Foxboro®

by Schneider Electric

Foxboro Evo™
Process Automation System

# Time Synchronization User's Guide

B0700AQ

Rev R
June 9, 2015

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# *Preface*

## Purpose

This document provides information for installing, configuring, troubleshooting, and operating the Time Synchronization system, part of the Foxboro Evo™ Process Automation Systems and legacy I/A Series® systems.

## Who This Book Is For

This book is intended for the use of process control engineers and operators, instrument and maintenance engineers, and other qualified and authorized personnel involved in setting up, configuring, and maintaining the Foxboro Evo or I/A Series equipment to provide time synchronization.

## What You Should Know

Prior to using this book, you should be generally familiar with the Foxboro Evo and I/A Series system. Detailed information relating to the various I/A Series or Control Core Services software and Foxboro Evo or I/A Series hardware elements is found in the reference documents listed below.

## Revision Information

For this revision of the document (B0700AQ-R), the following changes were made:

**Appendix A "Wiring Guide for Time Strobe Network Installation"**

- Updated part numbers in Figure A-1 through Figure A-12.

## Workstation Types

You should be aware of the various types of workstations and their definitions as indicated below.

| Term | Definition |
|---|---|
| Foxboro Evo workstation | Any workstation installed with a Foxboro Evo software component, including Control Core Services, Control Software, Wonderware Historian, I/A Series software, FCS or any combination of thereof. |
| Control Core Services workstation | Any Foxboro Evo workstation installed with Control Core Services or I/A Series software. This workstation is connected to the Mesh network. |

| Term | Definition |
|---|---|
| non-Control Core Services workstation | Any Foxboro Evo workstation that does not have Control Core Services or I/A Series software installed. This type of workstation is not connected to the Mesh network, but can have Control Software installed on it. |
| Control Software workstation | Any Foxboro Evo workstation installed with Control Software components, including Control Editors, Control HMI, Wonderware Historian, or other components installed as part of Control Software. This workstation may or may not also be a Control Core Services workstation. |

# Reference Documents

The following documents provide additional and related information:

- *Time Synchronization Overview* (PSS 31H-1TIME)
- *Time Synchronization Equipment* (PSS 31H-4C2)
- *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA)
- *Field Control Processor 280 (FCP280) User's Guide* (B0700FW)
- *Field Control Processor 270 (FCP270) User's Guide* (B0700AR)
- *Z-Module Control Processor 270 (ZCP270) User's Guide* (B0700AN)
- *System Manager* (B0750AP)
- *System Management Displays* (B0193JC)
- *Control Core Services v9.0 Software Installation Guide* (B0700SP) - Refer to the *Hardware and Software Specific Instructions* list of workstations in the Preface of this document.

These documents are available on the Foxboro Evo Electronic Documentation media (K0174MA). The latest revisions of each document are also available through our Global Customer Support at *https://support.ips.invensys.com.*

# Glossary of Terms

The following terminology, used throughout this document, relates to the time synchronization system including its software and associated equipment.

| | |
|---|---|
| API | Application Programming Interface |
| AW | Application Workstation - superceded by WSTA70 (Windows 7) and WSVR70 (Windows Server 2008 R2 Standard) stations. |
| COTS | Commercial Off The Shelf |
| EXT SRC MTK | Externally Sourced Master Time Keeper |
| FCM100Et | Fieldbus Communications Module, 100 MB, TDR/Time Sync Ready |

| | |
|---|---|
| FCP270 | Field Control Processor 270 |
| FCP280 | Field Control Processor 280 |
| Foxboro Evo Control Core Services | Core software environment, formerly known as “I/A Series (Intelligent Automation Series) software”. |
| Foxboro Evo Control Editors | Control Software engineering and configuration tools built on the ArchestrA Integrated Development Environment (IDE). Formerly known as “FCS Configuration Tools”, “InFusion Engineering Environment”, or “IEE”. |
| Foxboro Evo Control Software | Packages which provide expanded functionality to the Foxboro Evo Control Core Services (hereinafter referred to as Control Core Services). Formerly known as Foxboro Control Software. |
| Foxboro Evo System Configurator | Any of the Foxboro software products which allow you to configure your Foxboro Evo or I/A Series system; includes System Definition, IACC, or the Foxboro Evo Control Editors (hereinafter referred to as Control Editors) |
| GPS | Global Positioning System |
| IACC | I/A Series System Configuration Component |
| INT SRC MTK | Internally Sourced Master Time Keeper |
| IPC | Inter-Process Communication |
| ISR | Interrupt Service Routine |
| MMF | Multi-Mode Fiber [Optic Cabling], simplex or duplex |
| MTK | Master TimeKeeper |
| NTP | Network Time Protocol |
| NTP DAEMON | NTP daemon provides the NTP services on the workstation |
| Non-Pulsed Stations | Stations that are not wired to receive a sync pulse. |
| Nucleus Plus | An embedded real-time operating system used on the FCP270 and ZCP270 control stations. |
| OS | Operating system |
| OS Tick | Operating system timer value (duration between clock interrupts) |
| PC | Personal computer |
| SMAS | Station Management Application Services |

| | |
|---|---|
| SMDH | System Management Display Handler, a legacy tool, part of the Control Core Services; equivalent to the System Manager |
| SMF | Single-Mode Fiber [Optic Cabling] |
| SMON | System Monitor |
| SOE | Sequence of Events |
| STK | Slave TimeKeeper - the time keeper process running as a slave or a station where the slave time keeper process may reside |
| Sync Pulsed Stations | Stations that may RECEIVE a sync pulse (for example, FCP280, ZCP270, FCP270, or FCM100Et) |
| SYSNET | System and Network Management - the TimeKeeper is a subset of SYSNET which is responsible for synchronizing stations on the network. |
| TDR | Trend Data Recorder |
| TK | TimeKeeper |
| TSC | Time Strobe Converter - module which provides fiber-to-copper conversion and copper connections of time strobe pulse from a source to the Foxboro control processors. See “Time Strobe Converter” on page 14. |
| UTC | Universal Coordinated Time. UTC uses a 24-hour notation. Zero hours UTC is midnight in Greenwich England and 11:00PM is expressed as 23:00 UTC. If the universal time were 14:30 UTC, United States Eastern Standard Time would be 9:30 AM (EST) or 10:30 AM Eastern Daylight Savings Time (EDST). |
| WSRV70 | Windows Server 2008 R2 Standard-based Foxboro Evo server. Station that interfaces to a monitor for graphical displays and input devices such as alphanumeric keyboards, mice, trackballs, and so forth. It connects to bulk storage devices and to information networks to allow bi-directional information flow. It performs various system management tasks. |
| WSTA70 | Windows 7-based Control Core Services or I/A Series workstation. Station that interfaces to a monitor for graphical displays and input devices such as alphanumeric keyboards, mice, trackballs, and so forth. It connects to bulk storage devices and to information networks to allow bi-directional information flow. It runs I/A Series, Foxboro Evo and third party applications. |
| ZCP270 | Z-Module Control Processor 270 |

# 1. Introduction

*This chapter provides an overview of the Time Synchronization system.*

Control Core Services and I/A Series workstations and servers that are Master TimeKeepers (MTKs) have two possible ways of determining the time: internal source and external source.

The standard method for Foxboro Evo and I/A Series system is the internal source Master TimeKeeper with the external source as a system option.

The internal source Master TimeKeeper (INT SRC MTK) is a supported workstation or server with no GPS antenna and receiver. The INT SRC MTK gets its time from the internal clock of the hosting workstation or server. You enter the date and time using any system management application (such as the Set Date and Time display in the System Management Display Handler (SMDH), or in the System Manager). At runtime, you can also change the time using the Set Date and Time Display or allow the time to continue to run on its internal clock. The INT SRC MTK distributes this time to all stations on the control network.

**NOTE**

Foxboro Evo and I/A Series servers do not support PCI-based time cards; only Control Core Services and I/A Series workstations support these cards.

The internal source time synchronization system features are:

- MTK synchronizes to its internal real time clock.
- Time is synchronized to within 50 ms on all workstations or servers.
- Network Time Protocol (NTP) is used in all workstations or servers.
- Control stations are synchronized by the "time-of-day" messages sent by the MTK, via IPC, every 10 minutes.
- System messages are logged for TimeKeeper operation.
- Time is synchronized using Universal Coordinated Time (UTC).
- Date and time can be manually adjusted using System Management displays.
- Time may be displayed in local time (if adjusted by the Windows® time/date applet).
- MTK is automatically switched to a backup MTK in case of Primary MTK failure.

An externally sourced Master TimeKeeper (EXT SRC MTK) is a supported workstation with a GPS antenna and receiver. The time obtained by the GPS is in Universal Coordinated Time (UTC) format. The EXT SRC MTK get its date and time from the GPS receiver via a PCI time card in the workstation. The EXT SRC MTK synchronizes its local clock to the time on the PCI time card and distributes time to all stations on the control network. The EXT SRC MTK also provides an accurate time strobe pulse to Sync Pulsed Stations. The time strobe pulse is produced by the PCI time card and allows for the accurate synchronization of all Sync Pulsed Stations (see Figure 1-1).

The external source time synchronization system features are:

- MTK synchronizes to GPS time.
- Time is synchronized to within 1 ms on TDR/SOE FBMs.

**⚠ WARNING**

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.

- Control Processor time is time-stamped to the Basic Processing Cycle (BPC).
- Time is synchronized to within 50 ms on all workstations or servers.
- Network Time Protocol is used in all workstations or servers.
- Control stations with time strobe hardware are synchronized by the "time at the next pulse" message sent by the MTK, via IPC, every minute.
- Control stations without time strobe hardware are synchronized by the "time-of-day" messages sent by the MTK, via IPC, every 10 minutes.
- Non-redundant or redundant time strobe network.
- System messages are logged for TimeKeeper operation.
- Time is synchronized using Universal Coordinated Time (UTC).
- Date and time cannot be adjusted at System Management displays.
- Time may be displayed in local time (if adjusted by the Windows Date/Time applet).
- Automatic establishment and synchronization of time is based on GPS time.
- MTK is automatically switched to a backup MTK in case of primary MTK failure.
- Optional use of extenders for distribution to additional sites. With extenders, GPS time strobes can be distributed to a remote cluster up to 10 km (6.2 mi) over single-mode fiber cable and be distributed to multiple targets within the cluster over multi-mode cable up to 2 km (1.2 mi).

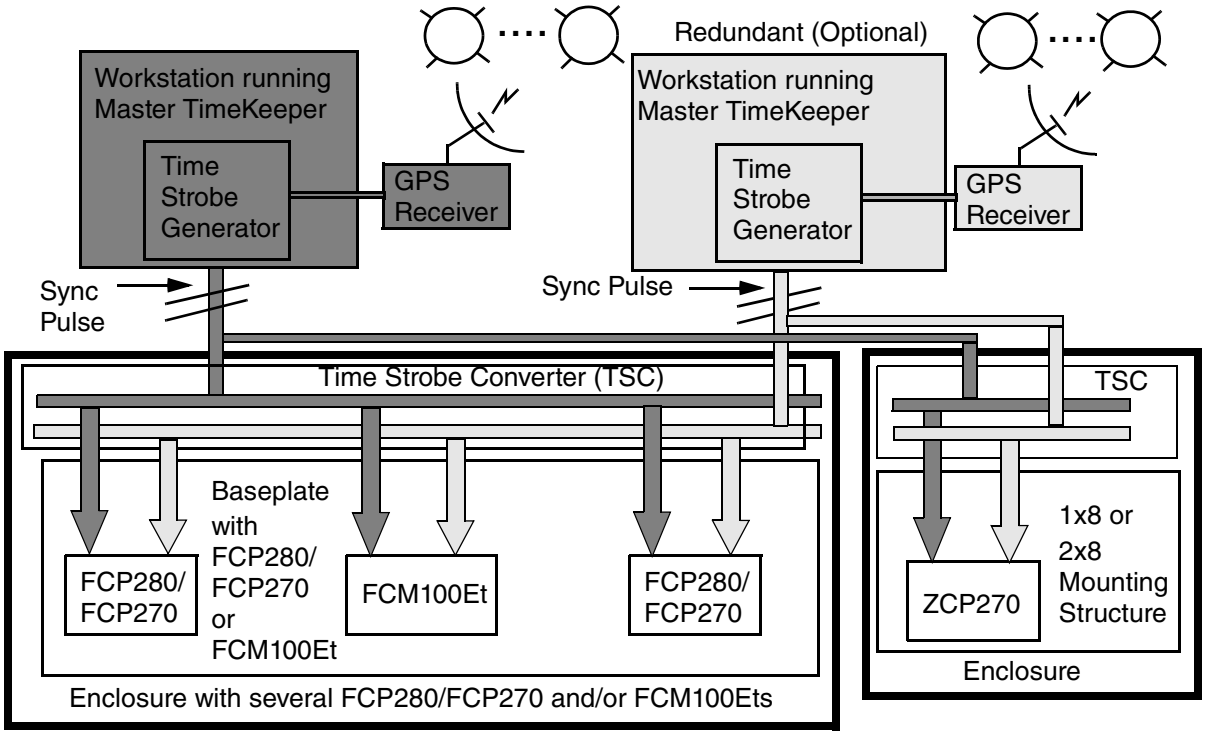



**Figure 1-1. Sync Pulse Distribution**

In EXT and INT sourced systems, the TimeKeeper synchronizes the time on stations that are on the control network. On workstations/servers, the TimeKeeper consists of one component that acts as a Master TimeKeeper (MTK) or Slave TimeKeeper (STK) depending on the station's role. On all other stations, there is a component that acts as an STK.

The Master TimeKeeper uses NTP or a combination of NTP and time-set messages to distribute the date and time to all stations on the control network. The STKs receive the date and time from the Master TimeKeeper and synchronize their stations by adjusting the real-time clock (workstations) or time counters. If the sync pulse is available, Sync Pulsed Stations adjust their time counters using the highly accurate fixed pulse interval.

For reliability, the TimeKeeper subsystem allows the active MTK to switch from one workstation or server to another. The active MTK will switch automatically due to a failure on the active MTK's workstation or server. In systems with a functioning EXT SRC MTK, the MTK is switched to another External Source (EXT SRC) MTK before any other MTK.

In an EXT SRC MTK system, the TimeKeeper subsystem can distribute the data and time messages through one of three network configurations:

- Direct Connect Extended Time Strobe Network (without extenders) - The GPS time pulse is distributed over optical cabling to daisy-chained Time Strobe Converters (see Figure 1-1), which send it to the appropriate controller over copper cables.
- Extended Time Strobe Network with extenders - The GPS time pulse is distributed over multi-mode fiber (MMF) optic, simplex cabling (up to 2 km (6562 ft)) to an extender which repeats the signal to up to six Time Strobe Converters over MMF cabling. The TSCs can be daisy-chained to other TSCs with MMF cabling.

- Site-Wide Time Strobe Network - The GPS time pulse is distributed over MMF cabling to an extender which repeats the signal to up to six Time Strobe Converters over single-mode fiber (SMF) optic cabling (up to 10 km (6.2 mi)). The fiber outputs of the TSCs can be daisy-chained to other TSCs with MMF cabling. This configuration is optimal for an expansive plant, where GPS time is required to be distributed to small clusters apart from one another.

# TimeKeeper Operation

A Master TimeKeeper, or MTK, maintains the time source and distributes the system time to all other stations on the control network. The Master TimeKeeper application software resides in a supported system workstation or server. A Slave TimeKeeper, or STK, receives time information from a Master TimeKeeper station and keeps itself synchronized with the Master TimeKeeper station (and therefore with all other stations on the control network). Slave TimeKeepers reside in all stations in the control network. The Master TimeKeeper determines the time by which all slave stations are synchronized by either using the workstation's or server's real-time clock or by using the optional GPS time strobe generation equipment to establish the actual time as determined by the GPS. The Master TimeKeeper uses this time source (real-time clock or GPS) to synchronize all slave stations. The MTK uses a hardware connection to the Sync Pulsed Stations to increase the synchronization accuracy by providing a time strobe pulse, which is sent periodically by the MTK at a precise five second time interval.

There are two different hardware configurations for a workstation or server acting as the Master TimeKeeper:

- A workstation with a GPS receiver and a time strobe generator.
- A workstation or server without a GPS receiver and without a time strobe generator.

When configured, sync pulses are issued to the **Sync Pulsed Stations** on the control network. The Control Processors have built-in hardware to receive the sync pulses generated at a workstation and synchronize the CP time to the GPS time.

A second MTK (backup) will automatically take over in the event of a failure of the active MTK station. Any externally sourced (EXT SRC) station is given priority over an internally sourced (INT SRC) station.

Time increases monotonically according to the following guidelines:

- In normal operation, time never goes back in sync pulsed control stations.
- Time can be set back by an operator manually via any system management application for internally sourced TimeKeepers.

Local time is used for displaying and entering the time. You adjust the time zone for each station using the Windows Date/Time Properties applet.

# Time Synchronization

This section discusses synchronization between the Master TimeKeeper and the Slave TimeKeeper. During normal operation, the synchronization between the master station and the slave stations conforms to the specifications discussed in "GPS Operating Synchronization" on page 5.

In the case where the Master TimeKeeper is moved to another supported workstation or server, synchronization between the master station and the slave stations conform to the specifications discussed in “Synchronization during MTK Takeover” on page 5.

## GPS Operating Synchronization

Time is synchronized to within 1 ms of the MTK time on TDR/SOE FBMs. Control Processor time is synchronized with the Basic Processing Cycle (BPC). Time is synchronized via NTP to within 50 ms between workstations.

## Synchronization during MTK Takeover

If the active MTK GPS fails and the backup external source MTK takes over, the Sync Pulsed Stations on the control network stay synchronized. Synchronization is not affected during the takeover if the backup MTK is receiving GPS time.

If the active MTK is switched from an external source MTK to an internal source MTK, or vice versa, there will likely be a discrepancy in the time source. Since internal source MTKs do not receive the sync pulse (they synchronize via NTP), they can stray from an external source MTK by as much as 50 ms as described above. If an INT SRC MTK takes over from an EXT SRC MTK, at the point in time where the INT SRC MTK becomes fully active, the Sync Pulsed Stations may have a difference of up to 50 ms between their real-time clock and the time coming from the new MTK.

## Synchronization for Internal Source MTK

An Internal Source time synchronization system can exist under the following circumstances:

- Master Timekeeper configuration supports Internal Source MTK only.
- Master Timekeeper configuration supports External Source MTK but the External Source MTK(s) has failed (station power failure only) and an Internal Source MTK has taken over.

On an Internal Source Time synchronization system, time can be changed via any system management application. The TimeKeeper responds to the time change as follows:

- The time on all control stations is set directly to the new time entered via any system management application if the Master Timekeeper configuration supports Internal Source MTK only.
- For systems that have an Internal Source MTK, as the result of an External Source MTK failure, it is recommended that the user not enter the time via any system management application for:
  - 48 hours for systems with I/A Series software previous to v8.5 after the External Source MTK failure.
  - 10 hours for systems with I/A Series software v8.5-v8.8 or Control Core Services software v9.0 or later after the External Source MTK failure.

  Setting the time will only affect the workstations or servers. Sync-pulsed control stations will keep their own accurate time for this 48 or 10 hour period with the expectation that the GPS or workstation will be repaired.

- Time adjustment varies depending on the version of I/A Series software or Control Core Services software:
  - For workstations or servers with I/A Series software previous to v8.3:
    The time on all workstations or servers is gradually adjusted by NTP if the time discrepancy is less that 1000 seconds. If the time discrepancy is greater than 1000 seconds, the time is set directly to the time entered via any I/A Series system management application.
  - For workstations or servers with I/A Series software revisions at v8.3-v8.8 or Control Core Services software v9.0 or later:
    The time on all workstations or servers is set directly to the time entered via any system management application, within approximately 35 seconds.
- A system message is generated in the SMON_log that is monitoring the TimeKeeper.

## Workstations Supporting GPS Cards

The following workstations support the Time Synchronization system with GPS cards:

- Model P92C and later workstations with available PCI-X slots
- Model H92 (HP Z420 and HP Z400 Workstation) with available PCI-X slots.

# 2. Configurations

*This chapter provides an overview of backup configuration for the Time Synchronization system.*

## Backup Configurations

For the Master TimeKeeper to continue functioning after a failure of the station where the Master TimeKeeper is running, there are backup configurations to allow another station to take over as Master TimeKeeper.

Backup configurations provide module redundancy for the TimeKeeper subsystem.

The difference between the configurations is the type of MTK (external source versus internal source) for the primary MTK station and the backup MTK station.

The Foxboro Evo system configurators (Control Editors, SysDef, or IACC) configure the system such that only one supported workstation or server is designated as the primary Master TimeKeeper and optionally one workstation or server as backup. Software installation places configuration files on each workstation or server, such that each station can detect whether or not it is the primary, backup or a possible Master TimeKeeper (workstation or server) and whether the primary and backup have a GPS receiver.

Table 2-1 shows examples of the backup configurations supported by the TimeKeeper subsystem.

**Table 2-1. Master TimeKeeper Backup Configurations**

| Configuration | Station | Time Source | Sync Pulse Generator Hardware |
|---|---|---|---|
| 1 | Primary MTK | External GPS | Pulse Generator installed |
| | First Backup MTK | External GPS | Pulse Generator installed |
| | Additional Backup MTKs | Internal (No GPS) | No Pulse Generator |
| 2 | Primary MTK | External GPS | Pulse Generator installed |
| | First Backup MTK | Internal (No GPS) | No Pulse Generator |
| | Additional Backup MTKs | Internal (No GPS) | No Pulse Generator |
| 3 | Primary MTK | Internal (No GPS) | No Pulse Generator |
| | First Backup MTK | Internal (No GPS) | No Pulse Generator |
| | Additional Backup MTKs | Internal (No GPS) | No Pulse Generator |

## Takeover Strategy for Time Strobe Distribution

If the primary MTK fails, the backup strategy provides for a new supported workstation or server to take over as the active MTK.

Figure 2-1 and Figure 2-2 show the basic hardware components and connections for distributing the time strobe for each of the backup configurations listed in Table 2-1 above. Each configura-

tion has a slightly different takeover strategy because each configuration has different hardware capability.

## Takeover Strategy for Backup Configuration 1

In this configuration, the Primary MTK and first backup MTK are both EXT SRC MTKs (refer to Figure 2-1).

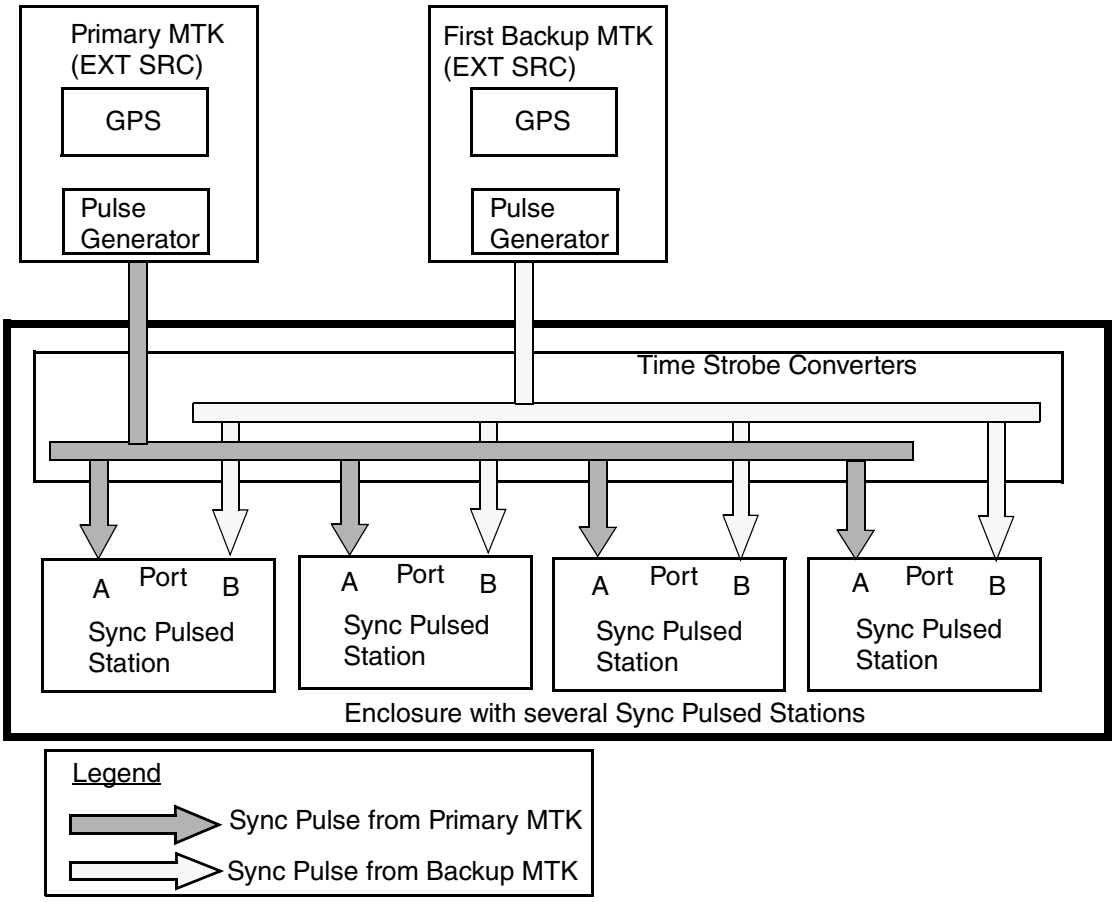



**Figure 2-1. Backup Configuration 1**

In the event of failure of the GPS on the primary EXT SRC MTK, the MTK function automatically switches to the backup if it has a functioning GPS. When the GPS on the primary recovers, the primary automatically takes over as the MTK. If the primary has a station failure, the MTK function automatically switches to the configured backup EXT SRC MTK. If the GPS fails on the backup while running as the MTK, it continues as the MTK. If the backup station fails while running as the MTK, any available workstation or server operates as an INT SRC MTK. When the backup restarts it automatically takes over as the MTK if the primary is not running. When the primary restarts, it takes over as the MTK.

The primary MTK, which has a GPS receiver, provides the sync pulses to port A on the Sync Pulsed Stations. Under normal conditions, they listen on port A.

The first backup MTK, which also has a GPS receiver, provides the sync pulse (even while in backup mode) to port B on the Sync Pulsed Stations.

If a control station can not sense a time strobe on port A, it uses the time strobe on port B.

## Takeover Strategy for Backup Configuration 2

In this configuration, the primary MTK is an EXT SRC MTK, and the backup MTKs are INT SRC MTKs (Figure 2-2).

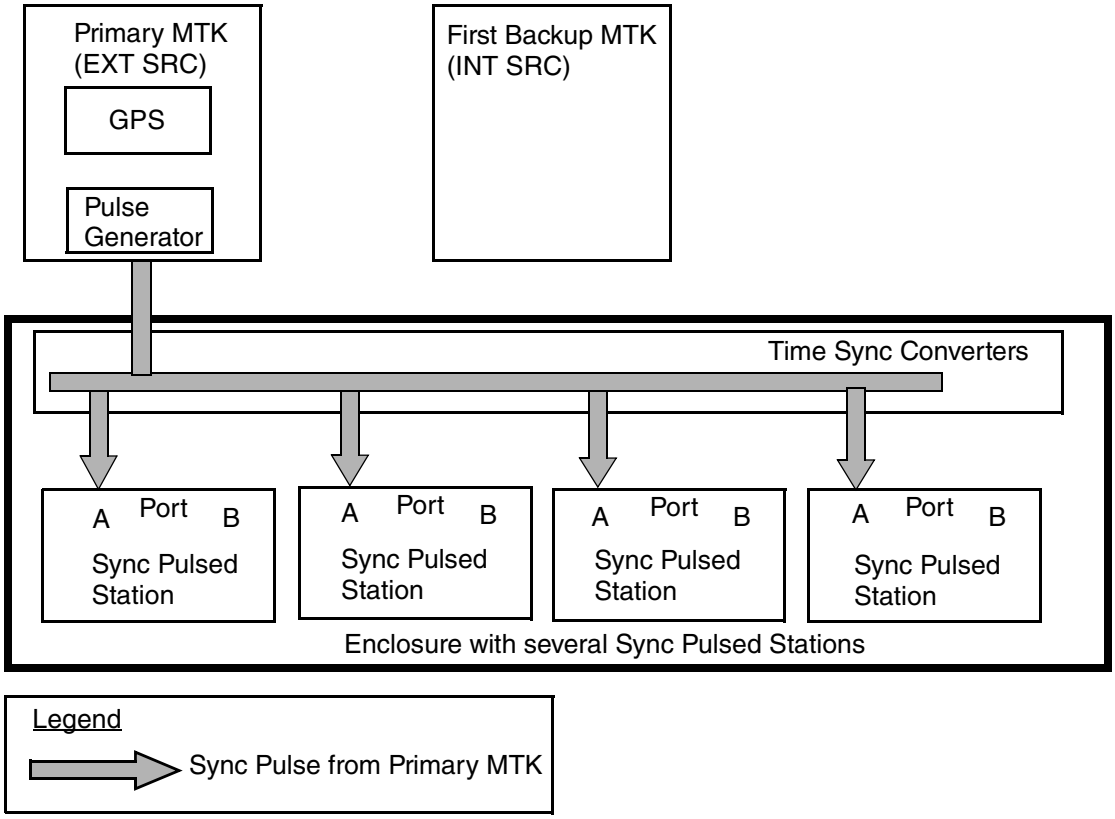



**Figure 2-2. Backup Configuration 2**

In the event of failure of the GPS on the primary EXT SRC MTK, the MTK function remains on the primary. If the primary has a station failure, the MTK function automatically switches to the configured backup INT SRC MTK. If the backup station fails while running as the MTK, any available workstation or server operates as an INT SRC MTK. When the backup restarts it automatically takes over as the MTK, if the primary is not running. When the primary restarts, it takes over as the MTK.

## Takeover Strategy for Backup Configuration 3

In this configuration all the MTKs are INT SRC MTKs.

In the event of station failure of the primary INT SRC MTK, in this configuration the Master TimeKeeper function automatically moves to the configured backup INT SRC MTK. If the backup fails, any available workstation or server operates as an internal source Master TimeKeeper. When the primary MTK restarts, it automatically takes over.

# 3. Time Synchronization System Hardware

*This chapter provides an overview of the Time Strobe network and the equipment used to receive and distribute the time strobe.*

The optional time strobe (that is, time pulse) is distributed once every 5 seconds via the hardware described in this section. The Master TimeKeeper station, once every minute, informs each of the distributed controllers, in advance, what the time will be when the controllers receive the next time strobe.

An MTK maintains the time source and distributes the system time to all other stations on the application network. The Master TimeKeeper resides in any supported workstation or server. An MTK maintains the time source and distributes an accurate time strobe pulse to sync pulsed stations. These sync pulsed stations are connected via the Control Network, and the time strobe pulse, derived from a satellite GPS system, allows for the accurate synchronization of all the TDR/SOE FBMs.

## Hardware Modules

The hardware modules in the optional Time Synchronization system are the:

- GPS Antenna system
- Time Strobe Generator
- MTK modem
- Time Strobe Converters
- Optional Time Strobe Distribution Extenders.

Figure 3-1 shows the hardware modules in a redundant time synchronization, time pulse distribution system.

### GPS Antenna System

The GPS provides the accuracy of the time strobe signal. It is derived from a GPS satellite which transmits its position, altitude, and time. The Time Strobe Network (TSN) described here distributes only the time information although the position and altitude data are decoded within the Time Strobe Generator card.

The GPS receiver uses an omni-directional antenna to detect satellite signals that specify the time and satellite position. The GPS receiver determines the antenna's position (longitude, latitude, and elevation) and the time by decoding the signals simultaneously from at least four of the GPS satellites. When power is first applied, the GPS receiver begins searching for the satellites. This process can take up to fifteen minutes, as the receiver locates satellites, refines its position, and determines which satellites to search for, through an iterative process. The receiver remembers the last known position when power is turned off. This results in faster satellite acquisition the next time power is turned on, if the antenna position is not changed.

The antenna system is an active module which needs a 12 V dc source of power. It contains the GPS receiver and drives signals to the Time Strobe Generator card through a copper cable [30 m (100 ft), maximum] and an optional fiber optic cable [2 km (6562 ft), maximum].

### *Wire Antenna Data Transmission*

Copper wire is used to connect the antenna module with the MTK or copper-to-fiber optic converter. The antenna system power is provided via the wire cable.

### *Fiber Optic Antenna Data Transmission*

If fiber optic transmission for connection between the antenna and the Time Strobe Generator is used, a COTS copper-to-fiber transmitter and a COTS fiber-to-copper receiver is used to convert the signals. Because the power for the antenna module cannot be transmitted over the fiber optic cable, a 12 V dc source of power must be provided at the copper-to-fiber optic transmitter end.

## Time Strobe Generator

The Time Strobe Generator is a PCI card that resides in a supported workstation. This card receives the antenna system's output, provides time data to the workstation and passes it through to the MTK modem. The MTK modem module connects to the Time Strobe Generator card and modifies the card's electrical time strobe outputs to drive two fiber optic lines.

The PCI card (Time Strobe Generator) has the facility to 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 internal clock if the GPS signals are not available.

## MTK Modem

The PCI card generates and transmits a periodic time pulse using RS-422 signal levels. This signal is converted via the Master TimeKeeper Modem (MTK modem) for long distance transmission, via two fiber optic outputs, to Time Strobe Converters (TSC) or Time Strobe Distribution Extenders.

Multi-mode fiber (MMF) optic cable is used for the transmission of the time strobe between the MTK modem and the Time Strobe Converter (TSC) modules or Time Strobe Distribution Extender(s). This signal is suitable for long distance transmission [up to 2 km (6562 ft) for a single cable segment] to various enclosures throughout the plant which house devices being synchronized.

## Time Strobe Distribution Extender

Two optional Time Strobe Distribution Extenders are available to distribute the time strobe from the MTK modem to multiple locations within a plant. The extenders use fiber optic cable for long distance transmission to the various enclosures which house the sync pulsed stations:

- RH100AM - Time Strobe Distribution Extender with seven MMF-compatible ports; one for the GPS time pulse input, and six for the repeated time pulse outputs. This MMF-compatible extender can be daisy-chained to other MMF-compatible extenders, or can connect directly to the MMF-compatible Time Strobe Converters (P0972KA).

- RH100AN - Time Strobe Distribution Extender with one MMF-compatible port for the GPS time pulse input, and six SMF-compatible ports for the repeated time pulse outputs. This SMF-compatible extender can connect its outputs only to the SMF-compatible Time Strobe Converters (P0973BW).

One Time Strobe extender can distribute the time strobe to up to six TSCs (usually one per enclosure). MMF cabling supports up to 2 km (6562 ft) in a simplex fiber optic cable segment. SMF cabling supports up to 10 km (6.2 mi) in a simplex fiber optic cable segment. The number of fiber optic cable segments are not limited. Multimode fiber optic cables greater than 50 m (164 ft) are customer-supplied. All single-mode fiber optic cables are customer-supplied.

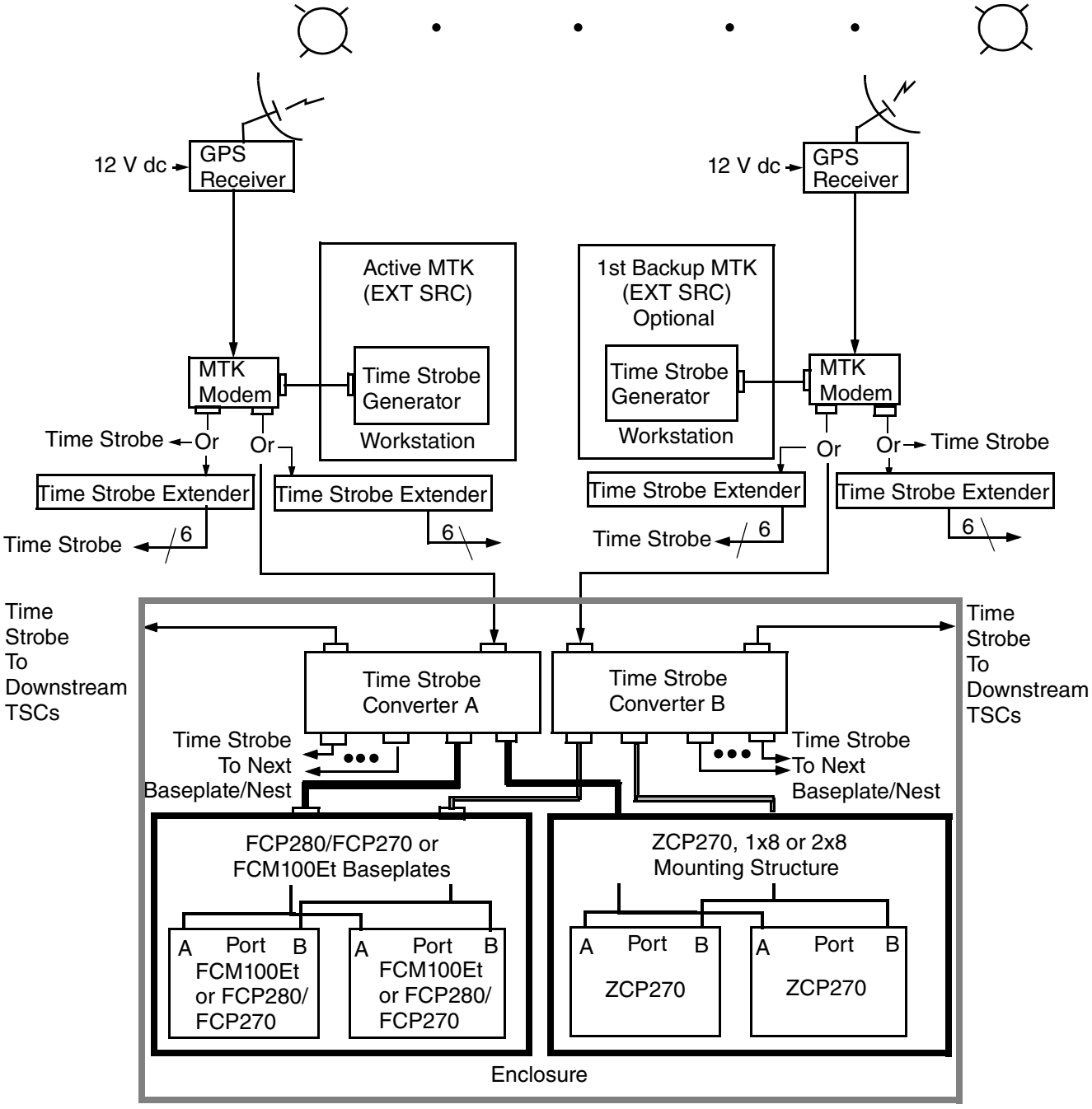



**Figure 3-1. Time Strobe Network (Redundant System Shown), Hardware Overview**

## Time Strobe Converter

Two types of Time Strobe Converters (TSCs) provide the conversion and connection of the accurate time strobe pulse from a Master TimeKeeper station to the controller stations. Mounted inside the enclosure, the TSC transforms the fiber time strobe signal to eight copper RS-422 differential output signals. The TSC module is mounted in an enclosure containing the controller stations.

