

MiCOM P594

GPS Synchronizing Unit

P594/EN M/E33

Hardware Suffix D

Technical Manual

Note: The technical manual for this device gives instructions for its installation, commissioning, and operation. However, the manual cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions or specific problems, do not take any action without proper authorization. Contact the appropriate Schneider Electric technical sales office and request the necessary information.

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SAFETY SECTION

STANDARD SAFETY STATEMENTS AND EXTERNAL LABEL INFORMATION FOR SCHNEIDER ELECTRIC EQUIPMENT

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1. INTRODUCTION

This guide and the relevant equipment documentation provide full information on safe handling, commissioning and testing of this equipment. This Safety Guide also includes descriptions of equipment label markings.

Documentation for equipment ordered from Schneider Electric is despatched separately from manufactured goods and may not be received at the same time. Therefore this guide is provided to ensure that printed information which may be present on the equipment is fully understood by the recipient.

The technical data in this safety guide is typical only, see the technical data section of the relevant product publication(s) for data specific to a particular equipment.



Before carrying out any work on the equipment the user should be familiar with the contents of this Safety Guide and the ratings on the equipment's rating label.

Reference should be made to the external connection diagram before the equipment is installed, commissioned or serviced.

Language specific, self-adhesive User Interface labels are provided in a bag for some equipment.

2. HEALTH AND SAFETY

The information in the Safety Section of the equipment documentation is intended to ensure that equipment is properly installed and handled in order to maintain it in a safe condition.

It is assumed that everyone who will be associated with the equipment will be familiar with the contents of that Safety Section, or this Safety Guide.

When electrical equipment is in operation, dangerous voltages will be present in certain parts of the equipment. Failure to observe warning notices, incorrect use, or improper use may endanger personnel and equipment and also cause personal injury or physical damage.

Before working in the terminal strip area, the equipment must be isolated.

Proper and safe operation of the equipment depends on appropriate shipping and handling, proper storage, installation and commissioning, and on careful operation, maintenance and servicing. For this reason only qualified personnel may work on or operate the equipment.

Qualified personnel are individuals who:

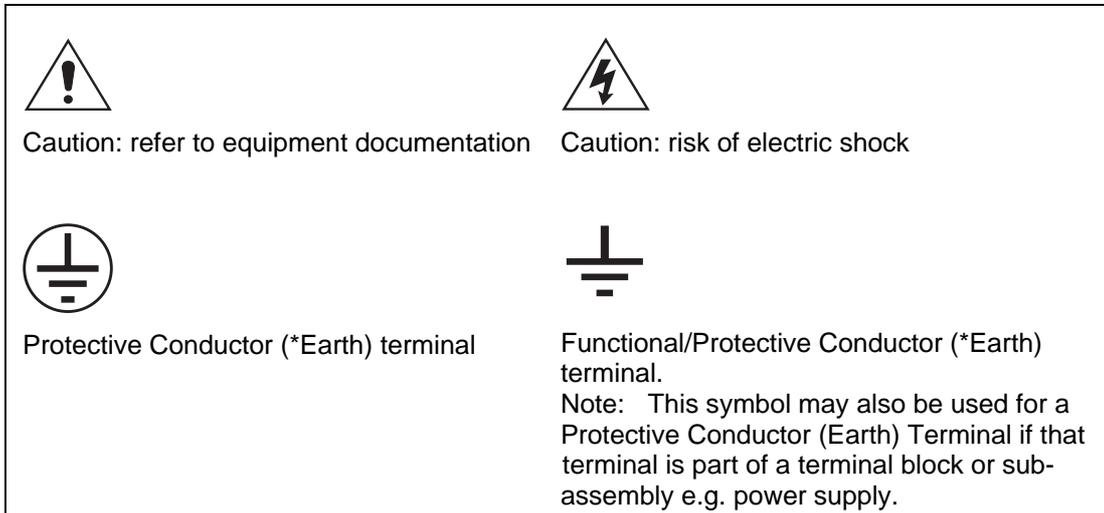
- Are familiar with the installation, commissioning, and operation of the equipment and of the system to which it is being connected;
- Are able to safely perform switching operations in accordance with accepted safety engineering practices and are authorised to energize and de-energize equipment and to isolate, ground, and label it;
- Are trained in the care and use of safety apparatus in accordance with safety engineering practices;
- Are trained in emergency procedures (first aid).

The equipment documentation gives instructions for its installation, commissioning, and operation. However, the manual cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions or specific problems, do not take any action without proper authorization. Contact the appropriate Schneider Electric technical sales office and request the necessary information.

3. SYMBOLS AND EXTERNAL LABELS ON THE EQUIPMENT

For safety reasons the following symbols and external labels, which may be used on the equipment or referred to in the equipment documentation, should be understood before the equipment is installed or commissioned.

3.1 Symbols



*NOTE: THE TERM EARTH USED THROUGHOUT THIS GUIDE IS THE DIRECT EQUIVALENT OF THE NORTH AMERICAN TERM GROUND.

3.2 Labels

See Safety Guide (SFTY/4L M/G11) for equipment labelling information.

4. INSTALLING, COMMISSIONING AND SERVICING



Equipment connections

Personnel undertaking installation, commissioning or servicing work for this equipment should be aware of the correct working procedures to ensure safety.

The equipment documentation should be consulted before installing, commissioning, or servicing the equipment.

Terminals exposed during installation, commissioning and maintenance may present a hazardous voltage unless the equipment is electrically isolated.

The clamping screws of all terminal block connectors, for field wiring, using M4 screws shall be tightened to a nominal torque of 1.3 Nm.

Equipment intended for rack or panel mounting is for use on a flat surface of a Type 1 enclosure, as defined by Underwriters Laboratories (UL).

Any disassembly of the equipment may expose parts at hazardous voltage, also electronic parts may be damaged if suitable electrostatic voltage discharge (ESD) precautions are not taken.

If there is unlocked access to the rear of the equipment, care should be taken by all personnel to avoid electric shock or energy hazards.

Voltage and current connections shall be made using insulated crimp terminations to ensure that terminal block insulation requirements are maintained for safety.

Watchdog (self-monitoring) contacts are provided in numerical relays to indicate the health of the device. Schneider Electric strongly recommends that these contacts are hardwired into the substation's automation system, for alarm purposes.

To ensure that wires are correctly terminated the correct crimp terminal and tool for the wire size should be used.

The equipment must be connected in accordance with the appropriate connection diagram.

Protection Class I Equipment

- Before energizing the equipment it must be earthed using the protective conductor terminal, if provided, or the appropriate termination of the supply plug in the case of plug connected equipment.
- The protective conductor (earth) connection must not be removed since the protection against electric shock provided by the equipment would be lost.
- When the protective (earth) conductor terminal (PCT) is also used to terminate cable screens, etc., it is essential that the integrity of the protective (earth) conductor is checked after the addition or removal of such functional earth connections. For M4 stud PCTs the integrity of the protective (earth) connections should be ensured by use of a locknut or similar.

The recommended minimum protective conductor (earth) wire size is 2.5 mm² (3.3 mm² for North America) unless otherwise stated in the technical data section of the equipment documentation, or otherwise required by local or country wiring regulations.

The protective conductor (earth) connection must be low-inductance and as short as possible.

All connections to the equipment must have a defined potential. Connections that are pre-wired, but not used, should preferably be grounded when binary inputs and output relays are isolated. When binary inputs and output relays are connected to common potential, the pre-wired but unused connections should be connected to the common potential of the grouped connections.

Before energizing the equipment, the following should be checked:

- Voltage rating/polarity (rating label/equipment documentation),
- CT circuit rating (rating label) and integrity of connections,
- Protective fuse rating,
- Integrity of the protective conductor (earth) connection (where applicable),
- Voltage and current rating of external wiring, applicable to the application.



Accidental touching of exposed terminals

If working in an area of restricted space, such as a cubicle, where there is a risk of electric shock due to accidental touching of terminals which do not comply with IP20 rating, then a suitable protective barrier should be provided.



Equipment use

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



Removal of the equipment front panel/cover

Removal of the equipment front panel/cover may expose hazardous live parts, which must not be touched until the electrical power is removed.

**UL and CSA/CUL Listed or Recognized equipment**

To maintain UL and CSA/CUL Listing/Recognized status for North America the equipment should be installed using UL or CSA Listed or Recognized parts for the following items: connection cables, protective fuses/fuseholders or circuit breakers, insulation crimp terminals and replacement internal battery, as specified in the equipment documentation.

For external protective fuses a UL or CSA Listed fuse shall be used. The Listed type shall be a Class J time delay fuse, with a maximum current rating of 15 A and a minimum d.c. rating of 250 Vd.c., for example type AJT15.

Where UL or CSA Listing of the equipment is not required, a high rupture capacity (HRC) fuse type with a maximum current rating of 16 Amps and a minimum d.c. rating of 250 Vd.c. may be used, for example Red Spot type NIT or TIA.

**Equipment operating conditions**

The equipment should be operated within the specified electrical and environmental limits.

**Current transformer circuits**

Do not open the secondary circuit of a live CT since the high voltage produced may be lethal to personnel and could damage insulation. Generally, for safety, the secondary of the line CT must be shorted before opening any connections to it.

For most equipment with ring-terminal connections, the threaded terminal block for current transformer termination has automatic CT shorting on removal of the module. Therefore external shorting of the CTs may not be required, the equipment documentation should be checked to see if this applies.

For equipment with pin-terminal connections, the threaded terminal block for current transformer termination does NOT have automatic CT shorting on removal of the module.

**External resistors, including voltage dependent resistors (VDRs)**

Where external resistors, including voltage dependent resistors (VDRs), are fitted to the equipment, these may present a risk of electric shock or burns, if touched.

**Battery replacement**

Where internal batteries are fitted they should be replaced with the recommended type and be installed with the correct polarity to avoid possible damage to the equipment, buildings and persons.

**Insulation and dielectric strength testing**

Insulation testing may leave capacitors charged up to a hazardous voltage. At the end of each part of the test, the voltage should be gradually reduced to zero, to discharge capacitors, before the test leads are disconnected.

**Insertion of modules and pcb cards**

Modules and PCB cards must not be inserted into or withdrawn from the equipment whilst it is energized, since this may result in damage.

**Insertion and withdrawal of extender cards**

Extender cards are available for some equipment. If an extender card is used, this should not be inserted or withdrawn from the equipment whilst it is energized. This is to avoid possible shock or damage hazards. Hazardous live voltages may be accessible on the extender card.



External test blocks and test plugs

Great care should be taken when using external test blocks and test plugs such as the MMLG, MMLB and MiCOM P990 types, hazardous voltages may be accessible when using these. *CT shorting links must be in place before the insertion or removal of MMLB test plugs, to avoid potentially lethal voltages.

*Note: When a MiCOM P992 Test Plug is inserted into the MiCOM P991 Test Block, the secondaries of the line CTs are automatically shorted, making them safe.



Fiber optic communication

Where fiber optic communication devices are fitted, these should not be viewed directly. Optical power meters should be used to determine the operation or signal level of the device.



Cleaning

The equipment may be cleaned using a lint free cloth dampened with clean water, when no connections are energized. Contact fingers of test plugs are normally protected by petroleum jelly, which should not be removed.

5. DECOMMISSIONING AND DISPOSAL



De-commissioning

The supply input (auxiliary) for the equipment may include capacitors across the supply or to earth. To avoid electric shock or energy hazards, after completely isolating the supplies to the equipment (both poles of any dc supply), the capacitors should be safely discharged via the external terminals prior to de-commissioning.



Disposal

It is recommended that incineration and disposal to water courses is avoided. The equipment should be disposed of in a safe manner. Any equipment containing batteries should have them removed before disposal, taking precautions to avoid short circuits. Particular regulations within the country of operation, may apply to the disposal of the equipment.

6. TECHNICAL SPECIFICATIONS FOR SAFETY

Unless otherwise stated in the equipment technical manual, the following data is applicable.

6.1 Protective fuse rating

The recommended maximum rating of the external protective fuse for equipments is 16A, high rupture capacity (HRC) Red Spot type NIT, or TIA, or equivalent. Unless otherwise stated in equipment technical manual, the following data is applicable. The protective fuse should be located as close to the unit as possible.



CAUTION - CTs must NOT be fused since open circuiting them may produce lethal hazardous voltages.

6.2 Protective Class

IEC 60255-27: 2005
EN 60255-27: 2006

Class I (unless otherwise specified in the equipment documentation). This equipment requires a protective conductor (earth) connection to ensure user safety.

6.3 Installation Category

IEC 60255-27: 2005
EN 60255-27: 2006

Installation Category III (Overvoltage Category III):
Distribution level, fixed installation.

Equipment in this category is qualification tested at 5 kV peak, 1.2/50 μ s, 500 Ω , 0.5 J, between all supply circuits and earth and also between independent circuits.

6.4 Environment

The equipment is intended for indoor installation and use only. If it is required for use in an outdoor environment then it must be mounted in a specific cabinet or housing which will enable it to meet the requirements of IEC 60529 with the classification of degree of protection IP54 (dust and splashing water protected).

Pollution Degree - Pollution Degree 2
Altitude - Operation up to 2000m

Compliance is demonstrated by reference to safety standards.

IEC 60255-27:2005
EN 60255-27: 2006

INTRODUCTION

Date: 2nd March 2010
Hardware Suffix: D
Connection Diagrams: 10P5940201

IT

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1. MiCOM DOCUMENTATION STRUCTURE

The manual provides a functional and technical description of the MiCOM protection unit and a comprehensive set of instructions for the unit's use and application.

The section contents are summarized below:

P594/EN IT Introduction

A guide to the MiCOM range of equipment and the documentation structure. General safety aspects of handling Electronic Equipment is discussed with particular reference to safety symbols. Also a general functional overview of the unit and brief application summary is given.

P594/EN TD Technical Data

Technical data including setting ranges, accuracy limits, recommended operating conditions, ratings and performance data. Compliance with norms and international standards is quoted where appropriate.

P594/EN ST Settings

List of all unit settings, including ranges, step sizes and defaults, together with a brief explanation of each setting.

P594/EN OP Operation

A comprehensive and detailed functional description of the unit functionality.

P594/EN CM Commissioning

Instructions on how to commission the unit, comprising checks on the functionality of the unit.

P594/EN TS Troubleshooting

Advice on how to recognize failure modes and the recommended course of action. Includes guidance on whom within Schneider Electric to contact for advice.

P594/EN IN Installation

Recommendations on unpacking, handling, inspection and storage of the unit. A guide to the mechanical and electrical installation of the unit is provided, incorporating earthing recommendations. All external wiring connections to the unit are indicated.

P594/EN VH Firmware and Service Manual Version History

History of all hardware and software releases for the product.

2. INTRODUCTION TO MiCOM

MiCOM is a comprehensive solution capable of meeting all electricity supply requirements. It comprises a range of components, systems and services from Schneider Electric.

Central to the MiCOM concept is flexibility.

MiCOM provides the ability to define an application solution and, through extensive communication capabilities, integrate it with your power supply control system.

The components within MiCOM are:

- P range protection relays;
- C range control products;
- M range measurement products for accurate metering and monitoring;
- S range versatile PC support and substation control packages.

MiCOM products include extensive facilities for recording information on the state and behavior of the power system using disturbance and fault records. They can also provide measurements of the system at regular intervals to a control center enabling remote monitoring and control to take place.

For up-to-date information on any MiCOM product, visit our website:

www.schneider-electric.com

3. PRODUCT SCOPE

The MiCOM P594 GPS Synchronizing Unit was originally designed to allow GPS-derived time synchronization for the P543 to P546 Current Differential Relays when used in Synchronous Digital Hierarchy (SDH)/Synchronous Optical Network (SONET) or other switched communication networks.

Hardware suffix D of the P594 additionally provides GPS-derived synchronization of Schneider Electric CVCOM Merging Units for use with the IEC 61850-9-2 interface for Sampled Analogue Values, and provides IRIG-B time synchronization outputs, both modulated and un-modulated.

The P594 provides one pulse per second (1 PPS) fiber outputs for the purpose of synchronizing P543 to P546 relays and CVCOM. The unit is housed in a MiCOM 20TE case and can be located up to 1 km away from the relay or CVCOM.

