Configurator tool. Max. 128× 1-pole binary signals freely configurable in the device or alternatively up to max. 128× 2-pole switchgear position indications for using the Control/Interlocking conditions.

## GSSE

Function group GSSE has been removed. It has been replaced by the extended GOOSE input option.

## COMM1

Bug fixing:

- Bug fixing concerning the IEC 60870-5-103 protocol:  
Test of sending spontaneous signals with “start” information was not executed.  
The status information (036 102) PSS: Control via user was not spontaneously transmitted (Typ 82h, Inf 08h).

## OUTP

Bug fixing:

- Output relay test failed for K1002. It was not possible to trigger K1002 neither from HMI nor from MiCOM S1 Studio. Instead relay K1001 got operated. This has now been corrected.  
Execution of (005 255) MAIN: General reset EXT did not reset latched outputs.

## MAIN

The DTOC and IDMT starting signals can now get linked into the MAIN starting signaling by setting (013 072) MAIN: Gen. start w. OC PSx. If MAIN: Gen. start w. OC PSx is set to Yes, upon DTOC/IDMT starting also MAIN General starting and (if applicable) phase-selective starting signals are issued.

Neutral and negative-sequence OC elements can be included or excluded from general starting (017 027 - MAIN: Gen. start. mode PSx), depending on the neutral starpoint treatment and operation philosophy.

Along with this new signaling the following group signals have been implemented:

- (040 000) MAIN: OC General starting  
= starting of any DTOC or IDMT phase stage  
or (neutral or negative-sequence starting if MAIN: Gen. start. mode PSx is set to *With start. IN, Ineg*)
- (040 005) MAIN: OC Starting A  
= starting of any DTOC or IDMT phase A  
(equivalent signals for starting in phases B and C)
- (040 008) MAIN: OC Starting GF  
= starting of any DTOC or IDMT neutral stage
- (040 105) MAIN: OC General starting  
= starting of any DTOC or IDMT negative-sequence stage

**Note:**

SOTF in operating mode *Trip with starting* still does operate upon DIST and BUOC starting only, irrespective of setting to include DTOC/IDMT starting in general starting. In order to accomplish OC trip the SOTF OC stages have to be used.

Bug fixing:

- Neutral starting (036 004 - MAIN: Starting GF) was not signaled if back-up overcurrent neutral element started (010 185 - BUOC: Zero-sequ. starting). This has now been corrected.

## DIST

The zone reach settings have been extended to the following maximum values (at  $I_{nom} = 1A$ ):

- (010 101) DIST: Zfw,PG PSx  
(010 105) DIST: Zfw,PP PSx up to 300.00  $\Omega$
- (010 050) DIST: Xfw PSx  
(010 051) DIST: Rfw,PG PSx  
(010 052) DIST: Rfw,PP PSx up to 400.00  $\Omega$
- (012 001) DIST: X1,PG (polygon) PSx  
(002 076) DIST: X1,PP (polygon) PSx  
(012 005) DIST: R1,PG (polygon) PSx  
(012 006) DIST: R1,PP (polygon) PSx up to 400.00  $\Omega$

(etc. for zones 2 ... 6; for the addresses of parameter sets PS2 ... PS4 see the "Settings" Chapter.)