A non-redundant MTK system uses a single TSC module to provide time strobe signals for up to eight baseplates or controller stations within a single enclosure. The TSC provides a MMF, simplex fiber cable output for daisy chaining to another TSC, up to 2 km (6562 ft) in a simplex fiber optic cable segment, the number of fiber optic cable segments are not limited. If more than eight controllers requiring time strobe inputs are housed in an enclosure, you must install more than one TSC module in the enclosure. The TSC modules are connected in daisy chain configuration within the enclosure.

Two types of TSCs are available, depending on the type of input fiber optic cable for the time strobe pulse:

- P0972KA - Time Strobe Converter with one MMF input/one MMF output, used with the Extended Time Strobe Network (discussed below).
- P0973BW - Time Strobe Converter with one SMF input/one MMF output, used with the Site-Wide Time Strobe Network (discussed below).

Two Master TimeKeepers are allowed, primary and backup (optional redundant MTK functionality), each providing their time strobe signals to the sync pulsed stations. Both MTKs use an independent PCI-bus based Time Strobe Generator card. Two TSC modules are used for connecting controller stations to primary and secondary MTK stations, as shown in Figure 3-1. In a redundant time strobe distribution system, any single TSC module can be removed without affecting the other path of the time strobe signal to the controller stations. TSC modules can be withdrawn/replaced while the system is under power.

**— NOTE**

When an external MTK (GPS) workstation loses connection to its antenna, the LEDs on its Time Strobe Converter (TSC) blink at a one second rate. System time is not affected by this and the normal sync pulse rate of five seconds is restored on power recovery.

# Distribution Network Configurations (EXT SRC MTK Only)

In an EXT SRC MTK system, the TimeKeeper subsystem can distribute the data and time messages through one of three network configurations, discussed below.

## Direct Connect Extended Time Strobe Network (Without Extenders)

In this network configuration, the Master TimeKeeper modem sends the GPS time pulses directly to up to two Time Strobe Converters (TSCs) over 2 km (1.2 mi) multi-mode fiber optic (MMF),

simplex cables. The TSCs send the time pulses to the appropriate controllers over copper cables, as well as to other TSCs daisy-chained to them via MMF cables.

This is illustrated in Figure 3-2.

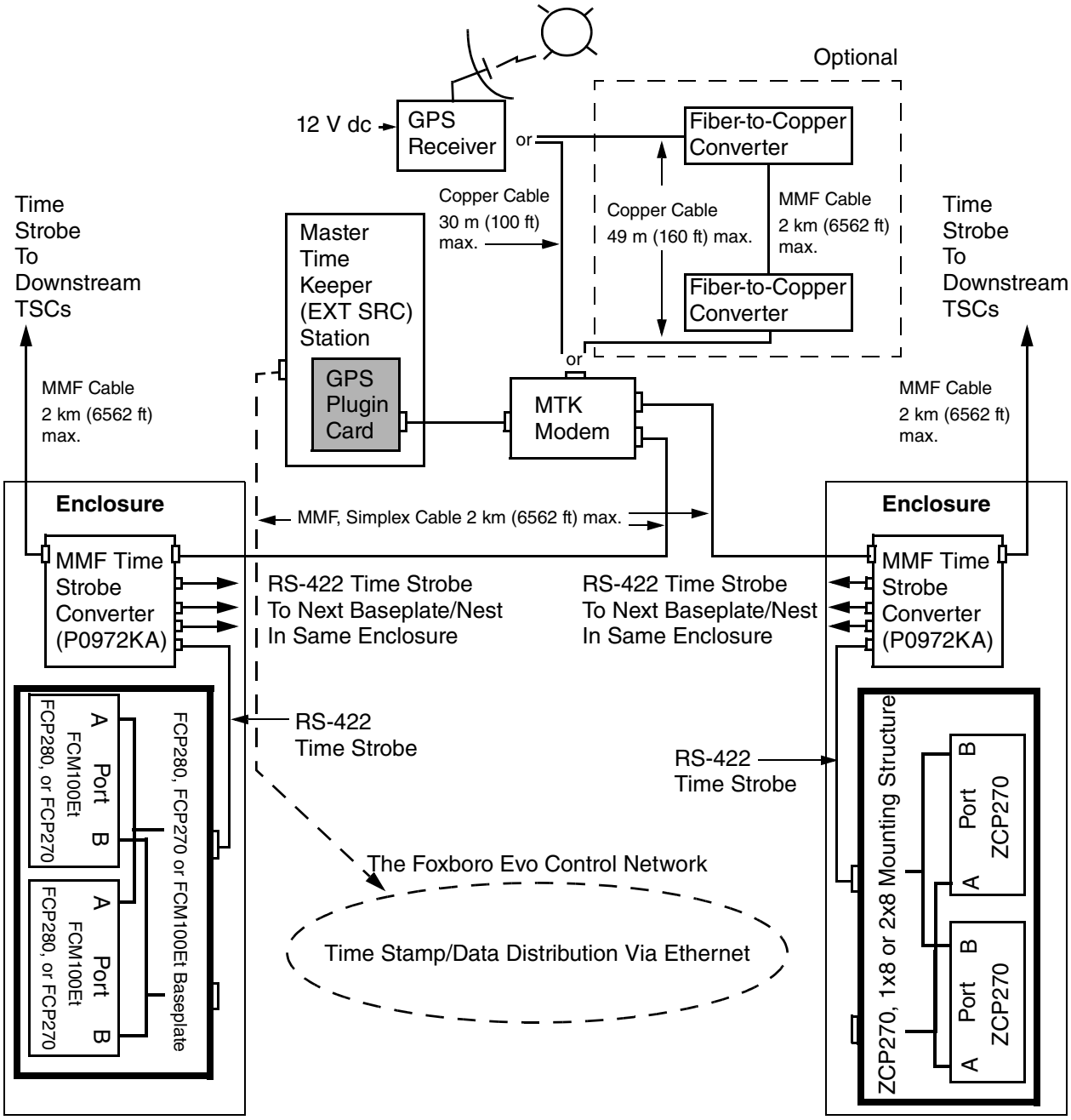



**Figure 3-2. Direct Connect Extended Time Strobe Network Without Extenders (Non-redundant Shown)**

## Extended Time Strobe Network with Extenders

In this network configuration, the Master TimeKeeper modem uses multi-mode fiber optic (MMF) cables and MMF-compatible Time Strobe Distribution Extenders to multiply and distribute the GPS time pulses to up to six TSCs. The GPS time pulse is sent to a MMF-compatible extender (RH100AM), which distributes the time pulses to other MMF-compatible extenders or

MMF-input TSCs. These TSCs can daisy-chain the optical pulse to other MMF-compatible TSCs over MMF cable. With their eight RS-422 copper time strobe outputs, they connect to local controllers. Each MMF connection (extender-to-extender, extender-to-TSC, TSC-to-TSC) can be up to 2 km (1.2 mi) in length.

This is illustrated in Figure 3-3.

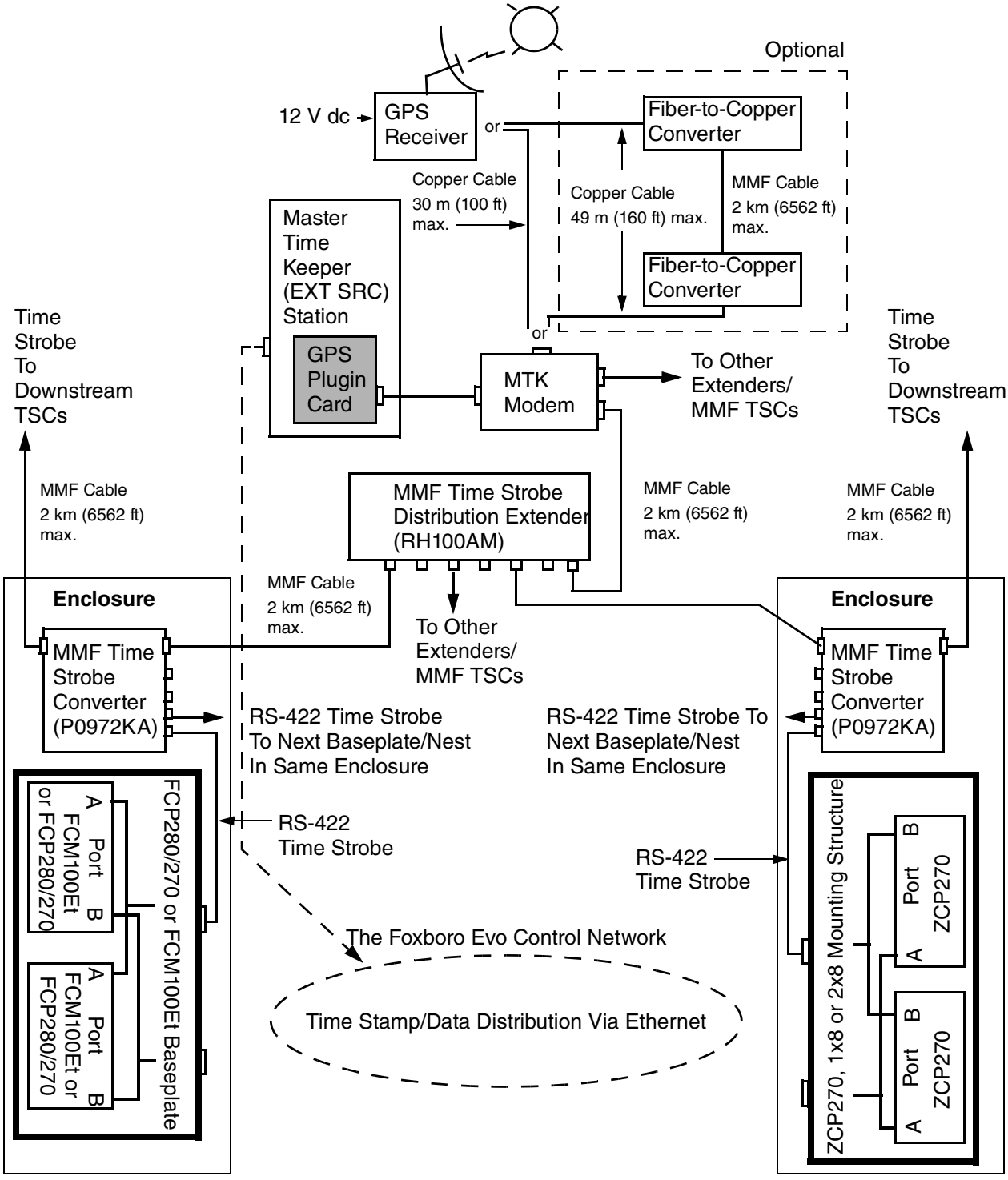



**Figure 3-3. Extended Time Strobe Network With Extenders (Non-redundant Shown)**

## Site-Wide Time Strobe Network

In this network configuration, the Master TimeKeeper modem sends the GPS time pulses to Time Strobe Distribution Extenders (RH100AN) via MMF cables in the same manner as the Extended Time Strobe Network. In contrast, the SMF outputs of this extender distribute the time pulses to six remote SMF-input TSCs (P0973BW) over SMF cables, which can range up to 10 km (6.2 mi), instead of MMF cables which are limited to 2 km (1.2 mi). The SMF-input TSCs also have a single MMF-compatible output port so they can forward the time pulse to a downstream MMF-input TSC via MMF cables. Each MMF connection (TSC-to-TSC) can be up to 2 km (1.2 mi) in length.

This configuration is optimal for an expansive plant, where time stamps are required to be distributed to small clusters apart from the central control room.

This is illustrated in Figure 3-4.

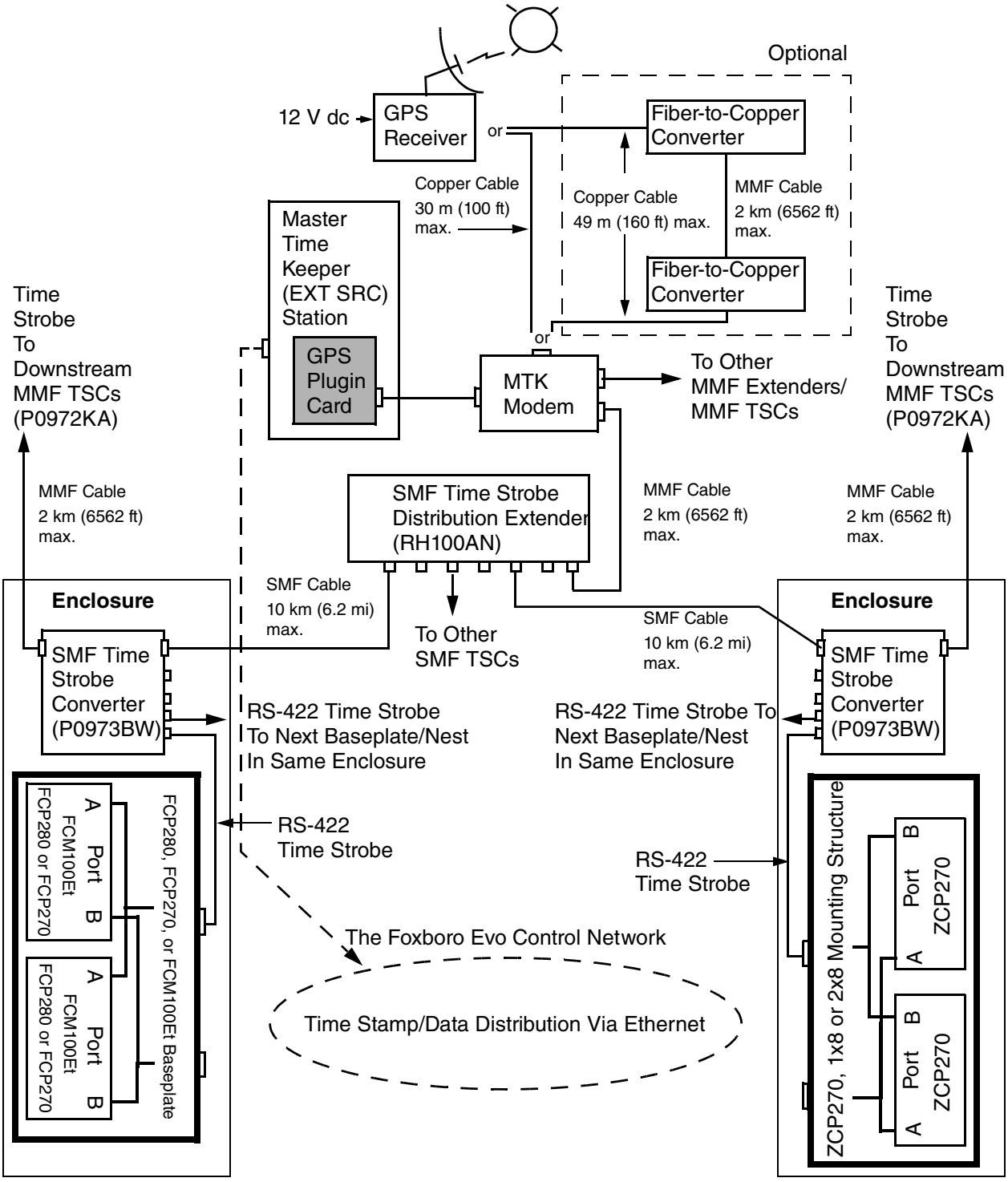



**Figure 3-4. Site-Wide Time Strobe Network (Non-Redundant Shown)**

# 4. Site Planning

*This chapter describes the equipment locations and cable distances for the purpose of planning for the installation of time synchronization equipment in a Foxboro Evo or I/A Series system.*

## Equipment Locations

### Time Strobe Pulse Distribution

For the Extended Time Strobe Network, a single fiber of 62.5/125 micron, multi-mode (MMF) fiber with ST connectors is needed for the time strobe pulse distribution. For the Site-Wide Time Strobe Network, a single fiber of 9/125 micron, single-mode (SMF) fiber with ST connectors is needed as discussed in "Site-Wide Time Strobe Network" on page 17.

Connection between the MTK modem and the TSC module or the Time Strobe Distribution Extender, and between TSC modules is made with a single MMF cable [2 km (6562 ft) maximum] with ST-type connectors. The MTK modem has two ST-type fiber outputs to allow connection to up to two MMF-compatible TSC modules or two MMF-compatible Time Strobe Distribution Extenders. These extenders (RH100AM) may connect to additional MMF-compatible extenders over MMF cable. There is no limit to the number of fiber optic cable segments that can be daisy chained except that each segment length cannot exceed 2 km (6562 ft).

In the Site-Wide Time Strobe Network, the SMF-output extenders connect to up to six of the SMF-compatible TSC modules (P0973BW) over SMF cable [10 km (6.2) maximum]. The MMF inputs of the RH100AN SMF-output extenders only support MMF cables (from the MTK modem). Therefore, SMF-output extenders cannot be daisy-chained together.

Both types of TSC modules are daisy-chained to downstream MMF-input TSCs by connecting an MMF cable from the output of one to the input of the next. There is no limit to the number of fiber optic cable segments that can be daisy chained except that each segment length cannot exceed 2 km (6562 ft). MMF outputs from a TSC module can be input into an MMF-compatible Time Strobe Distribution Extender.

In a system with ZCP270s, both the ZCP270 and its associated FCM100Et must receive a time strobe signal for time synchronization.

**— NOTE**

For workstation or server installation, refer to the *Hardware and Software Specific Instructions* document included with your workstation or server.

The equipment used for generation and distribution of the time strobe can be located in the locations listed in Table 4-1.

**Table 4-1. Equipment Locations**

| Equipment | Location | Notes |
|---|---|---|
| GPS Antenna | Outdoor | Within 30 m (100 ft) of MTK modem (MTK station) or copper wire-to-fiber converter. When using the copper wire-to-fiber converter, the antenna cable must be run inside metal conduit and the conduit must be grounded. Customer is responsible for supplying, installing and grounding metal conduit. See "GPS Antenna/Receiver Installation" on page 61 and "GPS Fiber Optic Isolator Installation" on page 62. |
| Optional - Copper to Fiber Power Supply | Indoor or Sheltered Enclosure | Shelf, table top, or enclosure mounted within 2 m (6 ft) of copper-to-fiber converter and 2m (6 ft) of a power outlet |
| Optional - Copper to Fiber Transmitter | Indoor or Sheltered Enclosure | Shelf, table top or enclosure mounted within 30 m (100 ft) of GPS antenna |
| Optional - Fiber to Copper Receiver | Indoor | Shelf or table top mounted within 3 m to 2 km (10 ft to 6562 ft) of copper-to-fiber converter/transmitter and within 0.3 m (1 ft) of MTK modem |
| MTK modem | Indoor | Connects to the back of the PCI card using a 0.3 m (1 ft) cable to a Windows workstation. |
| PCI card | Windows workstation | Inserts into a specific PCI slot in the workstation |
| Time Strobe Converter (MMF-compatible) | Inside enclosure | DIN rail or shelf mounted within 3 m to 2 km (10 ft to 6562 ft) of the MTK modem, or MMF-compatible Time Strobe Distribution Extender, or next enclosure and within 3 m (10 ft) of controller or baseplate |
| Time Strobe Converter (SMF-compatible) | Inside enclosure | DIN rail or shelf mounted within 10 km (10 ft to 6.2 mi) of the SMF-compatible Time Strobe Distribution Extender.<br>Within 3 m to 2 km (10 ft to 6562 ft) of next enclosure and within 3 m (10 ft) of controller or baseplate |
| Time Strobe Distribution Extender (MMF-compatible) | Indoor or Sheltered Enclosure | 19-inch rack or shelf mounted within 3 m to 2 km (10 ft to 6562 ft) of the MTK modem or TSC module or a daisy chain to another MMF-compatible extender. Within 3 m to 2 km (10 ft to 6562 ft) of enclosures containing Time Strobe Converter(s). |
| Time Strobe Distribution Extender (SMF-compatible) | Indoor or Sheltered Enclosure | 19-inch rack or shelf mounted within 3 m to 2 km (10 ft to 6562 ft) of the MTK modem.<br>Within 10 km (10 ft to 6.2 mi) of enclosures containing SMF-compatible Time Strobe Converter(s). |

Figure 4-1 on page 22 shows the distances for connecting the Time Strobe Generation equipment to control processors in a Foxboro Evo or I/A Series system.

# Equipment Size

Equipment sizes used for generation and distribution of the time strobe are listed in Table 4-2.

**Table 4-2. Equipment Size**

| Equipment | Size |
|---|---|
| GPS Antenna | 147 mm (5.8 inch) diameter, 100 mm (3.9 inch) high |
| Optional - Copper-to-Fiber Power Supply | 1.5 inch high, 4.0 inch deep, 2.0 inch wide (without connectors) |
| Optional - Copper-to-Fiber Transmitter | 1.3 inch high, 4.5 inch deep, 3.5 inch wide (without connectors) |
| Optional - Fiber-to-Copper Receiver | 1.3 inch high, 4.5 inch deep, 3.5 inch wide (without connectors) |
| MTK Modem | 1.0 inch high, 2.5 inch deep, 3.25 inch wide (without connectors) |
| Time Strobe Converter (any type) | 1.5 inch high, 4.0 inch deep, 3.5 inch wide (without connectors) |
| Time Strobe Distribution Extender (any type) | 1.75 inch high (1U), 7.5 inch deep, 16.8 inch wide (without connectors) |

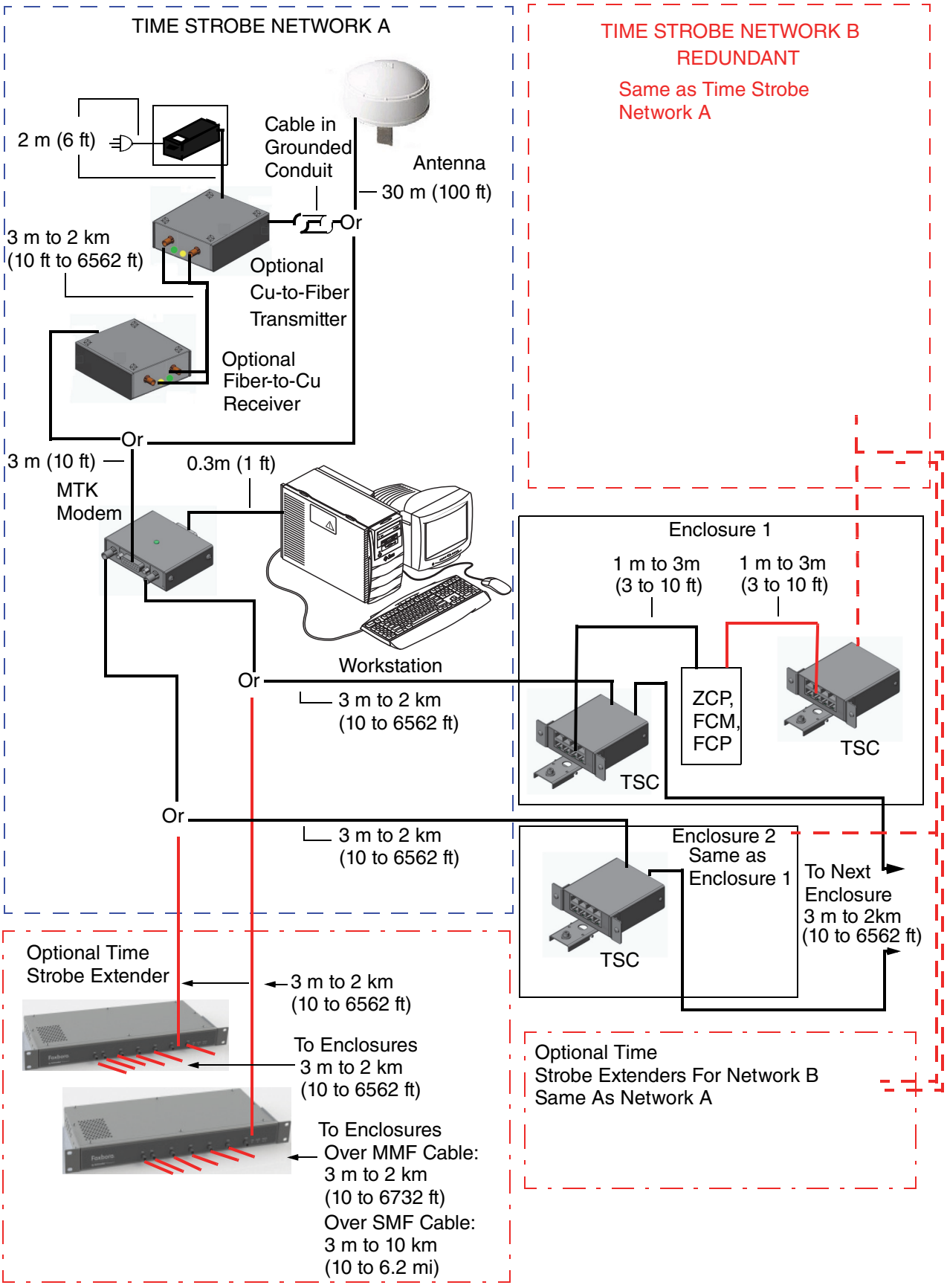



**Figure 4-1. Distances for Time Strobe Network Connections**

# Functional and Environmental Considerations

All equipment, except for the GPS antenna, is specified to operate in either a computer room or a control room with class G1 (mild) rating code (ISA® Standard S71.04). The GPS antenna is specified to operate outdoors.

For the standard Time Strobe Network component specifications (such as, operating temperature range, contamination class), refer to the Product Specification Sheet *Time Synchronization Equipment* (PSS 31H-4C2).

# Hardware Performance

## Time Strobe Communication Rates

The Time Strobe pulse width is 1 msec. The default rate of the time strobe signal is one pulse per five seconds. This time strobe signal is received and then re-transmitted through the Time Strobe Network.

## Transmission Delays

The time strobe signal delay through a single TSC module is less than 1 microsecond per each TSC. The propagation through the fiber is 5 microseconds per km.

The MTK modem contributes a 100 nsec signal propagation delay.

## Fiber Optic Power Budget

### *Multi-mode Fiber Optic Links*

The multi-mode fiber output power of both the MTK modem and the TSC is a minimum of -20 dbm. Both use 850 nm devices. The TSC uses a standard 10BASE-FL fiber transmitter and receiver. The receiver sensitivity of the TSC is -32 dbm, providing an optical power budget of 12 db. The loss from 2 km of 62.2/125 micron, multi mode fiber is 7 db. Therefore, the system has a margin of 5 db on each 2 km link for connectors and patch panels.

### *Single-mode Fiber Optic Links*

The single-mode fiber output power budget of the extender is 8 dB. A 10 km (6.2 mi) length of single-mode fiber optic cable has a loss of 3.5 dB, leaving a margin of 4.5 dB for connection losses and patch panels.

# Certifications

For the Time Strobe Network certifications, refer to the Product Specification Sheet *Time Synchronization Equipment* (PSS 31H-4C2).

# 5. Installation

*This chapter describes the procedures for installing the standard software and optional hardware for time synchronization in a Foxboro Evo or I/A Series system.*

## GPS Software and PCI Card Installation

The PCI card is ordered separately, as part of a kit, and must be installed into specified slots for the workstation (detailed in the workstation's *Hardware and Software Specific Instructions*).

You only install the PCI card(s) into the primary and backup Master TimeKeeper workstations as configured for MTK in the system configurators (Control Editors, SysDef, or IACC). Install the PCI card and Time Card Driver in the following sequence:

**— NOTE**

Refer to the appropriate documentation supplied with your workstation for detailed installation instructions. These instructions may vary from the instructions provided below.

1. If the system software is running, shut down the software before installing the PCI card (refer to "Turn Off I/A Series Software or Foxboro Evo Control Core Services Software" below).
2. Install the PCI card into the primary and backup workstations (refer to "Installing the PCI Card" on page 26 and to the appropriate documentation supplied with your workstation for detailed installation procedures).
3. Install the Spectracom®/KSI TSAT-PCI GPS System media which accompanies the PCI time card on the primary and backup workstations (refer to "Installing the Time Card Driver and Control Utility" on page 28.)
4. If required, install the Spectracom/KSI TPRO/TSAT-PCI Control Utility and execute the desired utility (refer to "Installing the Time Card Driver and Control Utility" on page 28 and "Executing the Spectracom/KSI TPRO/TSAT-PCI Control Utility for Windows XP" on page 55).
5. If required, start up the system software (refer to "Turn On I/A Series Software or Foxboro Evo Control Core Services Software" on page 59, or refer to the appropriate documentation supplied with your workstation for detailed hardware/software procedures).

## Turn Off I/A Series Software or Foxboro Evo Control Core Services Software

If the system software is running and you are installing the PCI card in a supported Control Core Services workstation or I/A Series workstation, shut down the system software before starting the PCI card installation.

Refer to the appendix "Shutting Down [*I/A Series or Control Core Services*] Software" or "[*Foxboro Evo* or *I/A Series*] Software Startup Options" in the *Hardware and Software Specific Instructions* document included with your workstation for additional information on setting the I/A Series software or Control Core Services software startup to "off" or "on".

To turn off the Control Core Services software or I/A Series software, proceed as follows:

1. From the Start menu, open the Control Panel and select **`Foxboro I/A`** or **`I/A Series Software Startup Options`**.
2. Select the **`Autologon`** option from the I/A Series Off group.
3. Click **`OK`**, and then reboot the station.

## Installing the PCI Card

The PCI card is ordered separately and must be installed into the slot specified for the workstation.

You install the PCI card into only the primary and backup Master TimeKeeper workstations as configured for MTK in the Foxboro Evo system configurators (Control Editors, SysDef, or IACC).

**⚠ CAUTION**

Always power down the host computer before installing or removing any hardware. Consider the effects on process control before powering down the equipment.

The PCI card has three versions: an older 5 V dc type and two versions of the 3.3 V dc type. Each one has the Foxboro® part number P0972VY.

All versions of the card have configuration jumpers present on the board:

- The 5 V dc version (TPRO-cPCI/TSAT-cPCI) has a single jumper marked as JP10, and all other jumper pins are empty. Verify that the jumpers are installed as shown in Figure 5-1 for the 5 V dc version of the PCI card.
- There are two 3.3 V dc versions of the card; the first (TPRO-PCI-U/TSAT-PCI-U) and the newest version (TPRO/TSAT PCI-33U/-66U). Each has multiple configuration jumpers. The first (TPRO-PCI-U/TSAT-PCI-U) should be configured as shown in Figure 5-2. The newest version (TPRO/TSAT PCI-33U/-66U) should be configured as shown in Figure 5-3. Verify the placement of jumpers before installing the card.

**NOTE**

Workstations which support Windows 7 or later operating systems may only use the 3.3 V dc versions of the card.

Not all jumper numbers are designated on the board. The newest version (TPRO/TSAT PCI-33U/-66U) of the card is identified by the additional component SW1 switch on the board.

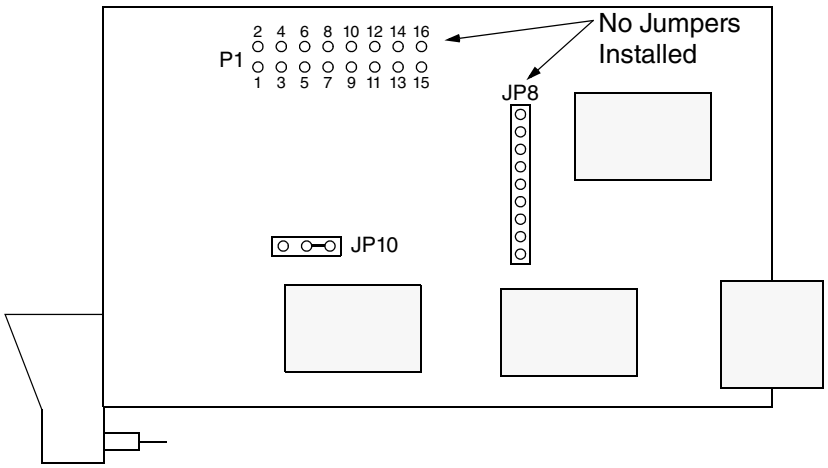
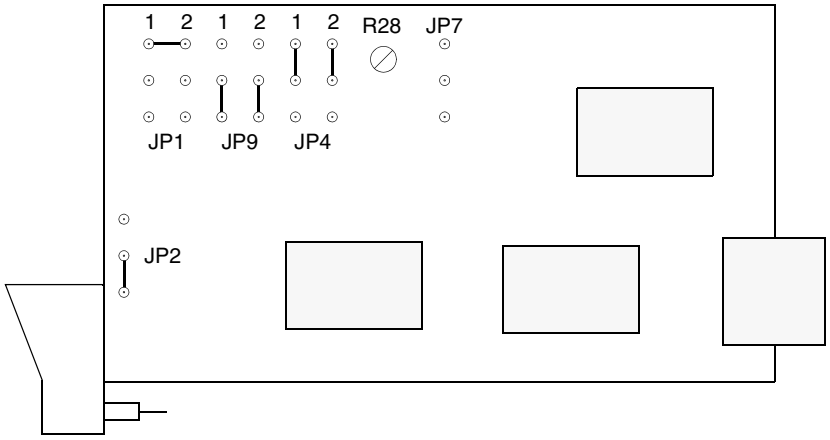
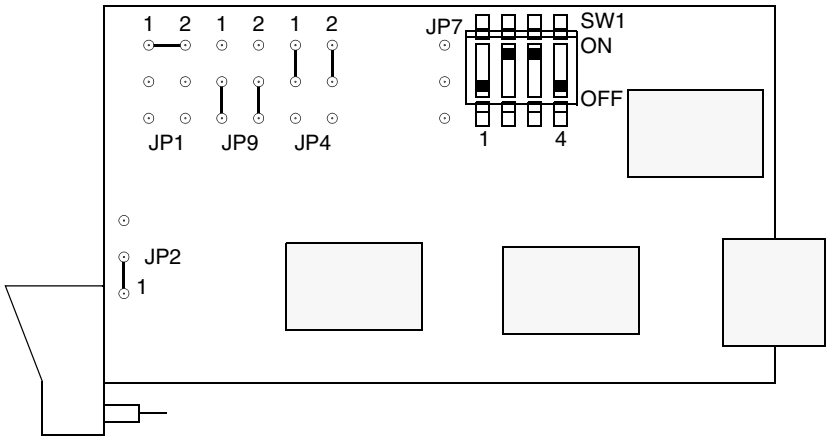



**Figure 5-1. PCI Board Jumpers: 5 V dc Version (TPRO-cPCI/TSAT-cPCI)**




| TSAT OPTIONS | JP1 | JP2 | JP4 | JP7 | JP9 |
|---|---|---|---|---|---|
| TSAT-PCIU-FXA | 1-2 | 1-2 | 1-3,2-4 | None | 3-5,4-6 |

**Figure 5-2. PCI Board Jumpers: 3.3 V dc Version (TPRO-PCI-U/TSAT-PCI-U)**




| TSAT OPTIONS | DIP SETTING SW1 (1.2.3.4) | JP1 | JP2 | JP4 | JP7 | JP9 |
|---|---|---|---|---|---|---|
| TSAT-PCIU-FXA | OFF,ON,ON,OFF | 1-2 | 1-2 | 1-3,2-4 | None | 3-5,4-6 |

**Figure 5-3. PCI Board Jumpers: 3.3 V dc Version with SW1 (TPRO/TSAT PCI-33U/-66U)**

To install the PCI card:

1. Power down the workstation.
2. Verify that the jumpers are installed on the PCI card as shown in Figure 5-1 for the 5 V dc version, Figure 5-2 for the first (TPRO-PCI-U/TSAT-PCI-U) 3.3 V dc version of the PCI card or Figure 5-3 for the newest version (TPRO/TSAT PCI-33U/-66U) of the 3.3 V dc version of the PCI card.
3. Install the PCI card in the Windows workstation.

   Refer to the *Hardware and Software Specific Instructions* documentation supplied with your workstation for determining the time cards I/O slot information.
4. Proceed to "Installing the Time Card Driver and Control Utility" on page 28.

**— NOTE**

For replacement procedures for this PCI card, refer to "Replacing Components" on page 99.

## Installing the Time Card Driver and Control Utility

The installation procedures for installing the Time Card Driver and Control Utility differ depending on the operating system of the Windows workstation in which the time card is installed. The two installation procedures are:

1. Windows XP Time Card Driver and Utility Installation.
2. Windows 7 Time Card Driver and Utility Installation.

The following notes apply to installing the Time Card driver and Control Utility.