In summary the P594 functionality is:

- 4 x 1 PPS fiber outputs
 - Synchronizing of P54x sampling, or
 - Synchronizing of CVCOM Merging Unit sampling
- 1 x Modulated IRIG-B output
- 2 x Un-modulated IRIG-B output
- 4 x Output Contacts - each 1 PPM/1 PPH pulse outputs or alarm contacts
- Statistics
- Front panel User Interface, per Px2x relays
- Watchdog outputs
- Software update port

Application overview

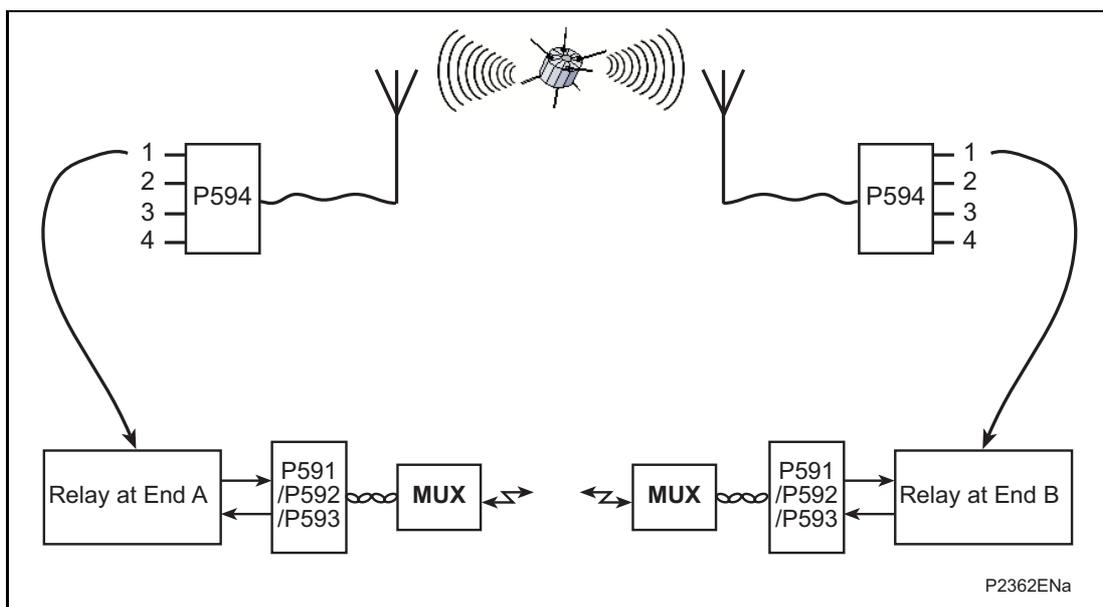


Figure 1: Functional diagram 1 - P54x application

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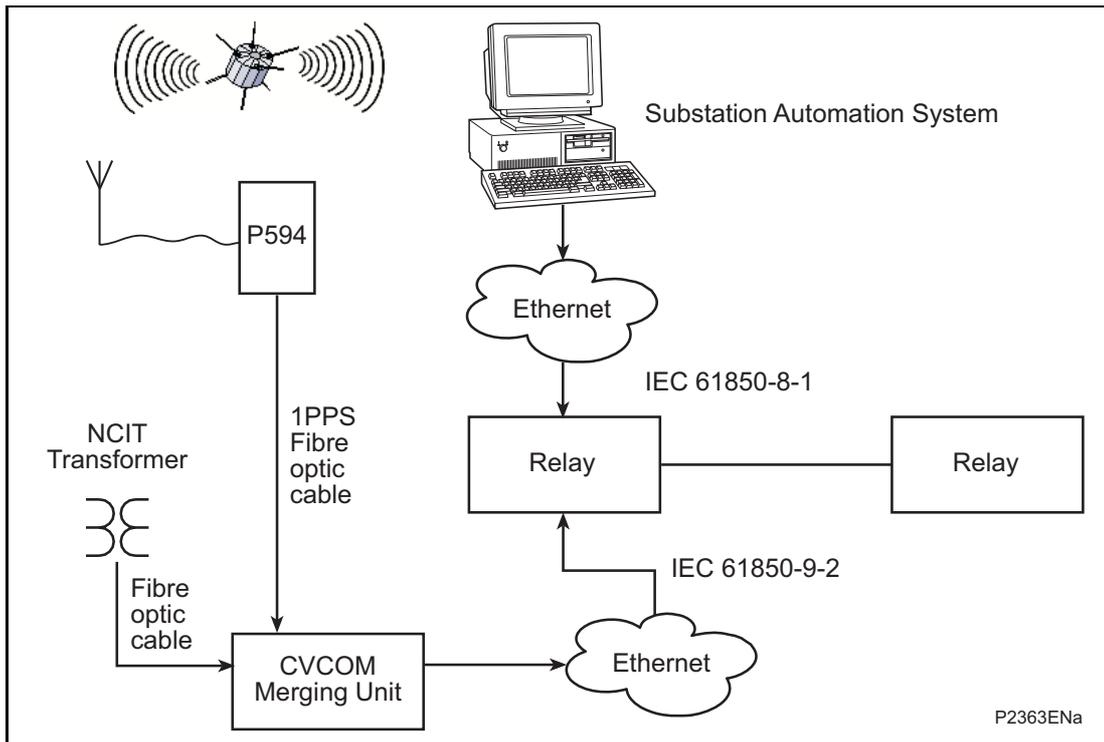


Figure 2: Functional diagram 2 - CVCOM application

4. ORDERING OPTIONS

Information Required with Order

P594 CORTEC		
Issue: See Model List (Factory Defined)	(A to Z)	
Language Options for Manual (including antenna installation guide)		
English	1	
French	2	
German	3	
Spanish	4	
Hardware Options		
P594 unit ONLY	000	
Kit 1: P594 + Kit + 25 metres (overall length) antenna cables	025	
Kit 2: P594 + Kit + 50 metres (overall length) antenna cables	050	
Kit 3: P594 + Kit + 100 metres (overall length) antenna cables + amplifier	100	
Kit 4: Kit + 25 metres (overall length) antenna cables	025	
Kit 5: Kit + 50 metres (overall length) antenna cables	050	
Kit 6: Kit + 100 metres (overall length) antenna cables + amplifier	100	
P594 Unit Casing		
P594 unit included – Schneider Electric	5	
P594 unit included - ALSTOM (no longer available)	0	
P594 unit excluded	9	
Vx Aux Rating		
Kits 4, 5 & 6 (without P594 unit)	0	
24 - 54 Vdc	1	
48 - 125 Vdc/30 - 100 Vac	2	
110 - 250 Vdc/100 - 240 Vac	3	
19 - 150 Vdc (no longer available)	7	
30 - 300 Vdc (no longer available)	8	
P594 - GPS Synchronizing Unit with optional kits comprising:		
P594 GPS Synchronizing Unit, Aerial, Aerial mounting bracket, 1 metre Pole, Lightning/Surge arrester, manual (and, where appropriate, a signal amplifier).		
P594	*	*
	*	***
	*	*





TECHNICAL DATA

Date: 2nd March 2010
Hardware Suffix: D
Connection Diagrams: 10P5940201

TD

Technical Data

Mechanical Specifications

Design

Modular MiCOM Px20 platform case size 20TE.

Enclosure Protection

Per IEC 60529: 1989
IP 52 Protection (front panel) against dust and dripping water.
IP 30 Protection for sides of the case.
IP 10 Protection for the rear.

Weight

P594 approx. 2.3 kg

Terminals

General Input/Output Terminals

For power supply and output contacts.
Located on rear general purpose (grey) blocks:
Threaded M4 terminals, for ring lug connection.

Case Protective Earth Connection

Two rear stud connections, threaded M4.
Must be earthed (grounded) for safety, minimum earth wire size 2.5mm².

GPS Antenna Input Terminal

BNC socket
Isolation to SELV level.
50 ohm coaxial cable.

1 PPS Fiber Optic Outputs

Wavelength: 850nm
Fiber: multi-mode glass fiber 50/125µm or 62.5/125µm
Connector style: BFOC/2.5 (ST®), as per IEC 874-10

IRIG-B 12X Output (Modulated)

External clock synchronization per IRIG standard 200-98, format B12X (B120, B121, B122, B123).

BNC socket (SK1):

Output impedance 50 Ω at 1000Hz
Modulation ratio: 3:1 to 6:1
Output signal, peak: 1, 2 or 5 V
Maximum load: 50 Ω

IRIG-B 00X Output (Un-modulated)

External clock synchronization per IRIG standard 200-98, format B00X (B000, B001, B002, B003).

BNC socket (SK1):

5V TTL level
Output impedance 50 Ω at 1000Hz
Maximum load: 50 Ω

9 pin D-type female connector (SK2):

EIA(RS)422
Isolation to ELV level
Maximum cable length 1000m.

Front Port Serial PC Interface

EIA(RS)232 DTE, 9 pin D-type female connector.
Protocol for interface to test software/for firmware updates.
Isolation to ELV level.
Maximum cable length 15m.

Ratings

Power Supply

Auxiliary Voltage (Vx)

Three ordering options:
(i) Vx: 24 to 48 Vdc
(ii) Vx: 48 to 125 Vdc, and 35 to 100Vac (rms)
(iii) Vx: 110 to 250 Vdc, and 100 to 240Vac (rms)

Operating Range

(i) Vx: 19 to 58 Vdc
(ii) Vx: 37 to 150 Vdc, and 30 to 110Vac (rms)
(iii) Vx: 87 to 300 Vdc, and 80 to 265 Vac (rms)

With a tolerable ac ripple of up to 12% for a dc supply, per IEC 60255-11: 1979

Nominal Burden

Quiescent burden: 5 W

Power Supply Interruption

Per IEC 60255-11: 1979
The unit will withstand a 20ms interruption in the DC auxiliary supply, without de-energizing.
Per EN 61000-4-11: 2004
The unit will withstand a 20ms interruption in an AC auxiliary supply, without de-energizing.

Output Contacts

Static Contacts

Static contacts for 1 PPM, 1 PPH and alarming:

Rated voltage: 48 V
Maximum operating voltage withstand: 60 V

Make, break and carry: 120 mA

Watchdog Contact

Non-programmable contact for unit healthy/unit fail indication:

Continuous current: 5 A
Short-duration current: 30 A for 3s
Making capacity: 30A for 3s

Breaking capacity:
DC: 30W resistive
DC: 15W inductive (L/R = 40ms)
AC: 1250VA inductive ($\cos \phi = 0.7$)

Durability:

Loaded contact: 10 000 operations minimum,
Unloaded contact: 100 000 operations minimum.

Environmental Conditions

Ambient Temperature Range

Per IEC 60255-6: 1988

Per EN 60068-2-1 : 1993 and
EN 60068-2-2 : 1993

Operating temperature range:
-25°C to +55°C (or -13°F to +131°F).

Storage and transit:
-25°C to +70°C (or -13°F to +158°F).

Ambient Humidity Range

Per IEC 60068-2-78: 2001:

56 days at 93% relative humidity and +40°C

Per IEC 60068-2-30: 1980:

Damp heat cyclic, six (12 + 12) hour cycles,
93% RH, +25 to +55°C

Type Tests

Insulation

Per EN 60255-27: 2005,

Insulation resistance > 100M Ω at 500Vdc
(Using only electronic/brushless insulation tester).

Creepage Distances and Clearances

Per EN 60255-27: 2005

Pollution degree 3,

Overvoltage category III,

Impulse test voltage 5 kV.

High Voltage (Dielectric) Withstand

Per IEC 60255-5:2000 Dielectric Withstand and ANSI/IEEE C37.90.1989 (R1994)

3.25kV rms 50Hz 1 minute, 3.6kV rms 50Hz 1s between Auxiliary input terminals (B1 and B2) and BNC IRIG-B output (SK1)

1.0kV rms 50Hz 1 minute, 1.2kV rms 50Hz 1s between EIA422 IRIG-B output SK2 (terminals 4 & 7) and all other circuits

2kV rms 50Hz 1 minute, 2.2kV rms 50Hz 1s between all remaining circuits not listed above

1kV rms 50Hz 1 minute, 1.2kV rms 50Hz 1s across open watchdog contacts

Impulse Voltage Withstand Test

Per EN 60255-27: 2005

Front time: 1.2 μ s, Time to half-value: 50 μ s,
Peak value: 5 kV, 0.5J

Between all terminals, and all terminals and case earth.

Electromagnetic Compatibility (EMC)

1 MHz Burst High Frequency Disturbance Test

Per EN 60255-22-1: 2005, Class III,

Common-mode test voltage: 2.5 kV,

Differential test voltage: 1.0 kV,

Test duration: 2s, Source impedance: 200 Ω

Immunity to Electrostatic Discharge

Per EN 61000-4-2: 1995, Class 4,

15kV discharge in air to user interface, display, and exposed metalwork.

8kV point contact discharge to any part of the front of the product.

Electrical Fast Transient or Burst Requirements

Per EN 60255-22-4: 2002. Test severity Class A:

Amplitude: 2 kV, burst frequency 5kHz applied directly to communication ports (excluding EIA(RS)422).

Amplitude: 4 kV, burst frequency 2.5kHz. applied directly to all other inputs excluding communications ports.

Per EN 61000-4-4: 2004. Test severity Level 4:

Amplitude: 2 kV, burst frequency 5kHz applied directly to all ports excluding power supply (excluding EIA(RS)422).

Amplitude: 4 kV, burst frequency 5kHz power applied directly to power supply.

Surge Withstand Capability

IEEE/ANSI C37.90.1: 2002:

4kV fast transient and 2.5kV oscillatory applied common mode and differential mode to opto inputs output relays, power supply.

4kV fast transient and 2.5kV oscillatory applied common mode to communications, IRIG-B.

Surge Immunity Test

Per IEC 60255-22-5:2002

Level 3 (2kV common mode) applied to antenna input

Per EN 61000-4-5:1995

Level 4 (4kV common mode, 2kV differential mode)

Immunity to Radiated Electromagnetic Energy

Per EN 61000-4-3: 2002 Level 3 with spot frequencies to EN 60255-22-3: 2001:

Test field strength, frequency band 80 MHz to 1.89 GHz: 10 V/m,

Test using AM: 1 kHz / 80%,

Spot tests at 80, 160, 450, 900 MHz; 1.89 GHz.

Per IEEE/ANSI C37.90.2: 1995:

25MHz to 1000MHz, zero and 100% square wave modulated.

Field strength of 35V/m.

Radiated Immunity from Digital Communications

Per EN61000-4-3: 2002, Level 4:

Test field strength, frequency band 800 to 960 MHz, and 1.4 to 2.0 GHz: 30 V/m,

Test using AM: 1 kHz / 80%.

Immunity to Conducted Disturbances Induced by Radio Frequency Fields

Per IEC 61000-4-6: 1996, Level 3, with spot frequencies to EN 60255-22-6: 2001.

Test field strength, frequency band 150kHz to 80 MHz: 10 V/rms,

Spot tests at 27, 68 MHz

Power Frequency Magnetic Field Immunity

Per EN 61000-4-8: 2001, Level 5,

100A/m applied continuously,

1000A/m applied for 3s.

Per EN 61000-4-9: 2001, Level 5,

1000A/m applied in all planes.

Per EN 61000-4-10: 2001, Level 5,

100A/m applied in all planes at

100kHz/1MHz with a burst duration of 2s.

Conducted Emissions

Conducted Emissions from the power supply shall not exceed the levels specified in EN 55022:1998 Group 1 Class A limits.

0.15 - 0.5MHz, 79dB μ V (quasi peak)66dB μ V (average)0.5 - 30MHz, 73dB μ V (quasi peak) 60dB μ V

average).

Radiated Emissions

Per EN 55022: 1998:

30 - 230MHz, 40dB μ V/m at 10m measurement distance230 - 1GHz, 47dB μ V/m at 10m

measurement distance.

100kHz/ 1MHz Damped Oscillatory Disturbance Test

Per EN 61000-4-18: 2006,

Common-mode test voltage: 2.5 kV,

Differential test voltage: 1.0 kV,

Power Frequency Test

Per EN 60255-22-7: 2003,

Common-mode test voltage: 300Vrms

Differential test voltage: 150Vrms

Voltage applied to all non-main frequency inputs.

EU Directives**EMC Compliance**

Per 2004/108/EC:

Compliance to the European Commission Directive on EMC. Product Specific

Standards were used to establish conformity:

EN 50263: 2000

Product Safety

Per 2006/95/EC:

Compliance with European Commission Low Voltage Directive.

Compliance is demonstrated by reference to generic safety standards:

EN 60255-27 :2005



2006/95/EC

R&TTE COMPLIANCE

Radio and Telecommunications Terminal Equipment (R & TTE) directive 99/5/EC.

Compliance demonstrated by compliance to the Low Voltage Directive, 2006/95/EC, down to zero volts by reference to safety standards.

Applicable to rear communications ports.

Mechanical Robustness

Vibration Test

Per IEC 60255-21-1: 1996
Response Class 2
Endurance Class 2

Shock and Bump

Per IEC 60255-21-2: 1995
Shock response Class 2
Shock withstand Class 1
Bump Class 1

Seismic Test

Per IEC 60255-21-3: 1995
Class 2

Accuracy

GPS receiver

Relative to actual GPS time when in over-determined clock mode and synchronized to GPS: ± 50 ns (nanosecond)

1 PPS fiber output for P54x

Maximum absolute error (between the actual GPS time and the rising edge of the 1 PPS signal): ± 50 ns (nanosecond)
The pulse width is $200\text{ms} \pm 1\text{ms}$
The rise and fall time of the 1 PPS signal is less than 20 ns (nanosecond) between 10% and 90% amplitude points
The maximum jitter of the 1 PPS signal is $\pm 100\text{ns}$ (nanosecond)
Maximum error between two P594 units both synchronized to GPS: $< \pm 200\text{ns}$ (nanosecond) with cable delay compensation applied.

1 PPS fiber output for CVCOM

As per 1 PPS fiber output for P54x when synchronized to GPS.
The pulse width is $1\mu\text{s} \pm 1\%$ when not synchronized to GPS
The rise and fall time of the 1 PPS signal is less than 20 ns (nanosecond) between 10% and 90% amplitude points
The maximum drift of the signal is $< 200\text{ns/s}$ when not synchronized to GPS

Modulated IRIG-B output

When synchronized to GPS: $< \pm 3\mu\text{s}$ of GPS receiver time
When not synchronized to GPS: $< \pm 200\text{ns/s}$ drift
Peak output voltage: $\pm 10\%$ of setting

Un-modulated IRIG-B output

BNC socket (SK1):

When synchronized to GPS: $< \pm 800\text{ns}$ of GPS receiver time

When not synchronized to GPS: $< \pm 200\text{ns/s}$ drift

9 pin D-type female connector (SK2):

When synchronized to GPS: $< \pm 1.5\mu\text{s}$ of GPS receiver time

When not synchronized to GPS: $< \pm 200\text{ns/s}$ drift

1 PPM/1PPH Static outputs

When synchronized to GPS: $< \pm 100\mu\text{s}$ of GPS receiver time

When not synchronized to GPS: $< \pm 200\text{ns/s}$ drift

SETTINGS

Date: 2nd March 2010
Hardware Suffix: D
Connection Diagrams: 10P5940201

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1. SETTINGS

The MiCOM P594 must be configured to the system and application using appropriate settings. The sequence in which the settings are listed and described in this chapter will be as per the User Interface menu.

From the default display the user can press the down key and will then be presented with the 'SYSTEM DATA' menu heading. The user can then use the Left and Right keys to navigate the menu headings in the following order:

- SYSTEM DATA
- MEASUREMENTS
- CONFIGURATION
- DATE TIME CONFIG
- FIBER CONFIG
- RELAYS CONFIG
- IRIG-B CONFIG
- COMMS CONFIG
- STATISTICS

The unit is supplied with a factory-set configuration of default settings.