|       |  |
|-------|--|
| MCMON | <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● The release threshold for current monitoring (010 183 – MCMON: I<sub>min curr. monitor.</sub>) now operates correctly. The previous implementation (as of -650) operated at half of the set threshold.</li> </ul>  |
| SOTF  | Please consider the note on SOTF in operating mode <i>Trip with starting</i> in above section “MAIN”.  |
| DTOC  | <p>By setting, any of the DTOC elements can be selected to trigger an autoreclosing cycle:</p> <ul style="list-style-type: none"> <li>● (013 127) DTOC: Funct. start ARC PS<sub>x</sub></li> </ul> <p>This selection has the following consequences:</p> <ul style="list-style-type: none"> <li>● Starting of any of the set DTOC elements triggers the ARC operative timer(s). An ARC dead time is started, if the general trip signal 1 ends within the operative timer(s).</li> <li>● The trip signal of the selected DTOC elements is automatically triggering the general trip signal 1 with no need to configure it by setting (021 001) MAIN: Fct.assig.trip cmd.1. This assignment to the general trip command 1 remains active, even if ARC is not ready.</li> </ul> <p>Unlike with the P132/P139 devices, there are no tripping time settings to facilitate instantaneous tripping if ARC is ready. The selected DTOC elements will operate with their set tripping time. If a dedicated tripping time is needed (e.g. instantaneous trip, if ARC is ready), then this requires a separate DTOC stage.</p> <p>The settings for neutral directional operation ((010 045) SCDD: VNG&gt; PS<sub>x</sub> und (004 092) SCDD: Charact. angle G PS<sub>x</sub>) have been moved to the new function group SCDD (Short-Circuit Direction Determination).</p> <p>As with neutral OC stages, phase OC stages can be set in non-directional mode by binary input signals:</p> <ul style="list-style-type: none"> <li>● (013 119) DTOC: Block. dir. tl&gt; EXT</li> <li>...</li> <li>(013 122) DTOC: Block.dir.tl&gt;&gt;&gt;&gt; EXT</li> </ul> <p>Setting ranges of all 4 phase OC stages have been extended to a maximum setting of 30.00 I<sub>nom</sub>:</p> <ul style="list-style-type: none"> <li>● (072 007) DTOC: I&gt; PS<sub>x</sub></li> <li>...</li> <li>(072 010) DTOC: I&gt;&gt;&gt;&gt; PS<sub>x</sub></li> </ul> |
| IDMT  | <p>A time setting (013 143 – IDMT: Time Correction PS<sub>x</sub>) has been implemented to provide compensation of the function starting time and thus harmonizing operation time with other installed devices. A negative setting will reduce the tripping time, a positive setting will prolong the tripping time accordingly. This feature is only needed in applications with potentially very short tripping times (i.e. extremely inverse characteristics, small time dial factors, high I/I<sub>ref</sub> ratio).</p>   |

## DTC, IDMT

Applies to direction-dependent starting/tripping:

The new parameters permit the selection whether the timer stages for phase or residual current stages are triggered with a starting or direction-dependent ('*With direction*'). The default for the parameter is the previous '*With starting*' standard setting.

Parameters:

- DTC: Mode timer start PSx
  - (002 138, 002 139, 002 142, 002 143)
- IDMT: Mode timer start PSx
  - (007 226, 007 227, 007 228, 007 229)

New settings permit the selection for each overcurrent stage whether the fundamental or on the r.m.s. value of the current shall be measured for starting. As further alternative, DTC measurement can be based upon peak-peak values. This setting is common for the phase and the neutral current stages.

Remark: For the negative-sequence stages, the starting decision is always based on the fundamental.

All phase and the residual overcurrent stages of DTC and IDMT can now be set directional:

- (017 071) DTC: Direction  $tI > PSx$  (etc.)
- (072 032) DTC: Direction  $tIN > PSx$  (etc.)
- (017 066) IDMT: Direct.  $tI_{ref,P} > PSx$
- (017 067) IDMT: Direct.  $tI_{ref,N} > PSx$

The fault direction information is commonly evaluated from the new function group SCDD (Short-Circuit Direction Determination).

Accordingly additional trip signals have been implemented, which get issued if the DTC or IDMT trip time elapses and the actual fault direction is equal to the set direction, e.g.:

- (013 123) DTC: Trip signal  $tI > =$  (040 010) DTC:  $tI >$  elapsed  
AND (040 039) SCDD: Fault P or G forwd.  
AND (017 071) DTC: Trip signal  $tI > =$  *Forward directional*

## SCDD

Function group SCDD (Short-Circuit Direction Determination) is implemented to provide directional information to DTOC and IDMT protection functions. It provides the same functionality as known from P132/P139, with just 2 annotations:

- The directional voltage memory is shared from DIST. Nevertheless, its only setting (010 109 – DIST: Oper.val.Vmemory PSx) remains in DIST function group for user convenience.  
Note: Even if DIST is disabled or de-configured by setting, the voltage memory is still available for SCDD.
- There is no biasing of the neutral directional element, and accordingly no setting to block it (as with the P132/P139 devices via (017 078) SCDD: Block. bias G PSx)

For the neutral directional element either calculated or measured neutral current IN and neutral displacement voltage VNG can be selected by settings:

- (008 105) SCDD: Evaluation IN PSx
- (071 056) SCDD: Evaluation VNG PSx

Measured fault direction and information about the voltage used for direction determination are signaled, e.g.:

- (013 110) SCDD: Fault P forward
- ...
- (013 114) SCDD: Direct. using memory

## f&lt;&gt;

A 5<sup>th</sup> frequency stage (f5) has now been introduced for over-/underfrequency protection.

## THERM

The thermal overload protection can now alternatively also be applied to the measured or calculated neutral current:

- (013 139) THERM: Select current PSx

## DEVxx

Bug fixing:

- Settings for supervision of correct beginning of the movement of the switchgear devices 06 and 09 are now also available:
  - (211 007) DEV06: StartCmdTime superv.
  - (211 157) DEV09: StartCmdTime superv.

