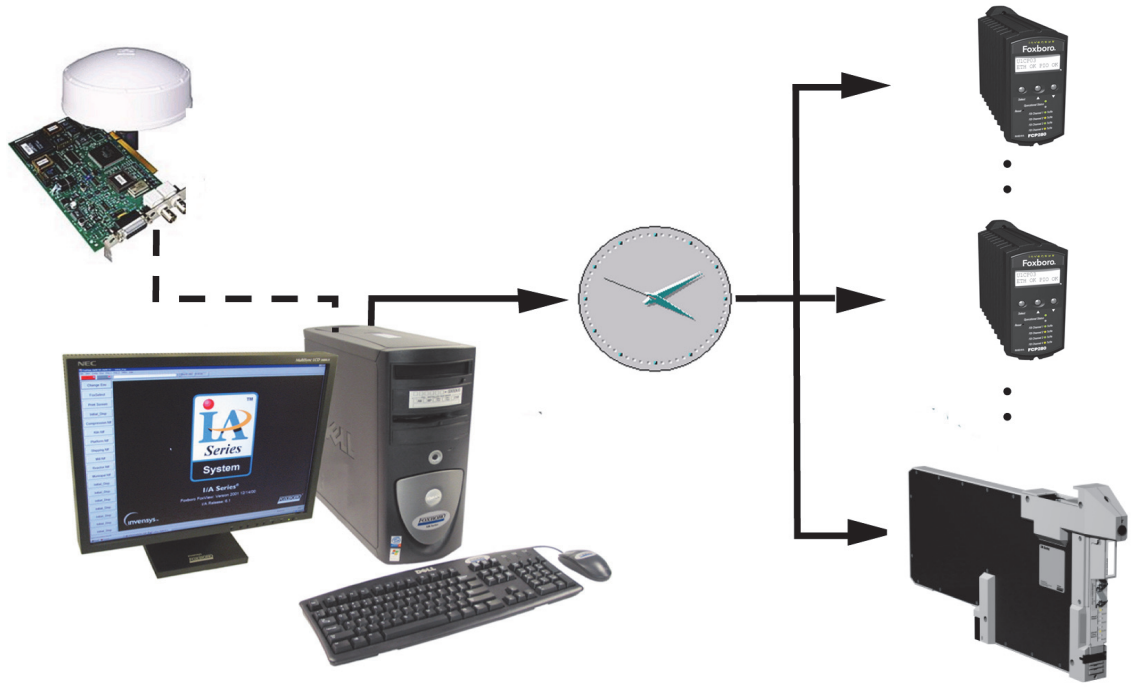
PSS 21H-4C2 B3

Time Synchronization Equipment



The I/A Series® Time Synchronization Equipment receives the date and time from the Global Positioning System (GPS) and distributes a time strobe pulse to sync pulsed stations.

FEATURES

Key features of the Time Synchronization Equipment are:

- Synchronizes Master TimeKeeper (MTK) workstation to Global Positioning System (GPS) time
- MTK sends “time at the next pulse” message via The MESH control network every minute
- Time strobe network distributes the time strobe pulse to control processors and other communications modules
- Field Control Processors (FCP280 and FCP270) and Z-module Control Processors (ZCP270) receive the time strobe and “time at the next pulse” message
- Fieldbus Communications Module (FCM100Et) receives current time of day message from the ZCP270 and time strobe from a Time Strobe Converter, and then calculates the time at next time strobe
- Synchronizes all Transient Data Recorder and Analysis (TDR/TDA) and Sequence of Events (SOE) Fieldbus Modules (FBMs) to within 1 ms

- Selected control stations can be synchronized in an I/A Series system
- Time strobe network can be installed as a single or redundant network.

INTRODUCTION

The Global Positioning System (GPS) is the source of the time and time strobe pulse. A Master TimeKeeper (MTK) workstation maintains the time source and distributes an accurate time strobe pulse to control stations on the application network. The MTK workstation, using The MESH control network, informs the distributed control and other stations what the time will be when the station receives the next time strobe. The hardware modules can be used in a nonredundant or redundant time strobe network.