1.1 System data

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
SYSTEM DATA				
Language	English	Español, Deutsch, Français		
<p>The user is able to change the language of the menu and display using this setting. The language options are: English, Spanish, German and French.</p> <p>To change the setting the user is able to press the enter key and the following heading will be visible. The letter 'E' on the second line, first character will flash if English is the current language setting. The user is then able to use the up and down keys to select German, Spanish or French. When the correct setting is visible the user must press the enter key to confirm the setting.</p> <p>The setting will be applied immediately and no timing outputs will be affected. If the user does not require the setting to be changed the 'Clear' key can be pressed during the settings change.</p>				
Description	P594	A-Z & 0-9 (16 characters)		
<p>The user is able to change the description of the P594 and a maximum of 16 characters are available to use. To change the description, the user is required to press the enter key then a heading will become visible and the first letter on the second line, first character will flash. The user is then able to use the up and down keys to select the correct letter.</p> <p>The user should use the left and right keys to select each of the 16 characters and change their letter displayed. When the correct setting is visible the user must press the enter key to activate the setting. The setting will be applied immediately and no timing outputs will be affected.</p> <p>If the user does not require the setting to be changed the 'Clear' key can be pressed during the settings change.</p>				

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Plant Reference	Schneider Electric	(16 characters)		
<p>The user is able to change the Plant Reference of the P594 and a maximum of 16 characters are available to use. To change the Plant Reference, the user is required to press enter then a heading will become visible, and the first letter on the second line, first character will flash.</p> <p>The user is then able to use the up and down keys to select the correct letter. The user can then use the left and right keys to select each of the 16 characters and change their letter displayed. When the correct setting is visible the user must press the enter key to activate the setting. The setting will be applied immediately and no timing outputs will be affected.</p> <p>If the user does not require the setting to be changed the 'Clear' key should be pressed. The Plant Reference cell should also be visible only via the default display by pressing either the left or right keys.</p>				
Database Reference	20070413	N/A		
The database reference is based on the date it was built and is displayed in Military format.				
Software Reference	0.02h 21/01/2010	N/A		
The software reference is based on the date on which the software was built.				
Access Level	Level 0	N/A		
The default setting is Level 0.				
Password Control	Access Level 0	N/A		
The default setting is Access Level 0.				

1.2 Configuration

Within the CONFIGURATION menu the following settings/changes can be made:

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
CONFIGURATION				
Password	(4 characters)	Access Level 1 (password protected)		
<p>The unit is to be password protected. The settings have a level 1 password. The Level 1 password is 4 capital alpha characters. To enter the password the user must press the enter key.</p> <p>The first digit of the password will then flash, and the correct character selected by pressing the up or down key. The user must then press the right key to select the next character. The user may scroll back to previous characters to make changes. Once the 4 characters have been selected the user must then press enter to confirm the password.</p> <p>Depending on the password entered. If no keypad presses are detected within 5 minutes the password will be disabled. To cancel the password the user must exit to the default display using the arrow keys or by pressing the 'C' key.</p> <p>The default password setting is off. The default level 1 password is 'AAAA'. The setting is applied immediately and has no affect on the timing outputs.</p>				



Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Global Control	Locked	N/A		
<p>The default setting is 'Outputs Off'.</p> <p>This setting will display 'Locked' and will not be configurable until first GPS synchronization, following energization.</p> <p>Once the first GPS Sync is gained the setting can be changed to either 'Outputs On' or 'Outputs Off'.</p> <p>This setting acts as a master switch for all outputs except static relay outputs that are set as alarm relays.</p> <p>If the setting is configured to 'Outputs On' then any outputs that are configured to be on by their individual setting will be output.</p> <p>If the setting is configured to 'Outputs Off' then all outputs will stop.</p> <p>If no GPS antenna is available during commissioning the 'Global Control' setting can be unlocked to allow testing of outputs that do not require GPS synchronization for the output to be on.</p> <p>To unlock the 'Global Control' Menu item the user must set the Date and Time in the 'DATE TIME CONFIG' Menu. Once these have been set a 'Commissioning Mode' Menu item will become visible in the 'DATE TIME CONFIG' Menu below the 'Time' setting menu item. The user must then enable commissioning mode by setting it to 'Yes'. The user will then be able to set 'Global Control' as required.</p>				
Cable Delay	0 Meters	0 Meters (password protected)	500 Meters (password protected)	1 Meter
<p>It is possible to compensate for cable delay with respect to the length of the antenna cable. The delay is adjustable between 0 to 500m. The delay per meter is 3.92ns. To change the setting the Level 1 password must have first been entered by the user, they must then press the enter key and the following heading will be visible, and the character on the second line, first character will flash.</p> <p>The user is then able to use the up, down, left, right arrow keys to adjust the delay setting. The user must confirm the setting by pressing the enter key. To avoid large leaps in the 1PPS output the GPS receiver can be adjusted at a rate of 1m per second until the required delay is achieved. The default setting is 0 meters. The Clear key can be pressed any time before the enter key is pressed to cancel the change.</p> <p>If the cable delay setting is changed all outputs will be disabled by the Global Control setting until the cable delay has been updated. The Global Control setting displays the 'Locked' message, and the user will not be able to change the setting. The setting is applied when the user exits the 'CONFIGURATION' menu by confirming the 'SAVE SETTINGS' prompt.</p>				
GPS Position	Auto Survey	Stored Check, Stored No Check		
<p>This setting allows the user to select how the GPS receiver is initialized when the P594 is energized or when this setting is updated. To change the setting the Level 1 password must have first been entered, the user must then press the enter key when the heading is displayed and the Letter 'A' on the second line, first character will flash. The user is then able to select the modes 'Stored Check' and 'Stored No Check' by using the up or down keys.</p> <p>The 'Stored Check' and 'Stored No Check' settings allows the user to bypass the auto survey feature that is used to determine the position of the GPS antenna when the unit is energized or when the setting is changed and instigated immediately.</p>				
Stored Latitude	+052.801584°	N/A		
<p>The default latitude setting is +052.801584° (updated automatically when auto-survey has completed).</p>				

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Stored Longitude	-002.094343°	N/A		
The default setting is -002.094343° (updated automatically when auto-survey has completed).				
Stored Altitude	79 Meters	N/A		
The default setting is 79 meters (updated automatically when auto-survey has completed).				
Level 1 Password	(4 characters)	N/A		
<p>To change the password, the Level 1 password must have first been entered by the user. The user must then press the enter key on the level 1 password setting, and the first character 'A' on the second line first character will flash.</p> <p>The user is then able to use the up and down keys to select the correct letter to create the first letter of the password which can be a letter or a number. The user can then use the left and right keys to select each of the 4 characters and change their character displayed.</p> <p>When the correct setting is visible, the user must press the enter key to activate the setting. The setting will be applied immediately and no timing outputs will be affected. If the user does not require the setting to be changed, the 'Clear' key can be pressed during the settings change. The default setting is 'AAAA'.</p>				
Level 2 Password	(4 characters)	N/A		
This option is provided for Engineering purposes only.				
Restore Defaults	No	N/A		
<p>There is an option to restore factory default settings. To restore default settings the Level 1 password must have first been entered by the user, they must then press the enter key and the character on the second line, first character will flash.</p> <p>The user is then able to use the up and down arrow keys to adjust the setting between 'Yes' and 'No'. The user must apply the setting by pressing the enter key. At this point all outputs are turned off, default settings are applied and the P594 will re-start.</p> <p>The default setting is 'NO'. The Clear key can be pressed any time before the enter key is pressed to cancel the change.</p>				

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1.3 Statistics

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
STATISTICS				
Select Period	Today	Today, Yesterday, Two days ago, Three days ago, Four days ago, Five days ago, Six days ago, Previous 7 days, This Month and Last Month		
The default period setting is Today. The GPS receiver stores information from midnight to midnight on a day and keeps it ready for the next day. The information becomes viewable within the 'Yesterday' period range. The same procedure takes place until the GPS receiver has stored information to be displayed for a past month.				
No GPS Sync. (Under Select Period Menu)		100%		N/A
This indicates the percentage of the GPS Sync. Signal that has not been detected in a 24 hour period.				
Min. Satellites (Under Select Period Menu)		0		N/A
This indicates the minimum no. of satellites detected in a 24 hour period.				

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Max. Satellites (Under Select Period Menu)			0	N/A
This indicates the maximum no. of satellites detected in a 24 hour period.				
0 Satellites (Under Select Period Menu)		100%		N/A
Indicates the percentage when no satellites have been detected in a 24 hour period.				
1-12 Satellites (Under Select Period Menu)			0%	N/A
Indicates the percentage of signal strength when 1 to 12 satellites have been found in a 24 hour period.				
Reset Counters (Under Select Period Menu)			No	N/A
<p>The counters used to calculate the survey statistics can be reset using this setting. To change the setting the Level 1 password must have first been entered, the user must then press the enter key and the Letter 'N' on the second line, first character will flash. The user is then able to change the setting. The user must press the enter key to update the setting. The counters will then be reset.</p> <p>The survey statistics are displayed as a percentage to the nearest whole number. The statistic calculations are a continuous rolling average of a duration based on the users setting. These are updated every time the averages are re-calculated. The default setting is No.</p> <p>The Clear key can be pressed any time before the enter key is pressed to cancel the change. No outputs are affected by changing this setting.</p>				

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1.4 Fibre configuration

There are 4 fiber optic outputs at the rear of the P594 and the menus under 'Fibre Configuration' relate to the setting of these outputs. There are 5 modes available for each of the outputs. To change the setting the Level 1 password must first have been entered by the user. These modes are shown below:

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
FIBRE CONFIG.				
Fibre Output 1-4	Output Off	P54x Sync, Test Duty Cycle, CVCOM GPS Sync, CVCOM Auto Sync (all password protected)		
<p>This configures the output to be off and is the default setting.</p> <p>In the 'P54x Sync' mode, the port is required to provide a 200ms GPS synchronized 1PPS signal. This is only available if the GPS receiver is in a synchronized state.</p> <p>In the 'CVCOM Auto Sync' mode, the port is required to provide a 200ms GPS synchronized 1PPS signal if the GPS receiver is GPS Synchronized, and a 1µs local 1PPS signal if the GPS receiver is not GPS synchronized.</p> <p>In the 'CVCOM GPS Sync' mode, the port is required to provide a 200ms GPS synchronized 1PPS signal. This is only available if the GPS receiver is in a synchronized state.</p> <p>In the 'Test Duty Cycle' mode, the port is required to provide a 625kHz 50% duty cycle square wave output.</p> <p>The user is then able to use the up and down arrow keys to adjust the setting.</p> <p>The user must confirm the setting by pressing the enter key. The setting is applied when the user exits the 'FIBRE CONFIG' menu by confirming the 'SAVE SETTINGS' prompt.</p> <p>The output is adjusted for the next available pulse. The IRIG-B or other pulsed outputs are not affected by changing a fibre output setting. The Clear key can be pressed any time before the enter key is pressed to cancel the change.</p>				

1.5 Relay configuration

There are 4 relay outputs at the rear of the P594 and the menus under 'Relay Configuration' relate to the setting of these outputs. There are 12 modes available for each of the outputs as shown below:

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
RELAY CONFIG.				
Relay Output 1-4	Off	P594 Not Healthy, 1PPHr GPS Sync, 1PPMn GPS Sync, 1PPHr Local Sync, 1PPMn Local Sync, Default Settings, Position Error, Antenna Fail, Test Mode On, Not Synchronized, GPS Not Healthy. (Level 1 password protected)		
<p><u>P594 Output Range:</u> The relay output is on to signify that the P594 is not Healthy.</p> <p><u>1PPHr GPS Sync Output Range:</u> The relay output is on for 200ms (±1ms) at the start of every hour and is off for the rest of the hour. It is driven from the local 1PPS signal and is only available when the GPS receiver is synchronized.</p> <p><u>1PPMn GPS Sync Output Range:</u> The relay output is on for 200ms (±1ms) at the start of every minute and is off for the rest of the minute. It is driven from the local 1PPS signal and is only available when the GPS receiver is synchronized.</p> <p><u>1PPHr Local Sync Output Range:</u> The duration is the same as the 1PPHr GPS Sync Output Range. This output is always available whether the GPS receiver is synchronized or not.</p> <p><u>1PPMn Local Sync Output Range:</u> The duration is the same as the 1PPMn GPS Sync Output Range. This output is always available whether the GPS receiver is synchronized or not.</p> <p><u>Default Settings Output Range:</u> The relay output is on to signify that default settings have been loaded.</p> <p><u>Position Error Output Range:</u> The relay output is on to signify that the GPS receiver position is incorrect.</p> <p><u>Antenna Fail Output Range:</u> The relay output is on to signify that the antenna has failed, either open or short circuit.</p> <p><u>Test Mode On Output Range:</u> The relay output is on if the P594 is in its start-up commissioning mode state or if any of the PPS outputs have been left in fibre optic test mode (625kHz test output).</p> <p><u>Not Synchronized Output Range:</u> The relay output is on to signify that the GPS receiver is not in a synchronized state.</p> <p><u>GPS Not Healthy Output Range:</u> The relay output is on to signify that the GPS receiver hardware is not in a synchronized healthy state.</p>				

1.6 Comms configuration

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
COMMS CONFIG.				
RS232 Port Mode	Standard Port	N/A		
The read only default setting is Standard Port.				

1.7 Date & time configuration

Within the configuration menu the following settings/changes can be made:

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
DATE TIME CONFIG.				
Date	01/01/2007	DD/MM/YYYY		
<p>It is possible to change the date stored in the P594's memory. However this setting option is only available at start-up before GPS synchronization occurs.</p> <p>If the GPS receiver is 'synchronized' then this setting is invisible.</p> <p>The user is able to enter in the date using the up, down, left, right arrow keys on the keypad. When the correct setting is visible the user must press the enter key to confirm the setting. The setting is applied when the user exits the 'DATE TIME CONFIG' menu by confirming the 'SAVE SETTINGS' prompt.</p> <p>The default date is set to 01/01/2007.</p>				
Time	P594 Operating Time	00:00:00 (Hours/Minutes/Seconds)		
<p>It is possible to change the time stored in the P594's memory. However this setting option is only available at start-up before GPS synchronization occurs.</p> <p>If the GPS receiver is 'synchronized' then this setting is invisible.</p> <p>The user is able to enter in the time using the up, down, left, right arrow keys on the keypad. When the correct setting is visible the user must press the enter key to confirm the setting. The setting is applied when the user exits the 'DATE TIME CONFIG' menu by confirming the 'SAVE SETTINGS' prompt.</p> <p>The default time displayed on the LCD is the P594 operating time since start-up.</p>				
Commissioning	No	Password Protected		
<p>Following the entry of date and time setting of start-up before 1st GPS Sync, the user will have a further prompt to enter a 'commissioning mode'. The user is able to adjust the setting to 'Yes' or 'No'. If 'YES' is selected then the 'Global Outputs' setting is unlocked and displays whatever the users current setting is.</p> <p>The unit will then use the entered time to provide the timing outputs, if the GLOBAL CONTROL Setting is set to 'ON' then the outputs configured to be on will commence. It should be noted that this is neither 'synchronized' or 'local' time as no accuracy can be quoted for the time signals. The commissioning mode can be stopped by entering the time and date again and selecting not to enter commissioning mode.</p> <p>If 'NO' is selected then the 'Global Outputs' setting remains locked and all timing outputs remain off until the user again enters the time and date and enters the commissioning mode.</p> <p>If synchronization of the GPS receiver occurs at any time the system will stop the timing outputs, re-align and restart the outputs (if enabled via the 'Global Control' setting) fully synchronized and operational. The Global Outputs setting is unlocked and displays whatever the users current setting is.</p> <p>The commissioning mode/test LED illuminates when in commissioning mode</p>				

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
UTC Offset	+ 0:00	-12:30 Hours to + 12:30 Hours (password protected)	30 minute steps	
<p>It is possible to apply an offset to the standard UTC time. This is adjustable from -12:30 Hours to + 12:30 Hours in 30 minute steps. To change the setting the Level 1 password must have first been entered by the user, they must then press the enter key and the symbol on the second line, first character will flash.</p> <p>The user is then able to use the up, down, left, right arrow keys to select the correct polarity and time adjustment setting. The user must press the enter key and the setting will be confirmed. The setting is applied when the user exits the 'DATE TIME CONFIG' menu by confirming the 'SAVE SETTINGS' prompt. The default setting is 0. The Clear key can be pressed any time before the enter key is pressed to cancel the change.</p> <p>Ensure that any device attached to the P594 IRIG-B outputs does not have any UTC adjustment or it will be applied twice.</p>				
DST Enable	No	Password Protected		
<p>It is possible to configure the P594 to adjust its time to allow for Daylight Saving changes. The method detailed in this section is based on the MiCOM Px40 platform DST adjustment configuration.</p> <p>To change the setting the Level 1 password must have first been entered by the user, they must then press the enter key and the character on the second line, first character will flash.</p> <p>The user is then able to select 'Yes' or 'No' using the up and down keys and then press enter to confirm the setting. The setting is applied when the user exits the 'DATE TIME CONFIG' menu by confirming the 'SAVE SETTINGS' prompt. The default setting is off. The Clear key can be pressed any time before the enter keys is pressed to cancel the change.</p> <p>Ensure that any device attached to the P594 IRIG-B outputs does not have any UTC adjustment or it will be applied twice.</p> <p>Note: The default settings for the DST configuration are already set up for UK DST Changes.</p>				
DST Offset	+1:00	Password Protected		
<p>It is possible to configure the settings for DST adjustment. To change the settings, Level 1 password must have first been entered by the user, they must then press the enter key and the character on the second line, first character will flash. The offset to be applied when DST is applied is adjustable via a setting; the setting has a range of 0, 30, 60, 90 or 120 minutes. The default setting is 60 minutes (+1:00 Hour).</p>				
DST Start Time	01:00:00	Password Protected	1 minute steps	
<p>This has a settings range of 0 to 23:59 in 1 minute steps. To change the settings, Level 1 password must have first been entered by the user, they must then press the enter key and the character on the second line, first character will flash.</p> <p>The offset is referenced from midnight local time with no DST adjustment applied. The default setting is 60 minutes. The hours and minutes fields are settable individually.</p>				