**NOTE**

1. Install the Time Card driver and Control Utility only on workstations with I/A Series software v8.x or Control Core Services software v9.0 or later, and also have the Spectracom/KSI time card already installed.
2. I/A Series software or Control Core Services software must be shut down prior to installing the time card driver and control utility software.
3. Only the TPRO/TSAT PCI-33U/-66U version of the time card is supported in workstations with I/A Series software v8.8 or Control Core Services software v9.0 or later (which have the Windows 7 operating system).

To complete installation, you must install the control utility application and driver for the Spectracom/KSI time card included on the media included with the PCI time card. If your V8.x system has a time card, the Windows operating system must recognize that the card is installed in the computer before you are allowed to install the card's driver.

You should install the time card's driver before I/A Series software or Control Core Services software installation, if possible. Otherwise, make sure you shut down I/A Series software or Control Core Services software before installing the PCI card (see "Turn Off I/A Series Software or Foxboro Evo Control Core Services Software" on page 26).

Prior to installing the driver, the Spectracom/KSI time card appears on selecting the **Device Manager** node, under **Other Devices** as either **PCI Device** or **Other PCI Bridge Device** (see Figure 5-4).

To view the Device Manager, right-click the **My Computer** icon on the desktop, select the **Manage** pick, and then select the **Device Manager** pick under the **System Tools** tab. The Device Manager appears as shown in Figure 5-4.

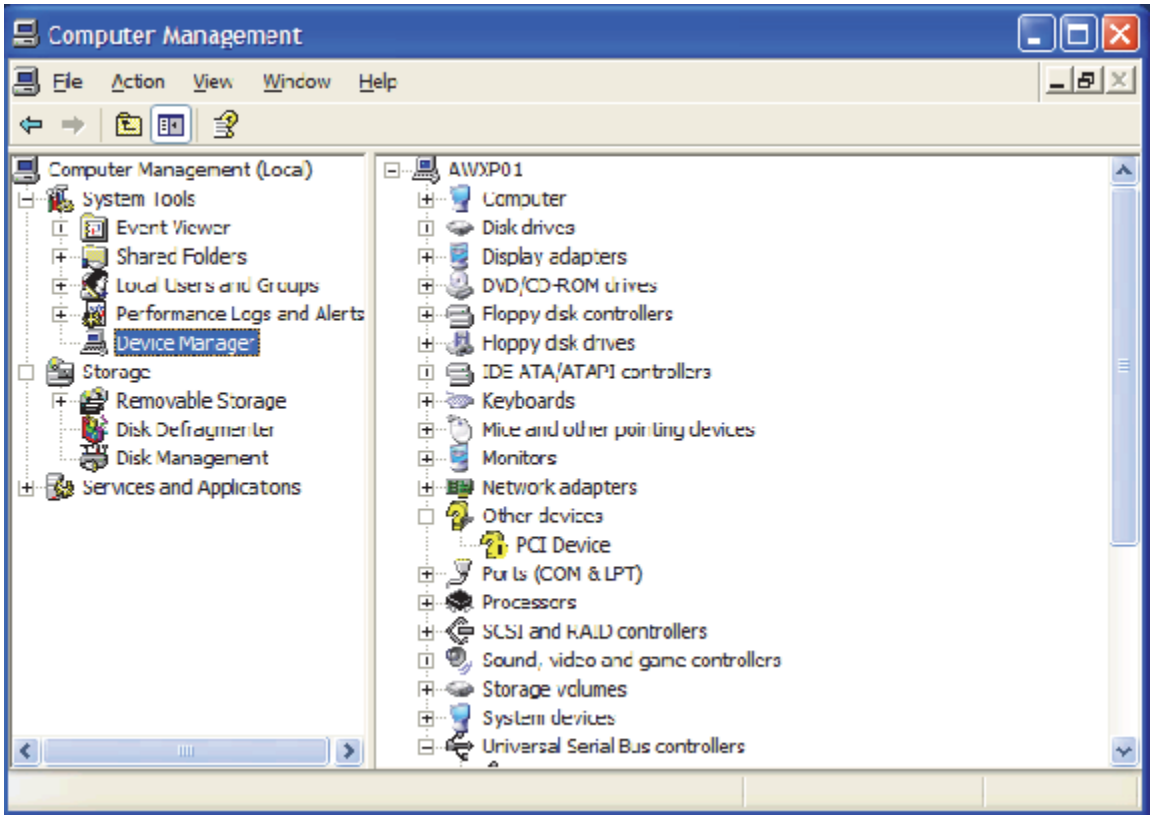



**Figure 5-4. Spectracom/KSI Time Card in the Device Manager**

## *Windows XP Time Card Driver and Utility Installation*

When a Windows XP station is initially booted with a time card installed, the Plug-and-Play wizard recognizes the new hardware. At this point, you can install the Spectracom/KSI time card driver by performing the following steps:

1. Identify which version of the Spectracom/KSI time card driver you need to install, from Table 5-1.

**Table 5-1. Spectracom/KSI Time Card Driver Versions for Windows XP Systems**

| Spectracom/KSI Time Card Type | Spectracom/KSI Time Card Driver Version | Foxboro CD-ROM Part Number |
|---|---|---|
| TPRO-cPCI/TSAT-cPCI - (see Figure 5-1) | V1.21 | n/a |
| TPRO-PCI-U/TSAT-PCI-U - (see Figure 5-2) | V1.40 | K0174HJ |
| TPRO/TSAT PCI-33U/-66U - (see Figure 5-3) | V1.40 | K0174HJ |

2. After the Plug-and-Play wizard recognizes the new hardware, the Welcome to the Found New Hardware Wizard window appears. Select **`No, not at this time`** and select **`Next`**. See Figure 5-5.


**Figure 5-5. Welcome to the Found New Hardware Wizard**

3. Select **`Install from a list or specific location (Advanced)`**, and select **`Next`**. See Figure 5-6.

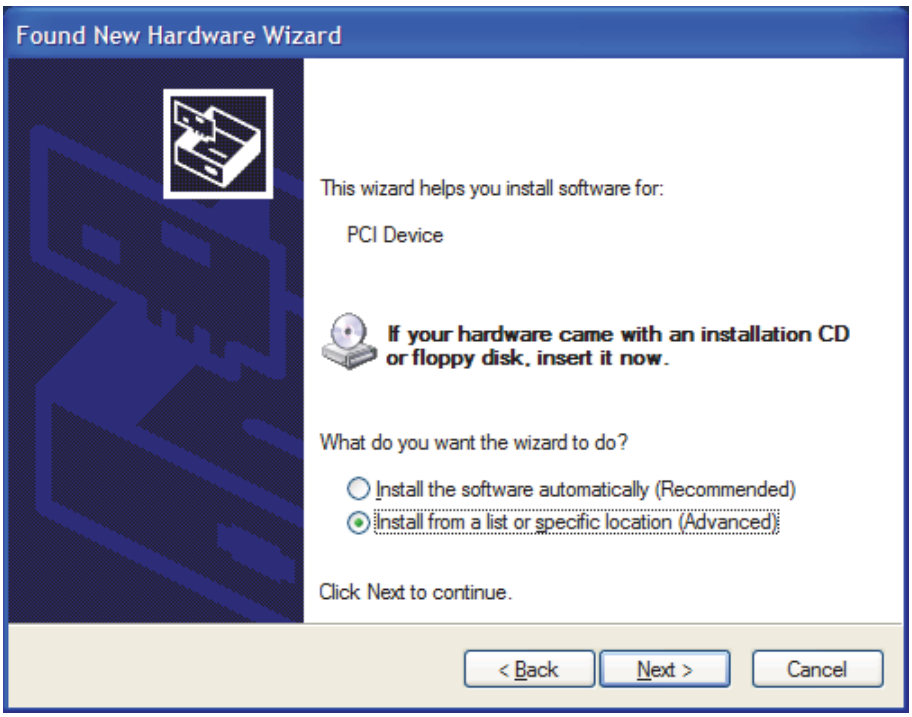



**Figure 5-6. Found New Hardware Wizard - Install from Specific Location**

4. Select **Don't search, I will choose the driver to install** and select **Next**. See Figure 5-7.

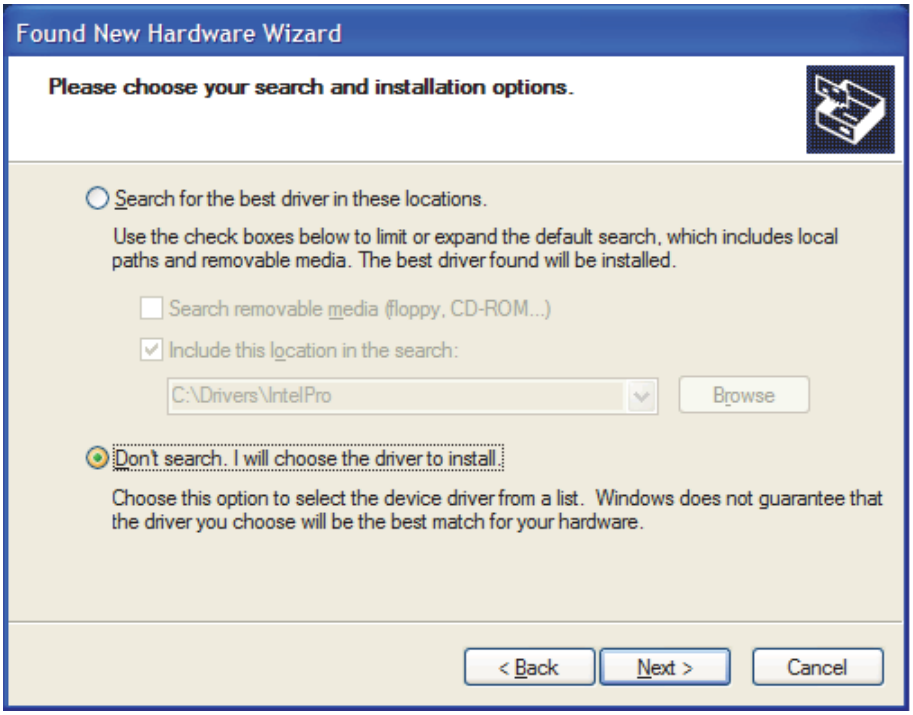



**Figure 5-7. Found New Hardware Wizard - Will Choose Driver**

5. In the **Common hardware types** field, select **Next**. See Figure 5-8.

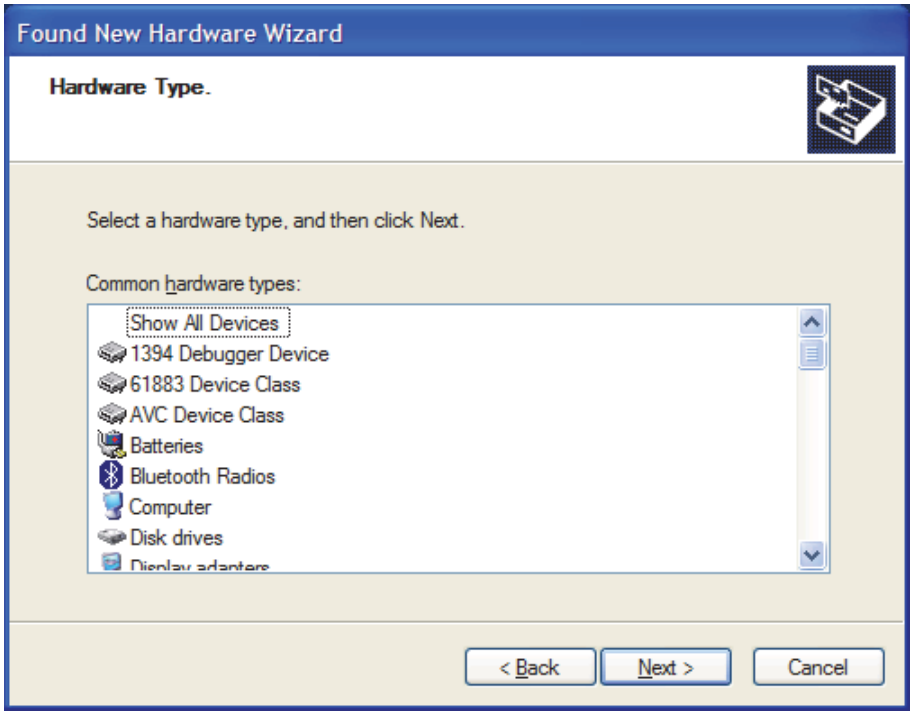



**Figure 5-8. Found New Hardware Wizard - Common Hardware Types**

6. Select **Have Disk** and select **Next**. See Figure 5-9.

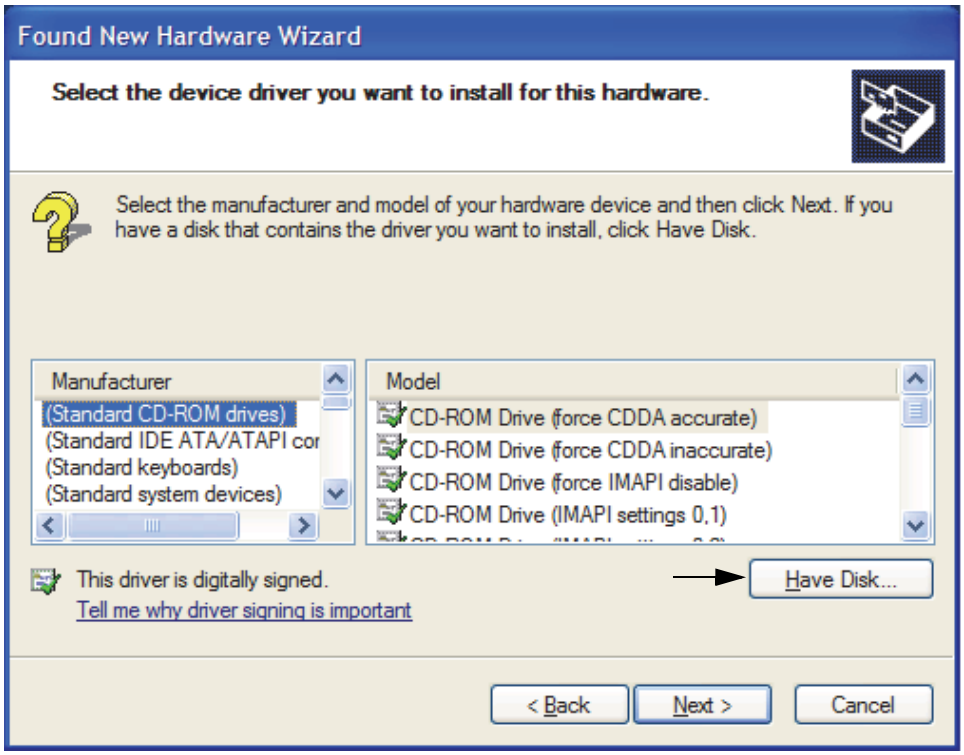



**Figure 5-9. Found New Hardware Wizard - Select Have Disk**

7. Select **Browse**. See Figure 5-10.

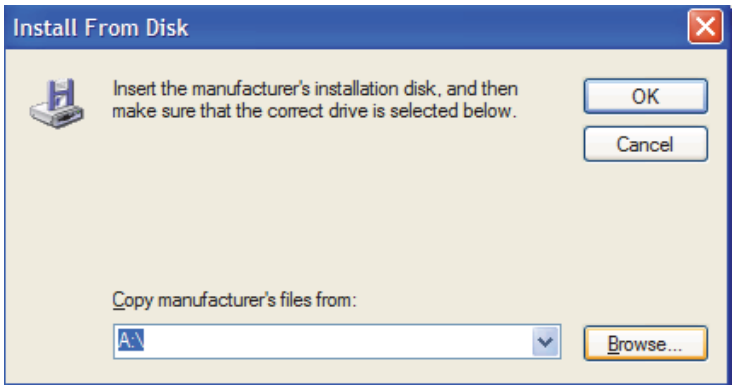



**Figure 5-10. Install from Disk Dialog Box**

8. Select the CD-ROM device (E:\). In the CD-ROM, select **tpro.inf** and select **Open**. See Figure 5-11.

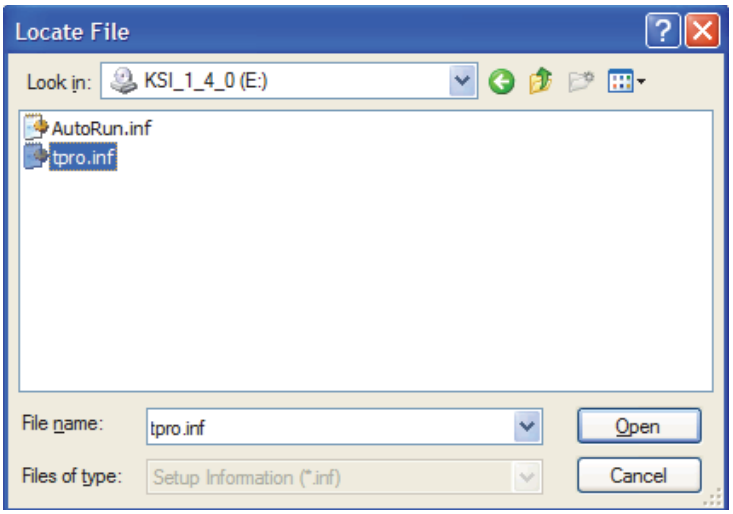



**Figure 5-11. Locate File Dialog Box**

9. Select **OK**. See Figure 5-12.

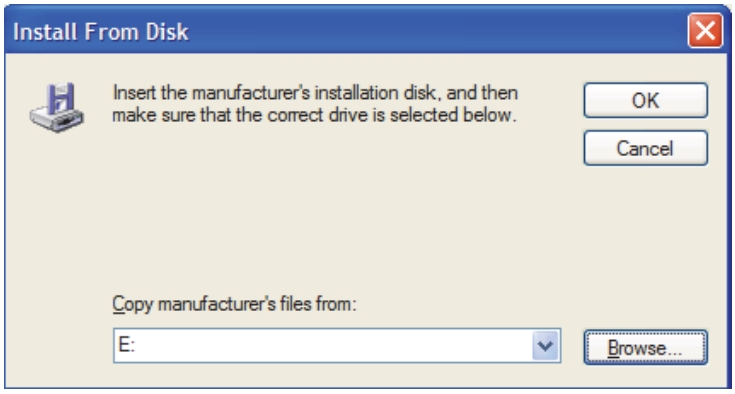



**Figure 5-12. Install from Disk Dialog Box - Driver Selected**

10. Select **`Spectracom TSAT PCI-FXA Timing board`** and select **`Next`**. See Figure 5-13.

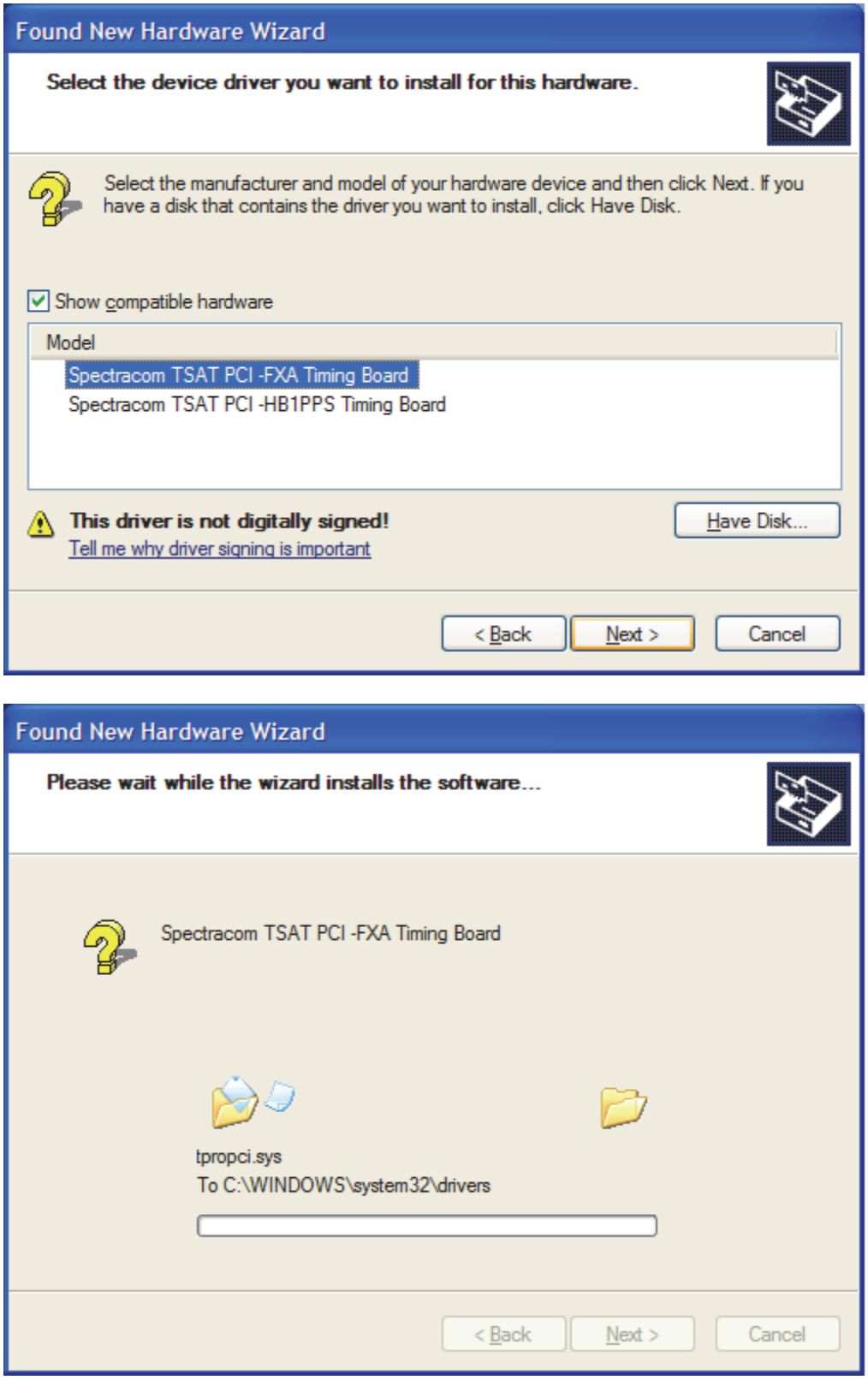



**Figure 5-13. Found New Hardware Wizard - Compatible Hardware**

11. In the Completing the Found New Hardware window, select **Finish**. See Figure 5-14.

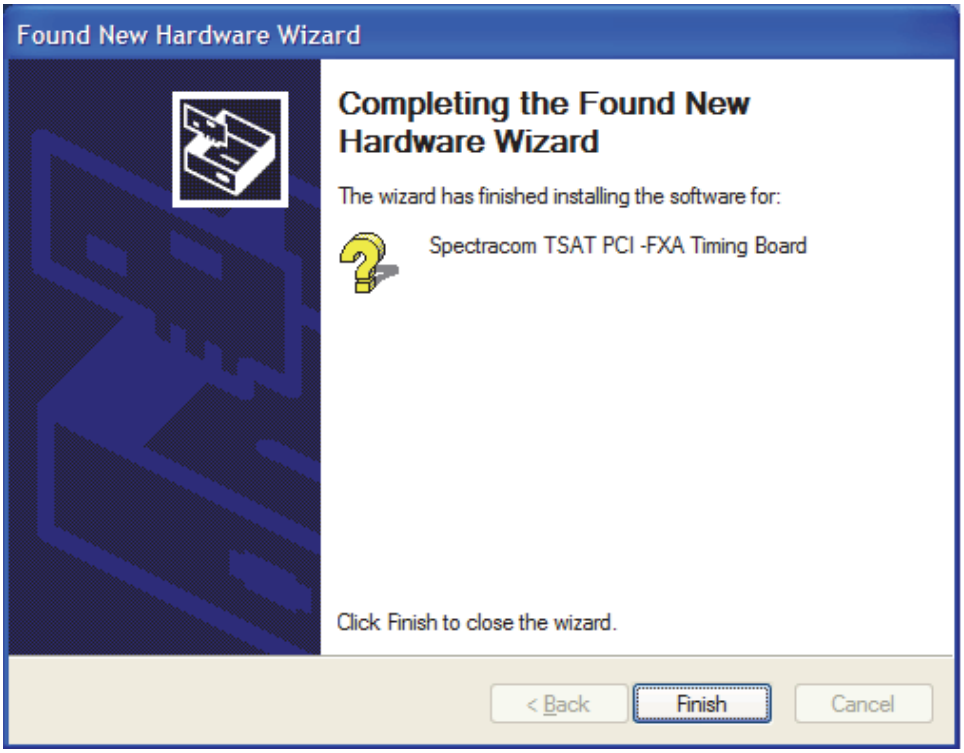



**Figure 5-14. Found New Hardware Wizard - Completed**

You have completed installation of the Spectracom/KSI time card driver.

Upon completion of the driver installation, the Spectracom/KSI timing card appears as **Spectracom TSAT PCI-FXA Timing Board** under **Timing Boards** in the Device Manager. See Figure 5-15.

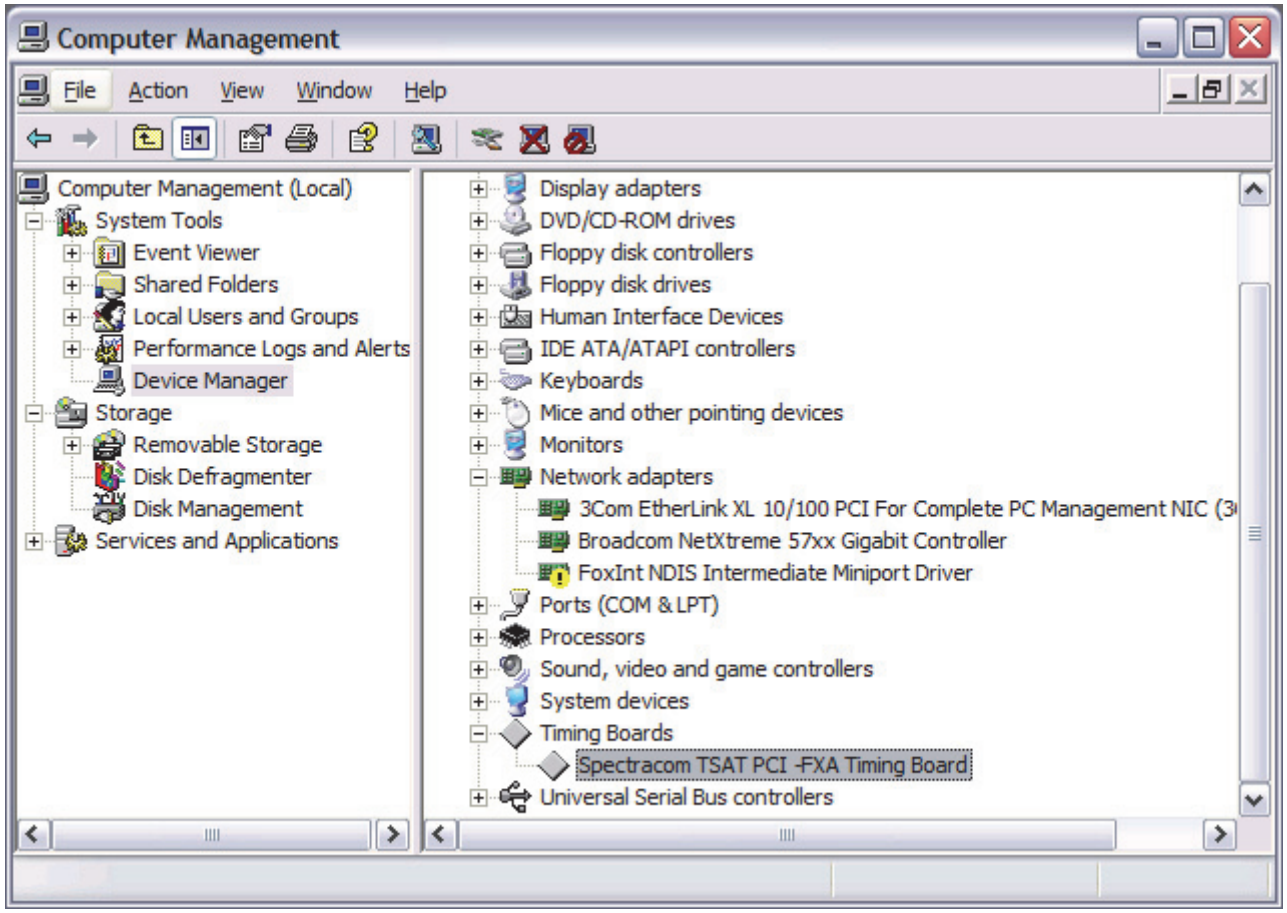



**Figure 5-15. Spectracom TSAT PCI-FXA Timing Board in Device Manager**

### Installing the Spectracom/KSI TPRO/TSAT-PCI Control Utility for Windows XP Stations

To install the Spectracom/KSI TPRO/TSAT-PCI Control Utility, proceed as follows:

1. Install the Spectracom/KSI CD-ROM in the CD-ROM drive and select **`Start`** > **`Run`**.
2. Type *<drive letter>***`:\setup`** (where *<drive letter>* is the CD-ROM drive).
3. Select **`Next`**. See Figure 5-16.

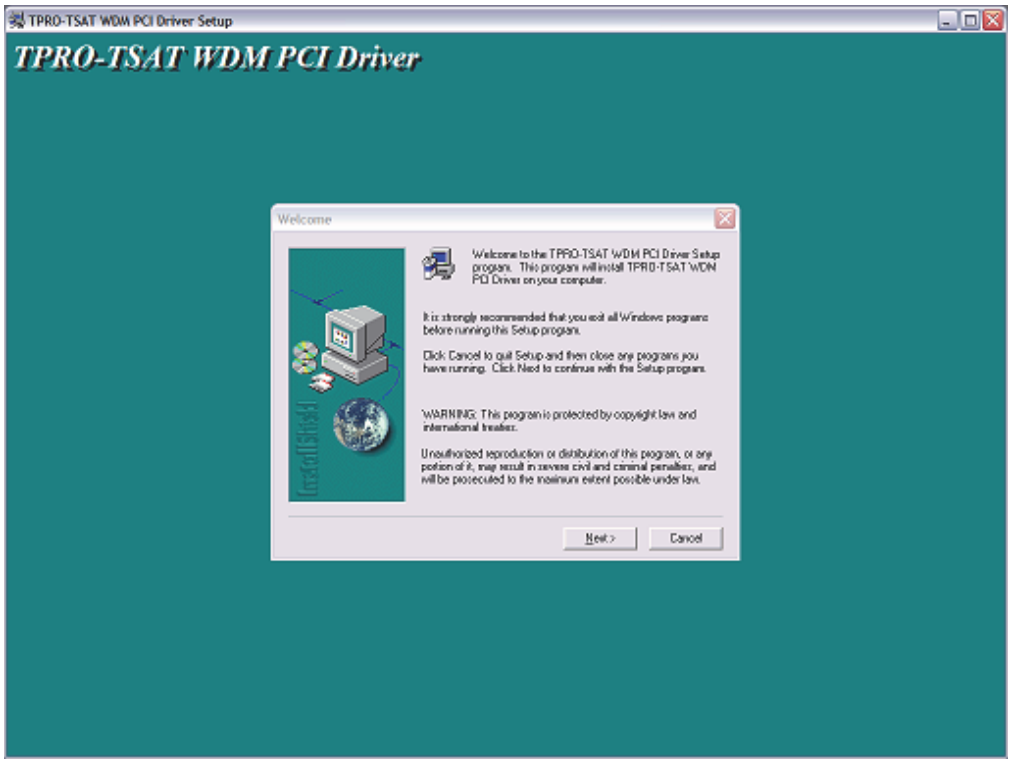



**Figure 5-16. TPRO-TSAT WDM PCI Driver Installation Progress**

4. Select **`Finish`**. See Figure 5-17.

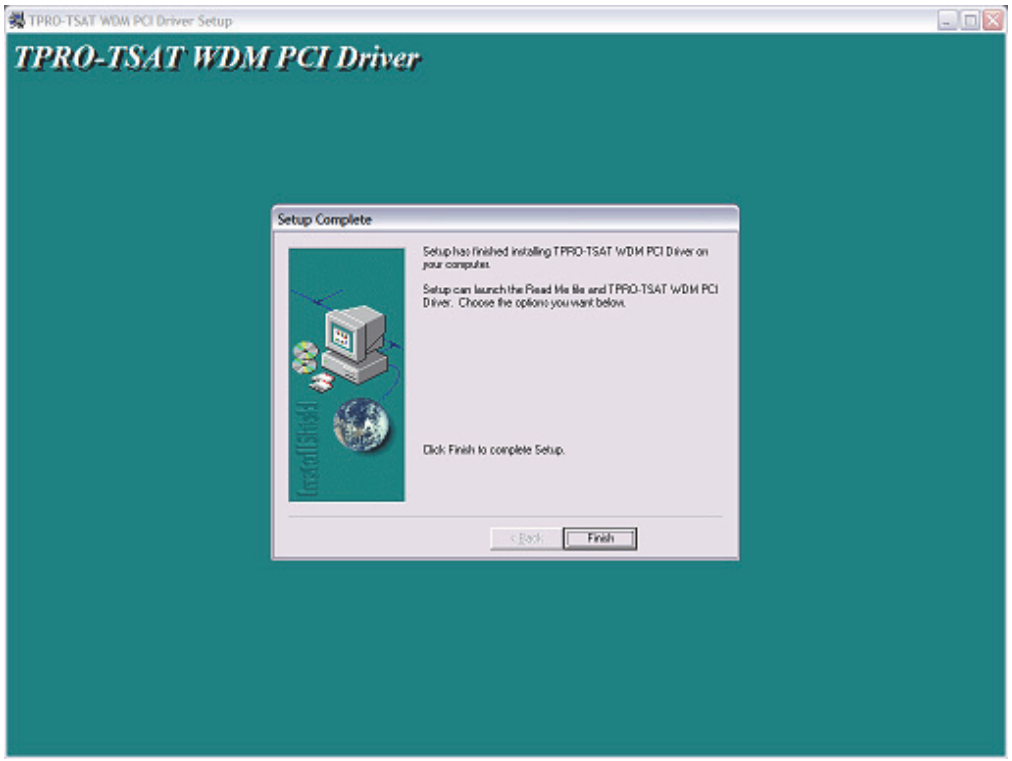



**Figure 5-17. TPRO-TSAT WDM PCI Driver Installation Completion**

You have completed installation of the Spectracom/KSI TPRO/TSAT-PCI Control Utility.

## *Windows 7 Time Card Driver and Utility Installation*

The following sections describe how to install the Spectracom Time Card driver and the Spectracom/KSI TPRO/TSAT-PCI Control Utility on workstations with the Windows 7 operating system.

### Installing the Spectracom Time Card Driver

Table 5-2 identifies the driver version of the Spectracom Time Card driver and CD-ROM media used for installation.

**Table 5-2. Spectracom Time Card Driver Versions for Windows 7**

| Spectracom Time Card Type | Spectracom Time Card Driver Version | Foxboro CD-ROM Part Number |
|---|---|---|
| TPRO/TSAT PCI-33U/-66U - (see Figure 5-3 on page 28) | V2.30 | K0174JM |

The Windows 7 operating system must recognize the card is installed in the station before you are allowed to install the card's driver.

You should install the Time Card's driver and Control Utility software before I/A Series software or Control Core Services software installation. Otherwise, make sure you shut down I/A Series software or Control Core Services software before installing the PCI card (see "Turn Off I/A Series Software or Foxboro Evo Control Core Services Software" on page 26).

Install the Spectracom Time Card driver as follows:

1. Insert the CD-ROM, part number K0174JM, for the Spectracom driver V2.30 in the CD/DVD drive.
   If the Autoplay wizard pops up, click **`Cancel`** and skip to step 2.
2. Click **`Start`** -> **`Control Panel`**, and then double-click **`Device Manager`**. The Device Manager opens.

3. In the Device Manager, the Spectracom time card appears under Other Devices as "PCI Device", appears as shown in Figure 5-18.