The hardware modules are:

- GPS Antenna/Receiver
- Time Strobe Generator (PCI card)
- MTK modem
- Time Strobe Converter (TSC) (with single-mode or multi-mode fiber optic cable inputs)
- GPS Fiber Optic Isolator (optional)
- Time Strobe hub (optional - with single-mode or multi-mode fiber optic cable outputs).

GPS ANTENNA/RECEIVER

The source of the time strobe signal are GPS satellites from which the GPS antenna/receiver (Figure 1) obtains the time information.

Figure 1. GPS Antenna/Receiver

The GPS receiver uses an omni-directional antenna to obtain synchronized pulses from multiple satellites to determine time and position. The GPS receiver decodes the time signals simultaneously from up to 8 GPS satellites (minimum of 4 satellites). The GPS antenna/receiver are housed in a single unit and must be mounted outdoors with an unobstructed view of the sky.

TIME STROBE GENERATOR

The Time Strobe Generator is a PCI card (Figure 2) that resides in the MTK workstation. It receives the antenna system's output, provides time data to the workstation and passes a time strobe to the MTK modem. Time is obtained and distributed in Coordinated Universal Time (UTC) format. Therefore, the same time (and date) is received in all parts of the control network, regardless of the local time zone.

The PCI card (Time Strobe Generator) can maintain the stream of time strobe signals even if it does not receive signals from the GPS antenna system. It reverts to a highly accurate ($2x10^{-7}$) internal clock if the GPS signals are not available.

Figure 2. Time Strobe Generator (PCI Card)

MASTER TIMEKEEPER MODEM

The Time Strobe Generator generates and transmits a periodic time pulse using RS-422 signal levels. The Master TimeKeeper Modem (MTK modem) passes all the signals between the GPS antenna and the Time Strobe Generator (PCI card). The time strobe pulse is converted to fiber optic signals via the MTK modem. Time Strobe signals are connected to the Time Strobe Converter located in an enclosure or to the optional Time Strobe hub for transmission throughout the plant locations.

Fiber optic cable is used for the transmission of the time strobe signals from the MTK modem to the Time Strobe Converter (TSC) modules or Time Strobe hubs, or between TSC modules.

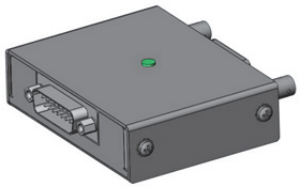


Figure 3. Master TimeKeeper Modem

TIME STROBE CONVERTER

The Time Strobe Converter (TSC) provides the conversion of the accurate time strobe pulse from a Master TimeKeeper station to the controller stations. The TSC module transforms the time strobe signal from a fiber optic cable to eight RS-422 differential output signals.

The TSC module (Figure 4) can be DIN rail mounted or tray mounted within an enclosure containing the controller stations. A non-redundant MTK system can have a single TSC module to provide time strobe signals for up to eight control stations/baseplates within a single enclosure.

Two types of TSCs are available. One accepts multi-mode fiber optic (MMF) inputs for connections from the MTK modem or an MMF-compatible hub, with cable lengths of up to 2 km (6562 ft) per segment. The second type accepts single-mode fiber optic (SMF) inputs for connections from a SMF-compatible hub, with cable lengths of up to 10 km (6.2 mi) per segment. The latter is optimal for an expansive plant, where time is required to be distributed to small clusters apart from the central control room.

Both types of TSCs also provide a multi-mode fiber optic (MMF) output for continuation of the time strobe signal, if needed, to the next MMF-compatible TSC module or MMF-compatible Time Strobe hub.

Time strobes can be selectively connected to any FCP280, FCP270, FCM100Et, or ZCP270 in the system. TDR/TDA and SOE FBMs receiving time messages from an FCP280, FCP270, or FCM100Et are synchronized to within an accuracy of 1 millisecond.