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Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
DST Start Day	Sunday	Password Protected		
<p>This has a settings range of Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday. The default setting is Sunday.</p> <p>To change the settings, Level 1 password must have first been entered by the user, they must then press the enter key and the character on the second line, first character will flash.</p>				
DST Start Week	Last	Password Protected		
<p>This has a settings range of First, Second, Third, Fourth and Last. The default setting is Last.</p> <p>To change the settings, Level 1 password must have first been entered by the user, they must then press the enter key and the character on the second line, first character will flash.</p>				
DST Start Month	March	Password Protected		
<p>This has a settings range of January, February, March, April, May, June, July, August, September, October, November and December. The default setting is March.</p> <p>To change the settings, Level 1 password must have first been entered by the user, they must then press the enter key and the character on the second line, first character will flash.</p>				
DST End Time		02:00:00	Password Protected	1 minute steps
<p>This has a settings range of 0 to 23:59 in 1 minute steps. The offset is referenced from midnight local time with no DST adjustment applied. The default setting is 60 minutes. The hours and minutes fields are settable individually. The default setting is 120 minutes (2 Hours).</p> <p>To change the settings, Level 1 password must have first been entered by the user, they must then press the enter key and the character on the second line, first character will flash.</p>				
DST End Day	Sunday	Password Protected		
<p>This has a settings range of Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday. The default setting is Sunday.</p> <p>To change the settings, Level 1 password must have first been entered by the user, they must then press the enter key and the character on the second line, first character will flash.</p>				
DST End Week	Last	Password Protected		
<p>This has a settings range of First, Second, Third, Fourth and Last. The default setting is Last.</p> <p>To change the settings, Level 1 password must have first been entered by the user, they must then press the enter key and the character on the second line, first character will flash.</p>				
DST End Month	October	Password Protected		
<p>This has a settings range of January, February, March, April, May, June, July, August, September, October, November and December. The default setting is October.</p> <p>To change the settings, Level 1 password must have first been entered by the user, they must then press the enter key and the character on the second line, first character will flash.</p>				

1.8 IRIG-B configuration

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
IRIG-B CONFIG.				
BNC O/P Mode	Off	Modulated, Un-modulated, Off		
<p>It is possible to select the type of IRIG-B output on the 50Ω IRIG-B output port (SK1) on the rear of the P594. To change the output type the Level 1 password must have first been entered by the user, they must then press the enter key to select between Modulated and Un-modulated outputs.</p>				
RS-422 O/P Mode	Off	Un-modulated, Off		
<p>To change the output type the Level 1 password must have first been entered by the user, they must then press the enter key to select Un-modulated output. The default setting is off.</p>				
IRIG-B12 Format	B123	B120, B121, B122, B123		
<p>To change the output type the Level 1 password must have first been entered by the user, they must then press the enter key to select either B120, B121 or B122 time code formats. The default setting is B120.</p>				
Modulation Ratio	3:1	3:1, 6:1		
<p>It is possible to select the modulation ratio of the IRIG-B signal on 50Ω IRIG-B output port (SK1) on the rear of the P594. To change the output modulation type the Level 1 password must have first been entered by the user, they must then press the enter key and the character on the second line, first character will flash. The user can only select between 3:1 and 6:1 Modulation ratio.</p> <p>This setting is only applicable and settable when the modulated output is enabled (IRIG-B12x). When the Non-modulated output setting is activated (IRIG-B00x) the Modulation setting is displayed as 'None'. The default setting is a modulation ratio of 3:1.</p>				
Output Voltage	1.0V Peak	1.0V/2.0V Peak and 5.0V Peak		
<p>It is possible to select the output voltage of the IRIG-B signal on 50Ω IRIG-B output port (SK1) on the rear of the P594. To change the output level the Level 1 password must have first been entered by the user, they must then press the enter key and the character on the second line, first character will flash.</p> <p>This setting is only applicable and settable when the modulated output is enabled (IRIG-B12x). When the Non-modulated output setting is activated (IRIG-B00x) the Output Voltage setting is as shown below and is not settable.</p> <p>The user must confirm the setting by pressing the enter key. The setting is applied when the user exits the 'IRIG-B CONFIG' menu by confirming the 'SAVE SETTINGS' prompt. The default setting is '1.0V Peak'. The Clear key can be pressed any time before the enter key is pressed to cancel the change.</p>				
IRIG-B000 Format	B000	B000, B001, B002, B003		
<p>To change the output type the level 1 password must have first been entered by the user, they must then press the enter key and character on the second line, first character will flash. The default setting is the IRIG-B000 format.</p>				

OPERATION

Date: 2nd March 2010

Hardware Suffix: D

Connection Diagrams: 10P5940201

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FIGURES

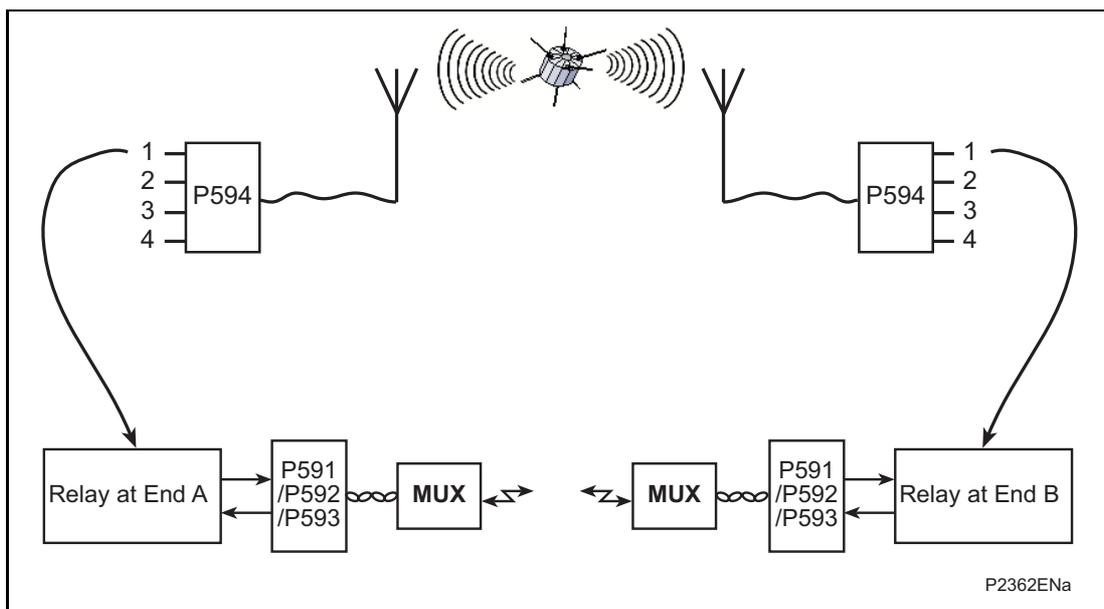
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1. OPERATION OF P594 SYNCHRONIZING UNIT

Both the MiCOM P543 to P546 Current Differential relays and the CVCOM400 Merging Unit for IEC 61850-9-2 Sampled Analogue Values can use a satellite-derived one pulse per second (1PPS) synchronizing signal from a MiCOM P594 GPS Synchronizing Unit, to synchronize sampling across a system.

One P594 unit can simultaneously support both applications, as each of the four 1PPS fiber outputs is separately configurable to either the P54x application or the CVCOM application.

These two applications are shown in Figures 1 and 2 below.



OP

Figure 1: Functional diagram 1 - P54x application

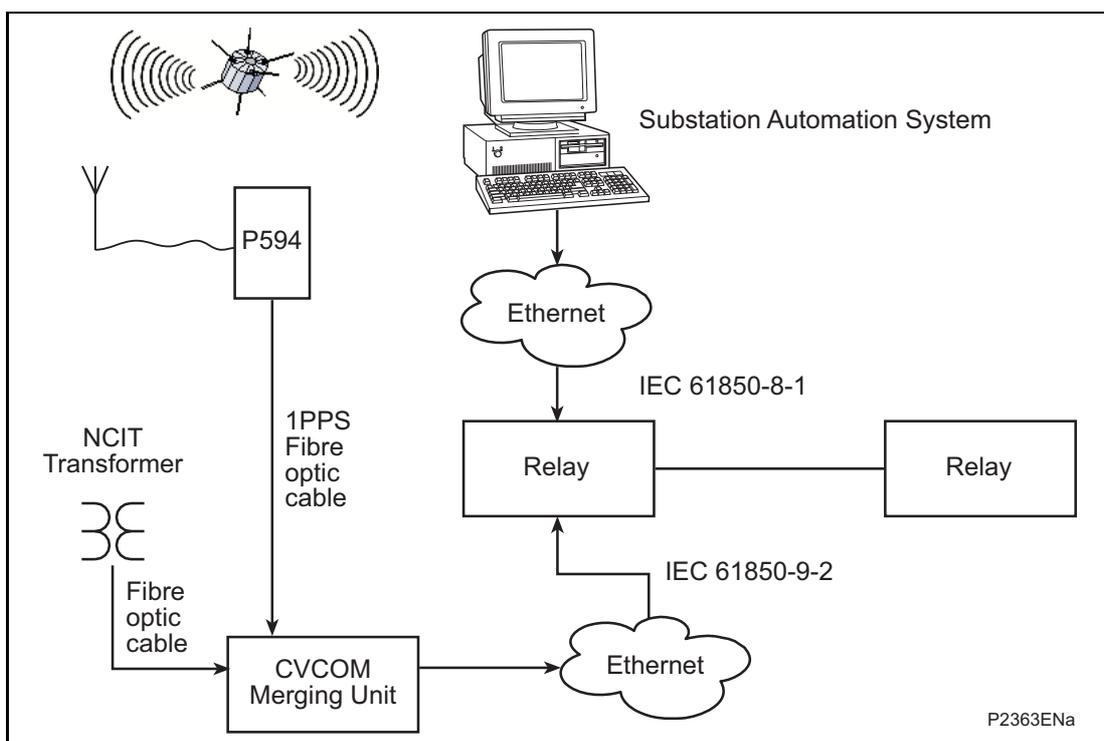


Figure 2: Functional diagram 2 - CVCOM application

1.1 1PPS fiber outputs

The P594 provides 4 x 1PPS fiber optic outputs. A fiber-optic link is used to reduce the risk of electrical interference. 850nm multimode fiber (50/125µm or 62.5/125µm) is used with BFOC/2.5 (ST®) connectors - refer also to the Technical Data section (P594/EN TD).

The pulse width depends on the configuration of each 1PPS output, under the FIBRE CONFIG menu heading.

1.1.1 P54x synchronization

When [FIBRE CONFIG, Fibre Output x] is set to 'P54x Sync', each pulse has a width of 200ms, as shown in Figures 3 and 4.

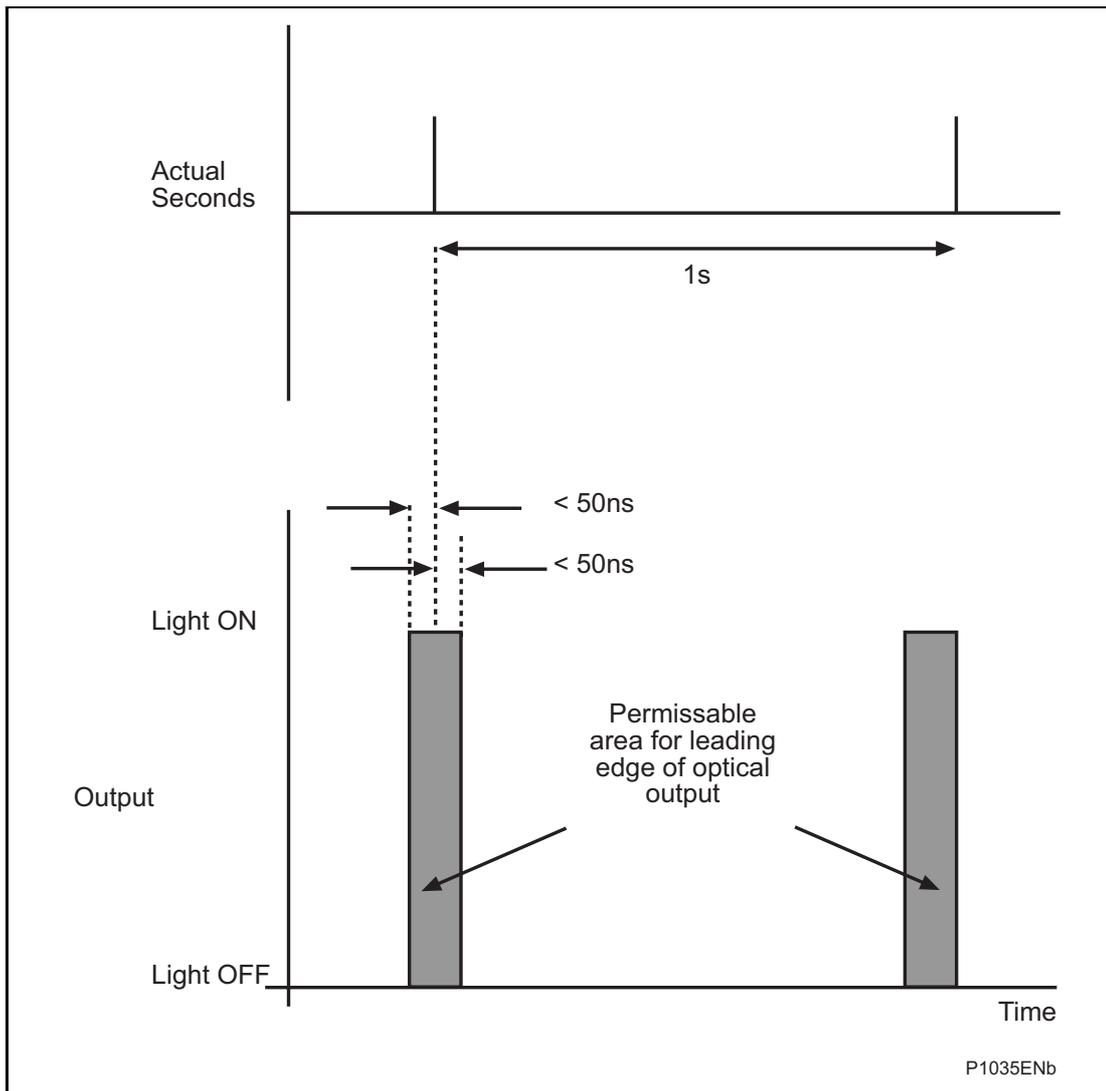


Figure 3: 1PPS Fiber output timing tolerance local end

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The relative error between any two P594 Synchronizing Units (which may be several kilometers apart) is less than 200 nanoseconds, see Figure 4. This includes variations in GPS receiver accuracy and in associated circuitry, and results in a minimal error of less than 0.1% in the overall system.

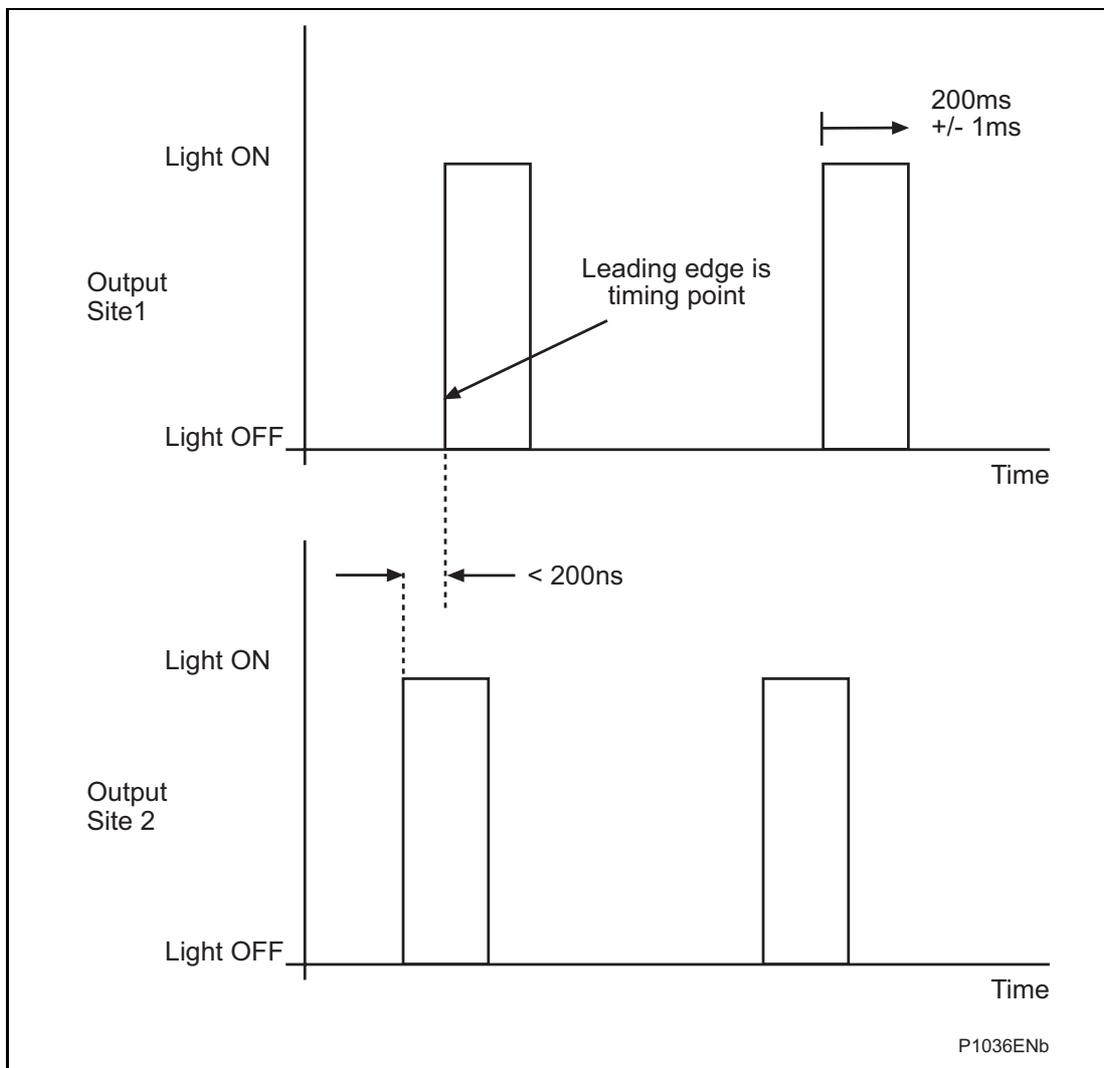


Figure 4: 1PPS Fiber output relative error local and remote ends

Note: The 1PPS output is only present when the P594 is synchronized to at least four valid satellites.

1.1.2 CVCOM synchronization

When [FIBRE CONFIG, Fibre Output x] is set to 'CVCOM GPS Sync', each pulse has a width of 200ms when the unit is synchronized to GPS (as shown in Figures 3 and 4 above). However if the GPS synchronization is lost, the output will be off.