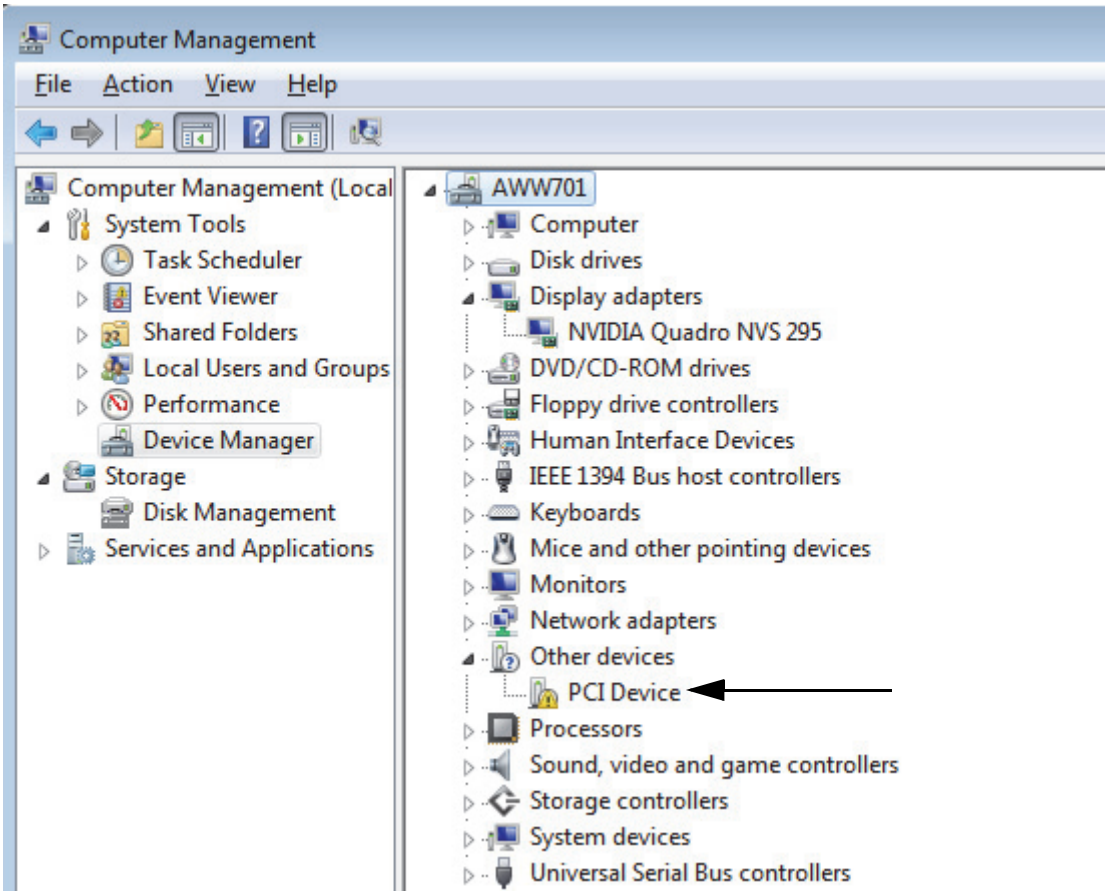



**Figure 5-18. Device Manager Other Devices PCI Device Window**

4. Right-click the PCI Device and select **`Update Driver Software`** as shown in Figure 5-19.

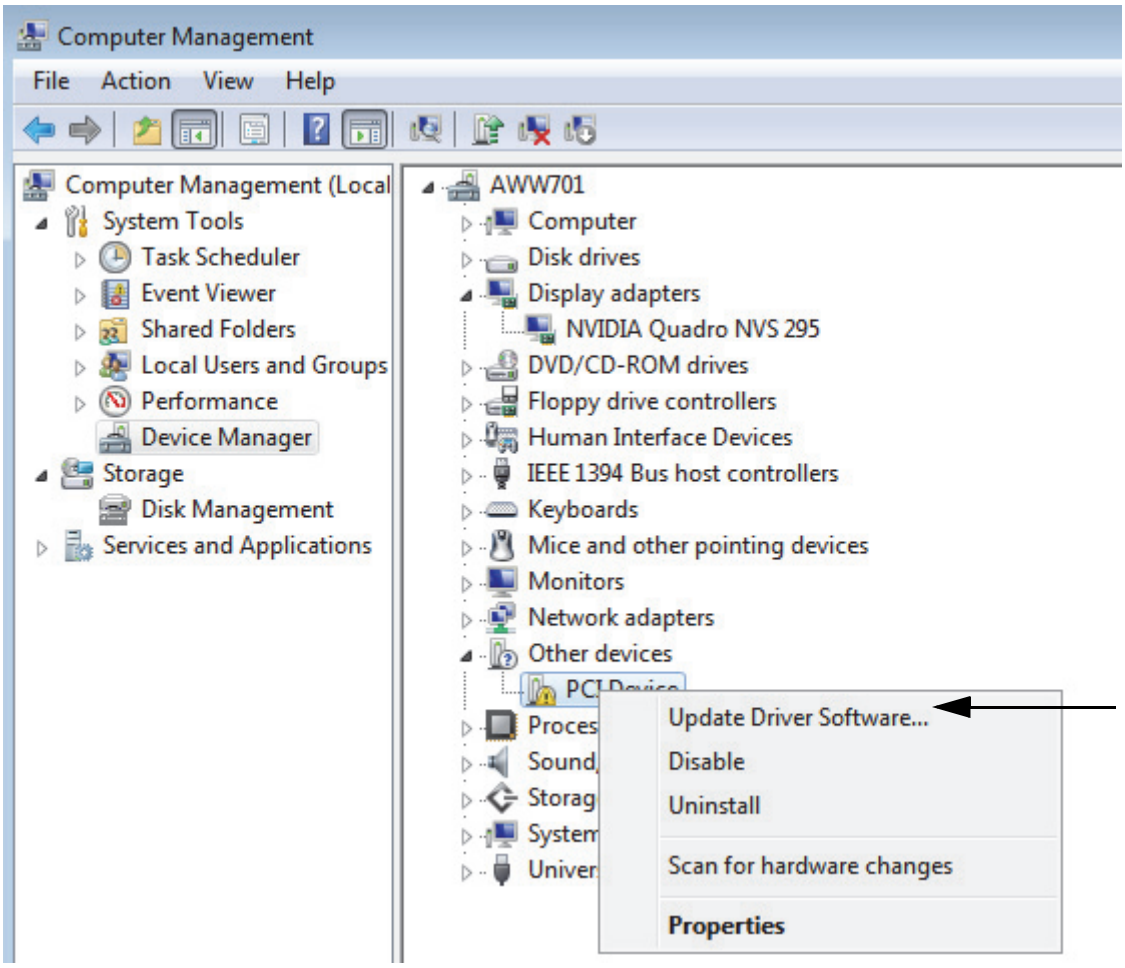



**Figure 5-19. Device Manager PCI Device Window**

5. Select **`Browse my computer for driver software`** as shown in Figure 5-20.

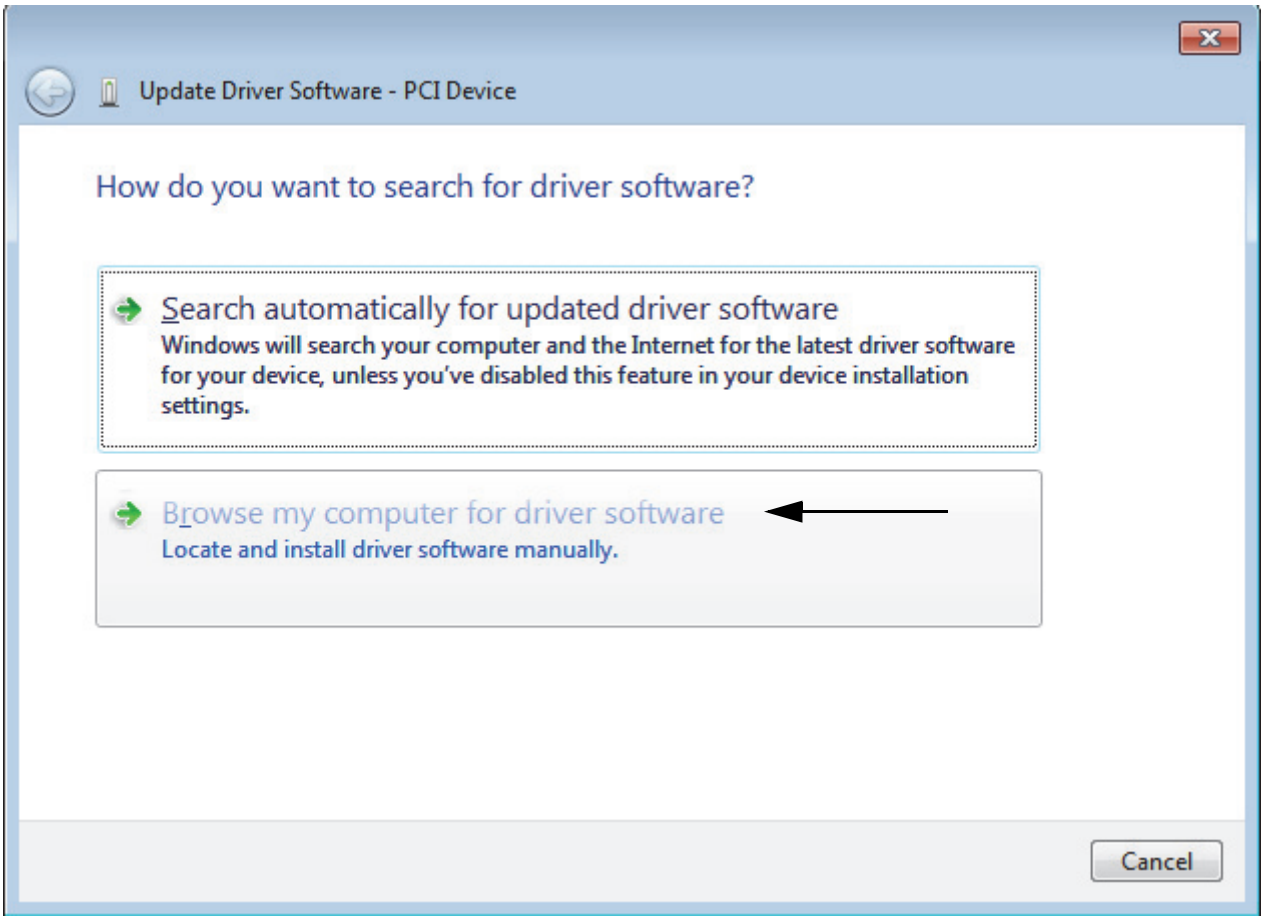



**Figure 5-20. Browse My Computer for Driver Software Window**

6. Select **`Let me pick from a list of device drivers on my computer`** as shown in Figure 5-21.

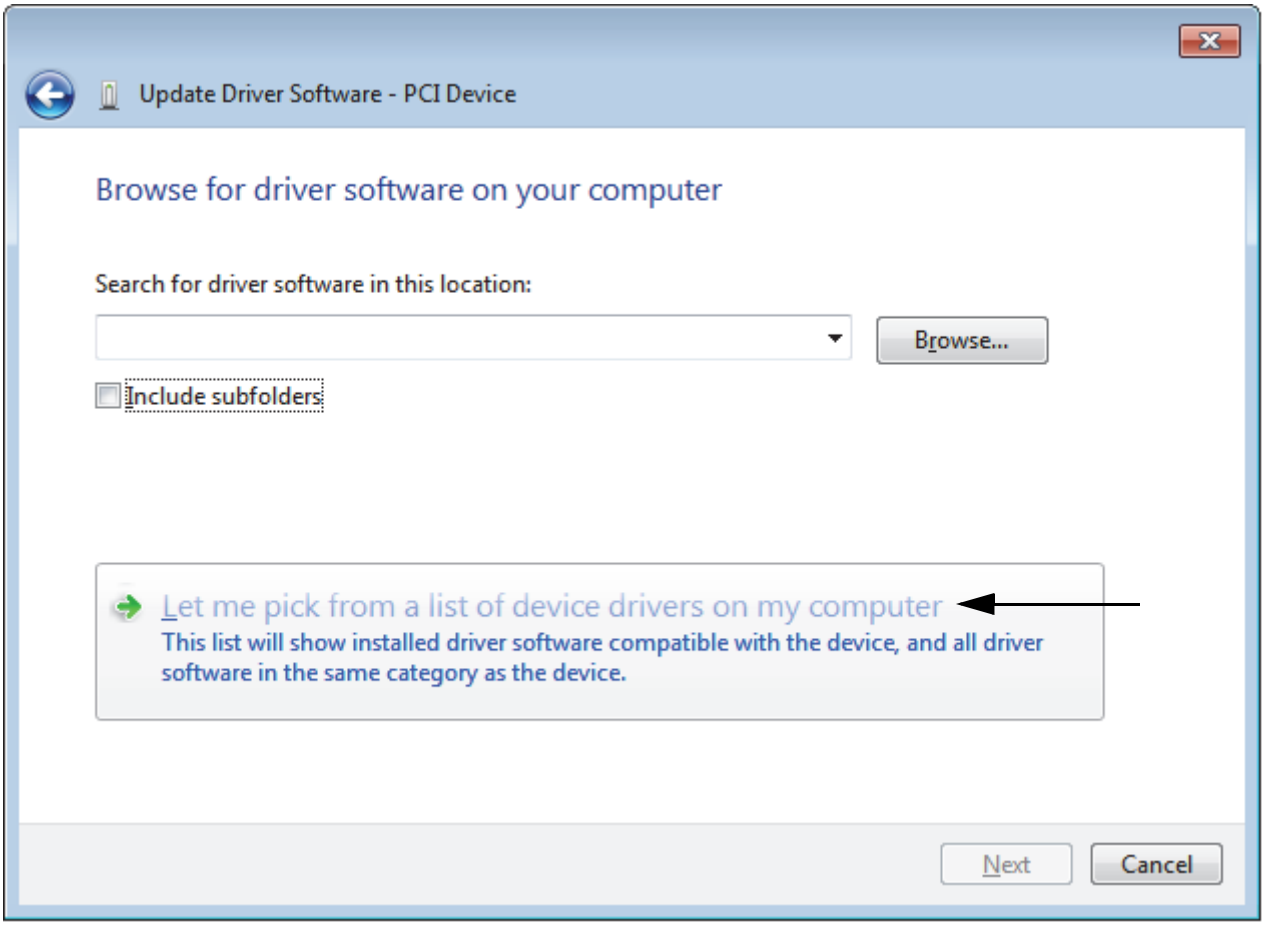



**Figure 5-21. Select To Choose From A List of Device Drivers**

7. Select **Show All Devices** then select **Next** as shown in Figure 5-22.

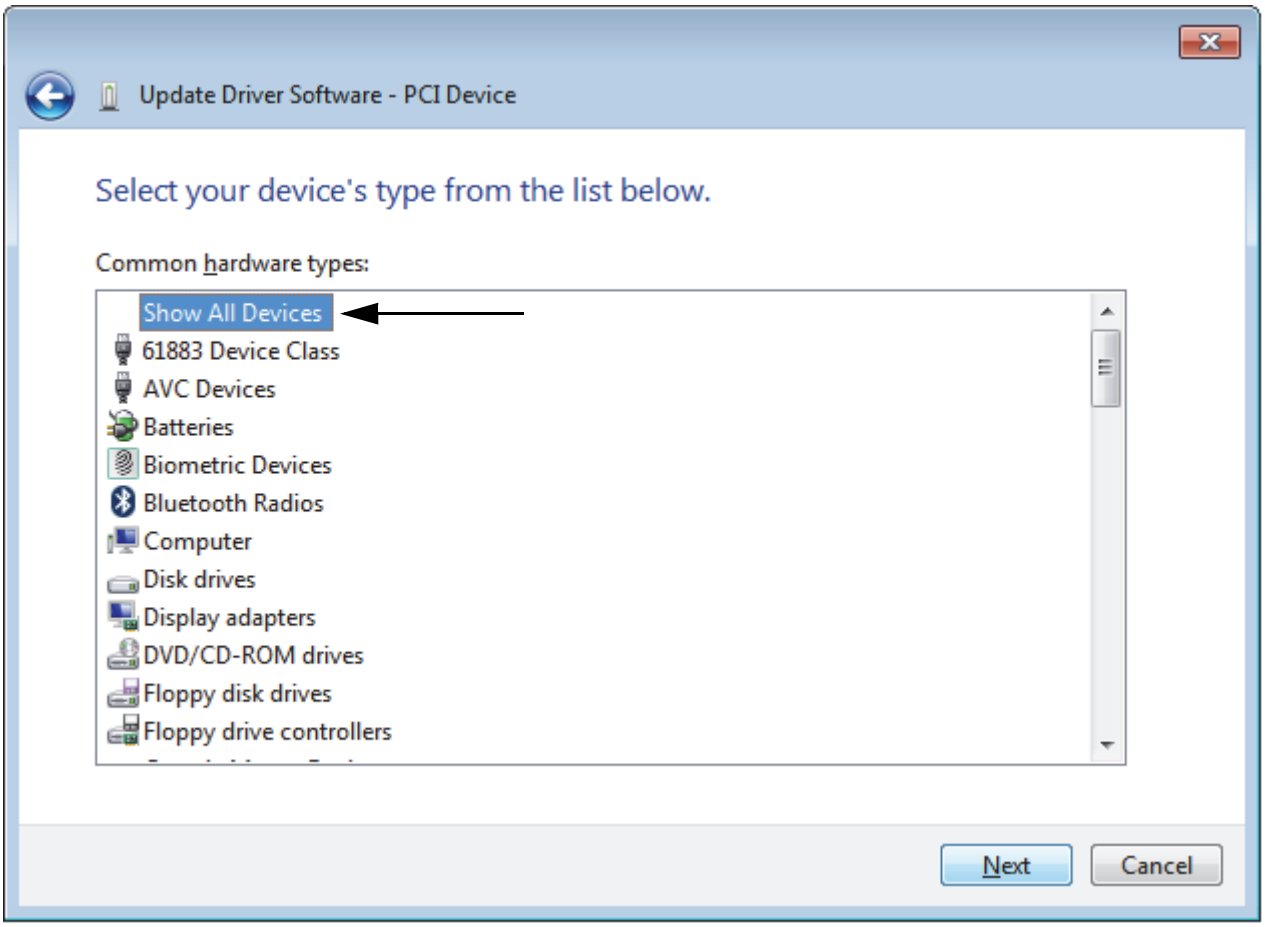



**Figure 5-22. Selecting Show All Devices**

8. Select **Have Disk** as shown in Figure 5-23.

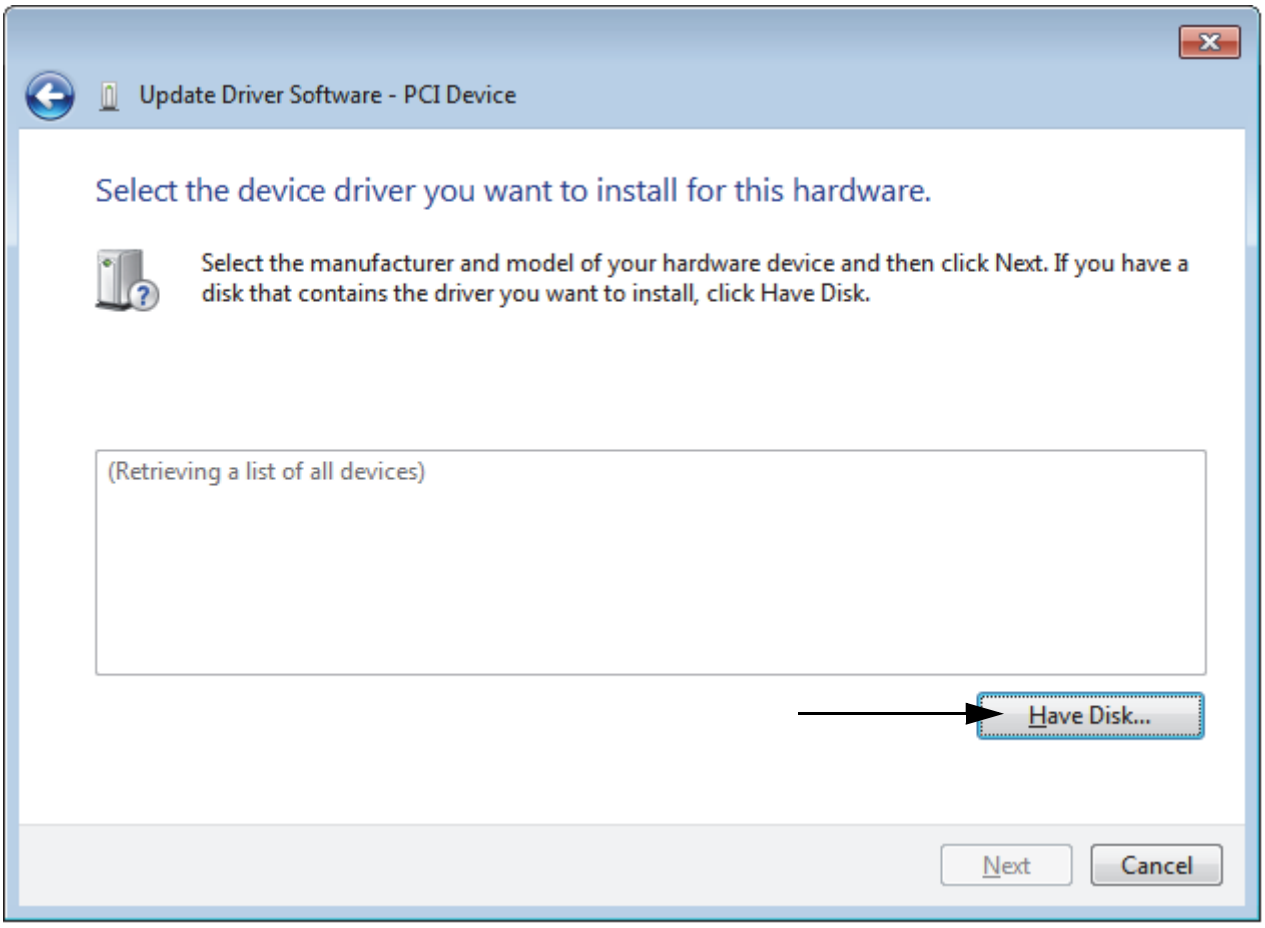



**Figure 5-23. Selecting Have Disk**

9. In the Install From Disk dialog box, select **Browse** and navigate to the folder: E:\Drivers\x64\Vista x64
Select the **TProPci.inf** file, select **Open** and then select **OK**, as shown in Figure 5-24.

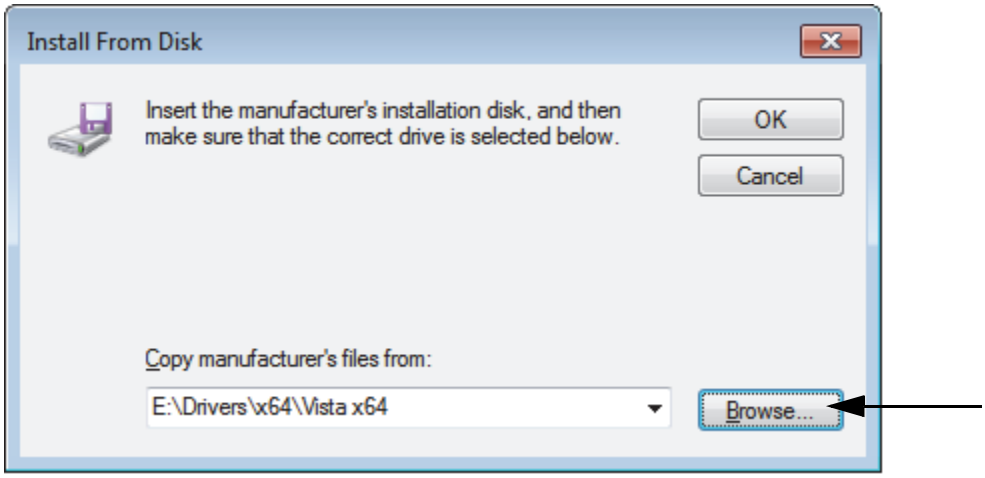



**Figure 5-24. Install From Disk**

10. Select the **Spectracom TSAT PCI-FXA Timing Board** and select **Next**. See Figure 5-25.

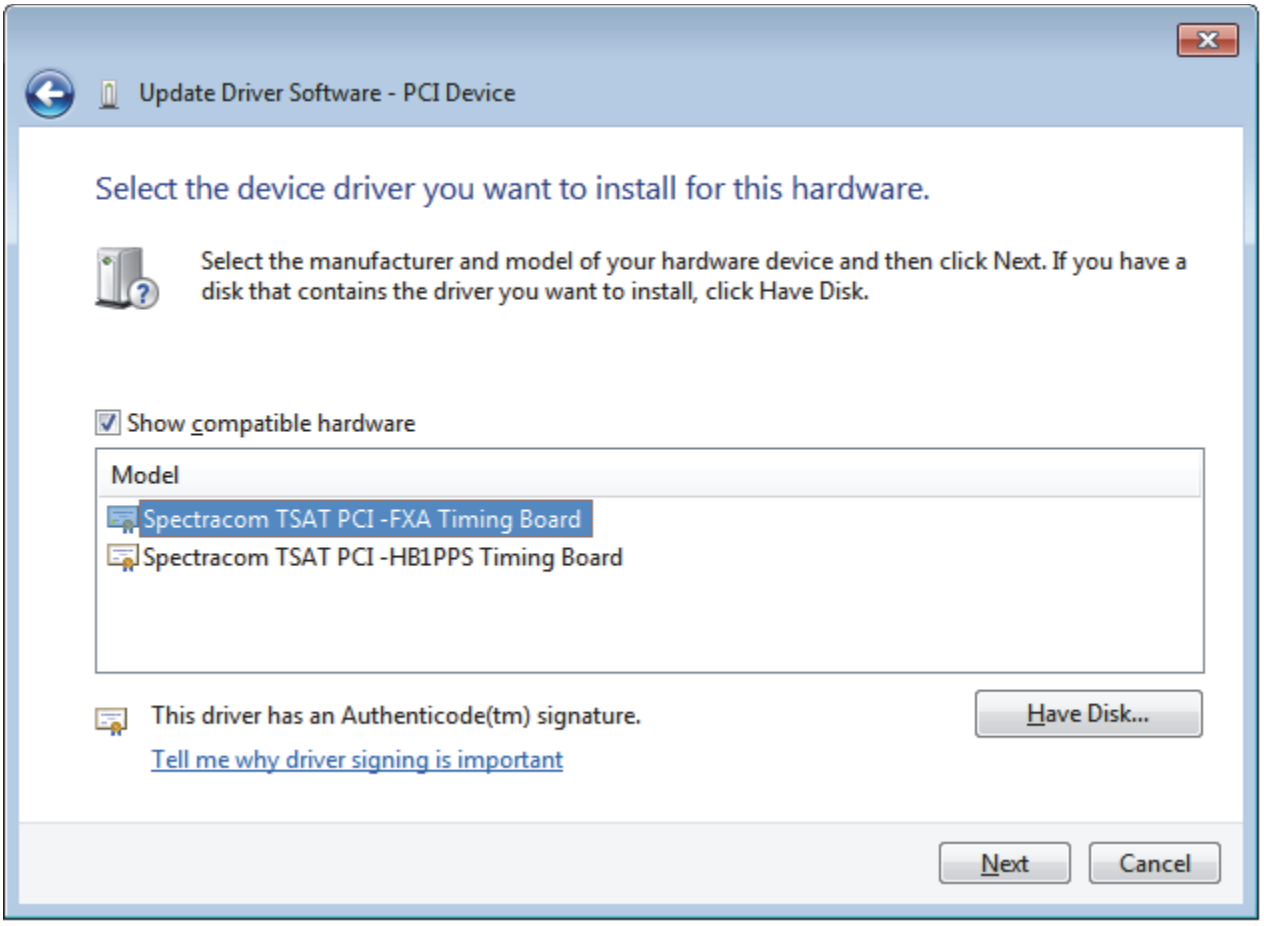



**Figure 5-25. Select the Device Driver You Want to Install**

11. Select **`Install`**, when prompted by Windows Security windows as shown in Figure 5-26.

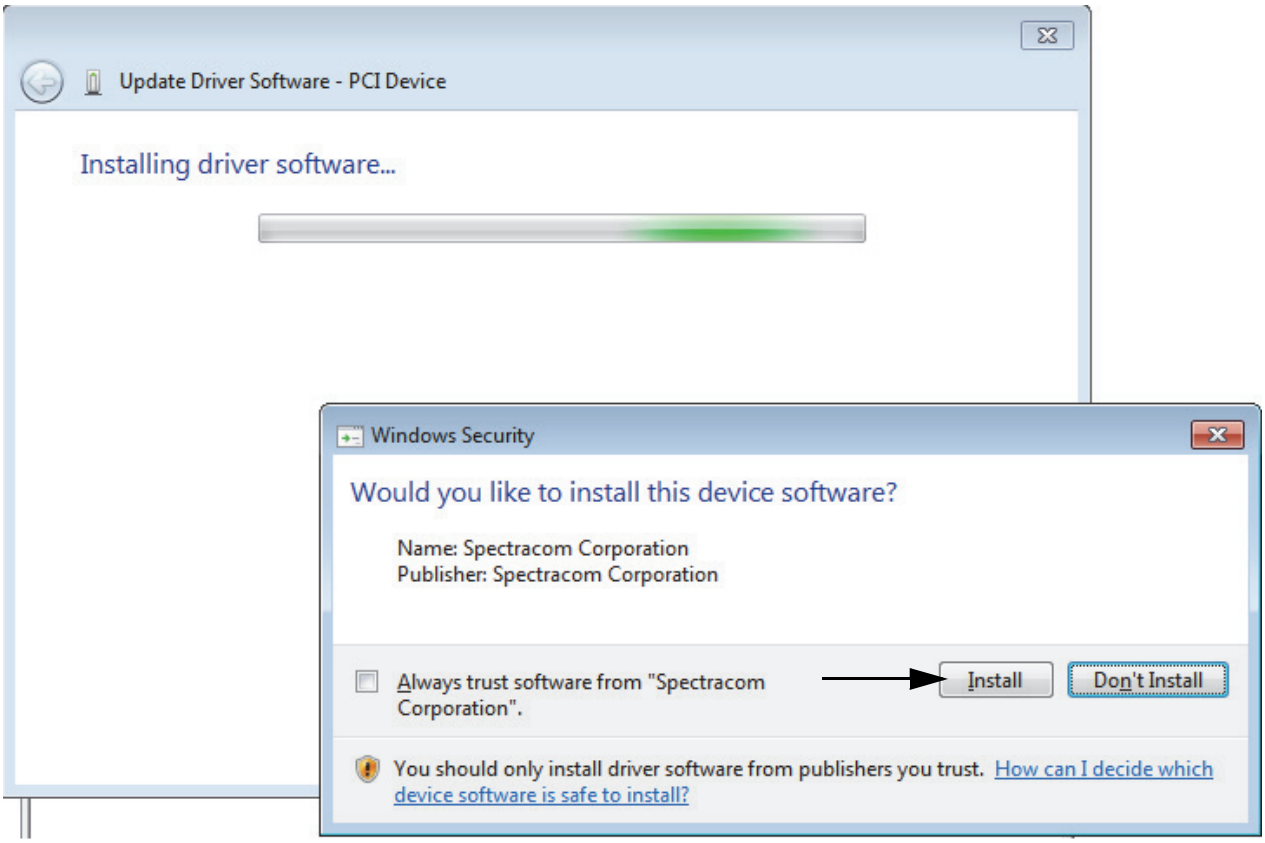



**Figure 5-26. Confirm Install at Windows Security Window**

12. When the Update Driver Software - Spectracom TSAT PCI -HB1PPS Timing Board window appears as shown in Figure 5-27, click **Close**.

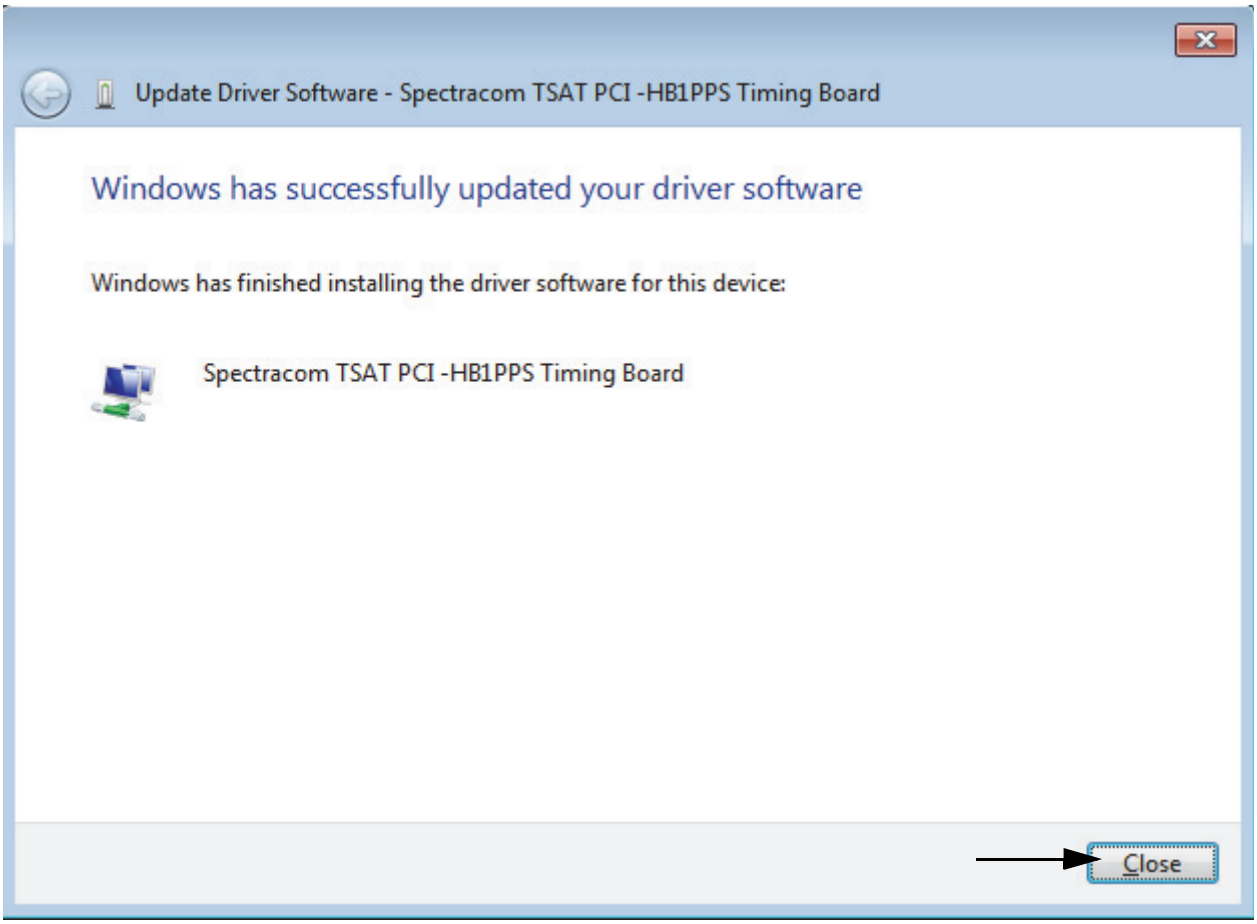



**Figure 5-27. Install Successful Completion Window**

13. Upon successful completion of the installation, the Spectracom Time Card will appear under Timing Boards in Device Manager screen as shown in Figure 5-28.

**NOTE**

While you select the "Spectracom TSAT PCI-FXA Timing Board", the Device Manager will show "Spectracom TSAT PCI -HB1PPS Timing Board" as shown in Figure 5-28. This is a Spectracom issue - the correct driver was installed for the Spectracom TSAT PCI-FXA Timing Board.

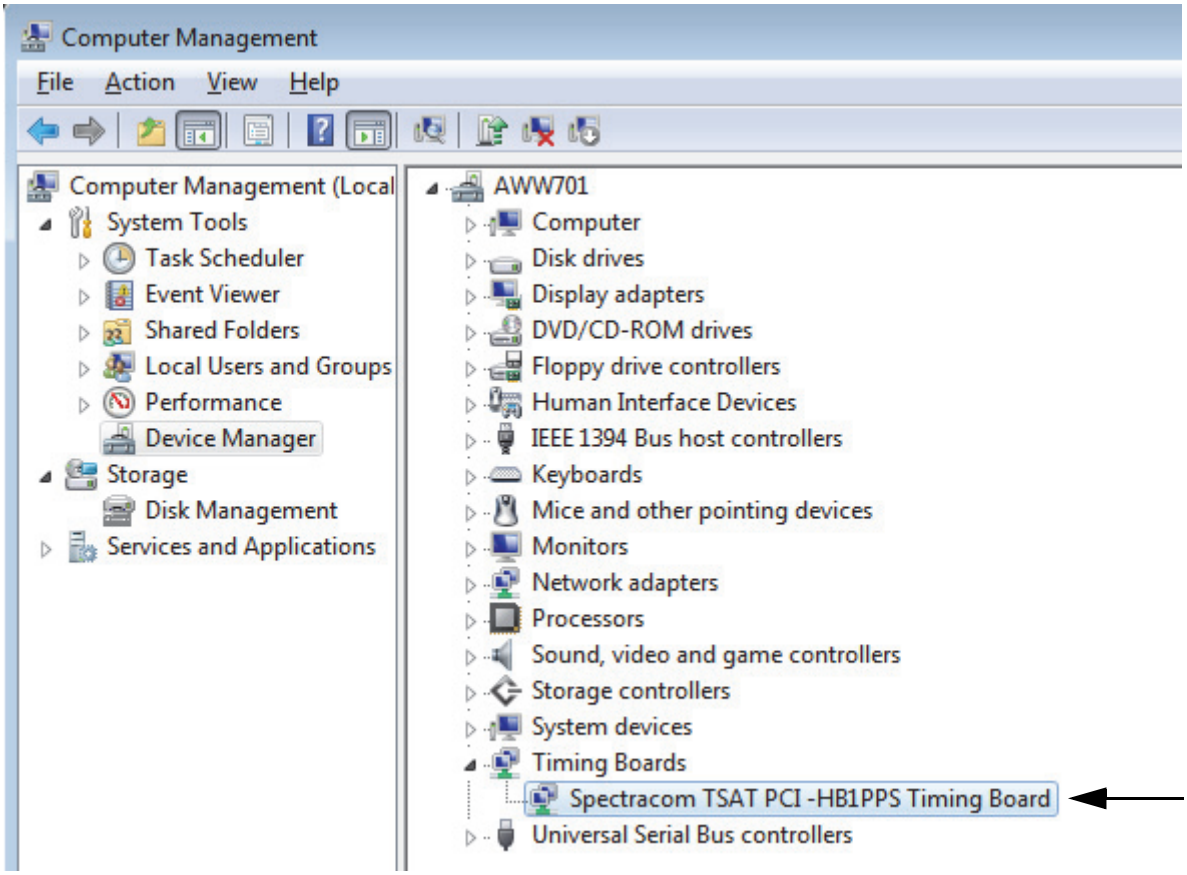



**Figure 5-28. Device Manager Timing Boards Window**

### Installing the Spectracom TPRO/TSAT-PCI Control Utility on Windows 7

To install the Spectracom TPRO/TSAT-PCI Control Utility, proceed as follows:

1. Insert the CD-ROM, part number K0174JM, containing the Spectracom driver V2.30 in the CD/DVD drive. If the Autoplay wizard appears, click **`Cancel`** and proceed to the next step.
2. Click the Start button, and then select **`All Programs`** -> **`Accessories`** -> **`Windows Explorer`**. In Windows Explorer, browse to the CD/DVD drive and double-click **`Setup.msi`** as shown in Figure 5-29.