CAUTION

AC signals coming into SOE points cannot be synchronized to 1 millisecond in the same manner as DC based points can. The AC SOE points will have a delay of ~8-20 millisecond due to the 50 or 60 Hz AC wave form. If 1 millisecond synchronization is critical when time synchronization is required, avoid the use of AC inputs.

In a system with ZCP270s, both the ZCP270 and it's associated FCM100Ets must receive a time strobe signal.

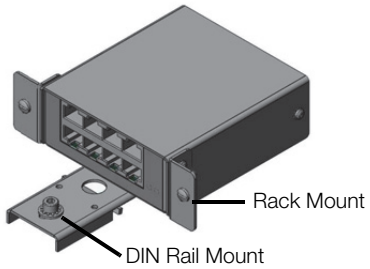


Figure 4. Time Strobe Converter (TSC)

GPS FIBER OPTIC ISOLATOR (OPTIONAL)

Fiber optic transmission extends the distance of the MTK host computer to the GPS antenna (see Figure 5) up to 2 km (6562 ft). This hardware provides electrical isolation in addition to extending the cabling distance. A Transmitter Unit (copper-to-fiber converter) and a Receiver Unit (fiber-to-copper converter), at the MTK host computer end, converts the signals to its native electrical signals. A 12 V dc source of power is provided by the Power Supply to the GPS antenna. The optional GPS Fiber Optic Isolator modules are shelf- or enclosure-mounted. When using the GPS Fiber Optic Isolator, the cable from the antenna/receiver must be run in grounded conduit.

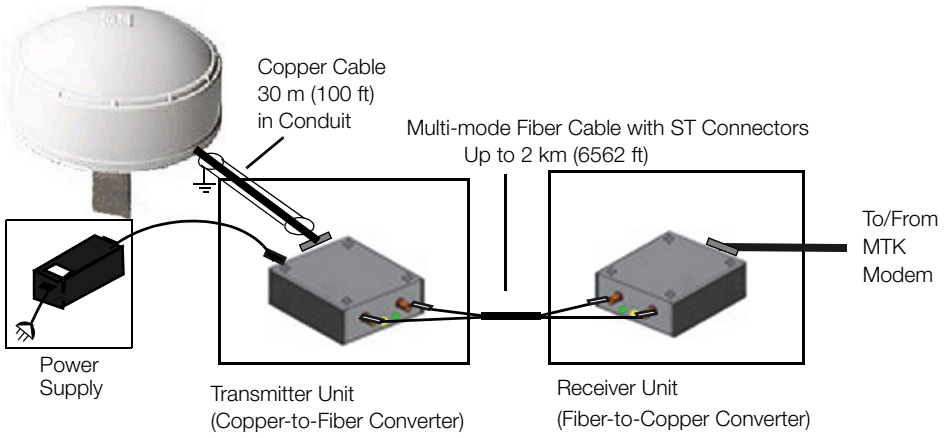


Figure 5. GPS Fiber Optic Isolator (Optional)

TIME STROBE HUB (OPTIONAL)

Figure 6. MMF Time Strobe Hub (Optional)

Two types of optional 6-port Time Strobe hubs (Figure 6) are available for distributing the time strobe signal. The MMF-compatible hub receives the GPS time pulse from the MTK modem or other TSCs or from other MMF hubs, and distributes it to enclosures containing MMF-compatible TSCs, or to other MMF-compatible hubs.

The SMF-compatible hub receives the GPS time pulse from the MTK modem or from MMF hubs and distributes it to up to five SMF-compatible TSCs. This hub has one MMF-compatible input port and five SMF-compatible output ports.

Depending on the choice of hub, the Time Strobe hubs use either single-mode or multi-mode fiber optic output cables to send their long distance transmission to the enclosures in various plant locations which house the controller stations. MMF cable supports lengths of up to 2 km (6562 ft) per segment, while SMF cable supports lengths of up to 10 km (6.2 mi) per segment.

One Time Strobe hub can distribute the time strobe signal to up to five TSCs. The Time Strobe hubs can be daisy-chained allowing distribution of the time strobe throughout the entire plant.