When [FIBRE CONFIG, Fibre Output x] is set to 'CVCOM Auto Sync', each pulse has a width of 200ms when the unit is synchronized to GPS (as shown in Figures 3 and 4 above). However if the GPS synchronization is lost, the P594 will continue to output a modified 1PPS signal, where each pulse has a width of 1µs (±1%) derived from the P594 free-running clock, as shown in Figure 5.

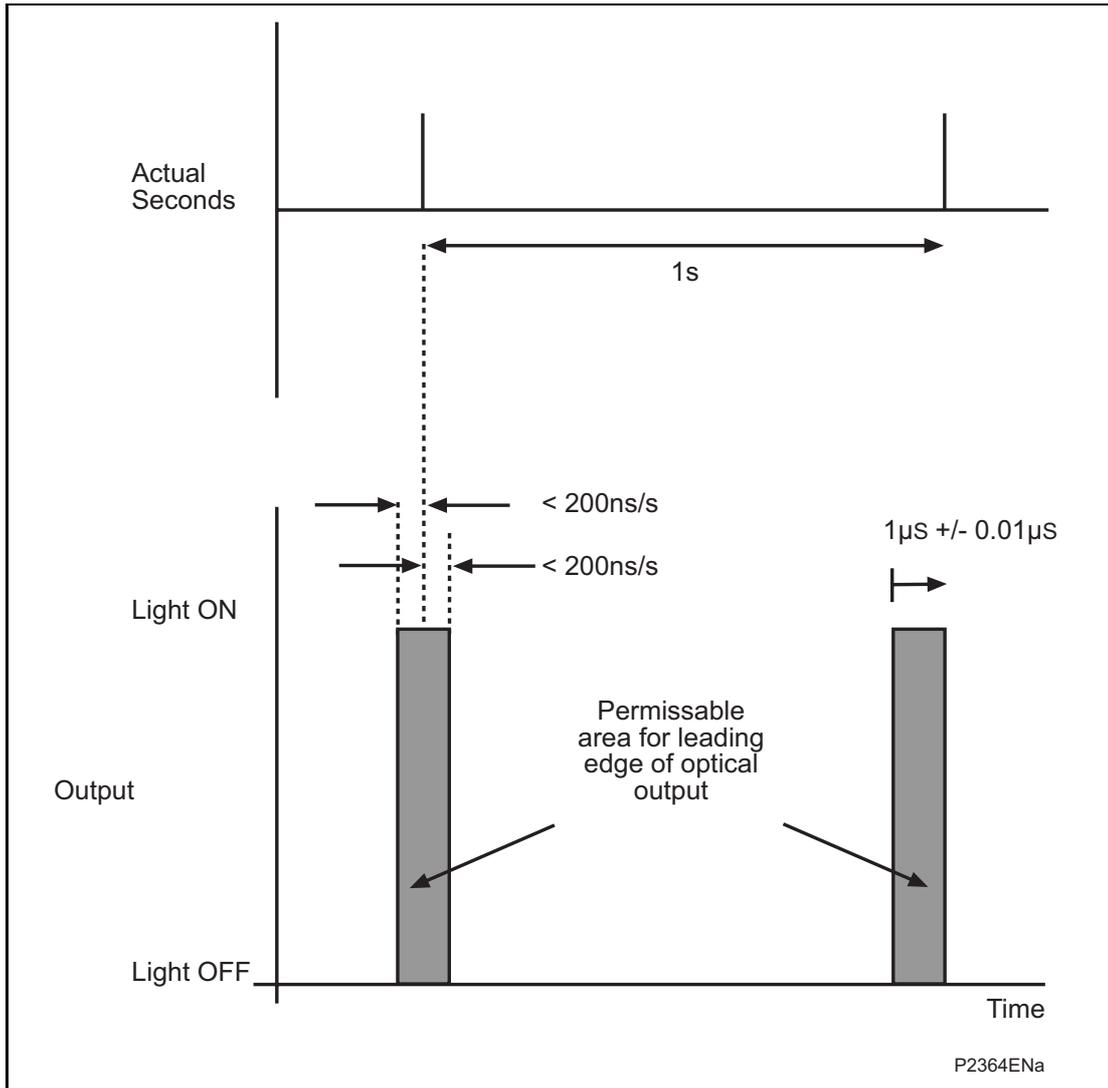


Figure 5: 1PPS Fiber output timing tolerance local end with P594 not synchronized

1.2 IRIG-B outputs

The P594 provides both a modulated and an un-modulated IRIG-B output.

1.2.1 Modulated IRIG-B output

The modulated IRIG-B output is a 1kHz modulated signal implemented on the BNC connector (SK1), suitable for connection to devices via a 50 ohm coaxial cable. The output can drive into a 50 ohm load and should be terminated appropriately.

The following parameters of the modulated IRIG-B output are configurable:

- Format (B120, B121, B122 or B123)
- Modulation Ratio
- Output Voltage

With default setting, the modulated output will interface with any MiCOM product that has a modulated IRIG-B input (MiCOM Px3x relay or MiCOM Px4x relay with appropriate hardware option fitted).

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1.2.2 Un-modulated IRIG-B output

The un-modulated IRIG-B output is a Pulse Width Coded signal implemented either on the BNC connector (SK1), suitable for connection to devices via a 50 ohm coaxial cable, or on a 9 pin D-type female connector (SK2), suitable for connection to devices via an EIA(RS)422 multidrop bus at TTL voltage, or on both simultaneously.

The following parameters of the un-modulated IRIG-B output are configurable:

- Format (B000, B001, B002 or B003)

With default setting, the un-modulated output will interface with any MiCOM product that has an un-modulated IRIG-B input (MiCOM Px4x relay or BiTRONICS Mx7x measurement device with appropriate hardware option fitted).

1.3 Static output contacts

The P594 provides 4 x static output contacts. Each of these output contacts can be configured as a one Pulse Per Minute (1PPM) or one Pulse Per Hour (1PPH) function, that could be used for time synchronization of a device that supports time synchronization by a pulse on a digital input. Each of the output contacts could alternatively be configured as an alarm contact for any of the indication/alarm conditions:

- 'P594 NOT Healthy'
- 'GPS NOT Healthy'
- 'Not Synchronized'
- 'Test Mode On'
- 'Antenna Fail'
- 'Position Error'
- 'Default Settings'
- '1PPMn Local Sync'
- '1PPHr Local Sync'
- '1PPMn GPS Sync'
- '1PPHr GPS Sync'

The configuration of each output contact is set under the RELAYS CONFIG menu heading.

1.4 Watchdog output contacts

The P594 provides both a normally closed and normally open watchdog contact. Operation of the watchdog output is initiated by in case of a serious internal error causing software reset.

Note: The watchdog output is not initiated on loss of GPS synchronization.

1.5 P594 operation on power up

The P594 is supplied with an antenna and mounting kit as described in section 1.6. On power up the green 'HEALTHY' LED illuminates and stays on indicating that the unit is healthy.

On power up, the P594 takes approximately 15 minutes to initialize after it detects four or more satellites before it starts to output the 1PPS signals. This delay ensures the accuracy of the timing signal. This is regardless of the setting [CONFIGURATION, GPS Position].

The setting [CONFIGURATION, GPS Position] determines the behavior of the P594 following reload of the default settings - when [CONFIGURATION, Restore Defaults] is set - or following a software update.

If [CONFIGURATION, GPS Position] is set to 'Auto Survey', then following reload of default settings or a software update, an auto survey is performed after it detects four or more satellites. This will take approximately 10 minutes before it starts to output the 1PPS signals.

If [CONFIGURATION, GPS Position] is set to 'Stored Check', then following reload of default settings or a software update and after it detects four or more satellites, 120 position fixes will be received and then the next positional information data received will be compared to the information stored in memory. If the co-ordinates (Longitude and Latitude only) are within $\pm 0.001^\circ$ of each other, then the co-ordinates stored in memory will be used and the P594 starts to output the 1PPS signals. If the co-ordinates are not correct then the 'WRONG POSITION' LED will be illuminated and an auto survey will be initialised. This will take approximately 2 minutes.

If [CONFIGURATION, GPS Position] is set to 'Stored No Check', then following reload of default settings or a software update and after it detects four or more satellites, the co-ordinates stored in memory will be used and the P594 starts to output the 1PPS signals. This will take approximately 10 seconds.

CAUTION: IF THE P594 UNIT HAS BEEN MOVED TO A NEW LOCATION, AN AUTO SURVEY MUST BE COMPLETED BEFORE THE CO-ORDINATES STORED IN MEMORY WILL BE CORRECT.

Once initialized, and provided the unit detects four or more satellites and the almanac is loaded, the 'SYNC' LED is illuminated. If the number of satellites drops below four the output turns off and the 'SYNC' LED will extinguish, until the number of satellites detected exceeds four again.

1.6 Default display

The default display of the LCD on the P594 front panel User Interface will look similar to the example shown in Figure 6 below:

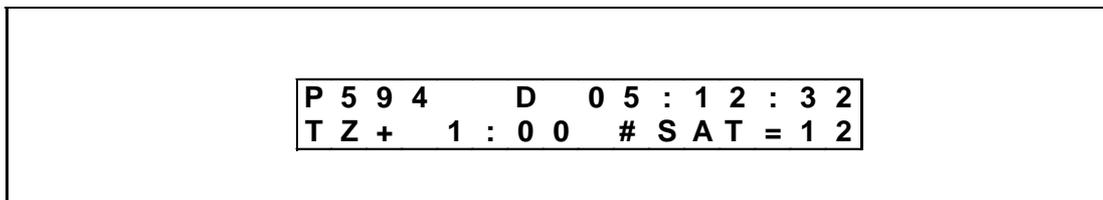


Figure 6: Default display

The text "P594" identifies the unit.

The letter "D" will be displayed when Daylight Saving Time is applied.

The text "05:12:32" in this example displays the time received from GPS.

The text "TZ+ 1:00" in this example displays the local time zone offset.

The text "#SAT=12" in this example displays the number of satellites currently detected (maximum 12).

1.7 LED indications

The P594 has 8 LEDs on the front User Interface, to provide operational indications and alarms.

1.7.1 'P594 HEALTHY' LED (green)

This LED is illuminated when the P594 is energized from the auxiliary supply and is functioning correctly.

1.7.2 'GPS HEALTHY' LED (green)

This LED is illuminated if the GPS Receiver Module is functioning correctly (even if the GPS antenna is not connected). If the GPS receiver becomes faulty or is being reconfigured then the LED will extinguish.

1.7.3 'SYNC' LED (green)

This LED is illuminated when the P594 is being synchronized from the incoming GPS signal.

1.7.4 '1 PPS' LED (green)

This LED flashes once per second.

1.7.5 'TEST' LED (red)

This alarm LED flashes once per second when one or more fiber outputs is in commissioning mode (set to 'Test Duty Cycle').

This LED is illuminated if the P594 is in commissioning mode, i.e. [DATE TIME CONFIG, Commissioning] = Yes.

1.7.6 'ANTENNA FAIL' LED (red)

This alarm LED is illuminated to indicate that there is a problem with the antenna (short-circuit or open-circuit). This status originates from the GPS receiver hardware, and indicates that the current drawn from the antenna and cabling exceeds 55mA or is less than 5mA.

1.7.7 'WRONG POSITION' LED (red)

This alarm LED is illuminated when the stored position of the antenna does not match with the GPS receiver derived position. This will be derived from the check that occurs at start-up if [CONFIGURATION, GPS Position] is set to 'Stored Check'. This LED will then latch on until an auto survey is carried out and the position data is corrected.

This alarm LED is also illuminated when the GPS receiver hardware sets its alarm bit to indicate an incorrect position is detected. If this occurs an auto survey will be instigated and the position data corrected. The LED will then extinguish.

1.7.8 'DEFAULT' LED (red)

This alarm LED is illuminated when the P594 is using default settings.

1.8 Measurements and statistics

The P594 provides measurement and statistics on the User Interface, giving status information about the P594 and the availability of GPS synchronization.

1.8.1 Measurements

The following measurements are provided as read only information under the MEASUREMENTS menu heading:

- Date
- Time
- Longitude
- Latitude
- Altitude
- Valid Satellites - the number of satellites currently detected (maximum 12)

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MiCOM P594

- GPS Receiver Status -synchronized or not
- Survey Status - percentage completion of current/last auto survey

These measurements are updated once per second.

1.8.2 Statistics

The following statistics are provided as read only information under the STATISTICS menu heading:

- No GPS Sync
- Min. Satellites
- Max. Satellites
- 0 Satellites
- 1 Satellites
- 2 Satellites
- 3 Satellites
- 4 Satellites
- 5 Satellites
- 6 Satellites
- 7 Satellites
- 8 Satellites
- 9 Satellites
- 10 Satellites
- 11 Satellites
- 12 Satellites

The period over which these statistics are viewable is set by the [STATISTICS, Select Period] setting. For a description of this setting, refer to the Settings section (P594/EN ST).

All statistics data can be cleared by the user by setting [STATISTICS, Reset Counters] = Yes.

1.9 Local time zone offset and daylight saving time offset

The user can set the local time zone offset and Daylight Saving Time configuration under the DATE TIME CONFIG menu heading. For a description of these settings, refer to the Settings section (P594/EN ST).

The time zone offset and Daylight Saving Time offset do not affect the 1PPS fiber outputs or the 1PPM/1PPH static outputs, but affect the time displayed on the User Interface and the time encoded in the IRIG-B outputs.

Note: If time zone offset and Daylight Saving Time offset are set in the P594, then any device that is connected to the IRIG-B output of the P594 should have its time zone offset and Daylight Saving Time offset (if supported) disabled, to avoid further adjustment that would result in incorrect time on the device.

2. P594 INSTALLATION KITS

The P594 unit requires an antenna, which is supplied as part of a kit. The basic kit contains the following:

- Trimble Bullet™ III antenna
- 25m of low loss cable
- Lighting/surge arrestor
- Mounting pole plus brackets

For installations where the antenna must be mounted >25m from the P594, alternative kits are required which contain 50m or 100m of low loss cable.

The correct mounting of the antenna is critical to the correct operation of the P594 and P54x or CVCOM. See the Installation section (P594/EN IN) for further details.

The P594 unit and each kit can be ordered separately, if required.

COMMISSIONING

Date: 2nd March 2010

Hardware Suffix: D

Connection Diagrams: 10P5940201

CM

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1. INTRODUCTION

The P594 employs a high degree of self-checking and, in the unlikely event of a failure, will give an alarm. To commission the P594, it is only necessary to verify that the hardware is functioning correctly and the application-specific software settings have been applied to the unit. It is considered unnecessary to test every function of the unit if the settings have been verified.

Unless previously agreed to the contrary, the customer will be responsible for determining the application-specific settings to be applied to the unit.

Blank commissioning test and setting records are provided at the end of this chapter for completion as required.

As the unit's menu language is user-selectable, it is acceptable for the Commissioning Engineer to change it to allow accurate testing as long as the menu is restored to the customer's preferred language on completion.

To simplify the specifying of menu cell locations in these Commissioning Instructions, they will be given in the form [COLUMN HEADING, Cell Text]. For example, the cell for selecting the menu language (first cell under the column heading) is located in the System Data column so it would be given as [SYSTEM DATA, Language].



Before carrying out any work on the equipment, the user should be familiar with the contents of the safety section/safety guide SFTY/4LM/D11 or later issue, the Technical Data section and the ratings on the equipment rating label.

2. SETTING FAMILIARIZATION

When commissioning a P594 unit for the first time, sufficient time should be allowed to become familiar with the method by which the settings are applied.

The Settings section (P594/EN ST) contains a detailed description of the menu structure and settings of the P594.

3. EQUIPMENT REQUIRED FOR COMMISSIONING

3.1 Minimum equipment required

Continuity tester.

Depending on application, one or more of the following equipments may be required:

- P54x relay
- CVCOM Merging Unit
- Any Px3x or Px4x relay with IRIG-B modulated input
- Any Px4x relay or Mx7x measurement device with IRIG-B un-modulated input

4. PRODUCT CHECKS

These product checks cover all aspects of the unit which should be checked to ensure that it has not been physically damaged prior to commissioning and is functioning correctly. It may not be necessary to perform all output tests, depending on the application for which the P594 is used.

If the application-specific settings have been applied to the unit prior to commissioning, it is advisable to make a copy of the settings so as to allow their restoration later. This should be done by manually creating a setting record. This could be done using a copy of the setting record located at the end of this chapter to record the settings as the unit's menu is sequentially stepped through via the front panel user interface

4.1 Visual inspection

Carefully examine the unit to see that no physical damage has occurred since installation.

The rating information, given under the top access cover on the front of the unit, should be checked to ensure that it is the correct model for the particular installation.

Ensure that the case earthing connection at the bottom left hand corner of the rear of the case is used to connect the unit to a local earthing bar using an adequate conductor.

4.2 Insulation

Insulation resistance tests are only necessary during commissioning if it is required for them to be done and they have not been performed during installation.

Isolate all wiring from the earth and test the insulation with an electronic or brushless insulation tester at a dc voltage not exceeding 500V. The auxiliary dc supply terminals should be temporarily connected together.

The insulation resistance should be greater than 100MΩ at 500V.

On completion of the insulation resistance tests, ensure that all external wiring is correctly reconnected to the P594.

4.3 External wiring

Check that the external wiring is correct to the connection diagram, that is included in section 10 of the Installation section (P594/EN IN).

It is especially important that the dc supplies are wired with the correct polarity.

4.4 Auxiliary supply

The P594 can be operated from either a dc only or AC/DC auxiliary supply depending on the unit's nominal supply rating. The incoming voltage must be within the operating range specified in the following below.

Without energizing the unit, measure the auxiliary supply to ensure it is within the operating range.

Nominal Supply Rating DC [AC rms]	DC Operating Range	AC Operating Range
24 to 48V [-]	19 to 58V	-
48 to 125V [35 to 100V]	37 to 150V	30 to 110V
110 to 250V [100 to 240V]	87 to 300V	80 to 265V

Table 1: Operational range of auxiliary supply V_x

It should be noted that the P594 unit is designed to withstand an ac ripple component of up to 12% of the normal dc auxiliary supply. However, in all cases the peak value of the dc supply must not exceed the maximum specified operating limit.



Do not energize the P594 using the battery charger with the battery disconnected as this can irreparably damage the units power supply circuitry.