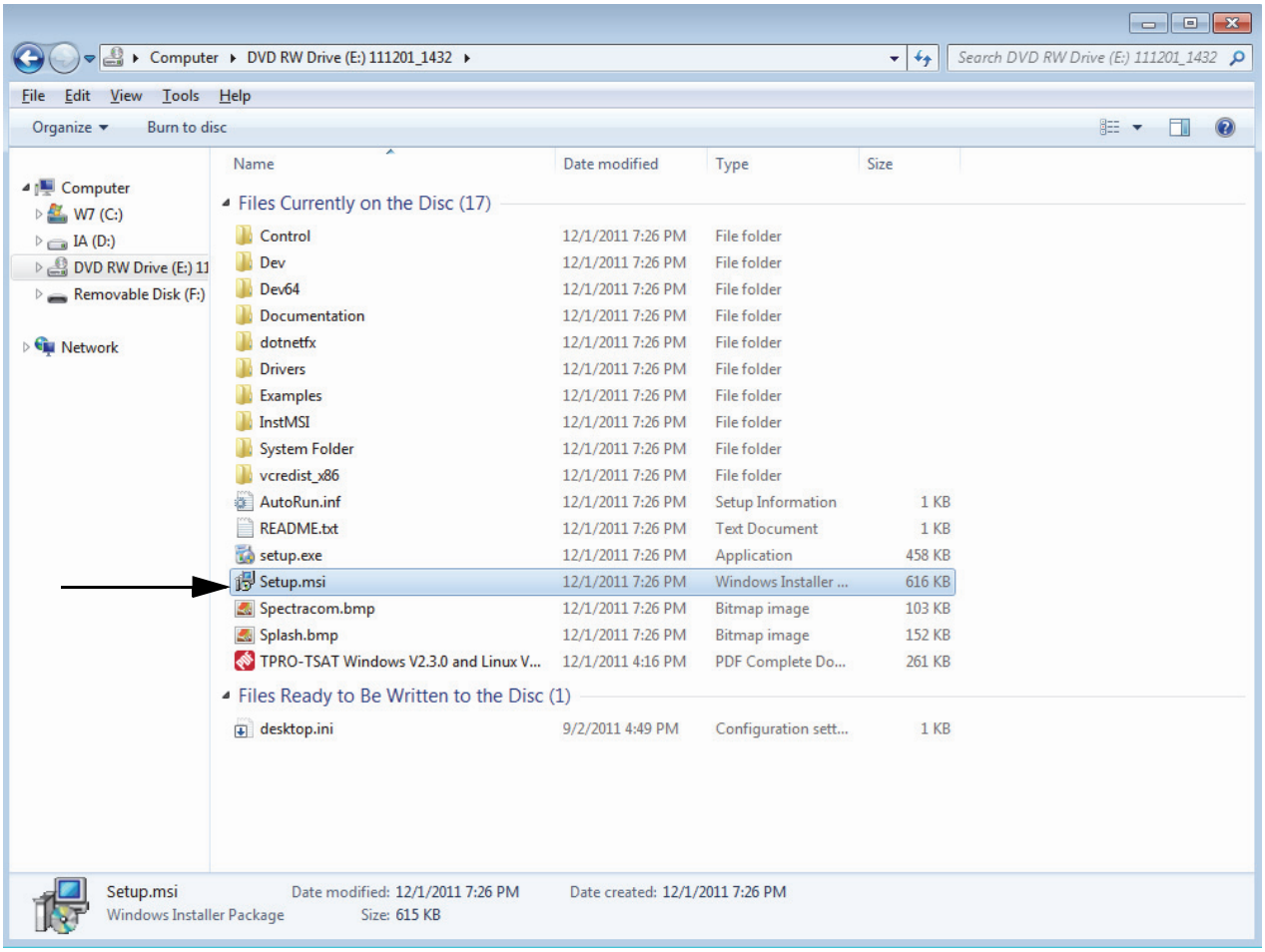



**Figure 5-29. Control Utility Setup.msi Window**

3. Select **Next** at the TPRO-TSAT DRIVER INSTALLATION window as shown in Figure 5-30.

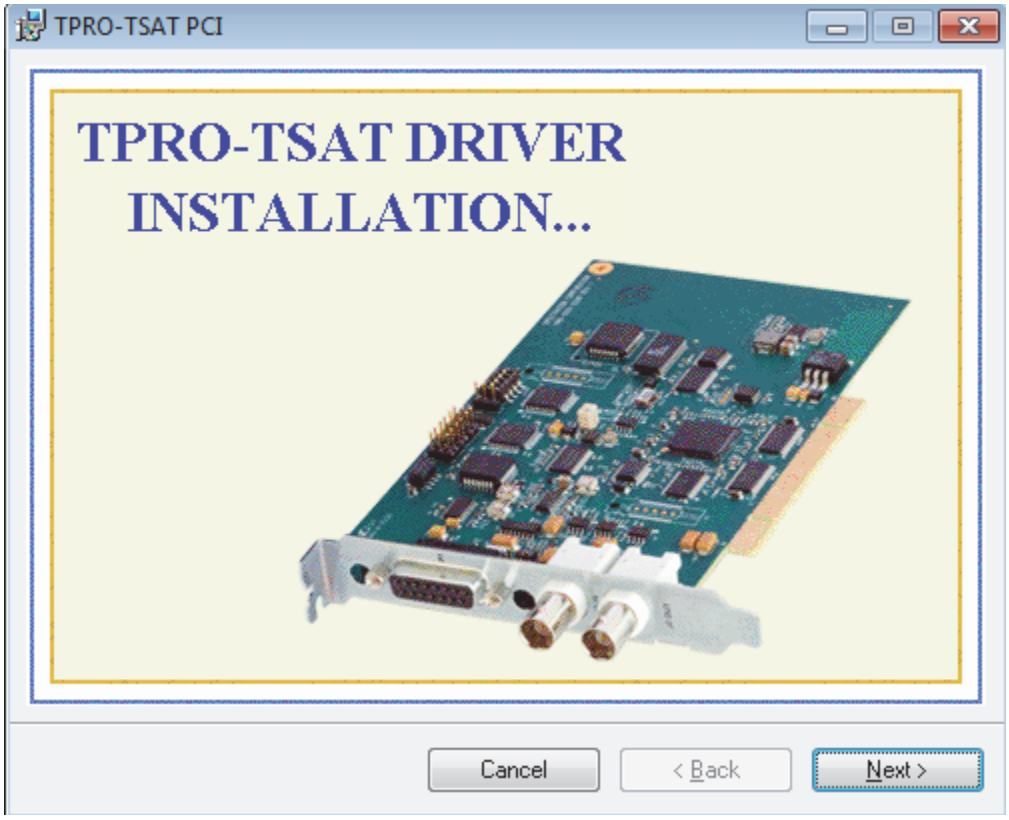



**Figure 5-30. TPRO-TSAT DRIVER INSTALLATION Window**

4. Select **Next** at the TPRO-TSAT PCI Select Installation folder window as shown in Figure 5-31.

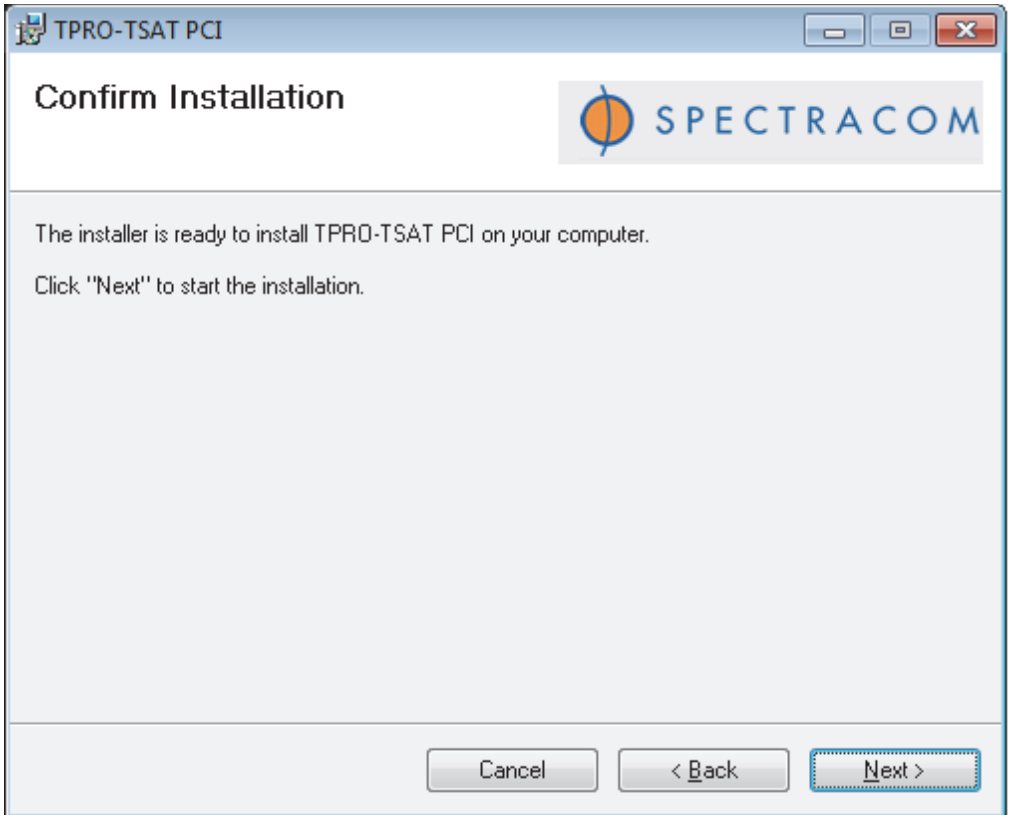



**Figure 5-31. TPRO-TSAT PCI Select Installation Folder Window**

5. Select **Next** at the TPRO-TSAT PCI Confirm Installation screen as shown in Figure 5-32.

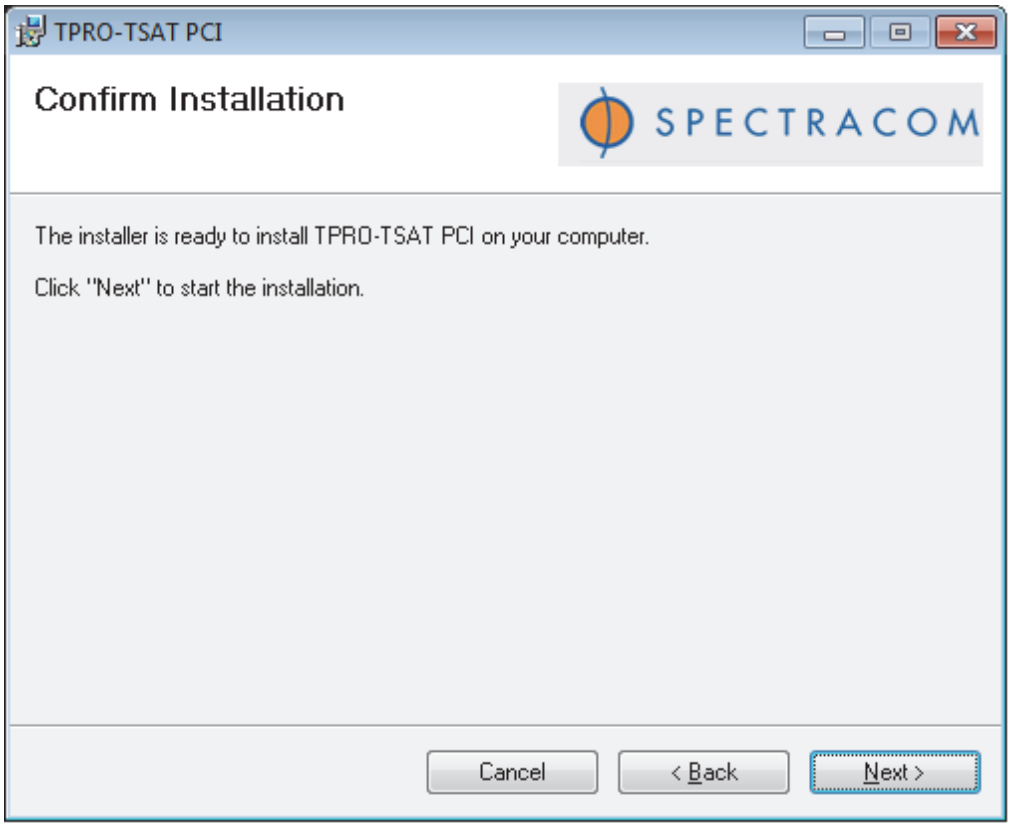



**Figure 5-32. TPRO-TSAT PCI Confirm Installation Window**

6. Select **Yes** when prompted with "Do you want to allow the following program from an unknown publisher to make changes to this computer?" as shown in Figure 5-33.

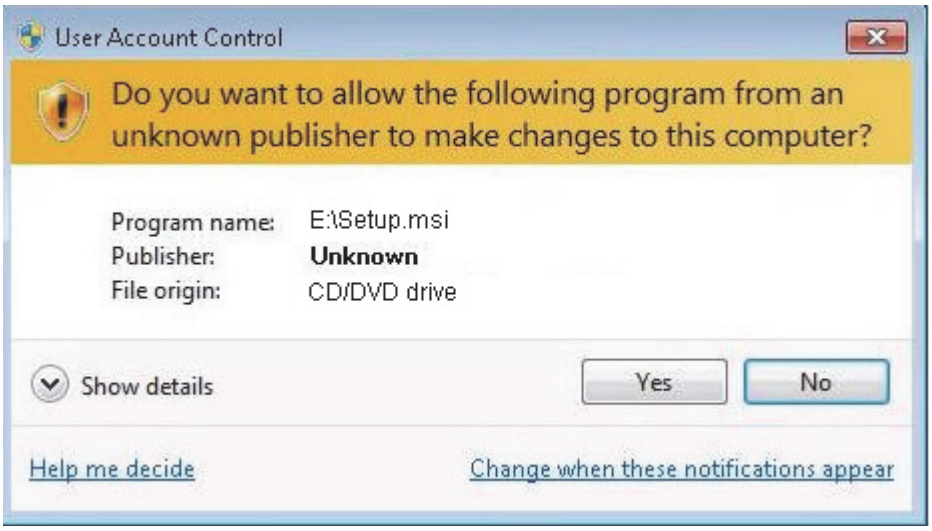



**Figure 5-33. Selecting Yes, Make Changes To This Computer**

7. Select **Close** at the TPRO-TSAT PCI Installation Complete screen as shown in Figure 5-34.

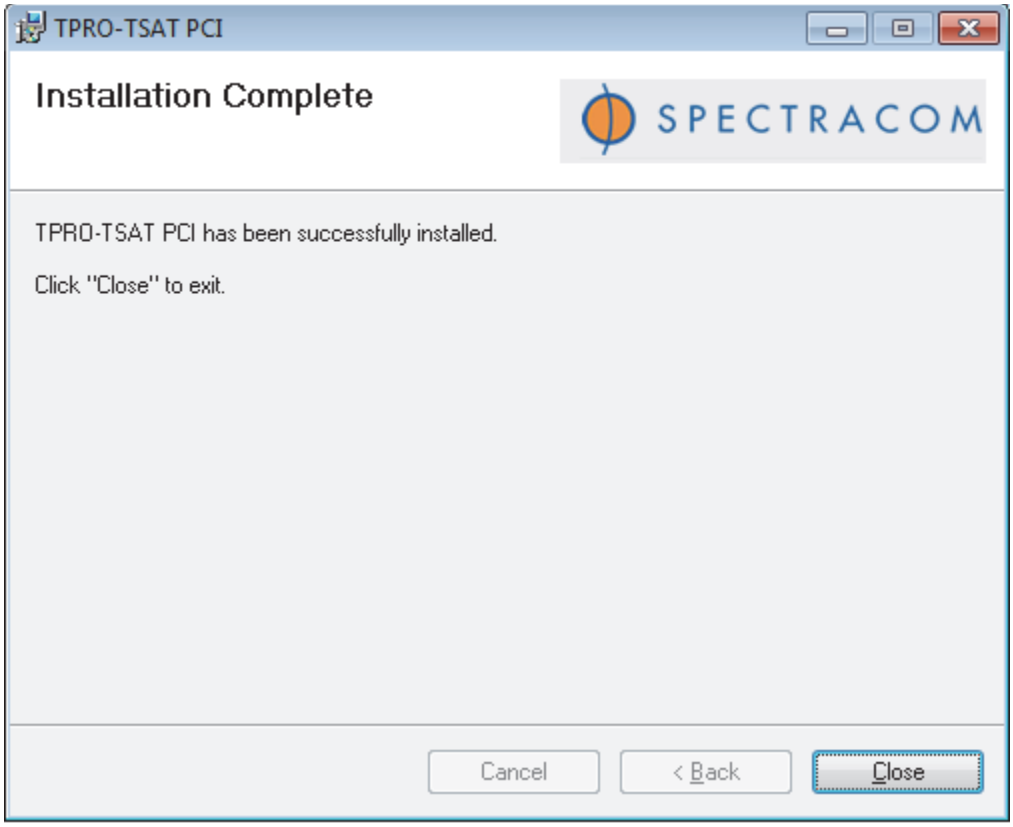



**Figure 5-34. TPRO-TSAT PCI Installation Complete Window**

8. After the time card driver and utility have been installed, open a command prompt (**Start** -> **All Programs** -> **Accessories** -> **Command Prompt**) to manually copy the Tpro.dll file to complete time card installation. Type the following command in the prompt and then press <**Enter**>.

```
Copy C:\"Program Files (x86)"\ksi\Dev64\Tpro.dll C:\Windows\System32
```

## *Continuous Reboot Cycle*

The supported workstation enters a continuous reboot mode after a reboot with the system running, if the workstation's GPS and/or Time strobe hardware options are configured to "Yes" in the System Definition configuration, but the workstation is unable to communicate with the time-strobe generator PCI card. The following paragraphs describe several scenarios where the workstation will be unable to communicate with the PCI card and give appropriate action for you to take in order to prevent and/or recover from the continuous reboot.

**Scenario #1**: You have intentionally configured the workstation's GPS and/or Time strobe hardware options to "Yes" in the System Definition, and you have already completed a committed installation of system software on the workstation, but the GPS PCI card is not yet available for installation into the workstation.

Action: Edit the /usr/fox/sp/tk.cfg file according to the examples given in "TimeKeeper Synchronization Failure at Boot Time" on page 97. After editing the file, reboot the workstation. This file should be changed back to its original content once a functioning PCI card is installed.

**Scenario #2:** You are unaware that the PCI card has failed in service, and you have rebooted the workstation.

Action: Edit the tk.cfg file as described in "TimeKeeper Synchronization Failure at Boot Time" on page 97.

**Scenario #3:** You have unintentionally configured the workstation's GPS and/or Time strobe hardware options to "Yes" in the Foxboro Evo system configurators (Control Editors, SysDef, or IACC), but have no intention of using this feature.

Action: Using System Definition, configure the GPS option to "No" and create a day-1 commit diskette, then re-commit the system.

## Executing the Spectracom/KSI TPRO/TSAT-PCI Control Utility for Windows XP

The Spectracom/KSI TPRO/TSAT-PCI has a control utility that allows you to:

- Retrieve/Set time information (Time Info)
- Set heartbeat type and frequency (Heartbeat)
- Set year (Date)
- Look for a Time Tag event (Events)
- Retrieve Satellite Altitude, Latitude, Longitude.

This utility may be executed after the time strobe equipment has been installed. After installing the time strobe equipment, if you shut down the I/A Series software or Control Core Services software, you should restart the software as described in "Turn On I/A Series Software or Foxboro Evo Control Core Services Software" on page 59.

**NOTE**

Some features of this utility will not work until the GPS antenna and its interconnecting hardware to the GPS card has been installed as described in "Time Strobe Generation Equipment Installation" on page 60.

To access the Spectracom/KSI TPRO/TSAT-PCI control utility on a Windows XP station, proceed as follows:

1. Click **Start**.
2. Select **Programs**.
3. Select **KSI.**
4. Click **TPRO/TSAT-PCI Control Utility**. The Select Timing Board screen appears (see Figure 5-35).

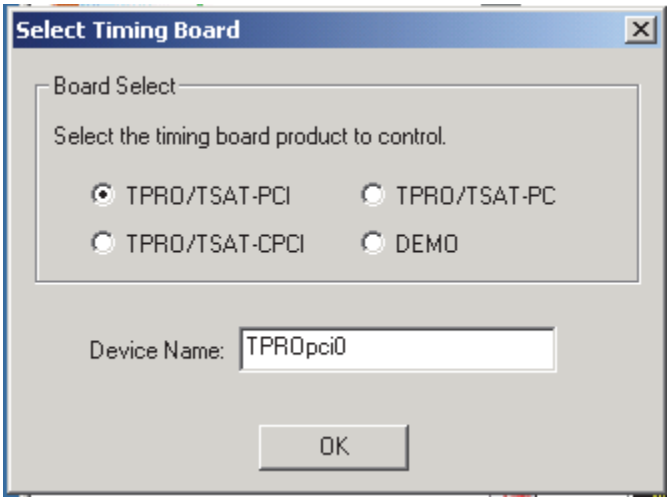



**Figure 5-35. TPRO/TSAT-PCI Control Utility - Select Timing Board Display**

5. On the Select Timing Board screen (see Figure 5-35), click the **TPRO/TSAT-PCI** radio button. If you desire to see a demonstration of the utility select **DEMO.**
6. On the Select Timing Board screen (see Figure 5-35), click **OK**.

   The TPRO/TSAT-PCI control utility screen appears (see Figure 5-36).


**Figure 5-36. TPRO/TSAT-PCI Control Utility**

At the top menu bar of the TPRO/TSAT-PCI control utility screen, click one of the menu buttons to view, adjust, or specify parameters related to the GPS receiver date/time, satellite position and other related GPS functions. For more information, refer to the Spectracom/KSI documents supplied with kit P0972TX or P0972KD or at *http://www.spectracomcorp.com.*

## Executing the Spectracom/KSI TPRO/TSAT-PCI Control Utility for Windows 7

The Spectracom TPRO/TSAT has a control utility that allows you to:

- Retrieve/Set time information (Time Info)
- Set heartbeat type and frequency (Heartbeat)
- Set year (Date)
- Look for a Time Tag event (Events)
- Retrieve Satellite Altitude, Latitude, Longitude.

This utility may be executed after the time strobe equipment has been installed. After installing the time strobe equipment, if you shut down the Control Core Services software or I/A Series software, you should restart the software as described in "Turn On I/A Series Software or Foxboro Evo Control Core Services Software" on page 59.

**NOTE**

Some features of this utility will not work until the GPS antenna and its interconnecting hardware to the GPS card has been installed as described in "Time Strobe Generation Equipment Installation" on page 60.

To access the Spectracom TPRO/TSAT control utility on a Windows 7 workstation, proceed as follows:

1. Click the **Start** button, and then select **All Programs** > **Spectracom Corp**.
2. Select **TPRO/TSAT Control Utility**. When prompted "Do you want to allow the following program from an unknown publisher to make changes to this computer?" as show in Figure 5-37, click **Yes**.

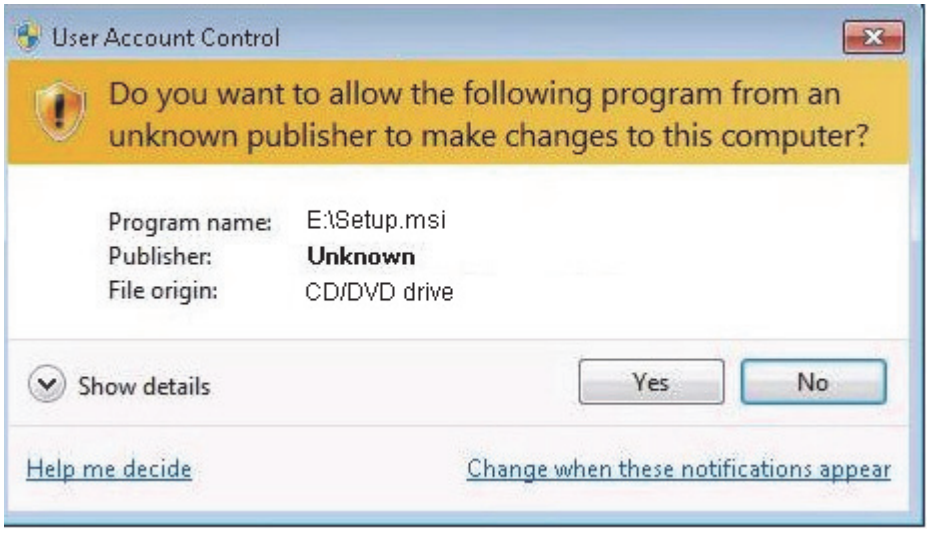



**Figure 5-37. Selecting Yes, Make Changes To This Computer**

The Select Timing Board dialog box appears as shown in Figure 5-38.

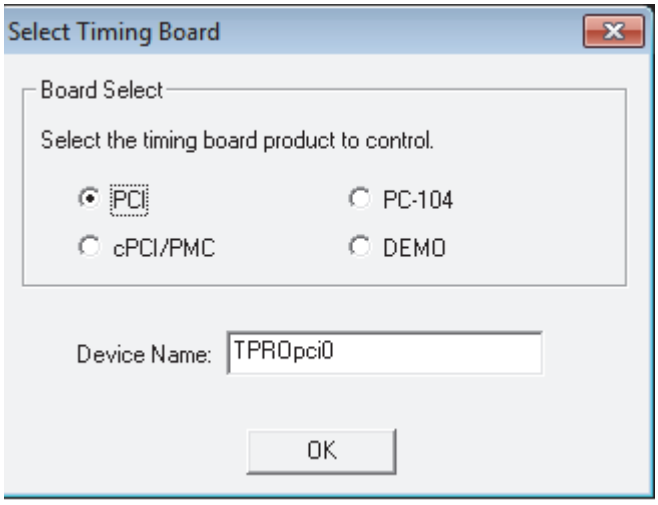



**Figure 5-38. TPRO/TSAT Control Utility - Select Timing Board Display**

3. In the Select Timing Board dialog box (shown in Figure 5-38), click the **PCI** radio button. If you desire to see a demonstration of the utility, select **DEMO**.
4. In the Select Timing Board dialog box (shown in Figure 5-38), click **OK**.

   The TPRO/TSAT-PCI Control Utility window appears, as shown in Figure 5-39.


**Figure 5-39. TPRO/TSAT Control Utility**

At the top menu bar of the TPRO/TSAT-PCI control utility screen, click one of the menu buttons to view, adjust, or specify parameters related to the GPS receiver date/time, satellite position and other related GPS functions. For more information, refer to the Spectracom/KSI documents supplied with kit P0972TX or P0972KD or at *http://www.spectracomcorp.com.*

## Removing Clock Daemon Shortcut

On Windows 7 workstations or Windows Server 2008 R2 Standard server, perform the following step to prevent startup of the Clock Daemon application.

1. Remove the shortcut to the Clock Daemon application from the following directory:
   `C:\users\All Users\Microsoft\Windows\Start Menu\Programs\Startup\`

## Turn On I/A Series Software or Foxboro Evo Control Core Services Software

If required, after installing PCI card and identifying the location of the driver software for the PCI card, start the Control Core Services software or I/A Series software. Refer to the appendix "Shutting Down [*I/A Series or Control Core Services*] Software" or "[*I/A Series or Control Core Services*] Software Startup Options" in the *Hardware and Software Specific Instructions* document

included with your workstation for additional information on setting the I/A Series software or Control Core Services software startup to “off” or “on”.

To turn on the Control Core Services software or I/A Series software, proceed as follows:

1. From the Start menu, open the Control Panel and select **Foxboro I/A** or **I/A Series Software Startup Options**.
2. Select the **Autologon** option from the I/A Series On group.
3. Click **OK**, and then reboot the station.

# Time Strobe Generation Equipment Installation

The GPS antenna/receiver signals are transmitted via a copper cable or fiber optic cable to a PCI card in the host computer. There are two different kits:

- P0972KD is for a copper GPS antenna connection. The kit contains:
  - GPS antenna/receiver (roof mounted assembly)
  - 30 m (100 ft) of waterproof copper cable
  - PCI card.
- P0972TX is for a fiber optic GPS antenna connection. The kit contains:
  - GPS antenna/receiver (roof mounted assembly)
  - 30 m (100 ft) of waterproof copper cable
  - PCI card
  - Copper-to-fiber transmitter
  - Power supply for copper-to-fiber transmitter
  - Fiber-to-copper receiver
  - 100 m (30 ft) of ‘ST’ to ‘ST’ fiber cable for indoor use
  - 2 m (1.3 ft) copper cable to connect Receiver to MTK modem.

Appendix A “Wiring Guide for Time Strobe Network Installation” provides cabling diagrams for interconnecting the time synchronization network. Multiple options are available for connecting the time synchronization equipment. The figures in the Appendix illustrate the way in which the time strobe equipment can be connected and lists the parts and cables necessary to accomplish the connections.

The paragraphs below provide a brief physical description of the Time Strobe Generation equipment and the installation procedure for each piece of the equipment.

# GPS Antenna/Receiver Installation

The GPS antenna is a mast (pole) mounted unit that is located outdoors (see Figure 5-40). The mounting threads are 1.0 inch ID, 14 turns per inch, straight (not tapered). It can accept a 3/4 inch galvanized water pipe for a mast.


**Figure 5-40. Antenna/Receiver Unit**

The GPS receiver and antenna are housed in a single unit. This unit must be mounted outdoors with an unobstructed view of the sky, free of objects that could obstruct satellite visibility from straight overhead to within 20 degrees of the horizon in all directions. Obstructions that block a significant portion of the sky result in degraded performance. The GPS receiver can track fewer than four satellites, which would prevent it from obtaining time synchronization. To optimize timing accuracy, the GPS receiver attempts to track satellites that are spread out as far as possible across the sky. Best timing accuracy is obtained when the unit has a clear view of the entire sky (for example, when the satellites being tracked are spread out as far apart as possible).

The antenna must be mounted horizontally (the mast should not be more than 30 degrees off of vertical). When using a redundant Time Strobe Network, each antenna must be at least 3m (10 ft) apart from each other.

Connection to the antenna unit is made with the supplied 12-conductor copper cable. This cable brings power to the unit and conveys the serial (RS-422) communication with one-pulse-per-second from the unit to the PCI card. Note that no RF signals are used in the cable. The user is responsible for weatherproofing the cable connection.

The connector on the antenna end of the cable is a 12-pin round connector, 20 mm (0.79 in) Outer Diameter (O.D) and the connector on the computer end of the cable is a DB-15 connector, 46 mm (1.80 in) O.D.

For more information refer to the vendors web site:

*http://www.spectracomcorp.com*

To install the GPS antenna/receiver:

**— NOTE**

The user is responsible for the installation and weather proofing of the antenna connector and cable holes. When using the copper wire-to-fiber converter, the antenna cable must be run inside metal conduit and the conduit must be grounded. The user is responsible for supplying, installing and grounding the metal conduit. The sequential steps for installing the antenna/receiver will vary depending on the site requirements.

1. Mount the 3/4-inch mounting mast (pole) at the desired location.
2. Screw the antenna/receiver to the top of the thread on the 3/4-inch mast (pole).
3. If you are connecting the antenna cable directly to the MTK modem (not installing a copper wire-to-fiber converter):
   a. Run the antenna cable connector (round 12-pin connector) through a 20 mm (0.79 in) diameter hole to the base of the antenna, or
   b. Run the workstation cable connector (DB-15) through a 46 mm (1.80 in) diameter hole to the location of the MTK modem.
4. If you are installing a copper wire-to-fiber converter:
   a. Install metal conduit from the base of the antenna to the copper wire-to-fiber converter (refer to Figure 5-41).
   b. As you are installing the metal conduit run the antenna cable inside the metal conduit.
   c. Ground the metal conduit to building steel or other suitable ground.
5. Using a weatherproof compound (such as, marine putty), waterproof the entry and exit holes for the antenna cable and/or the metal conduit.
6. Connect the round male 12-pin antenna cable connector to the female connector at the base of the antenna.
7. Waterproof the 12-pin connector at the base of the antenna.
8. Connect the DB-15 connector to the MTK modem or the fiber optic isolator.

## GPS Fiber Optic Isolator Installation

Fiber optic transmission is optionally used for isolation (eliminates the need for lighting arrestors or other high voltage interferences) and/or to extend the distance, up to 2 km (6562 ft), of the MTK host computer to the antenna. A COTS copper-to-fiber transmitter and a fiber-to-copper receiver at the MTK host computer converts the signals to its native electrical signals. Because the power for the antenna module cannot be transmitted over the fiber optic cable, a 12 V dc source of power must be provided for the copper-to-fiber transmitter (see Figure 5-41). The copper-to-fiber transmitter, fiber-to-copper receiver, and the power supply are shelf- or enclosure-mounted. Shelf or other suitable mounting requirements are user supplied.

**NOTE**

When using the GPS Fiber Optic Isolator, the antenna cable must be run inside metal conduit and the conduit must be grounded. The user is responsible for supplying, installing and grounding the metal conduit. The sequential steps for installing the GPS Fiber Optic Isolator components will vary depending on the site requirements.

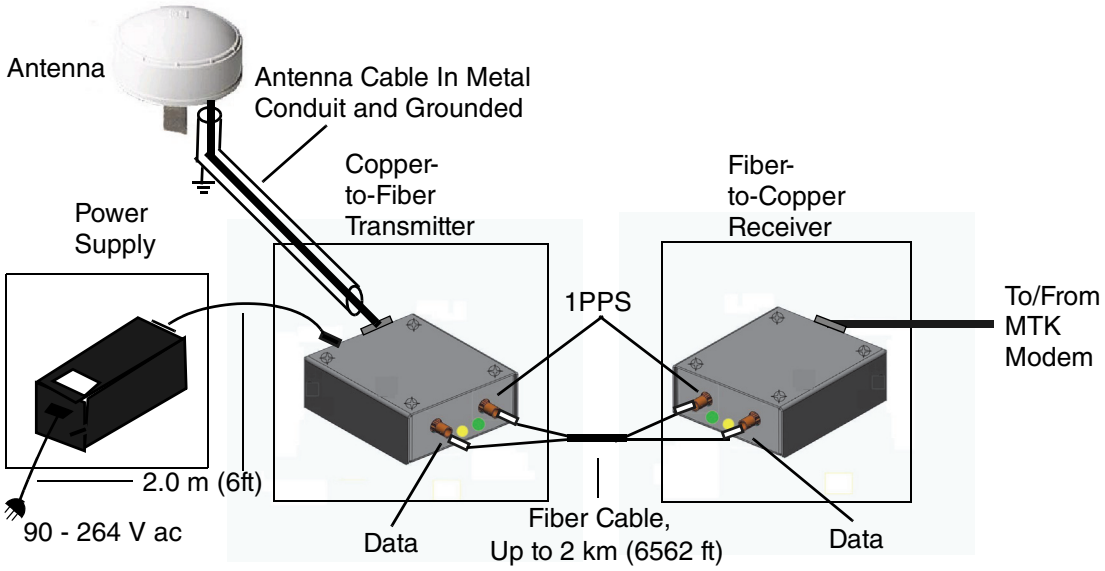



**Figure 5-41. GPS Fiber Optic Isolator**

To install the GPS fiber optic isolator:

**NOTE**

The sequential steps for installing the GPS fiber optic isolator may vary depending on the site requirements.

1. Place the power supply and the copper-to-fiber transmitter in the desired location.
2. If not connected, connect the DB-15 connector from the antenna to the copper-to-fiber transmitter.
3. Connect the power supply output cable to the copper-to-fiber transmitter.
4. Run the fiber cable from the copper-to-fiber transmitter to the fiber-to-copper receiver. One hundred meters of indoor fiber optic cable is supplied with the GPS Antenna/Receiver kit. For distances greater than 100 m (30ft) and less than 2 km (6562 ft), the customer must supply the appropriate cable.
5. Connect the fiber cable 1PPS and the DATA connectors to the copper-to-fiber transmitter and connect the correct 1PPS and the DATA connectors to the fiber-to-copper receiver.
6. Connect the power supply input cable to an ac source.

7. Run the MTK cable connector (DB-15 connector) from the fiber-to-copper receiver to the location of MTK modem and host computer.
8. Connect the DB-15 MTK cable connector to the fiber-to-copper receiver.
9. Connect the DB-15 cable connector to the MTK modem.

## MTK Modem Installation

The MTK modem connects to the back of the PCI card in the workstation. This connection is made via a short cable (P0972UC). The connector on the back of the card is a 15-pin D, female (Figure 5-42). A locking, 15-pin D, male connector on the MTK modem connects to the workstation. Signals from the workstation are passed through a female connector on the MTK modem for connection to the antenna cable. The MTK modem uses 12 V dc power from the workstation available at the DB-15 connector. The same power, when using a copper antenna wire, also supplies the antenna receiver.

It has two ST-type fiber connectors to provide time strobe signals to two TSC modules. A power-OK/Activity LED indicates acceptable dc power. It blinks for 0.1 seconds every 5 seconds when the time strobe pulse occurs.

In system with ZCP270s, both the ZCP270 and its associated FCM100Ets must receive a time strobe signal to synchronize the time within 1 ms.