REDUNDANT TIME SYNCHRONIZATION SYSTEMS

In redundant Time Synchronization systems (see Figure 7), two Master TimeKeeper workstations are required, primary and backup (optional redundant MTK functionality), each providing their time strobe signals to the controller modules. Two GPS antenna/receivers, Time Strobe Generator PCI cards, MTK modems, and TSC modules are used for connecting controller stations to primary and backup MTK stations. In a redundant time strobe distribution system, any module can be removed without affecting the other path of the time strobe signal to the controller stations. Each module can be withdrawn/replaced while the remainder of the system is under power.

FOR MORE INFORMATION

For additional information describing the I/A Series Time Synchronization system, refer to the *Time Synchronization Overview* Product Specification (PSS 21S-1C2 B3).

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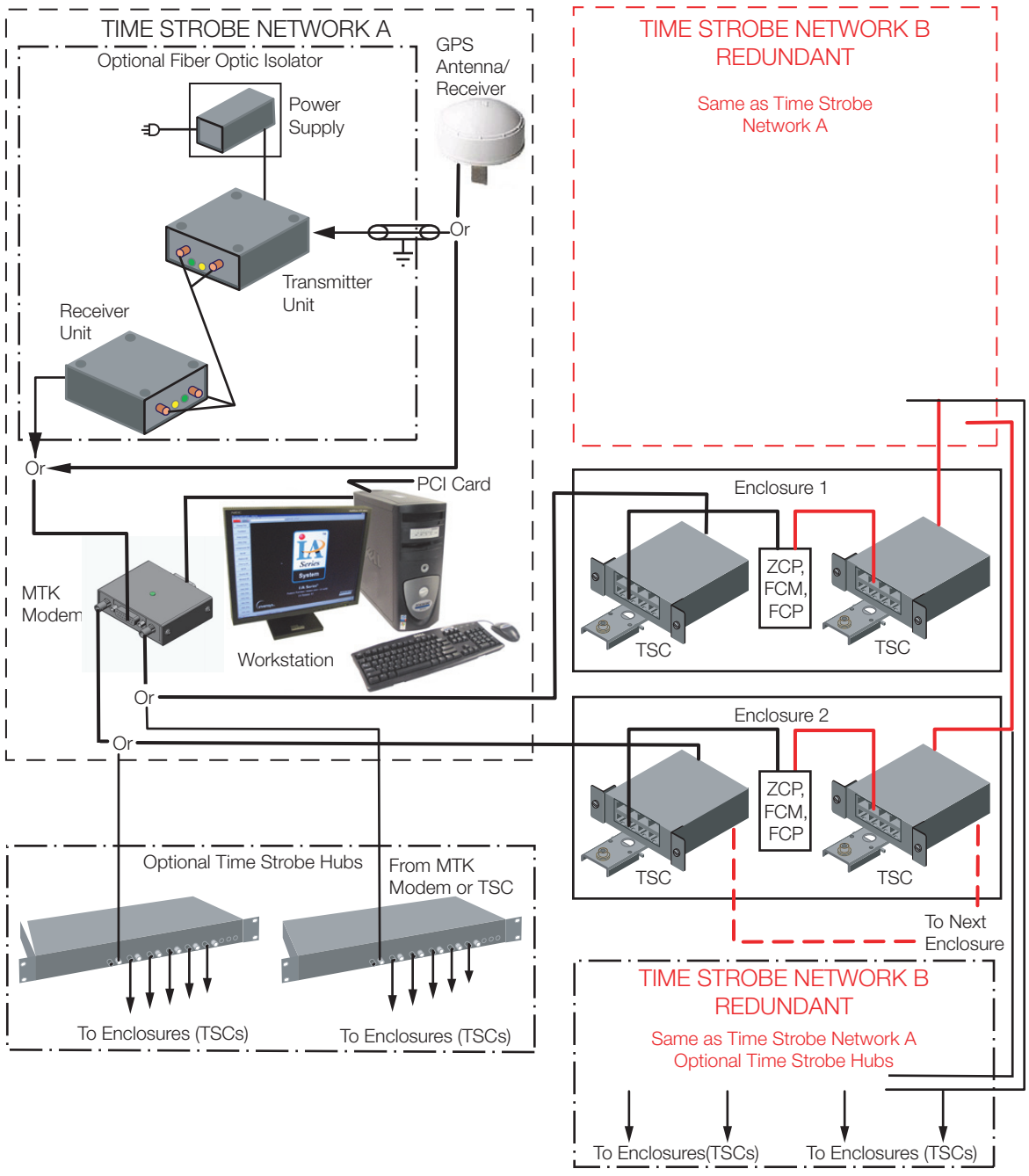