Energize the P594 only if the auxiliary supply is within the specified operating ranges. If a P991 test block is provided, it may be necessary to link across the front of the test plug to connect the auxiliary supply to the P594.

4.5 Watchdog contacts

Using a continuity tester, check that the watchdog contacts are in the states given in the table below for a de-energized P594 unit.

Terminals	Contact State	
	P594 De-energized	P594 Energized
15 - 16	Closed	Open
17 - 18	Open	Closed

Table 2: Watchdog contact status

4.6 Light emitting diodes

On power up the green 'P594 HEALTHY' LED should have illuminated and stayed on indicating that the unit is healthy. If the 'ANTENNA FAIL' LED is illuminated, check that the antenna is connected. Initially the 'SYNC' LED will be unlit, indicating the P594 has not initialized and is not outputting a signal. The P594 takes approximately 15 minutes to initialize before it starts to output any time signals. If the number of satellites drops below four the output again turns off again until the number of satellites exceeds four. Once the initialization is complete the antenna can be disconnected (see next section) and reconnected without the power on initialization time.

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4.7 Synchronizing signal

The normal optical output from the P594 is a 200ms light on with 800ms light off. Most optical power meters can not measure this signal. A commissioning feature has been added which allows commissioning engineers to measure the power of the fiber optic signals from the P594 to be measured.

Set [FIBRE CONFIG, Fibre Output 1] to 'Test Duty Cycle'. This replaces the output signal by a 625kHz 50% duty cycle square wave signal. This condition is indicated by the green 'Test Mode' LED flashing. The P54x and CVCOM are immune to this signal and treats it as a loss of GPS.

Measure and record the optical power of fiber output 1 using an optical power meter and length of 50/125µm optical fiber. The mean value should be in the range -24.8dBm to -30.8dBm.

Repeat for each fiber output.

4.8 Connection to P54x relay

Connect P594 fiber output 'TX1' to the P54x relay, and set [FIBRE CONFIG, Fibre Output 1] to 'P54x Sync'. Enable GPS synchronization in [PROT COMMS/IM64, GPS Sync Enabled] of the relay. Ensure that the P594 SYNC LED is illuminated. Check that the P54x relay is recognizing the GPS synchronization in [MEASUREMENTS 4, Channel Status] of the relay. If this is satisfactory bit 4 should be 1 i.e. * * 1 * * * *.

Repeat for each fiber output.

4.9 Connection to CVCOM merging unit

Connect P594 fiber output 'TX1' to the CVCOM Merging Unit, and set [FIBRE CONFIG, Fibre Output 1] to 'CVCOM Auto Sync'. Ensure that the P594 SYNC LED is illuminated. Check that the CVCOM is recognizing the GPS synchronization (refer to CVCOM manual).

Repeat for each fiber output.

Note: For commissioning mode see Settings section, part 1.2 and 1.7.

4.10 IRIG-B outputs

Note: For commissioning mode see Settings section, part 1.2 and 1.7.

4.10.1 Modulated IRIG-B

Connect P594 IRIG-B modulated output 'SK1' to the IRIG-B input of the Px3x or Px4x relay with IRIG-B modulated input, using 50 Ω coaxial cable.

To allow the relay's time and date to be maintained from an external IRIG-B source, relay cell [DATE and TIME, IRIG-B Sync.] must be set to 'Enabled'.

Ensure that the P594 SYNC LED is illuminated and that the relay is receiving the IRIG-B signal by checking that relay cell [DATE and TIME, IRIG-B Status] reads 'Active'.

Check the time, date and month are correct in relay cell [DATE and TIME, Date/Time]. The IRIG-B signal does not contain the current year so it will need to be set manually in this cell.

4.10.2 Un-modulated IRIG-B via BNC connector

Connect P594 IRIG-B un-modulated output 'SK1' to the IRIG-B input of the Px4x relay with IRIG-B un-modulated input, using 50 Ω coaxial cable. Configure the P594 with [IRIG-B CONFIG, BNC O/P Mode] = 'Unmodulated'.

To allow the relay's time and date to be maintained from an external IRIG-B source, relay cell [DATE and TIME, IRIG-B Sync.] must be set to 'Enabled'.

Ensure that the P594 SYNC LED is illuminated and that the relay is receiving the IRIG-B signal by checking that relay cell [DATE and TIME, IRIG-B Status] reads 'Active'.

Check the time, date and month are correct in relay cell [DATE and TIME, Date/Time]. The IRIG-B signal does not contain the current year so it will need to be set manually in this cell.

4.10.3 Un-modulated IRIG-B via EIA(RS)422 connector

Connect P594 IRIG-B un-modulated output 'SK2' to the IRIG-B input of the Mx7x measurement device with IRIG-B un-modulated input, using an EIA(RS)422 cable wired as per the connection diagram in the Installation section (P594/EN IN) and the Mx7x device manual. Configure the P594 with [IRIG-B CONFIG, RS422 O/P Mode] = 'Unmodulated'.

To allow the Mx7x device's time and date to be maintained from an external IRIG-B source, configure one of its COM ports P2, P3 or P4 as an IRIG-B input using the '70 series Configurator' software tool.

Ensure that the P594 SYNC LED is illuminated and that the Mx7x device is receiving the IRIG-B signal by checking its time and date, for example using 'BiView' monitoring software tool.

5. SETTING CHECKS

The setting checks ensure that all of the application-specific unit settings, for the particular installation, have been correctly applied to the relay.

6. FINAL CHECKS

The tests are now complete.

Remove all test leads, etc. If it has been necessary to disconnect any of the external wiring from the unit in order to perform the wiring verification tests, it should be ensured that all connections (wiring, fuses and links) are replaced in accordance with the relevant external connection or scheme diagram.

If the menu language has been changed to allow accurate testing it should be restored to the customer's preferred language.

Ensure that all the fiber outputs and IRIG-B outputs are connected as required by the application.

7. COMMISSIONING TEST RECORD

Date: _____ Engineer: _____
 Station: _____ Circuit: _____

Front Plate Information

Synchronizing unit	MiCOM P594
Model number	
Serial number	
Auxiliary voltage Vx	

Test Equipment Used

This section should be completed to allow future identification of protective devices that have been commissioned using equipment that is later found to be defective or incompatible but may not be detected during the commissioning procedure.

P54x relay	Model: Serial No:	
CVCOM Merging Unit	Model: Serial No:	
Px3x or Px4x relay with IRIG-B modulated input	Model: Serial No:	
Px4x relay or Mx7x measurement device with IRIG-B un-modulated input	Model: Serial No:	



*Delete as appropriate



Have all relevant safety instructions been followed?

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
------	--------------------------	-----	--------------------------

4. **Product checks**

4.1 Visual Inspection

Unit damaged?
 Rating information correct?
 Case earth installed?

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>

4.2 Insulation resistance

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
Not Tested*	<input type="checkbox"/>	N/A*	<input type="checkbox"/>

4.3 External wiring

Wiring checked against diagram?

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
N/A*	<input type="checkbox"/>		

4.4 Measured auxiliary supply

Vdc/ac		N/A*	<input type="checkbox"/>
--------	--	------	--------------------------

4.5 Watchdog contacts (auxiliary supply off)

Terminals 15 and 16 Contact closed?
 Terminals 17 and 18 Contact open?

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>

Watchdog contacts (auxiliary supply on)

Terminals 15 and 16 Contact open?
 Terminals 17 and 18 Contact closed?

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>

4.6 Light emitting diodes

All LED's working?

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
N/A*	<input type="checkbox"/>		

4.7 Synchronizing signal

Fibre Output 1
 Fibre Output 2
 Fibre Output 3
 Fibre Output 4

dBm		N/A*	<input type="checkbox"/>
dBm		N/A*	<input type="checkbox"/>
dBm		N/A*	<input type="checkbox"/>
dBm		N/A*	<input type="checkbox"/>

Signal strength within tolerance

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
N/A*	<input type="checkbox"/>		

4.8 Connection to P54x

Channel status correct?

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
N/A*	<input type="checkbox"/>		

4.9 Connection to CVCOM

Channel status correct?

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
N/A*	<input type="checkbox"/>		



4.10.1 IRIG-B outputs - IRIG-B modulated

Time and date correct in relay?

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
N/A*	<input type="checkbox"/>		

4.10.2, 4.10.3 IRIG-B outputs - IRIG-B un-modulated

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
N/A*	<input type="checkbox"/>		

Time and date correct in device?

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
N/A*	<input type="checkbox"/>		

5. Setting checks

5.1 Application-specific function settings applied?

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
------	--------------------------	-----	--------------------------

6. Final checks

6.1 All test equipment, leads, shorts and test blocks removed safely?

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
------	--------------------------	-----	--------------------------

Disturbed customer wiring re-checked?

Yes*	<input type="checkbox"/>	No*	<input type="checkbox"/>
N/A*	<input type="checkbox"/>		



COMMENTS #

--

(# Optional, for site observations or utility-specific notes).

CM

Commissioning Engineer

Customer Witness

Date: _____

Date: _____

8. SETTING RECORD

Date: _____ Engineer: _____
 Station: _____ Circuit: _____

Front Plate Information

Feeder protection relay	MiCOM P594
Model number	
Serial number	
Auxiliary voltage Vx	

SYSTEM DATA

Language	English* <input type="checkbox"/> Francais* <input type="checkbox"/> Deutsch* <input type="checkbox"/> Espanol* <input type="checkbox"/>
Description	
Plant Reference	
Database Reference	
Software Reference	
Access Level	
Password control	Level 0* <input type="checkbox"/> Level 1* <input type="checkbox"/>

CONFIGURATION

Password	Level 1* <input type="checkbox"/>
Global Control	
Cable Delay	
GPS Position	
Stored Latitude	
Stored Longitude	
Stored Altitude	
Level 1 Password	
Restore Defaults	



FIBRE CONFIGURATION

Fibre Output 1	Output Off* <input type="checkbox"/> P54x Sync.* <input type="checkbox"/> Test Duty Cycle* <input type="checkbox"/> CVCOM GPS Sync.* <input type="checkbox"/> CVCOM Auto Sync* <input type="checkbox"/>
Fibre Output 2	Output Off* <input type="checkbox"/> P54x Sync.* <input type="checkbox"/> Test Duty Cycle* <input type="checkbox"/> CVCOM GPS Sync.* <input type="checkbox"/> CVCOM Auto Sync* <input type="checkbox"/>
Fibre Output 3	Output Off* <input type="checkbox"/> P54x Sync.* <input type="checkbox"/> Test Duty Cycle* <input type="checkbox"/> CVCOM GPS Sync.* <input type="checkbox"/> CVCOM Auto Sync* <input type="checkbox"/>
Fibre Output 4	Output Off* <input type="checkbox"/> P54x Sync.* <input type="checkbox"/> Test Duty Cycle* <input type="checkbox"/> CVCOM GPS Sync.* <input type="checkbox"/> CVCOM Auto Sync* <input type="checkbox"/>

RELAY CONFIGURATION

Relay Output 1	P594 Not Healthy* <input type="checkbox"/> 1PPHr GPS Sync.* <input type="checkbox"/> 1 PPMn GPS Sync.* <input type="checkbox"/> 1PPHr Local Sync.* <input type="checkbox"/> 1PPMn Local Sync.* <input type="checkbox"/> Default Settings* <input type="checkbox"/> Position Error* <input type="checkbox"/> Antenna Fail* <input type="checkbox"/> Test Mode On* <input type="checkbox"/> Not Synchronized* <input type="checkbox"/> GPS Not Healthy* <input type="checkbox"/>
Relay Output 2	P594 Not Healthy* <input type="checkbox"/> 1PPHr GPS Sync.* <input type="checkbox"/> 1 PPMn GPS Sync.* <input type="checkbox"/> 1PPHr Local Sync.* <input type="checkbox"/> 1PPMn Local Sync.* <input type="checkbox"/> Default Settings* <input type="checkbox"/> Position Error* <input type="checkbox"/> Antenna Fail* <input type="checkbox"/> Test Mode On* <input type="checkbox"/> Not Synchronized* <input type="checkbox"/> GPS Not Healthy* <input type="checkbox"/>
Relay Output 3	P594 Not Healthy* <input type="checkbox"/> 1PPHr GPS Sync.* <input type="checkbox"/> 1 PPMn GPS Sync.* <input type="checkbox"/> 1PPHr Local Sync.* <input type="checkbox"/> 1PPMn Local Sync.* <input type="checkbox"/> Default Settings* <input type="checkbox"/> Position Error* <input type="checkbox"/> Antenna Fail* <input type="checkbox"/> Test Mode On* <input type="checkbox"/> Not Synchronized* <input type="checkbox"/> GPS Not Healthy* <input type="checkbox"/>
Relay Output 4	P594 Not Healthy* <input type="checkbox"/> 1PPHr GPS Sync.* <input type="checkbox"/> 1 PPMn GPS Sync.* <input type="checkbox"/> 1PPHr Local Sync.* <input type="checkbox"/> 1PPMn Local Sync.* <input type="checkbox"/> Default Settings* <input type="checkbox"/> Position Error* <input type="checkbox"/> Antenna Fail* <input type="checkbox"/> Test Mode On* <input type="checkbox"/> Not Synchronized* <input type="checkbox"/> GPS Not Healthy* <input type="checkbox"/>



COMMS CONFIGURATION

RS 232 Port Mode	
------------------	--

DATE & TIME CONFIGURATION

UTC Offset	
DST Enable	
DST Offset	0 minutes* <input type="checkbox"/> 30 minutes* <input type="checkbox"/> 60 minutes* <input type="checkbox"/> 90 minutes* <input type="checkbox"/> 120 minutes* <input type="checkbox"/>
DST Start Time	
DST Start Day	Monday* <input type="checkbox"/> Tuesday* <input type="checkbox"/> Wednesday* <input type="checkbox"/> Thursday* <input type="checkbox"/> Friday* <input type="checkbox"/> Saturday* <input type="checkbox"/> Sunday* <input type="checkbox"/>
DST Start Week	First Week* <input type="checkbox"/> Second Week* <input type="checkbox"/> Third Week* <input type="checkbox"/> Fourth Week* <input type="checkbox"/> Last Week* <input type="checkbox"/>
DST Start Month	January* <input type="checkbox"/> February* <input type="checkbox"/> March* <input type="checkbox"/> April* <input type="checkbox"/> May* <input type="checkbox"/> June* <input type="checkbox"/> July* <input type="checkbox"/> August* <input type="checkbox"/> September* <input type="checkbox"/> October* <input type="checkbox"/> November* <input type="checkbox"/> December* <input type="checkbox"/>
DST End Time	
DST End Day	Monday* <input type="checkbox"/> Tuesday* <input type="checkbox"/> Wednesday* <input type="checkbox"/> Thursday* <input type="checkbox"/> Friday* <input type="checkbox"/> Saturday* <input type="checkbox"/> Sunday* <input type="checkbox"/>
DST End Week	First Week* <input type="checkbox"/> Second Week* <input type="checkbox"/> Third Week* <input type="checkbox"/> Fourth Week* <input type="checkbox"/> Last Week* <input type="checkbox"/>
DST End Month	January* <input type="checkbox"/> February* <input type="checkbox"/> March* <input type="checkbox"/> April* <input type="checkbox"/> May* <input type="checkbox"/> June* <input type="checkbox"/> July* <input type="checkbox"/> August* <input type="checkbox"/> September* <input type="checkbox"/> October* <input type="checkbox"/> November* <input type="checkbox"/> December* <input type="checkbox"/>



IRIG-B CONFIGURATION

BNC O/P Mode	Off* <input type="checkbox"/> Modulated* <input type="checkbox"/> Un-Modulated* <input type="checkbox"/>
RS-422 O/P Mode	Off* <input type="checkbox"/> Un-Modulated * <input type="checkbox"/>
IRIG-B12 Format	B120* <input type="checkbox"/> B121* <input type="checkbox"/> B122* <input type="checkbox"/> B123* <input type="checkbox"/>
Modulation Ratio	3:1* <input type="checkbox"/> 6:1* <input type="checkbox"/>
Output Voltage	1.0V Peak* <input type="checkbox"/> 2.0V Peak* <input type="checkbox"/> 5.0VPeak* <input type="checkbox"/>
IRIG-B000 Format	B000* <input type="checkbox"/> B001* <input type="checkbox"/> B002* <input type="checkbox"/> B003* <input type="checkbox"/>

CM

Commissioning Engineer

Customer Witness

Date: _____

Date: _____

TROUBLESHOOTING

Date: 2nd March 2010

Hardware Suffix: D

Connection Diagrams: 10P5940201

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2.	INITIAL PROBLEM IDENTIFICATION	3
3.	POWER UP PROBLEM	3
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TS

1. INTRODUCTION



Before carrying out any work on the equipment, the user should be familiar with the contents of the Safety Guide (SFTY/4L M/D11) or later issue, or the Safety and Technical Data sections of this Technical Manual and also the ratings on the equipment's rating label.

The purpose of this section of the service manual is to allow an error condition on the P594 unit to be identified so that appropriate corrective action can be taken.

Should the P594 unit have developed a fault, it should be possible in most cases to identify what requires attention.

In cases where a faulty P594 unit is being returned to the manufacturer or one of their approved service centers, a completed copy of the Repair/Modification Return Authorization Form located at the end of this section should be included.

2. INITIAL PROBLEM IDENTIFICATION

Consult the table below to find the description that best matches the problem experienced, then consult the section referenced to perform a more detailed analysis of the problem.

Symptom	Refer To
P594 unit fails to power up	Section 3
P594 unit displays error message and reboots	Section 4

Table 1: Problem identification

3. POWER UP PROBLEM

If the P594 unit does not appear to power up (no display on the LCD, no LEDs illuminated), then the following procedure can be used to determine whether the fault is in the external wiring, auxiliary fuse, or internal to the P594 unit.

Test	Check	Action
1	Measure auxiliary voltage on terminals B1 and B2; verify voltage level and polarity against rating the label on front. Terminal B1 is -DC, B2 is +DC	If auxiliary voltage is present and correct, then proceed to test 2. Otherwise the wiring/fuses in auxiliary supply should be checked.
2	Do LEDs/and LCD backlight illuminate on power-up, also check the N/O watchdog contact for closing.	If they illuminate or the contact closes and no error code is displayed then error is either in the main processor board or the power supply.