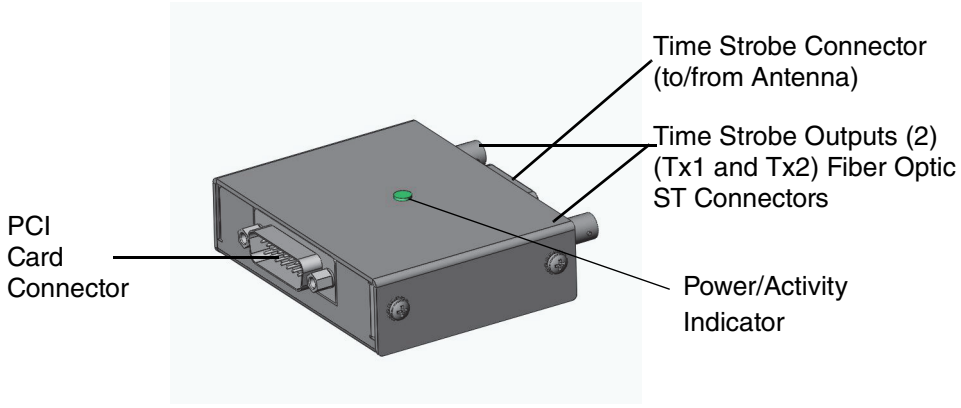



**Figure 5-42. MTK Modem (P0972SB)**

To install the MTK Modem:

1. Place the MTK modem close to the workstation in the desired location.
2. Connect the MTK cable connector (DB-15 connector) from the antenna/receiver (copper cable) to the MTK modem or from the fiber-to-copper receiver (DB-15 connector) to the MTK modem.
3. Install the PCI card in the host workstation (see “Installing the PCI Card” on page 26).
4. After the PCI card is installed, connect the MTK modem output cable [P0972UC - 0.5 m (1 ft)] to the MTK modem and the PCI card. Tighten the locking screws.
5. After the Time Strobe Converters (TSCs) are installed in their enclosures, connect the MTK time strobe outputs (Tx1 and Tx2) directly to the TSCs using MMF simplex cables with ST-type connectors, or indirectly through extenders, described later in this chapter.

# Time Strobe Converter Installation

The following instructions apply to both the MMF-compatible Time Strobe Converter (P0972KA) and the SMF-compatible Time Strobe Converter (P0973BW).

## *TSC Module Packaging*

The TSC module mounts on a DIN rail or shelf mountable chassis assembly. Two ST-type fiber connectors are used for fiber input (Rx) and output (Tx) connections to daisy-chain to other TSCs or MMF-compatible extenders.

The MMF-compatible TSC (P0972KA) accepts 62.5/125 micron, multi-mode fiber optic cable with ST-type connectors.

The SMF-compatible TSC (P0973BW) accepts user-supplied 9/125 micron, single-mode fiber optic cable with ST-type connectors.

P0972KA accepts MMF cable inputs, and P0973BW accepts SMF cable inputs. Both have MMF cable outputs.

Eight shielded RS-422 output ports provide eight connections to baseplates or ZCPs. Two screw terminal power connections are provided for connecting +24 V dc input power. Two additional power connections on the other terminal block are available for connecting +24 V dc input power to another TSC module.

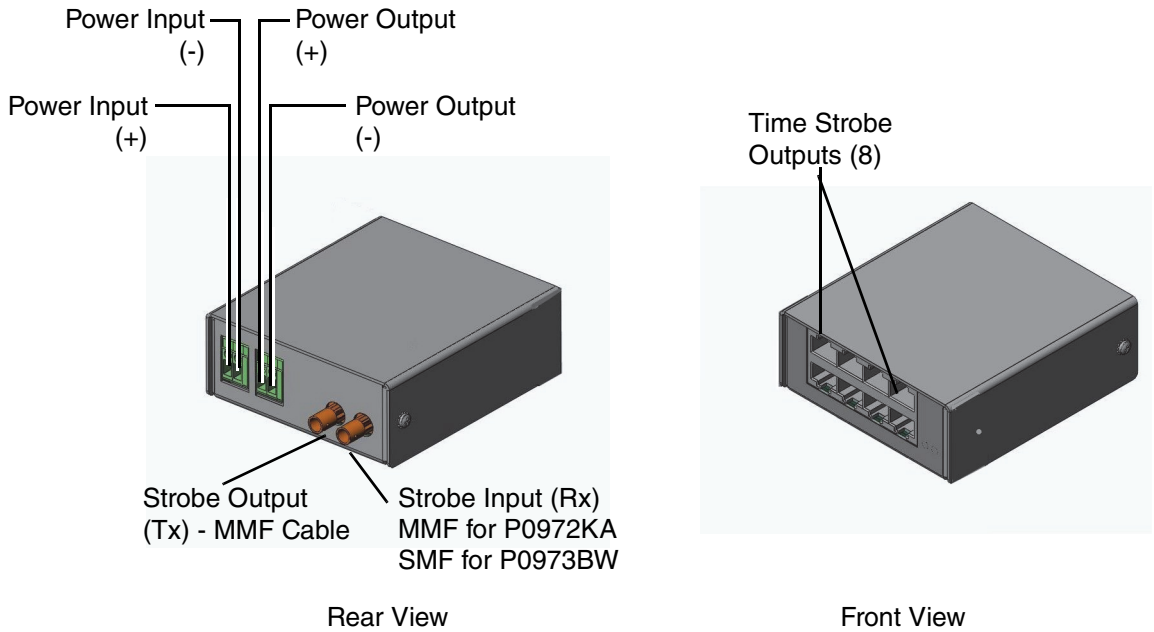



**Figure 5-43. Time Strobe Converter (P0972KA and P0973BW)**

## *Time Strobe Converter Grounding*

Standard CAT5® Shielded Twisted Pair cable (STP) with four twisted pairs is used for connecting Time Strobe Converter (TSC) modules to controllers. To provide noise and transient voltage protection, the shield is connected to chassis ground in the module. The TSC module must be connected to a frame ground in the enclosure. The signal return is routed on pin 4. This return is required for the FCP280 or FCP270 connection where it provides the common mode return for

the RS-422 receiver. The shield of the cable is not connected at the destination. It is common with the TSC case which has a path to frame ground. The module is connected to the enclosure protective earth ground via this mounting.

## *Time Strobe Converter Installation*

The TSC module can be mounted on a level surface, or, using an optional mounting adapter, on a panel or a DIN rail within an enclosure or on a wall.

### Time Strobe Converter DIN Rail Mounting

The TSC can be mounted on a standard DIN rail using a DIN rail clamp assembly. The rail clamp allows mounting on either a vertical or horizontal rail. Figure 5-44 shows the DIN rail clamp.

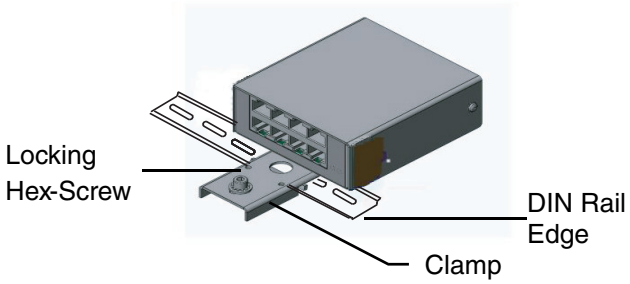



**Figure 5-44. Time Strobe Converter DIN Rail Clamp and Mounting Bracket Assembly**

To install the DIN rail clamp to the TSC:

1. Locate kit P0972VW.
2. Place the DIN rail clamp against the bottom of the TSC and insert the two screws through the clamp into the TSC. Tighten the two screws.

To install the TSC on a DIN rail:

1. Select a location for mounting the TSC on the DIN rail.
2. Loosen the locking screw so that the TSC can slide over the DIN rail.
3. Position and orient the TSC in the same position as it will be when installed on the DIN rail (that is, horizontal or vertical).
4. Slide the TSC over the DIN rail, making sure that the TSC mounting bracket is over the edge of the DIN rail.
5. Tighten the locking screw on the mounting bracket so that the TSC is locked to the DIN rail.
6. Connect power to the TSC as described in “Time Strobe Power Supply Connections” on page 68.

### Time Strobe Converter Chassis Mounting

The TSC can be mounted in a chassis assembly that is mounted on a 19-inch rack in an enclosure. The chassis assembly is mounted between and on two vertical 19-inch rails. Figure 5-45 shows the chassis assembly mounted in an enclosure.

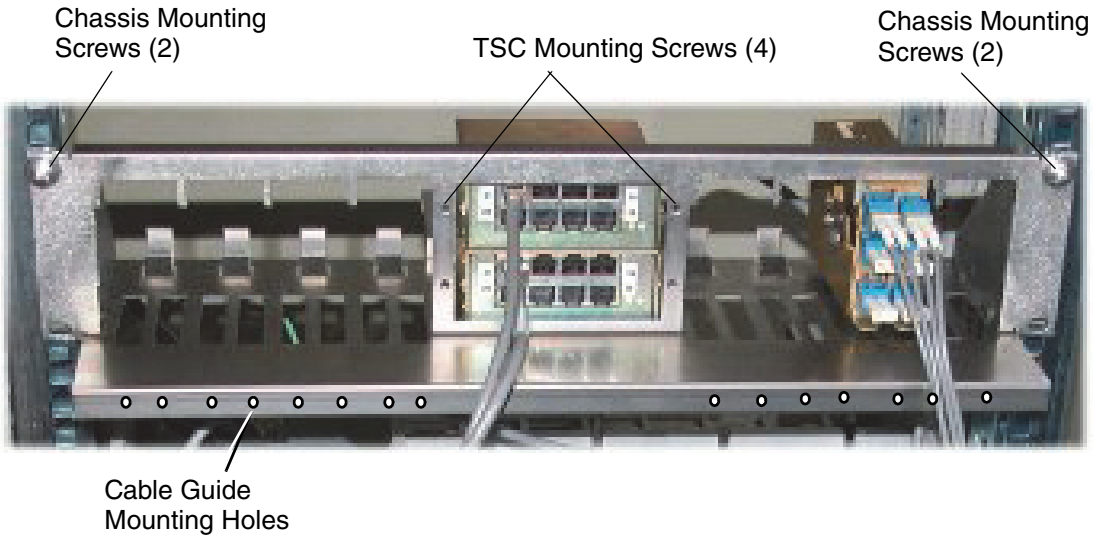



**Figure 5-45. Time Strobe Converter Chassis Mount**

The Time Strobe chassis assembly installation kit (P0926MZ) contains the following components:

**Table 5-3. Time Strobe Chassis Installation Components, Kit P0926MZ**

| Component (quantity) | Part Number |
|---|---|
| Chassis Assembly | P0926MZ |
| Cable Guides ws-1-01(20) | |
| Screw, 8-32x1/4 pan head (4) | |
| Screw, 4-40x1/4 pan head (8) | |
| Brackets (4) | |

The hardware to install the TSC chassis assembly is supplied by the customer. The TSC chassis mounting location and method of mounting may vary depending on the customer application. To install the TSC chassis assembly:

1. Ensure that there is at least 6 inches of vertical height available.
2. Align the four mounting holes in the chassis assembly to the 19-inch enclosure rail at the desired mounting location.
3. Install four clip nuts over the appropriate holes on the enclosure rail.
4. Insert the chassis assembly against the enclosure rail and fasten, with four screws, the chassis assembly to the enclosure rail.

To install the TSC:

1. Using two 8-32x1/4 pan head screws connect one bracket to the front side of each side of the time strobe converters (see Figure 5-46).

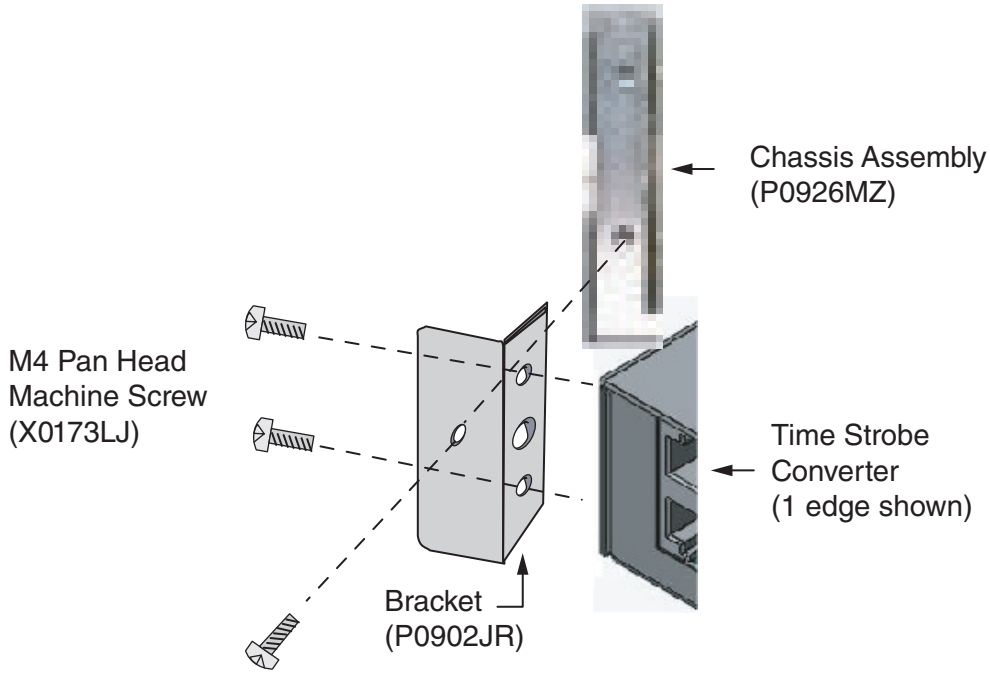



**Figure 5-46. Attaching Time Strobe Converter Bracket**

2. Insert the TSC module into the chassis assembly as shown in Figure 5-45. Insert the mounting screws (2) on each side of the chassis assembly into the TSC (see Figure 5-46). Tighten the mounting screws.
3. Repeat steps 2 and 3 for a redundant TSC.
4. Install the plastic cable guides into the front edge of the chassis assembly.
5. Connect power to the TSC as described in "Time Strobe Power Supply Connections" on page 68.

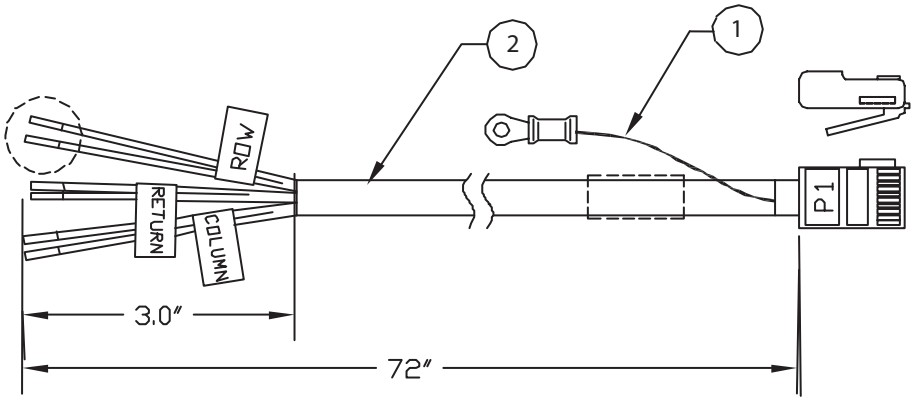
## Time Strobe Power Supply Connections

The power source for the TSC module can be either the FPS400-24 (24 V dc) power supply, or 26 to 39 V dc Cell bus power. The FPS400-24 power supply is used with DIN rail modules and the Celebes power is used with 1x8 or 2x8 nests. The two 2-position power terminal block provides two terminals for the input power, and two terminals for power connection to another TSC module. The two power terminal blocks (positives and negatives) are jumped together within the module (see Figure 5-43).

A 20 to 42 V dc to dc converter inside the TSC provides 5 V dc power to the module. The input voltage is fused and monitored. If it falls below 20 V dc, power is removed from the dc to dc converter.

### *Cell Bus Power*

Cell bus power is used with 1x8 or 2x8 nests. Cable P0972UD connects power from the Power Distribution Unit (PDU - P0904AU) to the TSC (see Figure 5-47). The following procedures describe how to install a single TSC or two TSCs from a single PDU.




| WIRE LIST | | | | |
|---|---|---|---|---|
| ITEM | WIRE | COLOR | FROM | TO |
| 2 | 1 | BK | P1-1 | "ROW" PAIR |
| 2 | 2 | BN | P1-2 | "ROW" PAIR |
| 2 | 3 | RD | P1-5 | "RETURN" PAIR |
| 2 | 4 | OG | P1-6 | "RETURN" PAIR |
| 2 | 5 | YE | P1-9 | "COLUMN" PAIR |
| 2 | 6 | GN | P1-10 | "COLUMN" PAIR |
| 2 | 7 | BU | N/C | |
| 1 | 8 | DRAIN | | |

**Figure 5-47. P0972UD, Power Distribution Unit to TSC Cable**

To install a single (one) TSC powered from a PDU:

1. Twist together the wires of cable P0972UD (see Figure 5-47) as follows:
   a. The pair of "row" power wires (black and brown color).
   b. The pair of "return" power wires (red and orange color).
   c. The pair of "column" power wires (yellow and green color).
2. Insert P1 of cable P0972UD into the PDU.
3. Connect the drain wire from P1 to a ground point on the power supply or in the enclosure.
4. Run and dress the cable P0972UD to the TSC input/output power terminal.

   If required, cut the cable to the proper length and strip 1/2-inch of insulation from the cable ends.

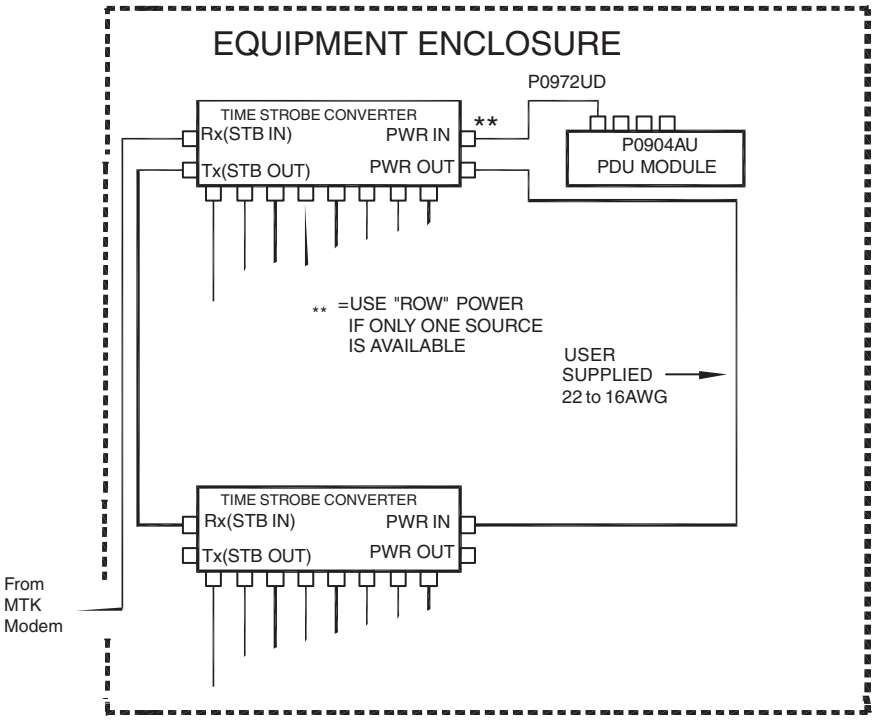



**Figure 5-48. P0904AU PDU, Single TSC Power Connection**

5. Connect cable P0972UD to the TSC (see Figure 5-48):
   a. Connect the "row" power wire to the TSC PWR IN (+) power terminal. If only one power source is available, use the "row" power source. Do not short the row and column power wires. Use only one source for the TSC power.

**⚠ CAUTION**

Do not short the row and column power sources together.

   b. Connect the return power wire to the TSC PWR (-) return power terminal.

To install two TSCs (A and B) powered from one PDU:

1. Twist together the wires of cable P0972UD (see Figure 5-47) as follows:
   a. The pair of "row" power wires (black and brown color).
   b. The pair of "return" power wires (red and orange color).
   c. The pair of "column" power wires (yellow and green color).
2. Insert P1 of cable P0972UD into the PDU.
3. Connect the drain wire from P1 to a ground point on the power supply or in the enclosure.
4. Run and dress the cable P0972UD to the TSC input/output power terminals.

   If required, cut the cable to the proper length and strip 1/2-inch of insulation from the cable ends.

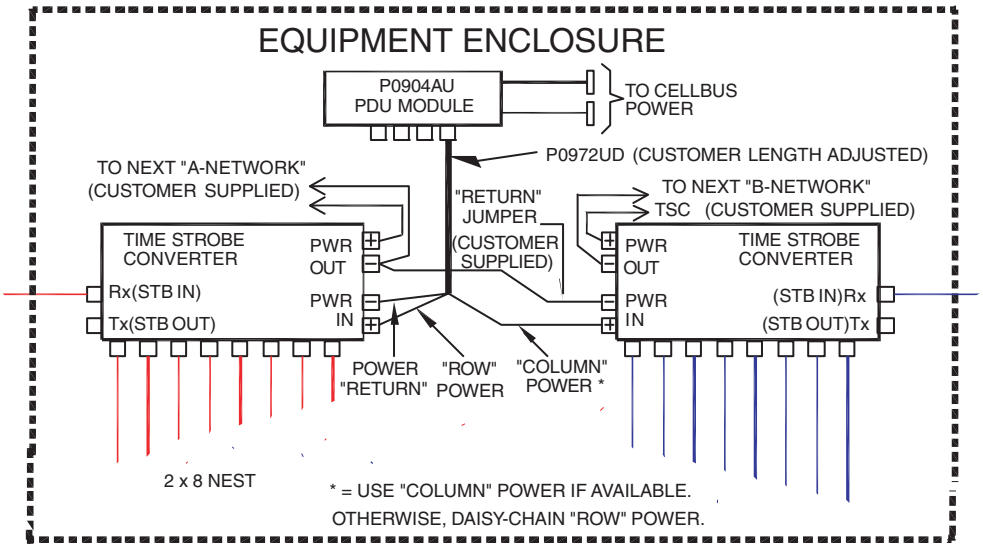



**Figure 5-49. P0904AU Power Distribution Module, Dual TSC Power Connection**

5. Connect cable P0972UD to the TSC (see Figure 5-49) as follows:
   - **a.** Connect the “row” power wire to the first TSC PWR IN (+) power input terminal.
   - **b.** Connect the “return” power wire to the first TSC PWR (-) power terminal.
   - **c.** Connect the “column” power wire to the second Time Strobe converter IN (+) power input terminal. If column power is not available, use row power.
   - **d.** Connect a jumper wire (22 AWG to 16 AWG), user supplied, from OUT (-) power terminal on the first Time Strobe Converter to the second Time Strobe Converter PWR (-) power terminal.

The PWR (+) and OUT (-) terminals from the TSC can be used to power other TSCs located within the same enclosure. All other cables, except P0972UD, are user supplied. Row power should be used for TSC “A” Network system and column power for TSC “B” Network system.

## *FPS 400-24 Power Supply Connections*

The FPS400-24 power supply is used with DIN rail modules. Cable P0972RN connects power from the FPS400-24 to the TSC (see Figure 5-50).

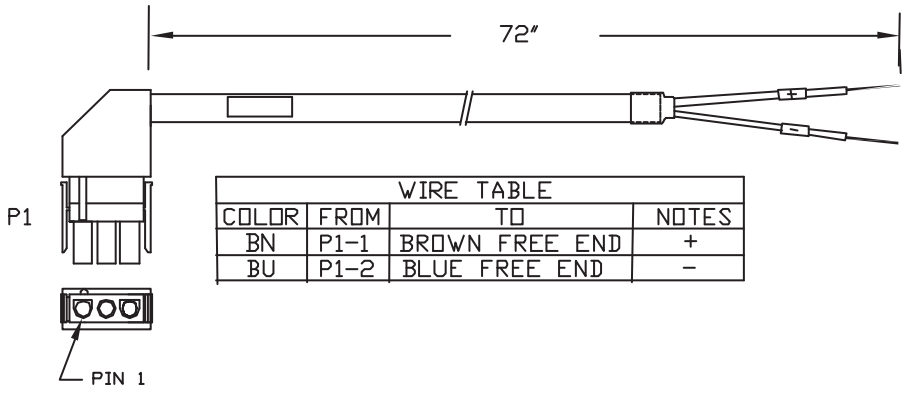



**Figure 5-50. P0972RN, FPS400-24 Power Cable to TSC**

To install a TSC powered from an FPS400-24, perform the following:

1. Run and dress the cable P0972RN to the TSC input/output power terminal. If required, cut the cable to the proper length and strip 1/2 inch of insulation from the cable ends.
2. Insert the brown wire of cable P0972RN into the PWR IN (+) input power terminal of the TSC. Tighten the screw on the TSC power input terminal.
3. Insert the blue wire of cable P0972RN into the PWR IN (-) input power terminal of the TSC. Tighten the screw on the TSC power input terminal.
4. Insert P1 of the cable P0972RN (see Figure 5-50) into an empty dc output plug of the FPS400-24.

### MTK Modem to Time Strobe Converter Cable Connections

The MTK modem has two ST-type fiber connectors to output time strobe signals over MMF, simplex cable, and each connector may connect to an MMF-compatible TSC module or to any type of Time Strobe Distribution Extender. The TSCs have one ST-type fiber input connector; P0972KA accepts an MMF, simplex cable but P0973BW accepts an SMF, simplex cable and cannot be directly connected to the MTK modem. Both TSCs have one ST-type fiber output connector that supports MMF, simplex cable only, and can provide time strobe signals to another MMF-compatible TSC located in another enclosure.

To connect the MTK modem:

1. If you are connecting the MTK modem to Time Strobe extenders, refer to the paragraph “Installing the Time Strobe Distribution Extender” on page 81. After you complete installing the Time Strobe Distribution Extender, return to this procedure to install the cabling between TSCs.
2. Connect the Tx1 (STB OUT) from the MTK modem or Tx**n** (Where **n** equals 2 to 6) from the appropriate Time Strobe Distribution Extender (RH100AM extender with P0972KA TSC, or RH100AN extender with P0973BW TSC) to the Rx (STB IN) of the Time Strobe Converter using the appropriate fiber optic cable (MMF or SMF) from a cable group D (see Figure 5-51).

3. If a second Time Strobe Converter is located in the same enclosure or a close by enclosure, connect the Tx2 (STB OUT) of the Time Strobe Converter to the Rx (STB IN) of the second Time Strobe Converter (P0972KA) using an MMF, simplex cable from cable group D (see Figure 5-51).
4. If another Time Strobe Converter is located in a second enclosure, connect the second Tx2 (STB OUT) from the MTK modem to Tx (STB IN) of the Time Strobe Converter located in the second enclosure (or from the first enclosure - whichever is convenient) using an MMF, simplex cable from cable group D (see Figure 5-51).
5. If a second Time Strobe Converter is located in the second enclosure, connect the cable as described in step 2.

The Time Strobe Converter output Tx (STB OUT) can be daisy chained to additional enclosures using MMF, simplex cable selected from cable group D. There is no limit to the number of multimode fiber optic cable segments that can be daisy chained except that each segment length cannot exceed 2 km (6562 ft). Each additional enclosure can contain two or more Time Strobe Converters for Time Strobe Network A and B. Use Figure 5-51 as a guideline to connect all Time Strobe Converters in the system. Ensure that Time Strobe Network "A" and "B" remain separate. Use one power source for TSCs "A" and another power source for TSCs "B".

Cables "A" and "B" should be in different parts of the plant, so the chances of both cables failing simultaneously is minimal.

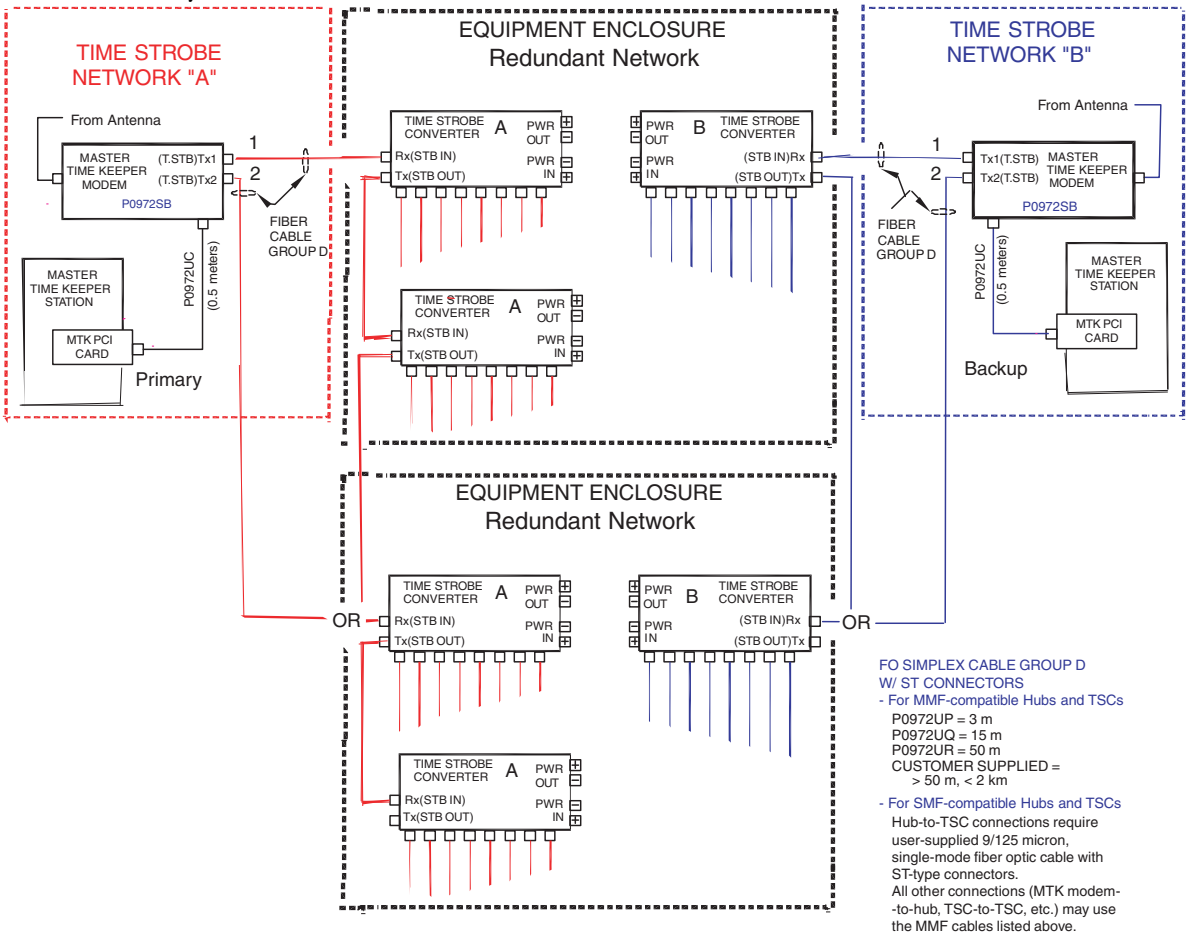



**Figure 5-51. MTK Modem to Time Strobe Converter, Cable Connections**

### Time Strobe Cable Connections to the FCP280, FCP270, and FCM100Et

Cabling between the TSC module and the baseplate containing an FCP280, FCP270, or FCM100Et consists of shielded twisted-pair (STP) cable with RJ-45 connectors at each end. The time strobe signal(s) are connected to the first baseplate only and distributed by the baseplate to all control processors plugged into only the first baseplate. Time strobe signals are not daisy chained to each baseplate by the baseplate interconnecting Module Fieldbus cables. The last baseplate in the daisy chain contains terminator (P0926KW or P0916RB) to terminate the A/B Module Fieldbus only. Time strobe signal termination is not required on the last baseplate.

**NOTE**

In a system with ZCP270s, both the ZCP270 and its associated FCM100Ets must receive a time strobe signal to synchronize the TDR/SOE FBM time to within 1 ms.

To connect a non-redundant Time Strobe to the FCP280, FCP270, or FCM100Et:

1. For a **non-FCP280 baseplate**, insert an A/B Module Fieldbus and Time Strobe Terminator (P0926KZ) (see Figure 5-52) into the A/B Module Fieldbus and Time Strobe 9-pin connector on the first baseplate (see Figure 5-54). Tighten the two retaining screws.
   This A/B Module Fieldbus and Time Strobe 9-pin connector is located on the lower left or upper left portion of the baseplate, depending on the orientation of the baseplate.

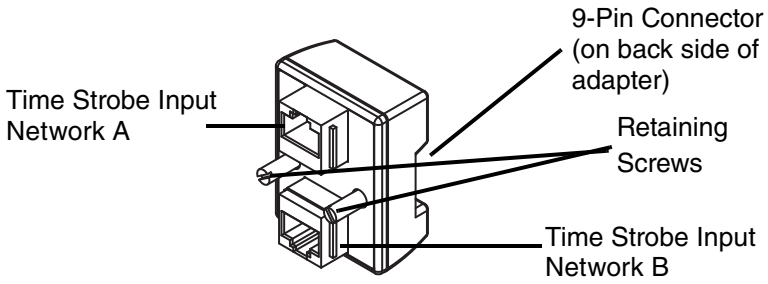



**Figure 5-52. P0926KZ A/B Module Fieldbus and Time Strobe Terminator**

For **an FCP280 baseplate**, insert a Time Strobe Adapter (RH924ZQ) (see Figure 5-53) into the 9-pin connector in Fieldbus port 1 in the FCP280 baseplate. Tighten the two retaining screws.

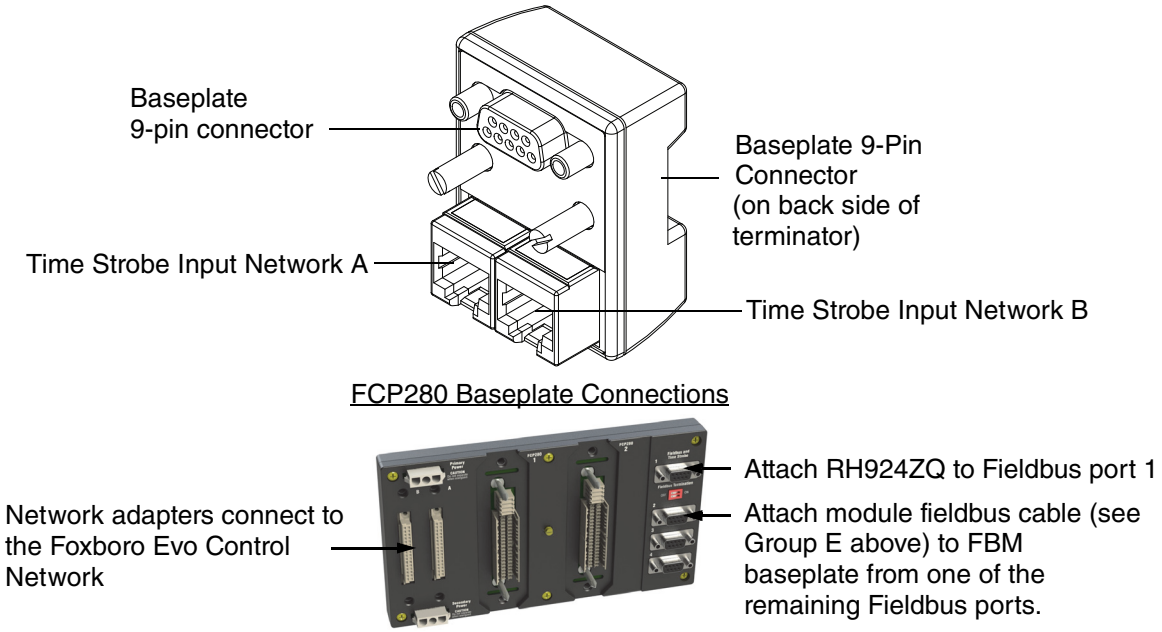
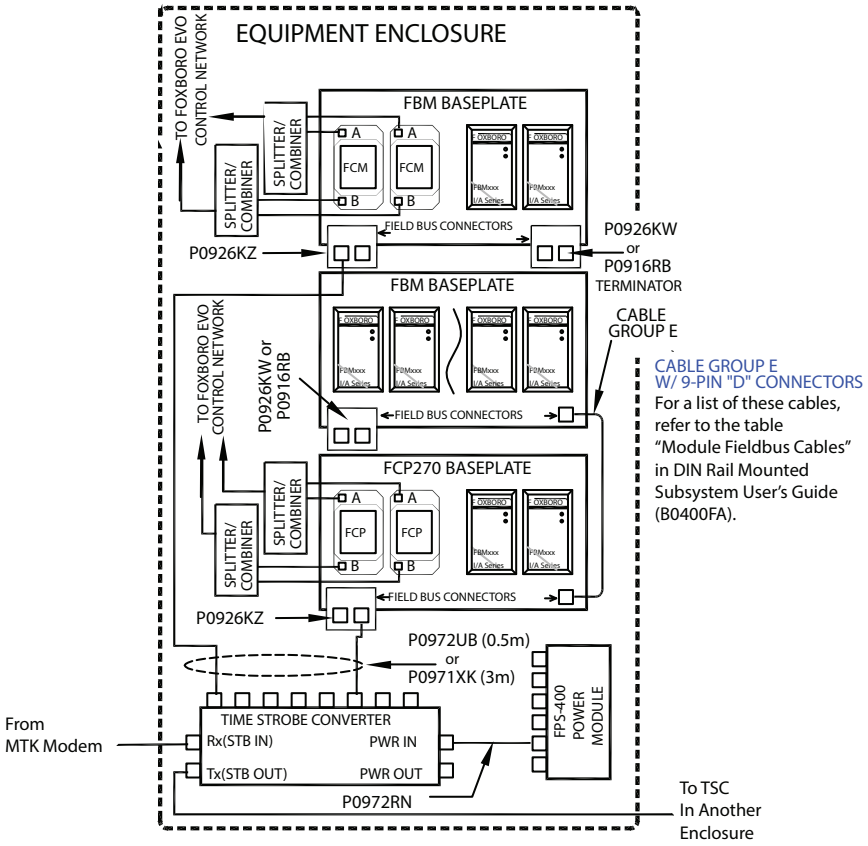



**Figure 5-53. RH924ZQ Time Strobe Adapter**




NOTE: FCP280 connections are similar to those shown above - no splitter/combiner is used. RH928ZQ is used in place of P0926KZ adapter. Refer to B0700FW for details.