Figure 7. Time Strobe Network Equipment (Redundant)

GPS ANTENNA/RECEIVER

FUNCTIONAL SPECIFICATIONS

Number of Satellites
Up to 8

Acquisition Time (cold start)
5 minutes typical, 15 minutes maximum

Re-acquisition Time
Less than 1 minute at the same physical location unless the antenna is powered down for longer than 14 days. After 14 days, it behaves as a cold start.

Frequency
1575 MHz (receive only)

Sync to UTC
Within ± 1.0 us maximum (antenna in stationary position).

IRIG-B Output

CODE FORMAT
IRIG-B (B122)

AMPLITUDE (MARK)
2.6 V p-p (type)

MODULATION RATIO
3:1

OUTPUT IMPEDANCE
600 ohms

Time Output

OUTPUT
RS-422 strobe compatible

WAVE SHAPE
Pulse

PULSE WIDTH
1 ms (also, see Caution in “MASTER TIMEKEEPER MODEM” on page 3)

PULSE POLARITY
Negative

SQUARE WAVE
45 to 55%

TIMING
Falling edge on-time pulse

RANGE
65.53 s to 2 ms (500 Hz to 0.0152543 Hz)

POWER-ON DEFAULT RATE
1 pps

Power Requirements

INPUT VOLTAGE RANGE
12 V dc +5%, -10%

ENVIRONMENTAL SPECIFICATIONS

Operating Conditions

TEMPERATURE
-30 to +70°C (-22 to +158°F)

Storage Conditions

TEMPERATURE
-55 to +100°C (-67 to +212°F)

Altitude
0 m to +18000 m (0 to 59,005 ft)

Salt Fog
MIL-STD-202F, Method 101D, Condition B

Water Proof
Submersion to 1 m (39 in)

GPS ANTENNA/RECEIVER (CONTINUED)

PHYSICAL SPECIFICATIONS

Mounting (Pole Mount)
1.00 in I.D., 14 turns/inch straight thread (not tapered)

Dimensions - Nominal

DIAMETER
147 mm (5.8 in)

HEIGHT
100 mm (3.9 in)

Mass - Approximate
475 g (16.5 oz)

Antenna Cable

TYPE
Copper

LENGTH
30.5 m ± 0.2m (100 ft ± 8 in)

CABLE SIZE
9mm (0.35 in) O.D.

CABLE TO OPTIONAL TRANSMITTER UNIT
Cable from antenna must be installed in grounded conduit when a Fiber Optic Isolator is used

CONNECTOR SIZE

Antenna End
12-pin round connector, 20 mm (0.79 in) O.D. to antenna

MTK Modem or Optional Transmitter Unit End
DB-15 connector, 46 mm (1.80 in) O.D.