Table 2: Failure of P594 unit to power up

4. ERROR MESSAGE

The P594 unit software performs self-testing during power-up and continually during operation. If an error is detected by the P594 unit during these self-tests, then an error message will be displayed on the LCD for approximately two seconds, then the P594 unit will re-boot.

If a self-test error occurs, note the error message and contact Schneider Electric. It may be necessary to remove and re-apply the auxiliary voltage to the P594, to see if the error message is repeated.



5. REPAIR AND MODIFICATION PROCEDURE

Please follow these 5 steps to return an Automation product to us:

1. Get the Repair and Modification Authorization Form (RMA)

Find a copy of the RMA form at the end of this section.

- To obtain an electronic version of the RMA form for e-mailing, please contact your local Schneider Electric service.

2. Fill

Fill in only the white part of the form.

Please ensure that all fields marked **(M)** are completed such as:

- Equipment model
- Model No. and Serial No.
- Description of failure or modification required (please be specific)
- Value for customs (in case the product requires export)
- Delivery and invoice addresses
- Contact details

3. Send RMA form to your local Schneider Electric contact

4. Receive from local service contact, the information required to ship the product

Your local service contact will provide you with all the information:

- Pricing details
- RMA n°
- Repair centre address

If required, an acceptance of the quote must be delivered before going to next stage.

5. Send the product to the repair centre

- Address the shipment to the repair centre specified by your local contact
- Ensure all items are protected by appropriate packaging: anti-static bag and foam protection
- Ensure a copy of the import invoice is attached with the unit being returned
- Ensure a copy of the RMA form is attached with the unit being returned
- E-mail or fax a copy of the import invoice and airway bill document to your local contact.

INSTALLATION

IN

Date: 2nd March 2010

Hardware Suffix: D

Connection Diagrams: 10P5940201

IN

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1. SCOPE

This document gives installation guidelines for using the P594 GPS synchronizing unit, with the P543 to P546 relays and the CVCOM Merging Unit. It includes the connection diagram for all external wiring.

2. APPLICATION

The P543 to P546 relays may be deployed on communications links where the Multiplexer employs Synchronous Digital Hierarchy (SDH or SONET). In such applications the conventional propagation delay measurement may be unreliable, and GPS time measurements are required.

A P594 unit must be deployed at each line terminal, to be connected by a coaxial cable to a GPS Antenna, and also by a single core 850nm fiber to the P543 to P546 relay.

One P594 may supply up to four P543 to P546 relays. It would be required that P594 be connected via its 1PPS fiber optic ports to synchronize both CVCOM units and P54x for current differential synchronization. A P594 also supplies modulated and un-modulated IRIG-B outputs to IRIG-B input ports of other relays.

It is essential that installation of the GPS synchronism scheme is undertaken with care. Poor installation may lead to periodic unavailability of the line unit protection.

This installation guide recommends good installation practice to be followed.



Before carrying out any work on the equipment, the user should be familiar with the contents of the safety section/safety guide SFTY/4LM/D11 or later issue, the technical data section and the ratings on the equipment rating label.

3. GUIDELINES

The following guidelines should be observed when installing the GPS system to ensure sufficient GPS availability. GPS is available in all parts of the world. It is only poor installation practice that can cause the signal to drop out.

The P594 supplied by Schneider Electric includes all the parts required for its installation. The antenna cable can be 25m, 50m or 100m long and depending on the length required, the material list and mounting description is as follows:

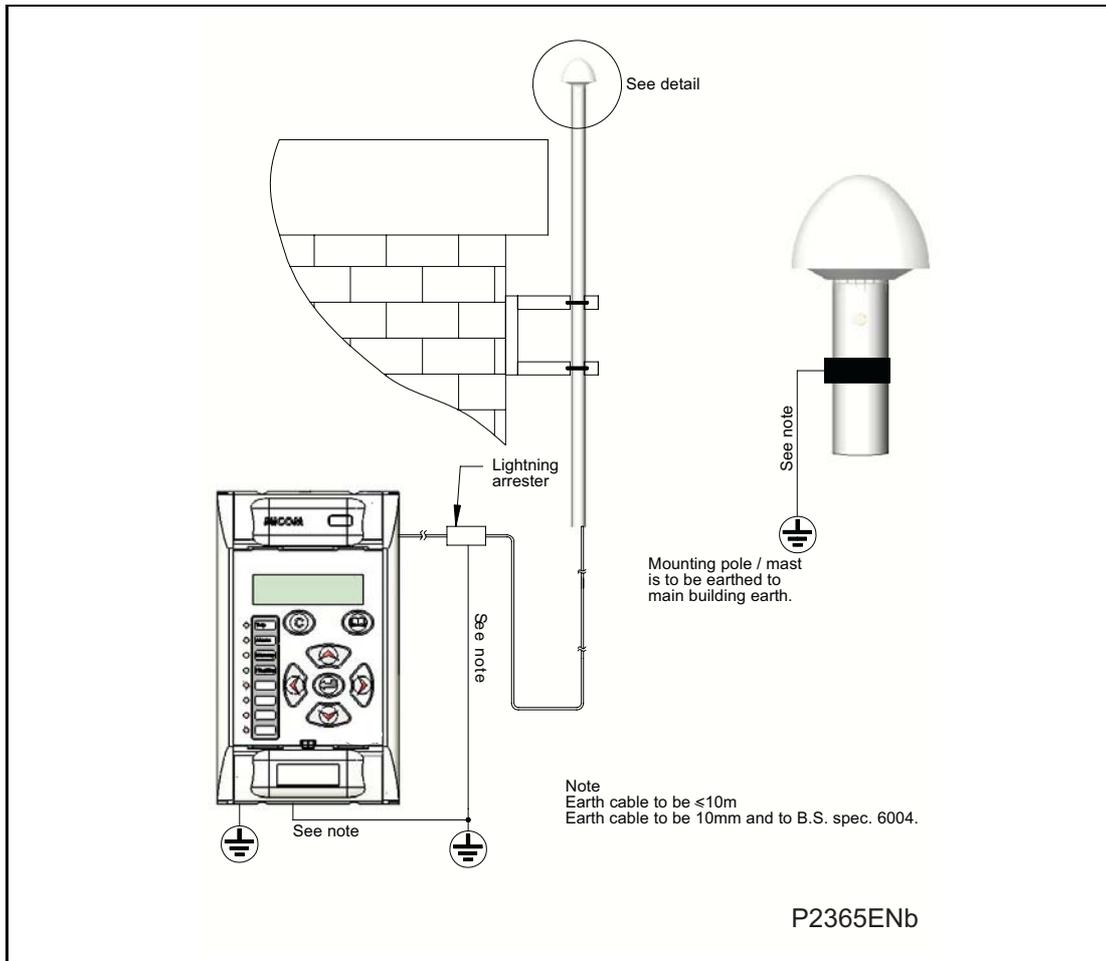


Figure 1: Mounting kit installation

25m antenna cable kit

1. One antenna
2. One 1m threaded antenna mounting pole
3. One pole-to-wall mounting bracket with fixings
4. One 'antenna to lightning arrester' cable
5. One lightning arrester
6. One 'lightning arrester to P594' cable
7. One P594

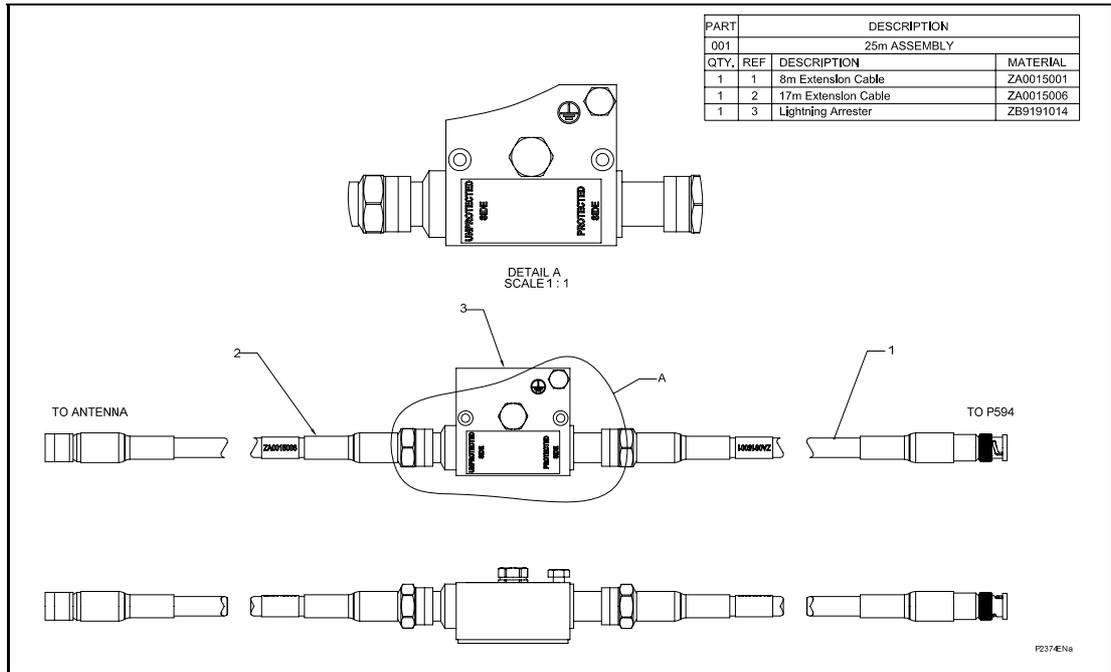


Figure 2: 25m antenna cable kit components

50m antenna cable kit

1. One antenna
2. One 1m threaded antenna mounting pole
3. One pole-to-wall mounting bracket with fixings
4. One 'antenna to lightning arrestor' cable
5. One lightning arrestor
6. One 'lightning arrestor to P594' cable
7. One P594

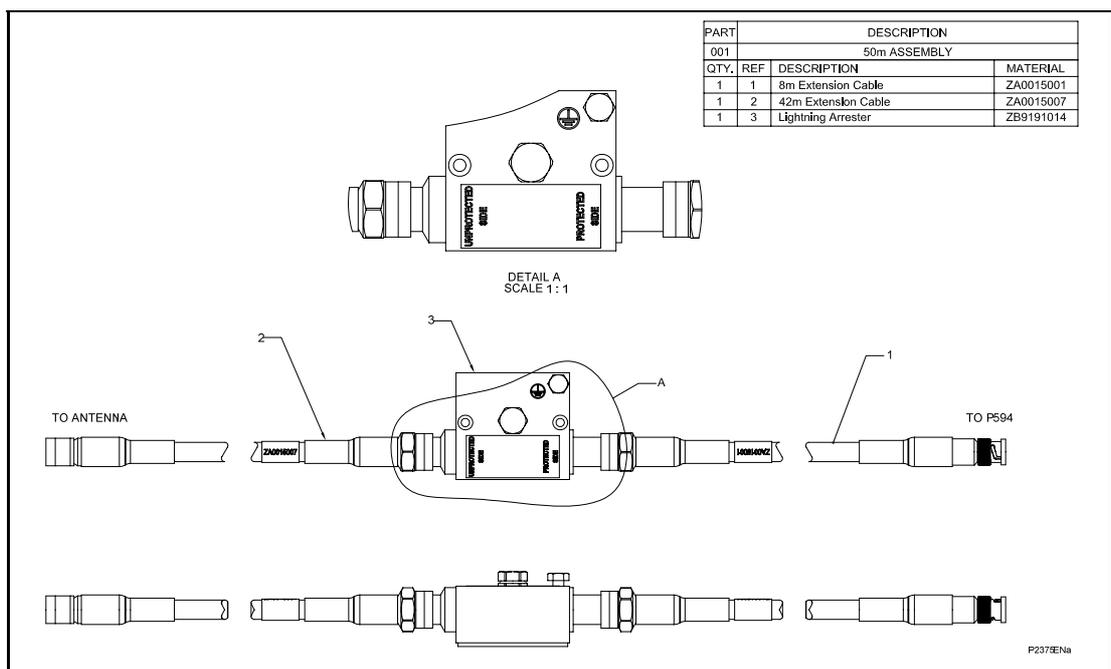


Figure 3: 50m antenna cable kit components

100m antenna cable kit

1. One antenna
2. One 1m threaded antenna mounting pole
3. One pole-to-wall mounting bracket with fixings
4. One 'antenna to amplifier' cable
5. One amplifier
6. One 'amplifier to lightning arrestor' cable
7. One lightning arrestor
8. One 'lightning arrestor to P594' cable
9. One P594

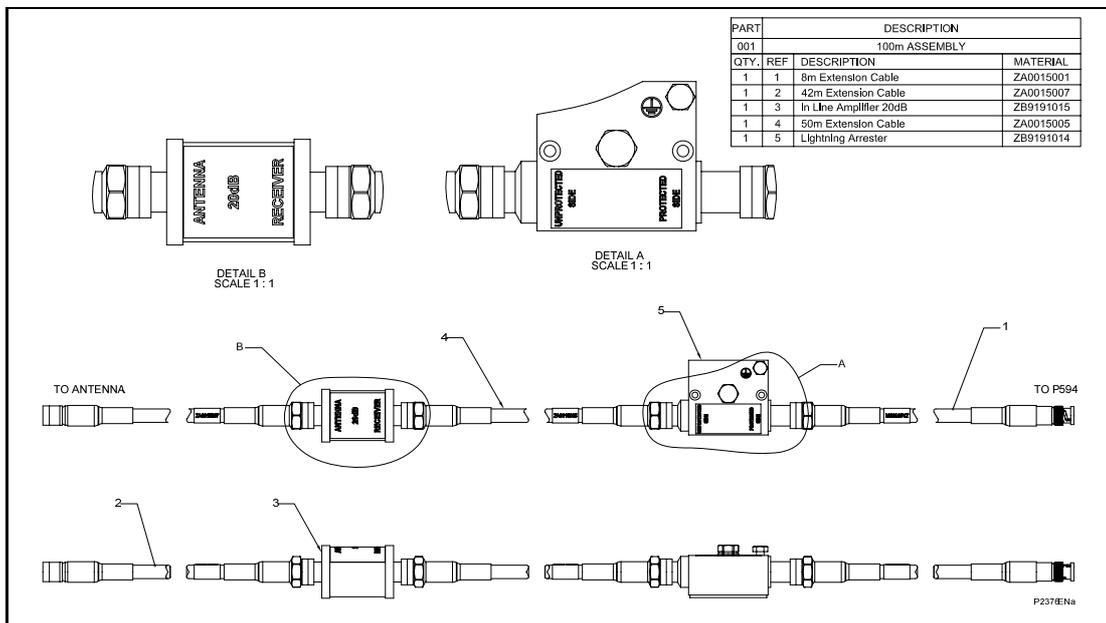


Figure 4: 100m antenna cable kit components



4. THE ANTENNA

The antenna supplied by Schneider Electric is the Trimble Bullet™ III. Description of this is available from the Trimble website.

4.1 Site survey

The installer must choose a suitable site for the antenna observing the following:

- The antenna should be mounted so that it is just above the roofline of the building ensuring that there is a 360° horizontal and 150° vertical view of the sky (max. masking angle of 15° with respect to the horizon - see Figure 3). Ideally there should be no obstructions in view e.g. metal structures or buildings. **Under no circumstances must the Antenna be mounted below the roofline.** If the masking angle is greater than 15° with respect to the horizon (i.e. if is a large obstruction) the antenna must be re-sited or mounted on a longer antenna pole. Any obstructions to the antenna's line of sight may cause a reduction in the P594's ability to provide the time synchronizing signal required by the P54x relay or CVCOM.

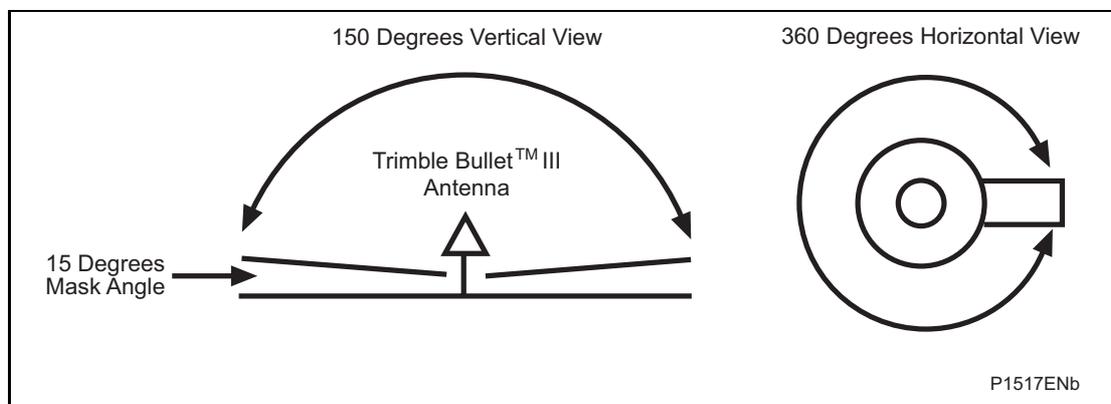


Figure 5: GPS antenna required line of sight

- Once the antenna is sited, a review should be made about how clean it will remain, during service. It is anticipated that a light build-up of dust or discoloration will occur, as most installations will be outdoors.

If the location is prone to salt, dirt, metallic dust, or sand, it must be ensured that a periodic cleaning regime is entered into the maintenance program for the site.

- Take care to mount the antenna securely, and not where standing water, ice, or snow coverage may be problematic.

Ensure that the antenna is mounted away from bare live equipment. This is to ensure that should any maintenance attention be needed, it will not be necessary to encroach upon the recommended safe electrical clearance, which would require a work permit to be obtained.

It should also be ensured that the structure to which the receiver is mounted is a permanent fixture, and is not planned for removal.

- If multiple antennas are to be installed it must be ensured there is a 1 meter gap between each antenna.

4.2 Mounting of the antenna

The Trimble Bullet™ III antenna must be mounted using its mounting bracket to an antenna pole. This pole should then be mounted to the side of the Communications/Radio Room via a wall bracket. Care must be taken that fixings for the wall bracket are into the brick and not into the mortar. This installation is shown in Figure 1. The location of the antenna must observe the recommendations described above.