**Figure 5-54. Non-redundant Time Strobe Cable Connections to FCP270, FCM100Et, or FCP280**

2. Using cable P0972UB or P0971XK (see Figure 5-54), connect a TSC output to the A/B Module Fieldbus and Time Strobe Terminator (P0926KZ) in the non-FCP280 baseplate, or to the Time Strobe Adapter (RH924ZQ) in the FCP280 baseplate.

   Any of the eight TSC outputs can be connected to the Time Strobe Terminator or Adapter in the baseplate. The cable length must be less than 3 m (10 ft).

3. If more than one baseplate is located within the enclosure, daisy chain the Module Fieldbus signals between the baseplates using a cable from cable group E (see Figure 5-54).

4. For a non-FCP280 baseplate, insert terminator (P0926KW or P0916RB) (see Figure 5-55) into the Time Strobe and Fieldbus termination 9-pin connector on the last or only baseplate in the enclosure. Tighten the two retaining screws.

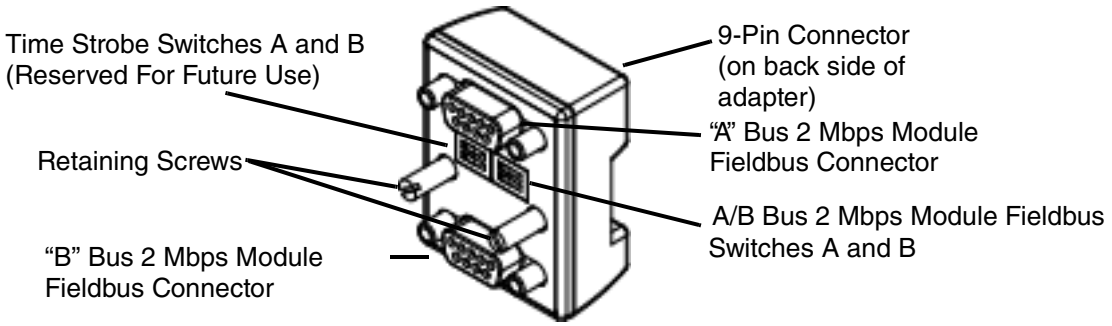



**Figure 5-55. P0926KW Module Fieldbus/Time Strobe Terminator**

**NOTE**

To attach redundant (A/B) module Fieldbus cables to the FCP280, refer to "Redundant Module Fieldbus Cable Adapter (RH924ZJ/RH928CY)" in *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA). Do not attach terminator P0926KW to the FCP280 baseplate.

5. If P0926KW Module Fieldbus/Time Strobe Terminator is used, set the A/B Bus 2 Mbps Module Fieldbus Switch A and Switch B DIP switches to the 1 (ON) position (see Figure 5-56). Time Strobe termination DIP switches on P0926KW are reserved for future use and can be set to any position without affecting time strobe operation.

6. If P0916RB Module Fieldbus Terminator is used, the A/B 2 Mbps Module Fieldbus is automatically terminated by the internal resistors.

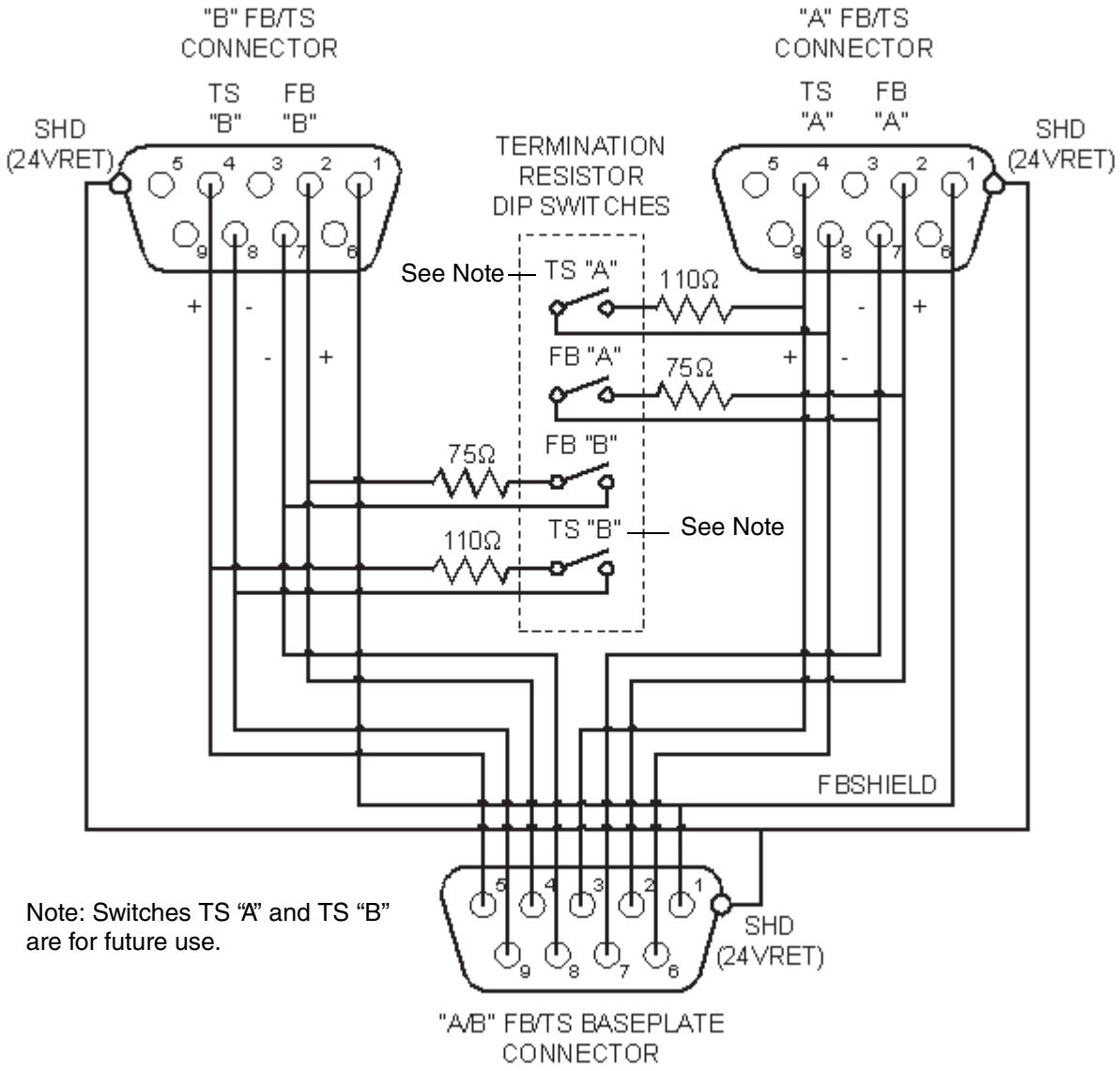


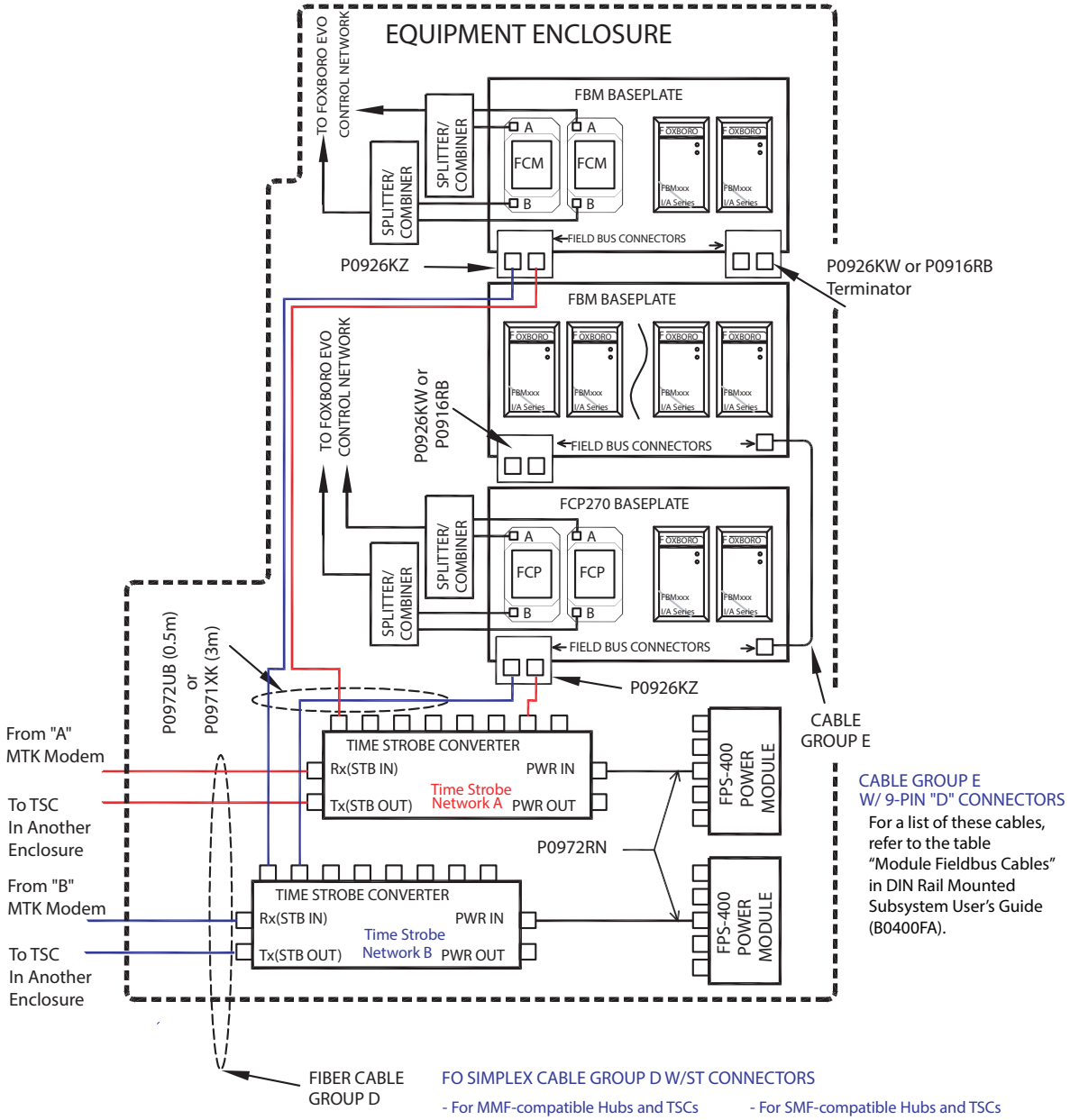

**Figure 5-56. P0926KW Module Fieldbus/Time Strobe Terminator Schematic**

To connect a redundant TSC strobe output to the FCP280, FCP270, or FCM100Et:

1. For **a non-FCP280 baseplate**, insert the A/B Module Fieldbus and Time Strobe Terminator (P0926KZ) (see Figure 5-52) into the baseplate (see Figure 5-57). Tighten the two retaining screws.

   This Time Strobe input is located on the lower left or upper left portion of the baseplate depending on the orientation of the baseplate.

   For **an FCP280 baseplate**, insert the Time Strobe Adapter (RH924ZQ) (see Figure 5-53) into the 9-pin connector in Fieldbus port 1 in the FCP280 baseplate. Tighten the two retaining screws.




See Figure 5-53 for FCP280 baseplate connections.

**Figure 5-57. Redundant Time Strobe Cable Connections to FCP270 or FCM100Et**

2. Using cable P0972UB or P0971XK (see Figure 5-57), connect one TSC output to the A/B Module Fieldbus and Time Strobe Terminator (P0926KZ) in the non-FCP280 baseplate, or to the Time Strobe Adapter (RH924ZQ) in the FCP280 baseplate.

   Any of the eight TSC outputs can be connected to the Time Strobe Terminator or Adapter in the baseplate. The cable lengths must be less than 3 m (10 ft).

3. Using cable P0972UB or P0971XK (see Figure 5-57), connect one output from the second TSC to the second input of the A/B Module Fieldbus and Time Strobe Terminator (P0926KZ).

   Any of the eight TSC outputs can be connected to the A/B Module Fieldbus and Time Strobe Terminator in the baseplate. The cable lengths used from cable group A should be less than 3 m (10 ft).

4. Insert terminator (P0926KW or P0916RB) (Figure 5-55) into the last or only baseplate in the enclosure. Tighten the two retaining screws.

**— NOTE**

To attach redundant (A/B) module Fieldbus cables to the FCP280, refer to "Redundant Module Fieldbus Cable Adapter (RH924ZJ/RH928CY)" in *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA). Do not attach terminator P0926KW to the FCP280 baseplate.

5. If P0926KW Fieldbus/Time Strobe Terminator is used, set the A/B Bus 2 Mbps Module Fieldbus Switch A and Switch B DIP switches to the 1 (ON) position (see Figure 5-56). Time Strobe termination DIP switches on P0926KW are reserved for future use and can be set to any position without affecting time strobe operation.
6. If P0916RB Fieldbus Terminator is used, the A/B 2 Mbps Module Fieldbus is automatically terminated by the internal resistors.

### Time Strobe Cable Connections Cabling to the ZCP270

Cabling between the TSC modules and the controllers consist of shielded twisted-pair (STP) cable with RJ-45 connectors at each end. Both non-redundant and redundant time strobes are supported.

**— NOTE**

In a system with ZCP270s, both the ZCP270 and its associated FCM100Ets must receive a time strobe signal to synchronize the TDR/SOE FBMs time to within 1 ms.

To connect a non-redundant Time Strobe to the ZCP270:

1. Using cable P0972ZL (0.5 m, 1.5 ft) or P0972ZM (3 m, 10 ft), connect a TSC output to the ZCP270 (see Figure 5-58). Any of the eight TSC outputs can be connected to any ZCP.
2. Repeat step 1 connecting all controllers to the TSC.

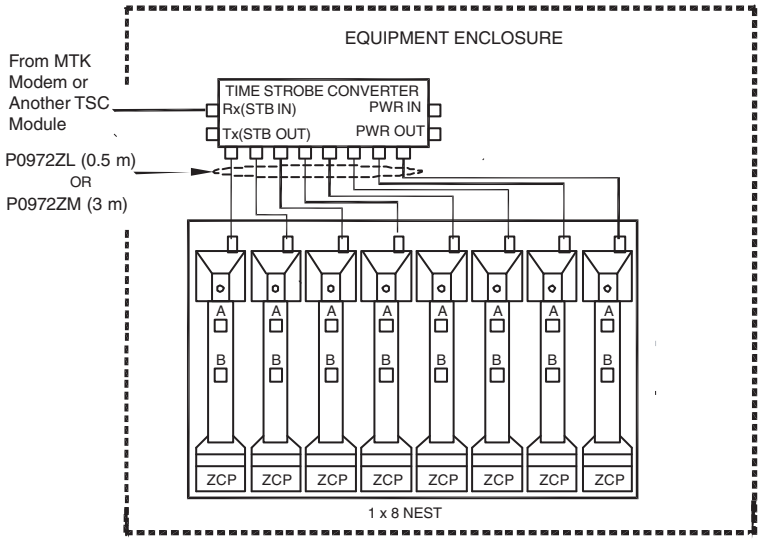



**Figure 5-58. Non-redundant Time Strobe Cable Connections to the ZCP270**

To connect a redundant Time Strobe to the ZCP270:

1. Insert P1 (RJ-45 connector) of the Y cable (P0972UE) into one of the eight TSC RJ-45 outputs (see Figure 5-59).

   The Y cable couples both A and B RS-422 time strobe signals into a single, multi conductor cable.

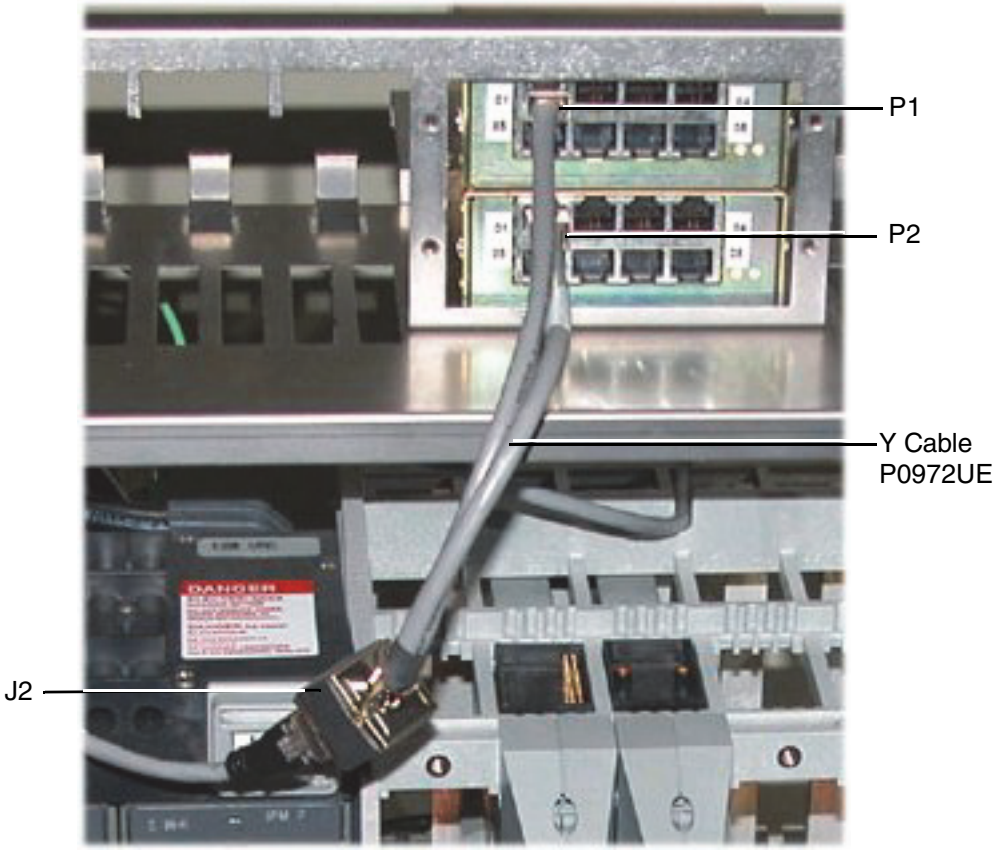



**Figure 5-59. Y Cable (P0972UE) to ZCP270**

2. Insert P2 (RJ-45 connector) of the Y cable (P0972UE) into one of the eight output RJ-45 connectors on the second TSC.
3. Repeat steps 1 and 2 connecting all the TSC outputs to the Y cables.
4. Insert into J2 (RJ-45 connector) of the Y cable (P0972UE) the RJ-45 connector of cable P0972UB (0.5 m, 1.5 ft) or P0971XK (3 m, 10 ft) (see Figure 5-60).

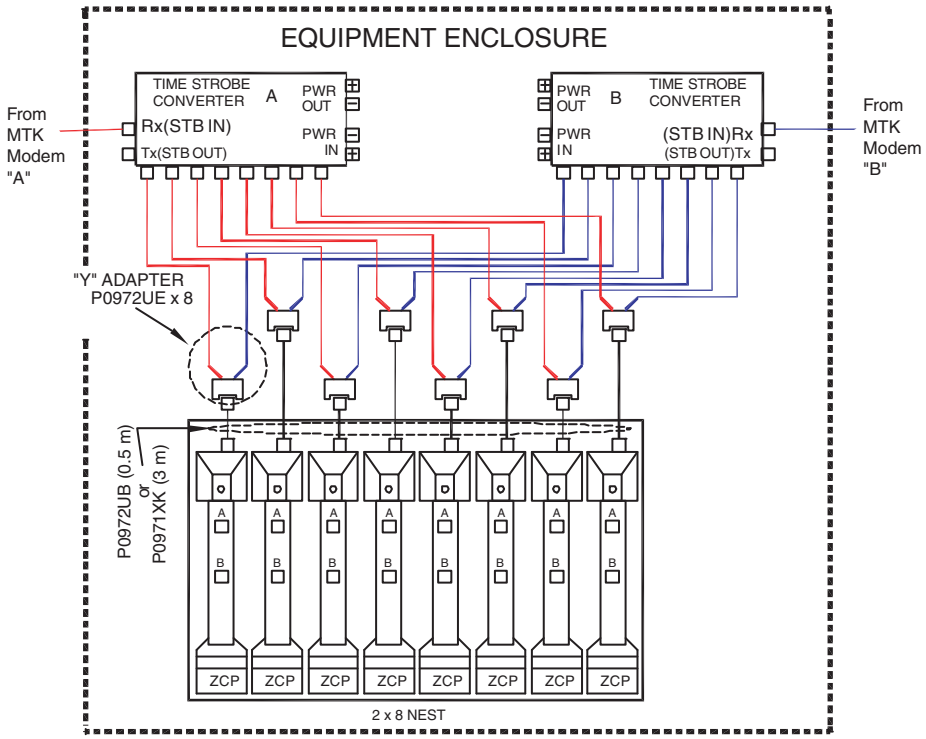



**Figure 5-60. Redundant Time Strobe Cable Connections to ZCP270**

5. Insert the RJ-45 connector of cable P0972UB (0.5 m, 1.5 ft) or P0971XK (3 m, 10 ft) (see Figure 5-60) into the ZCP connector.
6. Repeat steps 4 and 5 connecting each controller to the Y cables.

# Optional Time Strobe Distribution Extender

This section discusses the installation of the MMF-compatible, seven port Time Strobe Distribution Extender (RH100AM) and the SMF-compatible, seven port Time Strobe Distribution Extender (RH100AN). The instructions are the same for both extenders unless otherwise specified. Refer to “Distribution Network Configurations (EXT SRC MTK Only)” on page 14 for situations in which each of these extenders are used.

## Installing the Time Strobe Distribution Extender

Mount the Time Strobe Distribution Extender into an Enclosure or in a suitable 19-inch rack, as shown in Figure 5-61. The mounting brackets are shipped attached to either side of the backplate of the extender. The mounting brackets on the extender are removable. This allows the customer to install the extender with their faceplates facing either toward the front or the rear of the rack or enclosure.

The Time Strobe Distribution Extender can also be mounted on a shelf or other flat surface.

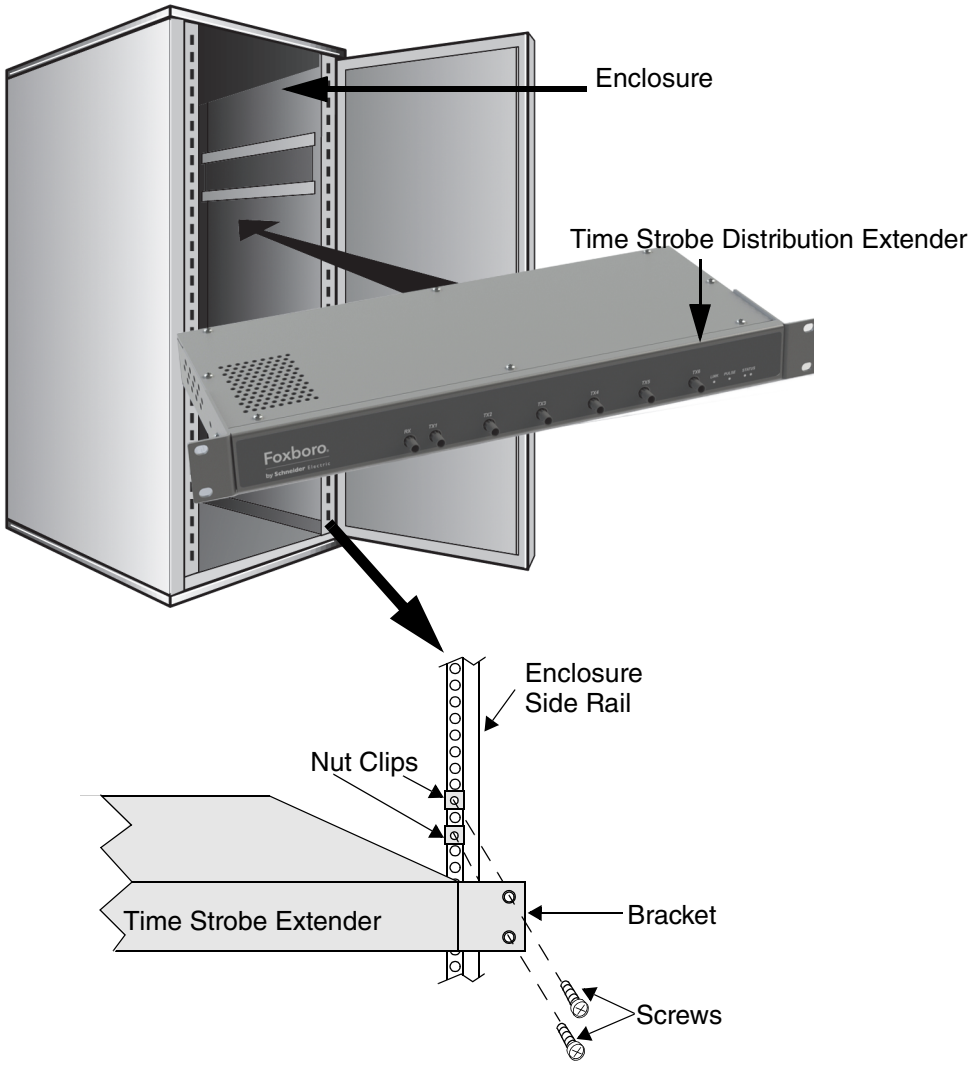



**Figure 5-61. Time Strobe Distribution Extender, Enclosure Mounting Procedure**

## Connecting Cabling to the Time Strobe Distribution Extender

When making cable connections to the Time Strobe Distribution Extender, refer to Figure 5-61 for the correct positions. Proceed as follows:

1. Ensure the fiber optic cables meet the following criteria:
   - For the RH100AM extender, the fiber type is 62.5/125 multi-mode fiber (MMF). For the RH100AN extender, the fiber type is 9/125 single-mode fiber (SMF).
   - The cable has a male ST fiber connector on both ends of the cable.
   - SMF cables with ST connectors are user-supplied.
   - Foxboro part numbers for MMF cables with ST connectors are:
     - P0972UP - 3 m (10 ft)
     - P0972UQ - 15 m (50 ft)
     - P0972UR - 50 m (160 ft)

- Cable lengths greater than 50 m (160 ft) are customer supplied.

These MMF cables interconnect the MTK modem to the MMF-compatible TSCs or to either of the Time Strobe Distribution Extenders (which both accept MMF cable inputs from the modem). These cables can also be used to interconnect (daisy chain) the MMF-compatible Time Strobe Distribution Extenders (RH100AM).

The SMF-compatible extender (RH100AN) can only connect its outputs to SMF-compatible TSCs.

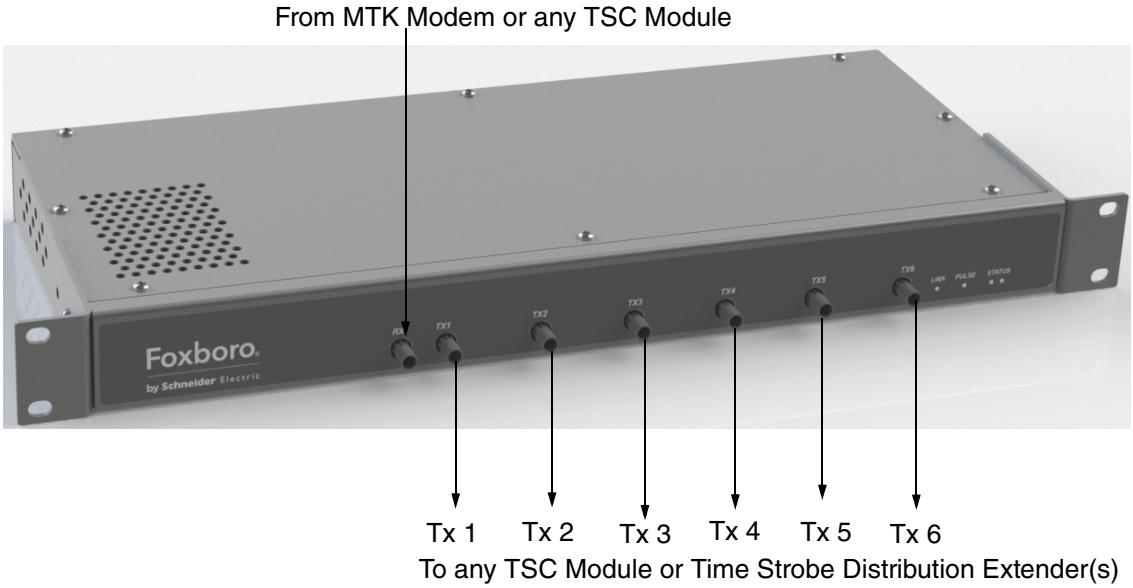



**Figure 5-62. Time Strobe Distribution Extender (RH100AM Shown), Cable Connections**

2. Connect the multi-mode fiber cable with ST connectors from one of the outputs of the MTK modem to the Rx 1 input of the extender (either type), as shown in Figure 5-62. The MMF-compatible extender can alternatively accept an input from a TSC module. For each connection, proceed as follows:
   a. At each applicable extender port, orient the cable connector to align with the slot on the port connector and fully insert the cable connector into the port connector.
   b. Rotate the outer sleeve of the ST connector approximately 1/8 turn in a clockwise direction to secure the connector in place.
3. If both outputs from the MTK modem or a TSC module are being connected to separate extenders, connect the multi-mode fiber cable with ST connectors from the other output of the MTK modem to the Rx 1 input of either type of second extender, as shown in Figure 3-1 on page 13. The MMF-compatible extender can alternatively accept an input from a TSC module. For each connection, proceed as follows:
   a. At each applicable extender port, orient the cable connector to align with the slot on the port connector and fully insert the cable connector into the port connector.
   b. Rotate the outer sleeve of the cable connector approximately 1/8 turn in a clockwise direction to secure the connector in place.
4. If a redundant Time Strobe Network is being installed, repeat steps two and three for the redundant MTK modems and Time Strobe Distribution Extenders. Refer to

Figure 3-1 on page 13, and to the diagrams in "Distribution Network Configurations (EXT SRC MTK Only)" on page 14 for an EXT SRC MTK system.

5. Connect the outputs of the Time Strobe Distribution Extenders (Tx1 through Tx6) to the inputs (Rx) of the appropriate Time Strobe Converter(s) (RH100AM extender to P0972KA TSC, or RH100AN extender to P0973BW TSC). Alternatively, the outputs of the MMF-compatible extender can be connected to another MMF-compatible Time Strobe Distribution Extender. MMF-compatible Time Strobe Distribution Extenders can be daisy chained. There is no limit to the number of MMF cable segments that can be daisy chained except that each segment length cannot exceed 2 km (6562 ft). If used, an SMF cable segment can be up to 10 km (6.2 mi) in length.
6. Connect the power supply cord to either a 120 or 240 V ac outlet.

**⚠ CAUTION**

Ensure that the input ac power outlet for the Time Strobe Distribution Extender is near to the extender and is easily accessible. You can only disconnect ac power to the Time Strobe Distribution Extender by removing the ac power plug from the outlet.

7. Check the power supply indicator on the front of the extender. If power has been applied to the system or enclosure, ensure that the indicators are showing the correct state.
8. Return to the procedure "MTK Modem to Time Strobe Converter Cable Connections" on page 72 to connect Time Strobe Converters to other Time Strobe Converters, either within an enclosure or interconnected to another enclosure, and to complete installing the Time Strobe Network.

There is no limit to the number of MMF cable segments that can be daisy chained except that each segment length cannot exceed 2 km (6562 ft).

# 6. Operation and Maintenance

*This chapter describes how to operate and maintain the Time Synchronization Network.*

**⚠ WARNING**

To prevent explosion, install and remove cables, wiring, modules and other replaceable components only when the area is known to be nonhazardous.

## Setting Time

### Overview

The Foxboro Evo and I/A Series system management applications (such as System Manager) provide the Set Date and Time display for operators to interact with the TimeKeeper subsystem. The equipment information display for each supported workstation or server shows the state of the TimeKeeper. The Set Date and Time display allows the user to change the time and date of the Master TimeKeeper if the Master TimeKeeper is internally sourced. The Set Date and Time display is disabled by any system management application to prevent user access if there is an externally sourced Master TimeKeeper.

An externally sourced TimeKeeper does not start up until it is synchronized with the GPS. An internally sourced TimeKeeper starts using the time from its real-time clock.

The Foxboro Evo or I/A Series system management applications work in conjunction with the TimeKeeper to control the operator's ability to set the time and date as follows:

- The user sets the local time zone and Daylight Savings flag using the Windows Time/Date applet. This has no effect on time synchronization. See "Setting the Time Zone" on page 88.
- For an internally sourced Master TimeKeeper (INT SRC MTK), the operator sets the local date and time using the Set Date and Time display in any system management application, available on any workstations or servers.
- In systems with an active externally sourced Master TimeKeeper, the system management applications make the Set Date and Time display unavailable on all workstations.
- All other operations of the TimeKeeper subsystem are automatic.

**NOTE**

For systems using Nodebus, do not set the time from any system management application running on a workstation or server on the Nodebus side of a network; the Foxboro Evo Control Network (hereinafter referred to as the control network) side of the network ignores the changes and overrides time changes on the Nodebus side of the network.

Refer to *System Management Displays* (B0193JC) for more information on the system time displays.

## Setting the Time Zone

The time zone is set from the Windows Date/Time applet. The Windows Date/Time applet contains three tabs. The **Date & Time** tab allows you to change the current time and date but should not be used. The **Time Zone** tab allows you to establish local time by setting a time zone. The **Internet Time** tab triggers time synchronization but should not be used.

If you select the **Internet Time** tab always exit via the **Cancel** button. Exiting via the **OK** button (as opposed to the **Cancel** button) automatically starts the Windows Time service when you reboot the workstation or server. The Windows Time service should always be set to **Disabled**; otherwise, the workstation's or server's time settings may fluctuate unpredictably.

In most cases, a Time Zone with a checked Daylight Savings Time (DST) box should always be selected for time synchronization to work properly.

When a Nodebus system is connected to the control network and the DST box is not checked, the DST selection in any system management application will not be activated, providing no way to control when the time change should occur on the Nodebus side of the network. Applications on the Nodebus side may lock up at the time of the DST change, usually 2:00 AM. When the DST box is checked, the Foxboro Evo or I/A Series system management applications provide operators with the option to choose the Manual switchover in the Fall and Spring.

**⚠ CAUTION**

Do not exit the Internet Time tab by clicking the **OK** button. Use the **Cancel** button or simply close the applet.

To set the time zone for a system with GPS:

1. Double click the displayed time on the Windows task bar.

   The Date and Time Properties display appears.
2. Click the Time Zone tab on the Date and Time Properties display.

   The Time Zone display appears (see Figure 6-1).

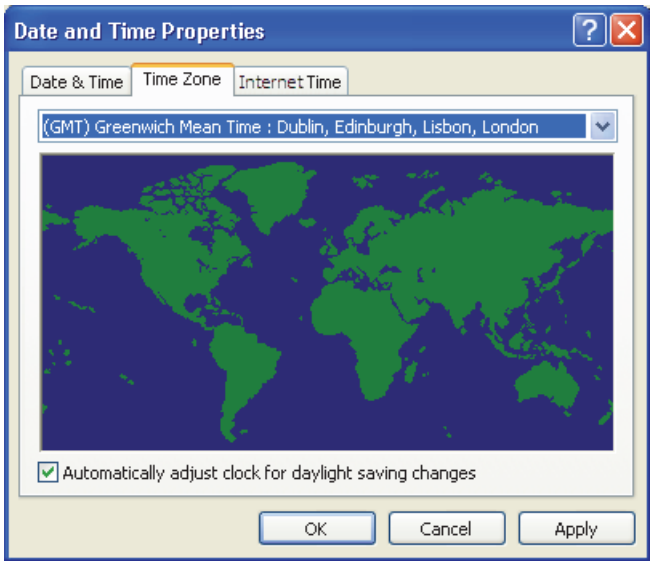



**Figure 6-1. Time Zone Display**

3. Select the Time Zone from the drop down menu.
4. Click **OK**.

# System Messages

The TimeKeeper sends system messages to printers, historians, and workstation or server message lines. System message destinations are determined by a station's System Monitor system configuration.

The messages and recommended corrective actions for each message are listed in Table 6-1.