TIME STROBE CONVERTER (TSC)

FUNCTIONAL SPECIFICATIONS

Outputs

ELECTRICAL SIGNAL CHARACTERISTICS
RS-422

NUMBER
8

PROTECTION
Surge protected

Inputs

MULTI-MODE FIBER COMPATIBLE TSC (FROM MTK, MMF-COMPATIBLE HUB OR ANOTHER TSC)
One 62.5/125 micron, simplex multi-mode Fiber Optic input

SINGLE-MODE FIBER COMPATIBLE TSC (FROM SMF-COMPATIBLE HUB)
One 9/125 micron, simplex single-mode Fiber Optic input

Outputs

One 62.5/125 micron, simplex multi-mode Fiber Optic output

Propagation Delay

TSC
1 us per TSC

FIBER CABLE
5 us per km

Power Requirements

INPUT VOLTAGE RANGE
21 to 42 V dc

INPUT POWER TERMINAL BLOCKS
2: one for power input, one for power output to next TSC within same enclosure

CONSUMPTION
3.3 W at 24 Vdc with all 8 outputs used,

ENVIRONMENTAL SPECIFICATIONS

Operating Conditions

TEMPERATURE
0 to +60°C (32 to +140°F)

RELATIVE HUMIDITY
5 to 95% (noncondensing)

Storage Conditions

TEMPERATURE
-40 to +70°C (-40 to +158°F)

RELATIVE HUMIDITY
5 to 95% (non condensing)

Vibration

5.0 m/s^2 (0.5 g) from 5 to 200 Hz

Contamination

Class G1 (Mild) as defined in ISA Standard S71.04

TIME STROBE CONVERTER (TSC) (CONTINUED)

PHYSICAL SPECIFICATIONS

Mounting

DIN RAIL
Accommodates multiple DIN styles including 32 mm (1.26 in) and 35 mm (1.38 in)

RACK
19 in rack on a special designed shelf

Dimensions - Nominal

HEIGHT
38 mm (1.5 in)

WIDTH
102 mm (4.0 in)

DEPTH
89 mm (3.5 in)

Mass - Approximate

681 g (1.5 lb)

Indicator

Green is power. Yellow is dual purpose; yellow on is link and yellow flashing is time pulse signal output

Cables

TYPE

Fiber Optic Cable

Multi-Mode Fiber Compatible TSC
One 62.5/125 micron, simplex multi-mode Fiber Optic input and output

Single-Mode Fiber Compatible TSC
One 9/125 micron, simplex single-mode Fiber Optic input
One 62.5/125 micron, simplex multi-mode Fiber Optic output

Copper Cable
Cat 5 STP cable

CABLE LENGTHS

Input and Output Fiber Cables

Multi-Mode Fiber Optic Cable
3 m to 2 km (10 to 6562 ft)
Greater than 50 m (160 ft); customer supplied

Single-Mode Fiber Optic Cable
3 m to 10 km (6.2 mi)
Customer-supplied

To Controller/Baseplates (Copper Cables
0.5 m (1.6 ft) to 3 m (10 ft) within same enclosure

CONNECTORS

Fiber Optic Input /Output Connectors (2)
One input and one output connector, ST Type

Copper Strobe Output Connectors (8)
RJ-45

MTK MODEM

FUNCTIONAL SPECIFICATIONS

Input Electrical Signal Characteristics
RS-422

Outputs (to TSC or Hub)
2 outputs for two physical directions of time strobe pulse

Propagation Delay
100 ns

Power Requirements

INPUT VOLTAGE RANGE (FROM WORKSTATION)
12 V dc +5%, -10%

OUTPUT VOLTAGE RANGE (TO ANTENNA)
12 V dc +5%, -10%

CONSUMPTION
1 W

ENVIRONMENTAL SPECIFICATIONS

Operating Conditions

TEMPERATURE
0 to +50°C (-4 to +122°F)

RELATIVE HUMIDITY
5 to 95% (noncondensing)

Storage Conditions

TEMPERATURE
-40 to +70°C (-40 to +158°F)

Storage Conditions (Continued)

RELATIVE HUMIDITY
5 to 95% (noncondensing)

Vibration
5.0 m/s^2 (0.5 g) from 5 to 200 Hz

Contamination
Class G1 (Mild) as defined in ISA Standard S71.04

PHYSICAL SPECIFICATIONS

Mounting
Free Standing: Shelf or desktop (customer supplied)

Dimensions - Nominal

HEIGHT
26 mm (1.0 in)

WIDTH
64 mm (2.5 in)