The antenna, pole, and wall bracket must (via a pole earth strap) be grounded (earthed) to the earth of the substation (<10 ohms). The recommended ground cable specification is a minimum of 10mm² diameter, 10m max. in length, stranded and complying with British Standard BS6004. Should a longer cable be required an earth cable with a bigger cross section should be used. The ground cable is not supplied by Schneider Electric.

Once the antenna has been installed and the P594 is in service, under no circumstances must the antenna be moved. If the antenna needs to be re-located the P594 must be de-energized or an auto survey initiated. This is because the P594 uses a position fix mode and if the antenna is moved, the GPS receiver in the P594 needs to compute a new position.

The antenna must not be painted. If there is a risk of future painting, or inadvertent removal, a warning notice must be affixed alongside the antenna, to prevent such actions.

For safety reasons do not carry out the above activities during thunder-storms.

5. THE COAXIAL CABLE

The coaxial cable that connects the GPS antenna to the P594 supplied by Schneider Electric is in total 25m, 50m or 100m long. This is the only cable that should be used to connect the GPS antenna to the P594.

5.1 Mounting and routing of the coaxial cable

The coaxial cable must run to the P594 unit via a safe and shielded route. In order to achieve that, the following recommendations should be taken into consideration:

During installation, always observe minimum bending radius.

The 'antenna to lightning arrestor' cable, including the lightning arrestor must not be mounted into cable ducts. It must be wall mounted and 0.5m away from any flammable material. The 'lightning arrestor to P594' cable can be mounted into cable ducts.

5.1.1 Indoors

At ground level, coaxial cables must be routed to avoid mechanical damage. Kinking of the cable as well as sharp bending radii should be avoided. Inserting the cable into cable ducts should be done carefully to avoid stress to the cable. If this is the case it is advisable to use cable guides and lubricants in order to avoid any physical damage. Any looping of excess cable must be secured tidily, and safely. The sections where the cable is not laying should be fixed to the wall by using circular U cable clips with the appropriated diameter. Do not use cable-clamping tool, which can compromise the concentricity of the coaxial cable.

5.1.2 Outdoors

The cable should be secured to prevent wind damage or, worse, wind blowing onto bare live equipment. The cable must not be exposed to any mechanical damage. If the cable cannot be secured to a wall using U clips, the cable run should be protected by ducting so birds/wildlife cannot gain access. Any moisture that builds-up inside the ducts must be able to drain away. The cable should run clear of standing water. Do not run the cable next to a heating source.

5.2 Minimum bending radius

The cable must be installed keeping smooth radii of curvature when traversing corners to avoid any sharp bends. The cable must not be bent beyond the minimum-bending radius. The diameter of the cable supplied 10.3mm and its minimum bending radius is 50mm. Any looping of excess cable must be done respecting the minimum-bending radius.

6. THE LIGHTNING ARRESTOR

The lightning arrestor must be mounted indoors against the wall of the building and not to any cubicle. It must not be inserted into a cable duct and must not be within 0.5m of any flammable material.

The lightning arrestor must be connected correctly ensuring that:

1. The end labelled 'Unprotected side' is connected to the 17m 'Lightning Arrestor to Antenna cable' (or for 50m or 100m kit to the 42m Lightning Arrestor to Antenna cable').
2. The end labelled 'Protected Side' is connected to the 8m 'lightning arrestor to P594 cable'.

The lightning arrestor must be earthed to the building earth bonding bar and not to a cubicle earth. The recommended ground cable specification is a minimum of 10mm² diameter, 10m max. in length, stranded and complying with British Standard BS6004. The P594 unit must additionally be earthed (using the same earth cable type and conditions as stated above for the lightning arrestor) to the same point of the bonding bar as well as being earthed to the cubicle earth.

Note : The Lightning Arrestor is not CE marked since:

- It is a component of the system
- It is EMC benign (89/336/EEC)
- The Low Voltage Directive (2006/95/EC) is not applicable since the device working voltage is below the minimum voltage requirement of this directive

WARNING:



It is recommended that a qualified person carry out the fitting/earthing of the Lightning Arrestor and pole. Schneider Electric accepts no responsibility for the results of improper or unsafe installation practices.

The lightning protection provided is designed to protect the P594 unit and associated wiring. It will protect against an in-direct/secondary lightning strike but not a direct lightning strike.

For a complete lightning protection system that meets IEC61024-1 and IEC61312-1 please seek professional lightning protection advice.

The lightning arrestor uses a gas discharge capsule. It is recommended that the lightning arrestor is periodically checked for correct operation, and if the gas capsule is faulty, it is replaced. Please contact Huber & Suhner for replacement capsules.

Disconnect or switch off in-line equipment when installing, checking, disconnecting and connecting the lightning arrestor. This also includes replacing the gas discharge capsule.

For safety reasons do not carry out the above activities during thunder-storms.

7. MOUNTING OF P594 UNIT

The P594 unit must be mounted indoors, e.g. within the telecommunications or relay room. The same site environmental constraints apply as those for installation of a protection relay.

The P594 unit must be earthed to the same point of the bonding bar as per the lightning arrester, observing the same earthing cable recommendations. The P594 unit will also be earthed by the cubicle where it is installed as standard installation for protective relays.

7.1 850nm fiber connection to the P54x relay or CVCOM merging unit

A single fiber optic 50/125 μ m or 62.5/125 μ m multimode fiber run terminated with BFOC/2.5 (ST®) connectors is required. The fiber runs from the P594 to the P54x current differential relay or to the CVCOM Merging Unit.

The fiber should run in ducting to be protected from mechanical damage, and to avoid sharp bending radii that might degrade the optical signal.

Ensure that the fiber is clearly marked at both ends with regard to the main protection relay that it serves.

The distance of the fiber optic cable between the relay or CVCOM and timing unit P594 can be up to 1 km and the length at one end of the system must not differ by more than 0.5km to that at the other end, as this could introduce timing problems.

7.2 IRIG-B connections

Both modulated and un-modulated IRIG-B outputs can be physically output through the BNC, and the un-modulated IRIG-B output can be physically output through the D9 connector types to other devices.

The modulated IRIG-B output is capable of driving into a 50 ohm load using a coaxial cable whilst remaining within specification.

The un-modulated IRIG-B output can be physically output using the BNC connector at TTL Level, and the D9 connector type, both simultaneously or independently.

8. P594 ANTENNA INSTALLATION CHECKLIST

It is advised that the installation of the P594 and antenna is checked against the list below:

Circuit: _____

Cable Kit supplied: _____

Tick Box

- 1. Has the installation manual been read prior to carrying out the installation?
- 2. Has the site survey for the antenna been carried out, please sketch rough position, including any obstructions of the antenna?
- 3. Has the antenna a clear view of the sky (re-site the antenna if not)?
- 4. Are there any large objects obstructing the view of the antenna (a taller antenna pole may be required to clear the object or the antenna may have to be re-sited)?
- 5. Is the antenna above the roofline of the building (if not it must be re-sited)?
- 6. If there are multiple antennas are they 1m (or greater) apart (if not re-site the antennas)?
- 7. Are the pole mounting bracket fixings directly into the brick and not the mortar?
- 8. Has the antenna pole been correctly earthed observing the minimum cable requirements?
- 9. Have the coaxial cables been correctly connected and mounted observing the guidelines in section 5 of this installation section?
- 10. Has the lightning arrestor been correctly installed as stated in section 6 of this installation section?
- 11. If supplied, has the line amplifier been correctly connected (the polarity)?
- 12. Has the earth connection between the lightning arrestor and the P594 been correctly connected observing the minimum cable requirements?
- 13. If the P594 has been installed, and is energized, after 10 minutes of connecting the antenna cable, does the P594 show any satellites (If not then check the antenna connection)?

Installation Engineer: _____

Date: _____

IN

9. P594 CASE DIMENSIONS

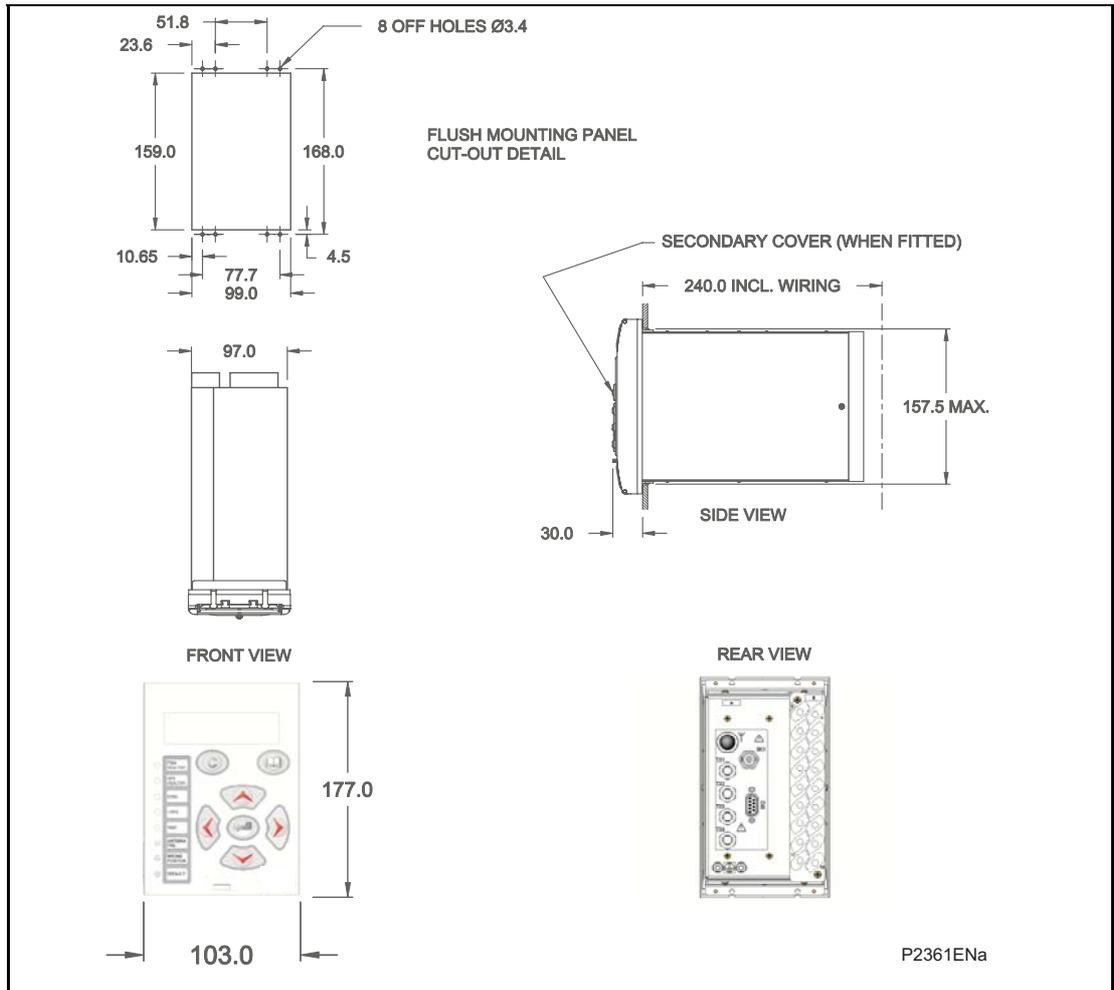
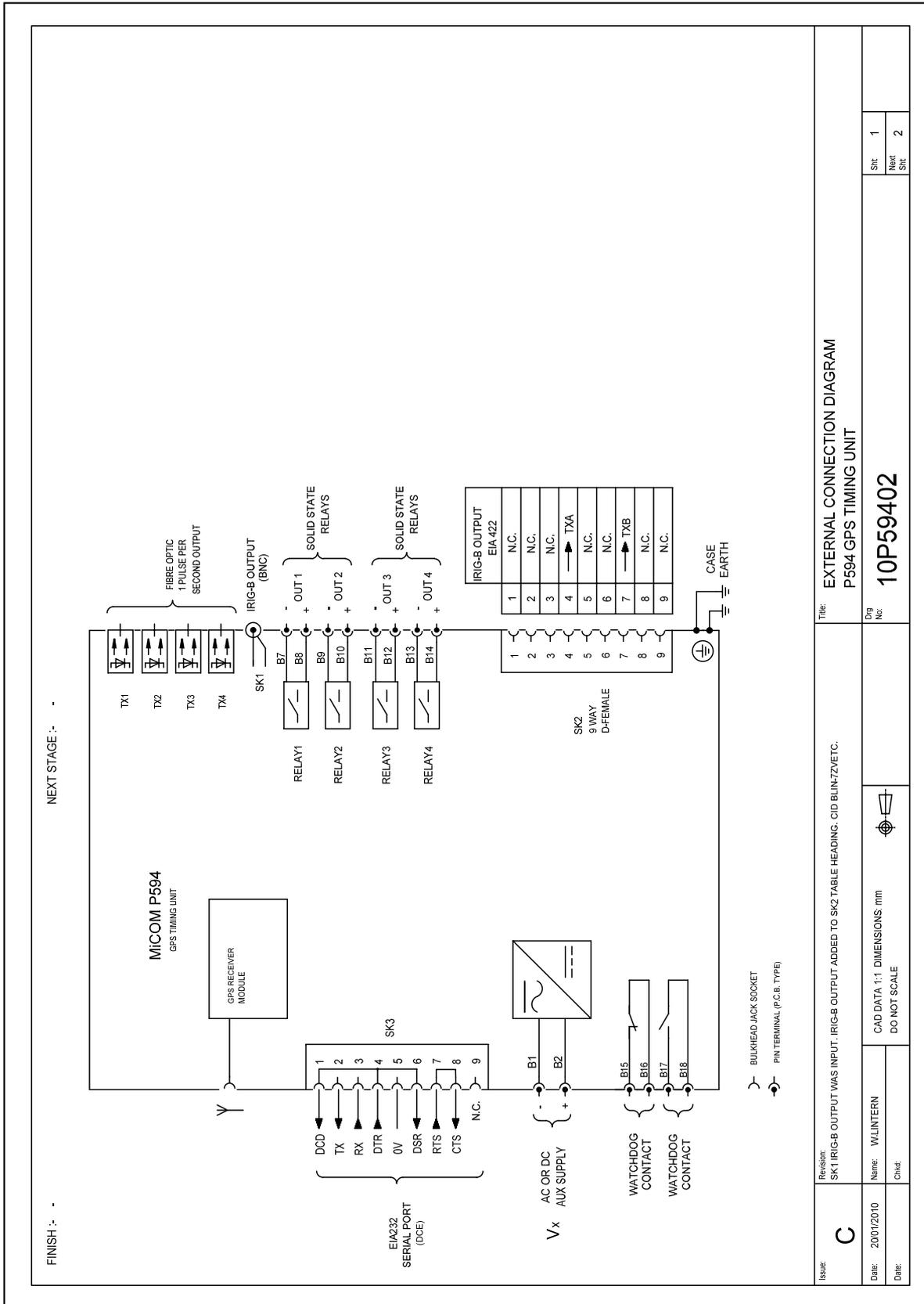


Figure 6: P594 Case dimensions



10. CONNECTION DIAGRAM



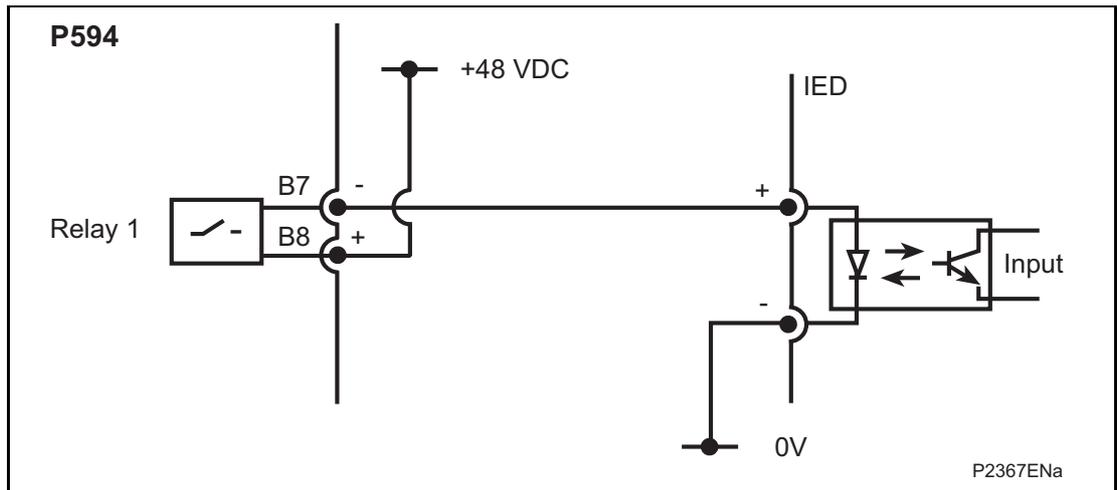


Figure 7: Energizing an input from a P594 alarm output



FIRMWARE AND SERVICE MANUAL VERSION HISTORY

VH

Date: 2nd March 2010

Hardware Suffix: D

Connection Diagrams: 10P5940201



Device type: P594			
Hardware Suffix	Original Date of Issue	Description of Changes	Technical Documentation
A	Jul 2001	✓ First release to production (obsolete)	P594/EN IN/A11 and P54x/EN x/E21
B	Apr 2003	✓ Resolved problems after start-up and problems with on board SRAM causing P594 to fail to start up (obsolete)	P594/EN IN/A11 and P54x/EN x/E21
C	May 2004	<ul style="list-style-type: none"> ✓ New GPS antenna and receiver hardware (Motorola M12+ Timing) ✓ Minimum satellites required increased to 4 and satellite selection criteria improved 	P594/EN IN/C11 and P54x/EN x/G42
D	Jan 2008	<ul style="list-style-type: none"> ✓ Major enhancement ✓ New GPS antenna and receiver hardware (Trimble Bullet™ III) ✓ 4 x 1PPS fiber outputs can be configured for synchronizing of CVCOM Merging Unit sampling in addition to P54x synchronizing ✓ 1 x Modulated IRIG-B output ✓ 2 x Un-modulated IRIG-B output ✓ 4 x Pulse output(s) (1 PPM/1 PPH/alarm) ✓ Auto survey function ✓ Front panel User Interface, per Px2x relays ✓ Watchdog outputs ✓ Software update port 	P594/EN M/D22
D	Jan 2010	✓ Software update to resolve GPS antenna and receiver hardware issues (Trimble Bullet™ III)	P594/EN M/D32

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