## ILOCK

This function group now can be (de-)configured:

- (250 102) ILOCK: Function group ILOCK

The interlock violation signal (221 018) MAIN: Interlock equ. viol. now will be automatically reset after a settable time period:

- (221 123) ILOCK: Rset ILOCK violation



**A6.1.1.39                      P439 -310 -416/418/419 -653**

Release: 2015-07-20

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

The data model has been enhanced to offer more selection values for some “m out of n” parameters.

*Control*

Bug fixing:

- After some time, it could happen that all controls (time synchronization, LED reset, operation of switchgear devices, etc.) were delayed by approx. 20 seconds, which could then be fixed only by a (warm or cold) restart. This problem existed since software version -650 and has been resolved now.

**A6.1.1.40****P439 -310 -416/418/419 -653-701**

Release: 2015–12–04

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## COMM1

Bug fixing:

- IEC 60870-5-103 and -101 protocols: Wrong energy measurement values were transmitted (low and high byte were interchanged).
- MODBUS protocol: The execution of the single pole command (CMD\_1: C001) did not return a response to the master.
- DNP3.0 protocol: After a warm restart of the P439 Class 0 objects were not available and a permanent time-out on link re-establishing stage was present.

## IEC

Bug fixing:

- The reporting of reset of general starting (PTRC1.ST.Str) was missing if the general starting had been triggered by the BUOC protection. (If it had been triggered by the DIST protection the reporting was correct.)
- A wrong command originator was reported (in *rcb*) upon change of control point.

## DIST

Bug fixing:

- Distance protection was not blocked from INP or LOGIC via “Blocking Zx EXT” (e. g. (036 034) DIST: Blocking Z1 EXT) if the blocking signal had also been assigned to (012 017) PSB: Fct. assign. block..

## IDMT

Bug fixing:

- Directional tripping of IDMT neutral overcurrent stage  $t_{Iref,N}$  was not available if all DTOC neutral overcurrent stages ( $t_{IN>}$ ,  $t_{IN>>}, \dots$ ) were blocked.

## V&lt;&gt;

Bug fixing:

- After a cold or warm restart the minimum current threshold ( $V<>: I_{enable} V< PSx$ ) was not functioning. This could result in inadvertent and chattering operation of undervoltage stages.

## A6.2 Version History - Easergy MiCOM 30

### A6.2.1 P439 -310 -4xx -654 ff

#### A6.2.1.1 P439 -310 -416/418/419 -654

Release: 2016-03-23

#### Hardware

No changes.

#### Diagram

No changes.

#### Software

LOC Flashing frequency of signal LOC: Chg.Sig.Panel flash. has been adjusted.

COMM1 Bug fixing:

- COMM1 communication was permanently blocked, if COMM1 was assigned to physical channel 2 and the device was rebooted while communication was busy.
- Bug fixing concerning the IEC 60870-5-103 protocol: The signal (090 010) SFMON: Battery failure is now sent spontaneously.

IEC The data modelling has been accomplished by Logical Nodes for 3p phase over-/undervoltage elements and the new trip commands 3 and 4, as well as for new function groups QV, Pf<.

MAIN Two further trip commands have been implemented with the same setting options and functionality as trip command 2. These can be used e. g. for transformer back-up protection schemes.

CB status inputs can now be used with no check that input signals are configured to opto-couplers. This allows to enter them through LOGIC inputs in case additional pick-up/drop-off delays are required.

Bug fixing:

- Visibility of (010 100) MAIN: Vref,nom V.T. prim. and (031 052) MAIN: Vref,nom V.T. sec. did not depend on whether or not the VT for Vref had been fitted.

SFMON Bug fixing:

- Self monitoring of output relays was not operating on all defects. Also the group signal (041 200) SFMON: Relay Kxx faulty was not activated in case of an output relay failure.
- Alarm signaling of internal auxiliary voltage failures was not proper maintained until the failure was cleared (alarm signaling could have been reset while a defect was still present).