DEPTH
58 mm (2.25 in)

Mass - Approximate
Less than 454 g (1 lb)

Connectors

ANTENNA OR FIBER -TO-COPPER RECEIVER TO MTK MODEM
DB-15, male

FIBER OPTIC OUTPUT CONNECTORS (2)
ST Type

Indicator
Dual purpose; yellow on is link and yellow flashing is time pulse signal

Cables

MTK TO PCI BOARD IN WORKSTATION

Length
0.3 m (1 ft)

Type
15-pin (DB-15) Male Connector

MTK OUTPUTS (2)

Length
3 m to 2 km (10 to 6562 ft)

Type
Single multi-mode fiber, 62.5/125 micron

GPS FIBER OPTIC ISOLATOR (OPTIONAL)

FUNCTIONAL SPECIFICATIONS

Transmitter Unit

INPUT VOLTAGE (FROM POWER SUPPLY)
12 V dc, 600 mA

OUTPUT VOLTAGE (TO ANTENNA)
12 V dc, 600 mA

INPUT THROUGH DB-15 CONNECTOR (FROM ANTENNA)
RS-422 GPS Data and RS-422 1PPS

FIBER OPTIC OUTPUT CONNECTORS (2)
ST Type

MULTIMODE CABLE

Attenuation
Less than 3.85 db/km at 860 nm

Propagation Delay
5 microseconds/km

Receiver Unit

INPUT VOLTAGE RANGE
12 V dc +5%, -10% (from DB-15 connector which connects to MTK modem)

PROPAGATION DELAY
Total propagation delay is 80 ns plus 6 ns per meter of fiber optic cable

OUTPUT THROUGH DB-15 CONNECTOR
RS-422 GPS Data and RS-422 1PPS

FIBER OPTIC INPUT CONNECTORS (2)
ST Type

Power Supply (for Transmitter Unit)

INPUT VOLTAGE RANGE
94 to 264 V ac, 50 Hz to 60 Hz

OUTPUT VOLTAGE RANGE
12 V dc, 600 mA

ENVIRONMENTAL SPECIFICATIONS

Operating Conditions

TEMPERATURE
0 to +50°C (-4 to +122°F)

RELATIVE HUMIDITY
5 to 95% (noncondensing)

Storage Conditions

TEMPERATURE
-40 to +70°C (-40 to +158°F)

RELATIVE HUMIDITY
5 to 95% (noncondensing)

Vibration
5.0 m/s^2 (0.5 g) from 5 to 200 Hz

Contamination
Class G1 (Mild) as defined in ISA Standard S71.04.

Location
Indoors

GPS FIBER OPTIC ISOLATOR (OPTIONAL) (CONTINUED)

PHYSICAL SPECIFICATIONS

Transmitter Unit (Copper-to-Fiber Converter)

INDOOR MOUNTING
Free Standing: Shelf or enclosure (customer supplied)

MASS - APPROXIMATE
460 g (1 lb)

DIMENSIONS - NOMINAL

Height
34 mm (1.3 in)
Width
89 mm (3.5 in)
Depth
115 mm (4.5 in)

CABLE

Length
Up to 2 km (6562 ft) fiber optic cable
Connectors
Input from Antenna
DB-15 Connector (Cable from antenna must be installed in grounded conduit when a GPS Fiber Optic Isolator is used)
Fiber Optic Output Connectors (2)
ST Type (1PPS and GPS Data)

INDICATORS (2)
Power (green) and Link Monitor/Activity (yellow)

Receiver Unit (Fiber-to-Copper Converter)

INDOOR MOUNTING
Free Standing: Shelf or enclosure (customer supplied)

MASS - APPROXIMATE
460 g (1 lb)

Receiver Unit (Fiber-to-Copper Converter) (Continued)

DIMENSIONS - NOMINAL

Height
26 mm (1.0 in)
Width
89 mm (3.5 in)
Depth
115 mm (4.5 in)

CABLE

Connectors
Output Connector to MTK modem
DB-15 Connector
Fiber Optic Input Connectors (2)
ST Type (1PPS and GPS Data)
Length of Cable to MTK modem
3 m (10 ft)

INDICATORS (2)
Power (green) and Link Monitor/Activity (yellow)

Power Supply (for Transmitter Unit)

INDOOR MOUNTING
Free Standing: Shelf or enclosure (customer supplied)

MASS - APPROXIMATE
460 g (1 lb)

DIMENSIONS - NOMINAL

Height
38 mm (1.5 in)
Width
51 mm (2.0 in)
Depth
102 mm (4.0 in)

CABLE

Length to Power Outlet
2 m (6 ft)
Length from Supply to Transmitter Unit
2 m (6 ft)

6-PORT TIME STROBE HUB (OPTIONAL)

FUNCTIONAL SPECIFICATIONS

Standards Supported
ISO 8802/3, IEEE 802.3, Ethernet 10Base-FL

Power

AC INPUT POWER
100 V ac to 240 V ac

POWER CONSUMPTION
50 to 60 Hz - 15 VA

FUSE
1 A

ENVIRONMENTAL SPECIFICATIONS

Operating Conditions

TEMPERATURE
0 to +50°C (-4 to +122°F)

RELATIVE HUMIDITY
0 to 95% (non condensing)

Storage Conditions

TEMPERATURE
-40 to +70°C (-40 to +158°F)

RELATIVE HUMIDITY
0 to 95% (non condensing)

Vibration
5.0 m/s^2 (0.5 g) from 5 to 200 Hz

Contamination
Class G1 (Mild) as defined in ISA Standard S71.04.

PHYSICAL SPECIFICATIONS MOUNTING

Free Standing, 19-inch rack, or wall mount

MASS - APPROXIMATE
2.7 kg (1 lb)

DIMENSIONS - NOMINAL

Height
44 mm (1.75 in) or 1U

Width
425 mm (16.8 in)

Depth
190 mm (7.5 in)

CABLE

Length
Multi-Mode Fiber Optic Cable
Up to 2 km (10 to 6562 ft)
Single-Mode Fiber Optic Cable
Up to 10 km (6.2 mi)

Connectors
Fiber Optic Input/Output Connectors - ST Bayonet Type

INDICATORS
Power (green), Collision, Port Status (active and partitioned), and Packet Received

REGULATORY COMPLIANCE AND CERTIFICATION FOR ALL MODULES

Regulatory Compliance

ELECTROMAGNETIC COMPATIBILITY (EMC)

European EMC Directive 89/336/EEC

Meets: EN 61326, Class A Emission standard
EN 61326, Annex A Immunity standard

CISPR 11, Industrial Scientific and Medical (ISM) Radio-frequency Equipment - Electromagnetic Disturbance Characteristics - Limits and Methods of Measurement

Meets: Class A Limits

IEC 61000-4-2 ESD Immunity

Contact 4 kV, air 8 kV

IEC 61000-4-3 Radiated Field Immunity

10 V/m at 80 to 1000 MHz

IEC 61000-4-4 Electrical Fast Transient/Burst Immunity

Antenna
1 kV when installed in metal conduit
Modules
2 kV on I/O, dc power and communication lines

IEC 61000-4-5 Surge Immunity

Antenna
1 kV when installed in metal conduit
Modules
2kV on ac and dc power lines; 1kV on I/O and communications lines

IEC 61000-4-6 Immunity to Conducted Disturbances Induced by Radio-frequency Fields

3 V (rms) at 150 kHz to 80 MHz on I/O, dc power and communication lines

IEC 61000-4-8 Power Frequency Magnetic Field Immunity

30 A/m at 50 and 60 Hz

PRODUCT SAFETY

Location

Is suitable for use in ordinary locations and is designed to meet ordinary safety standards for fire and shock hazards.

European Low Voltage Directive 73/23/EEC

Certified for use in ordinary locations and compliant with IEC 61010.

Certification for All Modules

The modules are certified for use in only ordinary (non-hazardous) locations.

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