|       |   |
|-------|---|
| FT_RC | <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● Disturbance recording didn't log binary signal changes during post-fault time.</li> </ul>   |
| DIST  | <p>Improvement of starting logic for correct discrimination of 2p faults in solidly grounded power systems, excluding false underimpedance starting on adjacent PP loops.</p> <p>For function group harmonization, release setting in parameter subsets has been added:</p> <ul style="list-style-type: none"> <li>● DIST: Enable PSx (019 009 / 019 015 / 019 030 / 019 039)</li> </ul> <p>Note that for backward compatibility reasons the DIST is enabled by default (i. e. the default setting is Yes).</p>   |
| MCMON | <p>Fuse Failure Vref monitoring has been accomplished by a blocking input (002 182) MCMON: Blocking FF, V EXT), that can be required in 1.5 CB applications.</p>  |
| BUOC  | <p>Input signals have been accomplished to block starting of overcurrent elements:</p> <ul style="list-style-type: none"> <li>● BUOC: Blocking I&gt; EXT (018 217)</li> <li>● BUOC: Blocking IN&gt; EXT (018 218)</li> </ul>  |
| SCDD  | <p>For function group harmonization, settings for configuration, general enable and release in parameter subsets have been accomplished.</p> <ul style="list-style-type: none"> <li>● SCDD: Function group SCDD (056 021)</li> <li>● SCDD: General enable USER (017 070)</li> <li>● SCDD: Enable PSx (076 235 / 077 235 / 078 235 / 079 235)</li> </ul> <p>Note that for backward compatibility reasons the SCDD is by default enabled.</p>   |
| ASC   | <p>The operating mode "NOT(V) OR NOT(Vref)" has been changed to permit (re)closure only if one voltage is below the V&lt; threshold and the other voltage is not in "undefined" condition, i.e. in between V&lt; and V&gt;.</p> <p>As an alternative to the 3-pole voltage the 1-pole T90 voltage input has been made available for ASC function. Selection can be made by setting/command or via binary input signal:</p> <ul style="list-style-type: none"> <li>● ASC: Meas.V(T90) USER PSx (016 222 / 016 223 / 016 224 / 016 225)</li> <li>● ASC: Meas.V(T90) EXT (016 221)</li> </ul> <p>Consequently ASC blocking in case of VT measurement circuit failure is now depending on the selected VT input(s).</p> |

|       |   |
|-------|---|
| V<>   | <p>New settings permit the selection for each neutral displacement overvoltage stage whether the fundamental or the r.m.s. value of the voltage shall be measured for starting:</p> <ul style="list-style-type: none"> <li>● V&lt;&gt;: Meas. Value VNG&gt; PSx (018 219 / 018 250 / 018 251 / 018 252)</li> <li>● V&lt;&gt;: Meas. Value VNG&gt;&gt;PSx (018 253 / 018 254 / 018 255 / 019 005)</li> </ul> <p>Minimum current enabling of undervoltage elements is now phase-selective. Additional signals are provided to indicate 1-pole undervoltage starting:</p> <ul style="list-style-type: none"> <li>● V&lt;&gt;: Starting V&lt; 1-pole (019 006)</li> <li>● V&lt;&gt;: Starting V&lt;&lt; 1-pole (019 007)</li> <li>● V&lt;&gt;: Starting V&lt;&lt;&lt; 1-pole (019 008)</li> </ul> |
| Pf<   | Implementation of a dedicated function group that provides under frequency load shedding (UFLS) depending on active power flow direction.   |
| QV    | Implementation of a dedicated function group that provides 3-pole undervoltage protection depending on reactive power direction, specifically required for connecting wind farms to the power system.   |
| CBF   | <p>Bug fixing:</p> <ul style="list-style-type: none"> <li>● If pole-selective CB status input signals were configured (031 029) MAIN: CB closed A EXT, etc.), CBF operation had always been falsely dependent on correct CB status signaling. If the CB status signals indicated a closed CB then CBF tripped even after current flow had ended.</li> </ul>   |
| CBM   | The hysteresis of undercurrent elements used to identify end of current flow has been improved to prevent signal chattering: (044 201) CBM: Curr. flow ended A, etc.  |
| TRMON | Implementation of a dedicated Transformer Monitoring function group that provides inputs for external transformer protection equipment (3 sets of Buchholz alarm and trip, insulation alarm).   |
| TIMER | Implementation of this function group inherited from P132 -655 / P139 -655. It provides 4 groups of timer clocks that operate upon settable times (of a settable set of week-days).   |

**A6.2.1.2****P439 -310 -416/417/418 -655**

Release: 2017-02-01

*Hardware*

No changes.

*Diagram*

No changes.

*Software*

## COMM1

Bug fixing in protocol IEC 60870-5-101:

Date and time information in 7 Byte frame is now correct (bug affected versions from -650).

## MEASO

Bug fixing:

Measurands with negative values were now correctly scaled as [0...20]mA current output signals.

## FT\_RC

Bug fixing:

When relay date was beyond 19.01.2038, no fault records were available.

## PSIG

Bug fixing:

In release scheme (permissive overreaching transfer trip mode) using below send and trip signal conditioning, no trip signal was issued.

- (015 000) PSIG: Operating mode PS1 = Release scheme
- (015 036) PSIG: Oper. mode send PS1 = Dist.-dependent
- (015 107) PSIG: Oper. mode trip PS1 = Direct.-dependent

**ARC****Bug notice:**

The following addresses of the new adaptive auto-reclosing function of P437 are erroneously also visible in the P439 data model:

**Settings:**

- (020 144) ARC Sec. arc eval. PS1
- (020 148) ARC Dead time min 1p PS1
- (020 152) ARC Sec. arc V< PS1
- (020 156) ARC Sec. arc d> PS1
- (020 160) ARC Sec. arc delay PS1
- (020 168) ARC Sec. arc tMin PS1

**Signals:**

- (020 164) ARC Sec. arc d> exceeded
- (020 165) ARC Sec. arc V< or d>
- (020 166) ARC RC block by sec. arc
- (020 167) ARC 3p-HSR by sec. arc

The function of adaptive auto-reclosing is not implemented, so any change of the above settings will have no impact on the function performance, and also none of these signals will get active at any time.

**P<>**

The new setting (021 074) P<>: Start w. Direct. PS1 determines the starting condition for all power stages:

- With setting "Yes" starting takes place only, if the power start threshold operates AND the measured direction is equal to the set direction of the stage.
- With setting "No" starting takes place, if the power start threshold operates.

**TIMER****Feature enhancement:**

When setting end time smaller than start time, the timer runs until reaching the end time on next day.

**A6.2.1.3****P439 -311 -419/420/421 -660**

Release: 2017-07-21

*Hardware*

The P439 is now fitted with Ethernet module (SEB LC/RJ45 or REB LC/RJ45). This module is used for IEC 61850 Edition 1 and Edition 2 and is fitted to slot 2, as an alternative to other communication modules.

HSR/PRP communication protocols are supported.

*Diagram*

The updated connection diagrams now include the Ethernet module communication interface with SEB and REB.

- P439 -419 (for 40 TE case, with pin-terminal connection)
- P439 -421 (for 40 TE case, with CT/VT ring-, I/O pin-terminal connection)
- P439 -420 (for 84 TE case, with ring-terminal connection)

*Software*

## CS

Implementation of a dedicated function group that provides Cyber Security protection to mitigate the security risks.

The Security Administration Tool is required for RBAC configuration and setting changes.

- (180 031) CS: CyberSecurity Vers.
- (180 002) CS: Number of users
- (180 032) CS: Comms logout
- (180 033) CS: HMI logout
- (180 043) CS: Comms username
- (180 034) CS: HMI username
- (180 013) CS: User access role
- (180 011) CS: Max login attempts
- (180 010) CS: Login attempts left
- (180 015) CS: Blocking time
- (180 012) CS: Blocking time left
- (180 041) CS: Result EPW setting
- (180 003) CS: Change pincode
- (180 044) CS: Config disabled
- (180 014) CS: Recovery Password
- (180 045) CS: Reset RABC

## IEC

The protocol of the redundant connection is configurable with IEC: ETH COMM Mode .

When Ethernet module (REB or SEB) is used, second Ethernet information is provided.

- (104 080) IEC: ETH COMM Mode
- (104 072) IEC: Gateway address 2
- (104 070) IEC: IP address 2
- (104 073) IEC: Block Port A/B
- (104 074) IEC: Block Port C
- (221 125) IEC: Ctrl blocked user
- (104 071) IEC: Subnet mask 2
- (104 079) IEC: IEC prot. variant

**A6.2.1.4****P439 -311 -419/420/421 -661**

Release: 2017–12–19

*Hardware*

PRP/HSR/RSTP communication protocols are supported.

*Diagram*

No changes.



*Software*

|       |   |
|-------|---|
| IEC   | <p>The RSTP protocol is supported and configurable via IEC: ETH COMM Mode. IEC 60870-5-104 protocol has been added. It can be enabled and selected via IEC: IEC60870-5-104enable and IEC: IEC prot. varian.</p> <p>To improve network administration, VLAN and port assignment are supported.</p> |
| VINP  | <p>VINP functional group includes 64 virtual inputs and is intended to process binary information from the Ethernet module running with protocol IEC 60870-5-104.</p> <p>This function group is only visible if IEC: IEC60870-5-104enable is set to Yes.</p>                                      |
| ADAPT | <p>The new functionality Adaptive protection is available. This function adapts the starting values of DIST and BUOC protection from Network Control Center (NCC) in response to changing network topology and load flow conditions.</p>  |
| DIST  | <p>The distance protection is extended to 8 zones.</p>  |
| DELTA | <p>The new functionality Delta-I protection is available. It designed to detect faults based on a continuous monitoring for sudden current changes.</p>   |







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