**Table 6-1. Time Synchronization System Message**

| System Message | Description | Corrective Action |
|---|---|---|
| Slave TimeKeeper sync pulse received port <port>.<br>Where port =<br>A, B. | The slave TimeKeeper is listening on port A or B and is receiving a sync pulses. | None |

**Table 6-1. Time Synchronization System Message (Continued)**

| System Message | Description | Corrective Action |
|---|---|---|
| Slave TimeKeeper lost sync pulse port <port>.<br>Where port =<br>A, B, A&B. | An error condition exists if the sync pulsed station was getting sync pulses from the active MTK that indicate it should use pulsed synchronization, but the sync pulsed station is no longer receiving any pulses. If this condition occurs the sync pulsed station sends a system error message. | Check activity indicators on TSC, MTK modem and Time Strobe Generator (PCI card) for correct operation. If all activity indicators are ON but not winking, check the GPS antenna and fiber optic isolator. If an activity indicator is OFF or not winking, check the module for correct operation.<br>Check for other TimeKeeper system diagnostic messages. |
| Slave TimeKeeper lost GPS message port <port>.<br>Where port =<br>A, B, A&B. | An error condition exists if a sync pulsed station is getting sync pulses from an MTK that indicate it should use pulsed synchronization, but the sync pulsed station is not receiving any “time at next pulse” message. If this condition occurs the sync pulsed station sends a system error message and switches to the other port (if available). | Check the Ethernet switches, power, and cables. Check for other TimeKeeper system diagnostic messages (such as erratic sync pulses). |
| Slave TimeKeeper GPS msg recovery port <port>.<br>Where port =<br>A or B. | The slave TimeKeeper reporting this message has resumed receiving “time at next pulse” message. | Recovery message. No action required. |
| TimeKeeper sync pulse failure code = C on station <lbug>.<br>Where C equals:<br>-1 = time value not on 5 second interval.<br>13 = Sync Pulse Time-out. TimeKeeper on workstation equipped with GPS hardware did not receive a sync pulse within time-out period. | If an MTK detects a failure of its Sync Pulse Generator, it sends a system error message. | Check activity indicators on TSC, MTK modem and Time Strobe Generator (PCI) for correct operation. If all activity indicators are ON but not winking, check the GPS antenna and fiber optic isolator. If an activity indicator is OFF or not winking, check the module for correct operation. |

**Table 6-1. Time Synchronization System Message (Continued)**

| System Message | Description | Corrective Action |
|---|---|---|
| TimeKeeper takeover as MTK by station <lbug>. | If the primary MTK fails, a backup MTK automatically takes over. The newly activated MTK sends a system message indicating that it has just taken over. | No action required. This message is also issued at system startup by the active MTK to inform you which MTK is master. |
| TimeKeeper synchronization state = X on station <lbug>. Where X equals: OK or FAIL | OK = Good GPS | No action required. |
| | FAIL = Failed GPS | Check GPS antenna or GPS Fiber Optic Isolator hardware/cables. |
| TimeKeeper process terminated on station <lbug>, code =C. Where C equals -1 through -5. | TimeKeeper process has aborted due to an unexpected error. Causes an automatic station restart. | Code = -1 means a fatal file error occurred while accessing the tk.cfg file. Check the content of the tk.cfg file. Refer to "Examples for Editing the tk.cfg file" on page 98.<br>Code = -2 means the TimeKeeper got an unexpected exception error. No corrective action required. This is a PCI driver error.<br>Code = -3 means an EXT SRC time keeper could not access the PCI card. Reinstall or install PCI card driver.<br>Code = -4 means the TimeKeeper received a kill signal. The system automatically shuts down and reboots.<br>Code = -5 means the time keeper could not start NTP. Check the NTP installation (files corrupted or missing). Reinstall workstation or server software. Check with Customer Service. |
| Time set on <time/date> to <time/date>. | System time has been set manually from any system management application. (Internal source Master TimeKeeper only.) | No action required. |

**Table 6-1. Time Synchronization System Message (Continued)**

| System Message | Description | Corrective Action |
|---|---|---|
| TimeKeeper takeover time-out, retrying <lbug>.<br>Where lbug is the letterbug of the station currently hosting the active Master TimeKeeper. | A TimeKeeper process attempted to takeover active Master TimeKeeper role and failed due to network communications. | Communications failure. Check the Ethernet switches and cables. |
| Slave TimeKeeper initialized as sync pulse station using <port>.<br>Where port = A or B. | The slave TimeKeeper reporting this message has received sync pulses on start up and has initialized as a pulsed station. | No action required. |
| Slave TimeKeeper initialized as no pulse station. | The slave TimeKeeper reporting this message has not received sync pulses on start up and has initialized as a non-pulsed station. | No action required. |
| Slave TimeKeeper lost set time message. | The slave TimeKeeper reporting this message has stopped receiving the time set message used by non-pulsed stations. | Verify that the active Master TimeKeeper is operational. Verify that a functional network connection exists between the active Master TimeKeeper and the station hosting the slave TimeKeeper reporting the problem. |
| Slave TimeKeeper recovered set time message. | 10-minute set time message now received. | No action required. |
| Slave TimeKeeper reverting to no pulse mode - no sync pulse for 48-hours | No sync pulses for 48-hours. | Check GPS antenna and cable connections to PCI card. |
| Slave TimeKeeper reverting to no pulse mode - no GPS messages | No GPS messages (time at next sync pulse) on initialization only. | Check Ethernet network communications and switch connections. |

# Indicators

Light-emitting diodes (LEDs) incorporated into the front of the MTK modem and TSC (all types) provide visual indication of its operational status and time strobe activity (see Figure 6-2 and Figure 6-3).

The Time Strobe Generator (PCI card) in the host computer also has 2 LEDs. They indicate time strobe activity and power. Refer to the Operation and Maintenance Manual provided by the vendor for the GPS and sync pulse hardware/software.

## MTK Modem Indicator LED

Figure 6-2 shows the location of the MTK modem Link/Strobe indicator and Table 6-2 describes the indicator.

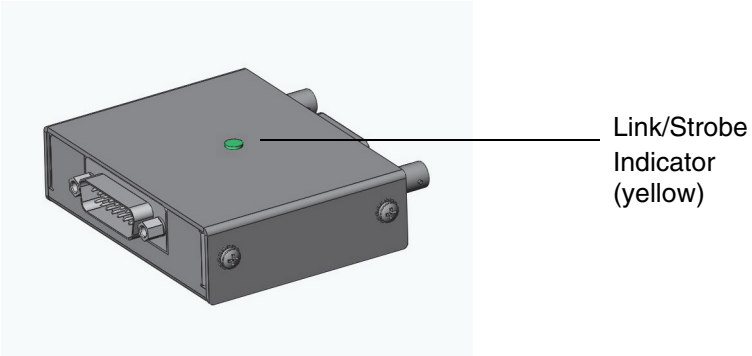



**Figure 6-2. MTK Modem Indicator**

**Table 6-2. MTK Modem Indicator**

| Indicator | Description | Corrective Action |
|---|---|---|
| Link/Strobe LED (yellow) | The LED is a dual purpose, yellow color indicator. The time strobe signal extinguishes (for example, winks) the Link/Strobe LED for 0.1 seconds every 5 seconds to give a visual indication of MTK modem activity. When winking, it indicates that the pulse is being transmitted. When ON, it indicates that the dc/dc converter in the MTK modem is producing sufficient operational power for the MTK modem. | If MTK modem Link/Strobe indicator is not winking:<br>**1.** Check if MTK Link/Strobe indicator is not ON. If not ON:<br>**a.** Check the cable to the workstation.<br>**b.** Check that power is applied to the workstation.<br>**c.** Check the Time Strobe Generator (PCI) activity indicator. If the PCI activity indicator is winking, MTK modem is OK.<br>**2.** Check time strobe cables to MTK modem. If cables are OK, replace MTK modem.<br>**3.** If MTK modem Link/Strobe indicator is not winking and MTK modem Link/Strobe indicator is ON, MTK modem is OK. Perform failure analysis on PCI card or GPS antenna subsystem. |

## Time Strobe Converter Indicator LEDs

Figure 6-3 shows the location of the Time Strobe Converter indicators on all types of TSCs (P0972KA and P0973BW). Table 6-3 describes the indicators.

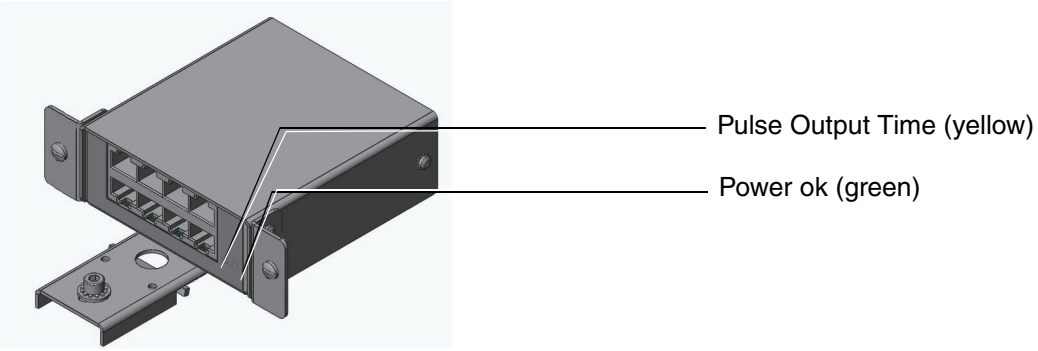



**Figure 6-3. Time Strobe Converter Indicators**

**Table 6-3. Time Strobe Converter Indicators**

| Indicator | Description | Corrective Action |
|---|---|---|
| Power ok LED (green) | The green power LED when ON indicates that the input power and dc-to-dc converter levels are acceptable. | **1.** Power ok indicator off<br>**a.** Check power cables from PDU or FPS400-24 power supply to TSC.<br>**b.** Check 24 V dc power from PDU or FPS400-24 to TSC. If power is present, replace TSC.<br>**c.** Check ac power to PDU or FPS400-24. |
| Link Monitor/Activity LED (yellow) | The LED is a dual purpose, yellow color indicator. When winking, it indicates that the TSC module is connected to either an active MTK modem or to an active TSC module. The time strobe signal extinguishes (for example, winks) the link monitor LED for 0.1 seconds every 5 seconds to give a visual indication of time strobe activity. | **1.** Indicator not winking:<br>**a.** Check if TSC power indicator is ON (see Power ok LED).<br>**b.** Check MTK modem activity indicator. If MTK modem activity indicator is winking, check cables.<br>**c.** Check time strobe cables to TSC. If cables are OK, replace TSC.<br>**d.** If MTK modem activity indicator is not winking and TSC Pulse Output Time indicator is ON, TSC is OK. Perform failure analysis on Time Strobe Generator (PCI) card or GPS antenna subsystem. |

## GPS Fiber Optic Isolator (Optional) Indicators

Both the Copper-to-Fiber Transmitter and the Copper-to-Fiber Receiver have two indicators. Each indicator denotes power and link activity. Figure 6-4 shows the location of the indicators and Table 6-4 describes the indicators.

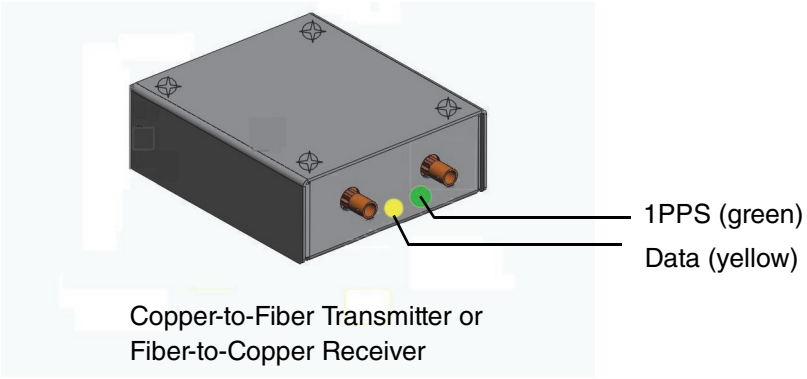



**Figure 6-4. GPS Fiber Optic Isolator Indicators**

**Table 6-4. GPS Fiber Optic Isolator Indicators**

| Indicator | Description | Corrective Action |
|---|---|---|
| Data LED (yellow) | The LED is a yellow color indicator. When winking, it indicates that the module is receiving data from either the antenna or the Copper-to-Fiber Transmitter. | **1.** Both the Data and 1PPS indicators are not winking on Copper-to-Fiber Transmitter.<br>**a.** Check cables and power to the power supply. Replace power supply to Copper-to-Fiber Transmitter.<br>**b.** If Data indicator is not winking, perform failure analysis on GPS antenna subsystem.<br>**c.** Replace Copper-to-Fiber Transmitter.<br>**2.** Indicator not winking on Fiber-to-Copper Receiver.<br>**a.** Check cables and power to from MTK modem. If MTK modem power indicator out, check the cables and check that the workstation power is on.<br>**b.** Check if Data/1PPS indicator on Copper-to-Fiber Transmitter is on. If not, perform failure analysis Copper-to-Fiber Transmitter and /or GPS antenna subsystem.<br>**c.** If Data indicator on Copper-to-Fiber Transmitter is on, check cables and if necessary, replace Fiber-to-Copper Receiver. |

**Table 6-4. GPS Fiber Optic Isolator Indicators (Continued)**

| Indicator | Description | Corrective Action |
|---|---|---|
| 1PPS (Pulse Per Second) LED (green) | The LED is a green color indicator. When winking (at approximately a 1 second rate), it indicates that the module is connected to an active time strobe from either the antenna or the Copper-to-Fiber Transmitter. | **1.** Both 1PPS and Data indicators are not winking on Copper-to-Fiber Transmitter.<br>**a.** Check cables and power to the power supply. Replace power supply to Copper-to-Fiber Transmitter.<br>**b.** If 1PPS indicator is not winking, perform failure analysis on GPS antenna subsystem.<br>**c.** Replace Copper-to-Fiber Transmitter.<br>**2.** Indicator not winking on Fiber-to-Copper Receiver.<br>**a.** Check cables and power to from MTK modem. If MTK modem power indicator out, check the cables and check that the workstation power is on.<br>**b.** Check if 1PPS/Data indicator on Copper-to-Fiber Transmitter is on. If not, perform failure analysis Copper-to-Fiber Transmitter and /or GPS antenna subsystem.<br>**c.** If 1PPS indicator on Copper-to-Fiber Transmitter is on, check cables and if necessary, replace Fiber-to-Copper Receiver. |

## Time Strobe Distribution Extender Indicator LEDs

Figure 6-5 shows the location of the Time Strobe Distribution Extender indicators on all types of these extenders (RH100AM and RH100AN). Table 6-5 describes the indicators.

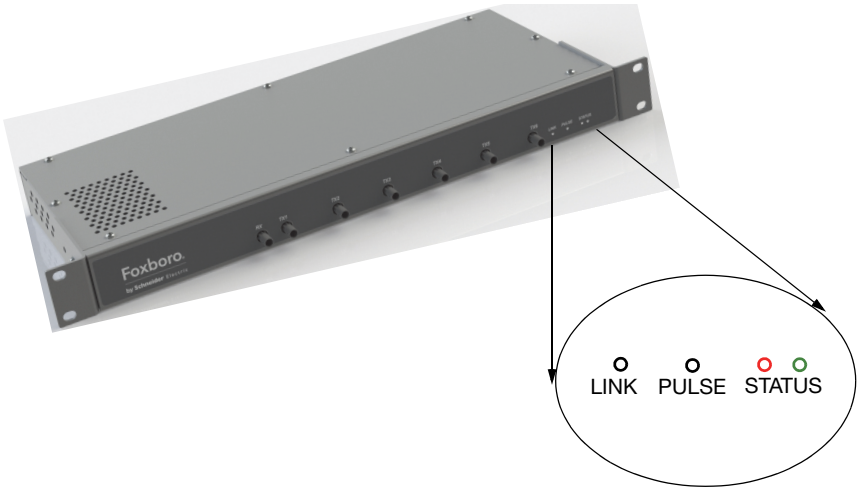



**Figure 6-5. Time Strobe Distribution Extender Indicators**

**Table 6-5. Time Strobe Distribution Extender Indicators**

| Indicator | Description | Corrective Action |
|---|---|---|
| Red Status LED | The red LED when ON indicates power failure. | Replace extender |
| Green Status LED | The green LED when ON indicates that the power supply is okay. | None |
| Yellow Link LED | The yellow link LED when ON indicates that link is established with the MTK modem. | Check for fiber connections |
| Yellow Pulse LED | The yellow link LED when ON indicates that the time strobe pulse is transmitted. | Check for link<br>Check fiber connections |

# TimeKeeper Synchronization Failure at Boot Time

## Description of Failure

The TimeKeeper at boot time must synchronize its PCI card to the GPS before the TimeKeeper proceeds. This is because the PCI card must get a least one good time reading. If the TimeKeeper tries to proceed by setting the time on an unsynchronized PCI card, the PCI card resets the time. Once the PCI card gets a good reading, it maintains time throughout any subsequent synchronization failures.

The following system notifications occur if the PCI card is not synchronized:

- SMON is notified that the GPS is failed and the station is color is changed to yellow
- The system message “TimeKeeper lost time synchronization input on station <lbug>” is printed on the system printer.

If the PCI driver is not installed on the workstation, the system message “TimeKeeper process terminated on station <lbug> code = -3”. This causes continuous station restarts until the PCI driver is installed.

The result is that the affected workstation is running off its internal PC clock unsynchronized with the current Master TimeKeeper workstation until it gets a synchronized PCI card. Foxboro Evo control is running. The failure can be:

- PCI card/driver installation
- Improper system configuration using the system configurators (Control Editors, SysDef, or IACC).

You should check the GPS antenna system, PCI card installation, other possible system messages, and the system configuration as defined by the Foxboro Evo system configurators.

A workaround, until the synchronization hardware/software is repaired, involves making edits to the /usr/fox/sp/tk.cfg file on the defective workstation. This file is normally built via the Foxboro Evo system configurators.

## Examples for Editing the tk.cfg file

The following four examples illustrate edits that can be made to the tk.cfg file to temporarily restore the TimeKeeper operation. It is strongly recommended that you should avoid editing the tk.cfg file.

**— NOTE**

First line in the tk.cfg file indicates primary Master TimeKeeper (MTK).

1. If the failure is on the primary TimeKeeper workstation or server (for example, AW0001) and there is a back up time keeper workstation or server (for example, AW0002) you should change the failed primary MTK and make the backup MTK the primary MTK.

| If the tk.cfg: | Change to: |
|---|---|
| `AW0001 SYN` | `AW0002 SYN` |
| `AW0002 SYN` | |

2. If the backup is INT, change the primary to INT, as follows:

| If the tk.cfg: | Change to: |
|---|---|
| `AW0001 SYN` | `AW0001 INT` |
| `AW0002 INT` | `AW0002 INT` |

3. If the failure is on the backup workstation or server, make the backup INT, as follows:

| If the tk.cfg: | Change to: |
|---|---|
| `AW0001 SYN` | `AW0001 SYN` |
| `AW0002 SYN` | `AW0002 INT` |

4. If there is no backup TimeKeeper, change the failed primary MTK to internal, as follows:

| If the tk.cfg: | Change to: |
|---|---|
| `AW0001 SYN` | `AW0001 INT` |

5. Also, an example of how to edit the tk.cfg file for an Off-control network NTP TimeKeeper (that is, an NTP TimeKeeper which is on a network other than the control network) is provided below. In this example:
   - Master TimeKeeper = `AW0001`
   - Backup TimeKeeper = `SVR001`
   - Primary NTP source = `181.182.22.1`
   - Secondary NTP source = `181.182.22.2`
   - Third NTP source = `181.182.22.100`

The example is as follows:

```
AW0001 NTP 181.182.22.1, 181.182.22.2, 181.182.22.100
SVR001 NTP 181.182.22.1, 181.182.22.2, 181.182.22.100
```

**NOTE**

One to three NTP servers can be configured as a time sync for the Master TimeKeeper and backup TimeKeeper. This configuration is supported in System Definition 3.0 or later for systems with I/A Series software v8.8 or Control Core Services software v9.0 or later.

6. After editing the tk.cfg file, reboot the workstation or server.

# Replacing Components

All other components (TSC, MTK modem and interconnecting cables) can be replaced without removing power.

**WARNING**

To prevent explosion, **do not** install or remove cables, wiring, modules, or other replaceable system components in hazardous locations. Remove power to the equipment at the source or ensure that the atmosphere is non-explosive before installing or removing any electrical component.

## Replacing the GPS PCI Card

If the GPS PCI card installed in a workstation should need to be replaced, proceed as follows:

1. If the system software is running, shut down the I/A Series software or Control Core Services software before continuing (refer to “Turn Off I/A Series Software or Foxboro Evo Control Core Services Software” on page 26).
2. Uninstall the GPS card device drivers as described in the section “Removing the GPS PCI Card Device Driver” on page 99.
3. Shutdown the workstation.
4. Remove the PCI card from the workstation.
5. Boot the workstation.
6. Install the new PCI card as described in “Installing the PCI Card” on page 26.

## Removing the GPS PCI Card Device Driver

Prior to uninstalling the driver, the Spectracom/KSI time card appears in the Device Manager under **Timing Boards** as either **Spectracom TSAT PCI -FXA Timing Board** or **KSI TSAT PCI -FXA Timing Board**.

To view the Device Manager, right-click the **My Computer** icon on the desktop, select the **Manage** pick, and then select the **Device Manager** pick under the **System Tools** tab. The Device Manager appears as shown in Figure 6-6.

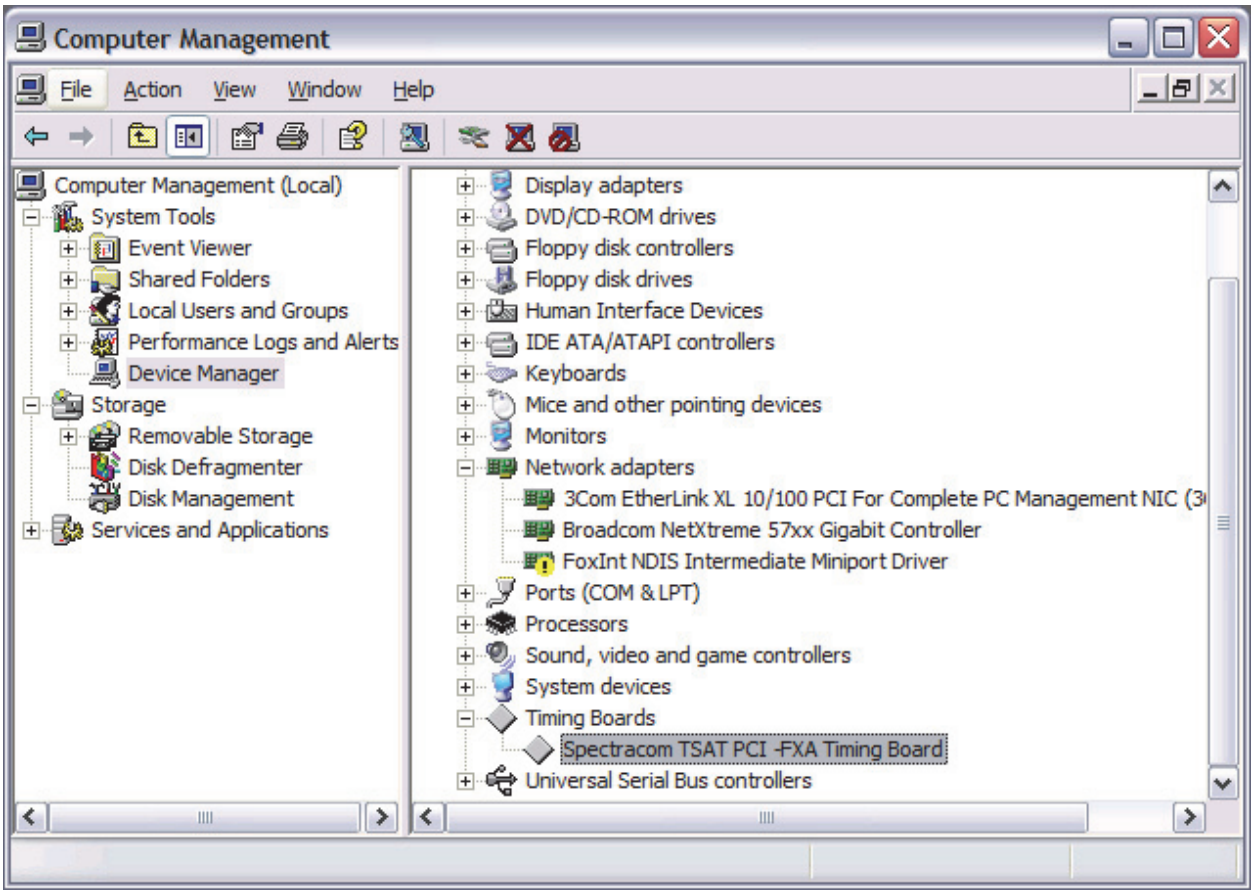



**Figure 6-6. Spectracom TSAT PCI-FXA Timing Board in Device Manager**

With the Spectracom or KSI timing board selection highlighted, select **`Uninstall from the Action Menu`**. When a dialog appears confirming that you want to uninstall the device, select **`OK`** to proceed with the device uninstallation process.

# Appendix A. Wiring Guide for Time Strobe Network Installation

*This appendix provides cabling diagrams for interconnecting the time strobe network.*

Multiple options are available for connecting the time synchronization equipment. The figures in this chapter illustrate the way in which the time strobe equipment can be connected and lists the parts and cables necessary to accomplish the connections. The illustrations are as follows.

For the FCP280 and FCP270:

- Extended Time Strobe Network - FCP270 with Fiber Antenna Connection, Redundant Cabling (Figure A-1)
- Extended Time Strobe Network - FCP270 with Fiber Antenna Connection, Non-redundant Cabling (Figure A-2)
- Extended Time Strobe Network - FCP270 with Wire Antenna Connection, Redundant Cabling (Figure A-3)
- Extended Time Strobe Network - FCP270 with Wire Antenna Connection, Non-redundant Cabling (Figure A-4)
- Site-Wide Time Strobe Network - FCP270 with Wire Antenna Connection, Redundant Fiber Cabling (Figure A-5)
- Site-Wide Time Strobe Network - FCP270 with Wire Antenna Connection, Redundant Copper Cabling (Figure A-6).

**NOTE**

FCP280 Time Strobe Network connections are similar to the FCP270; they are the same except that the FCP280 baseplate uses
- the Time Strobe Adapter (RH924ZQ) in place of the A/B Module Fieldbus and Time Strobe Terminator (P0926KZ), and
- the redundant module Fieldbus cable adapter (RH924ZJ/RH928CY) in place of the terminator (P0926KW).

Refer to Figure 5-53 “RH924ZQ Time Strobe Adapter” on page 75 for the details on FCP280 baseplate connections.

Note that the FCP280 only has a two-position baseplate which cannot accept 200 Series FBMs. Scenarios for upgrading existing systems with FCP270 four-position baseplates are provided in the *Field Control Processor 280 (FCP280) Upgrade Guide* (B0700GC).

For the ZCP270:

- Extended Time Strobe Network - ZCP270 with Fiber Antenna Connection, Redundant Cabling (Figure A-7)
- Extended Time Strobe Network - ZCP270 with Fiber Antenna Connection, Non-redundant Cabling (Figure A-8)
- Extended Time Strobe Network - ZCP270 with Wire Antenna Connection, Redundant Cabling (Figure A-9)
- Extended Time Strobe Network - ZCP270 with Wire Antenna Connection, Non-redundant Cabling (Figure A-10)
- Site-Wide Time Strobe Network - ZCP270 with Wire Antenna Connection, Redundant Fiber Cabling (Figure A-11).
- Site-Wide Time Strobe Network - ZCP270 with Wire Antenna Connection, Redundant Copper Cabling (Figure A-12).

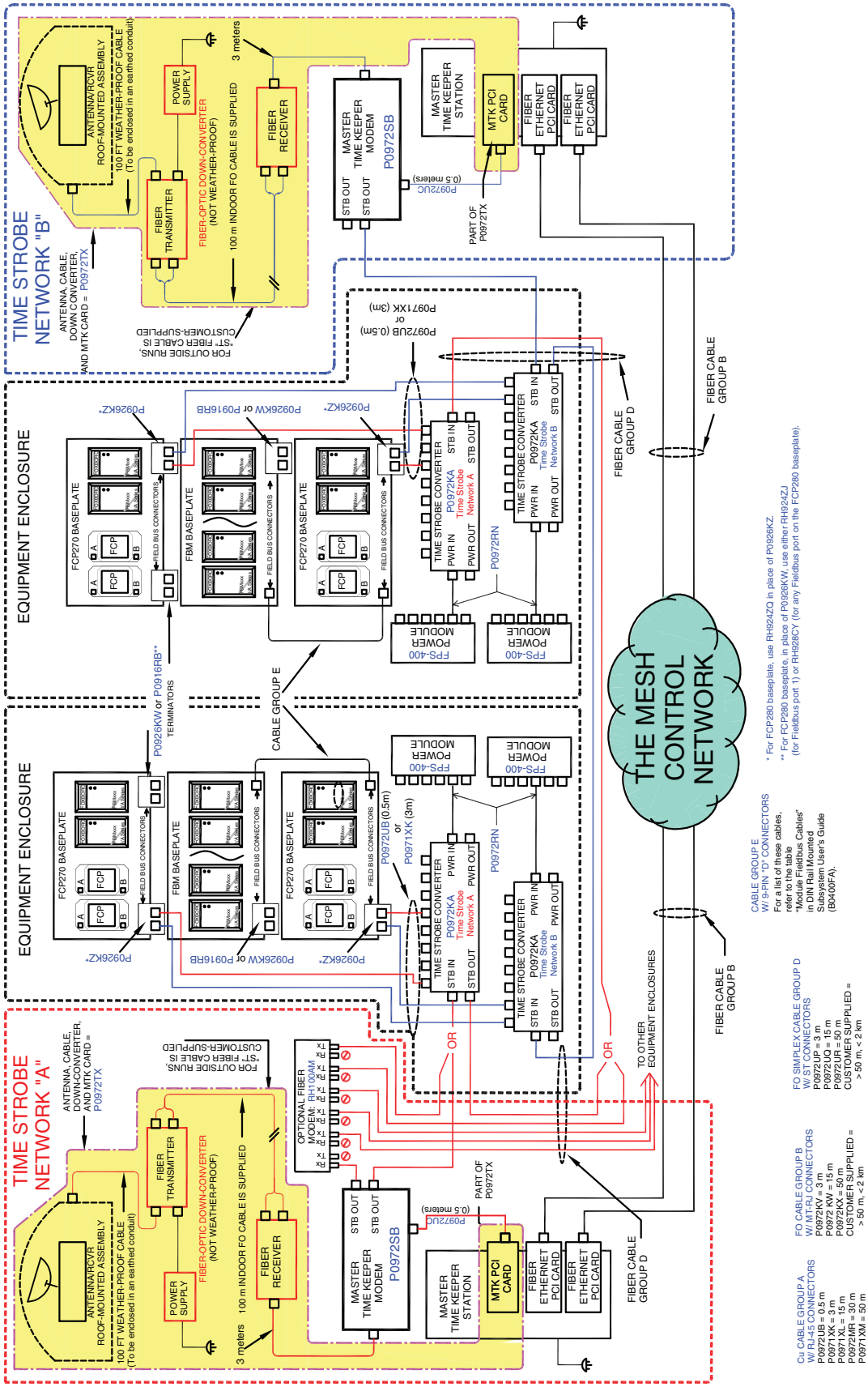



**Figure A-1. FCP270 with Fiber Antenna Connection, Redundant Cabling**

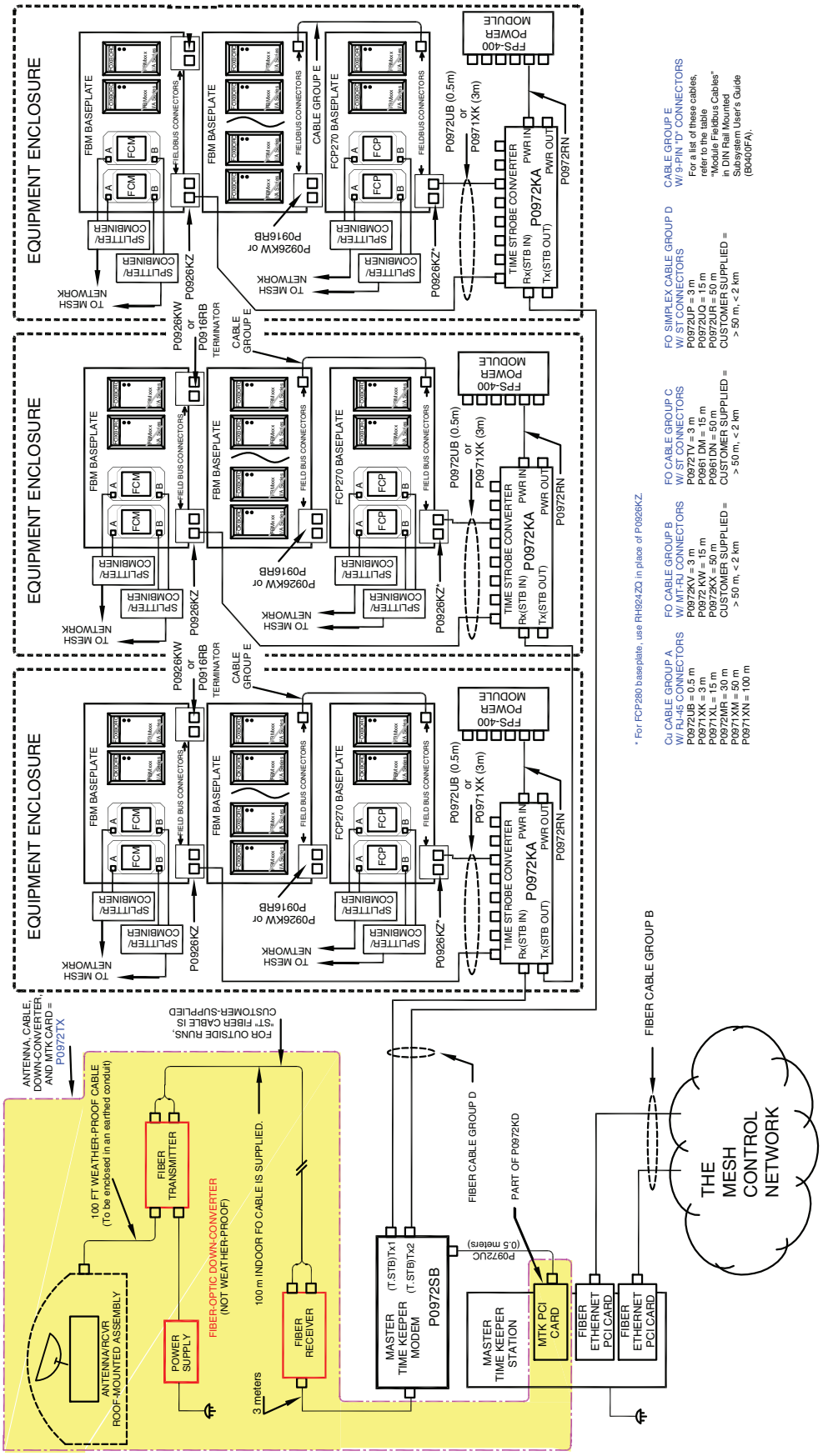



**Figure A-2. FCP270 with Fiber Antenna Connection, Non-redundant Cabling**

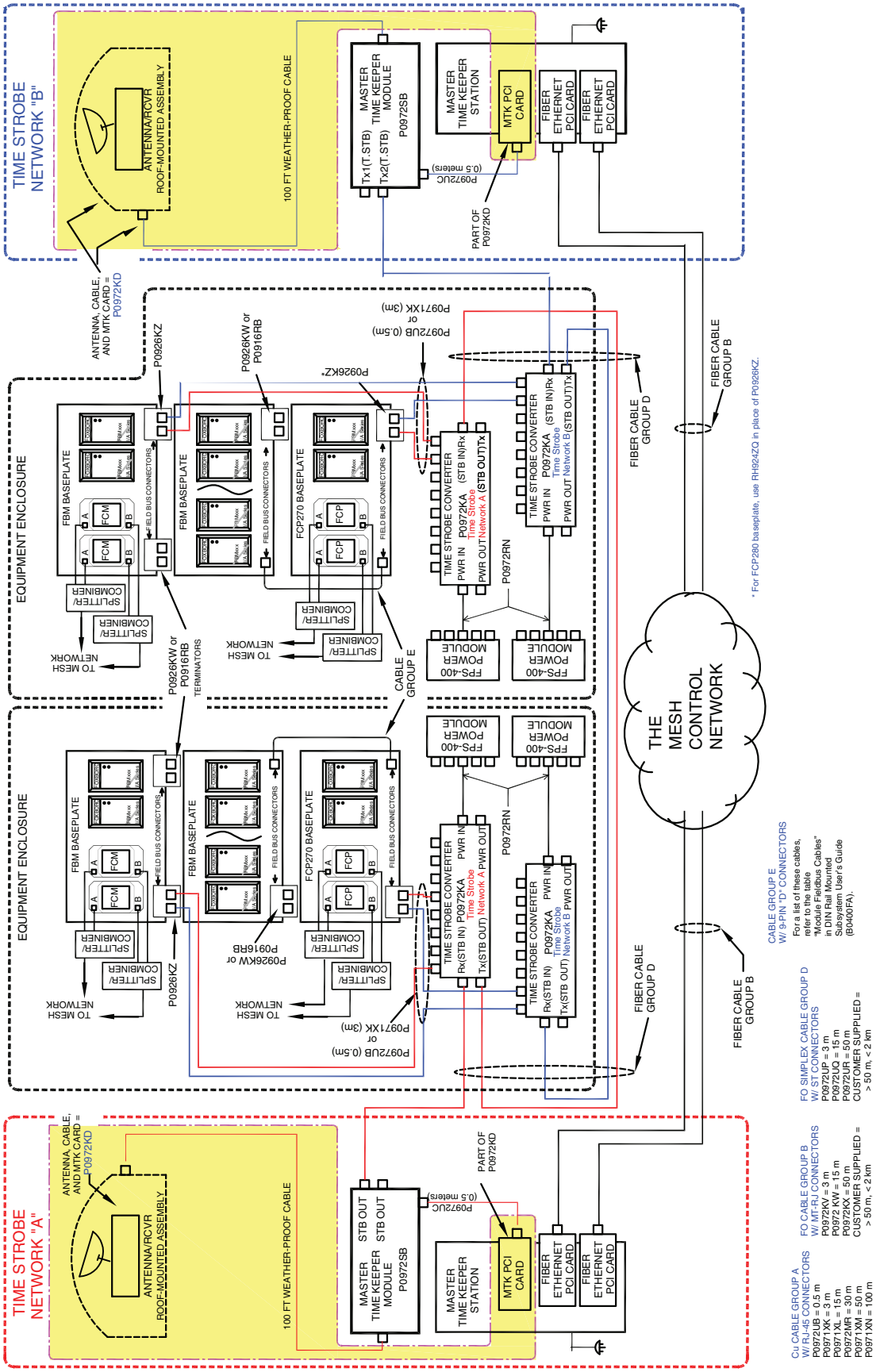



**Figure A-3. FCP270 with Wire Antenna Connection, Redundant Cabling**

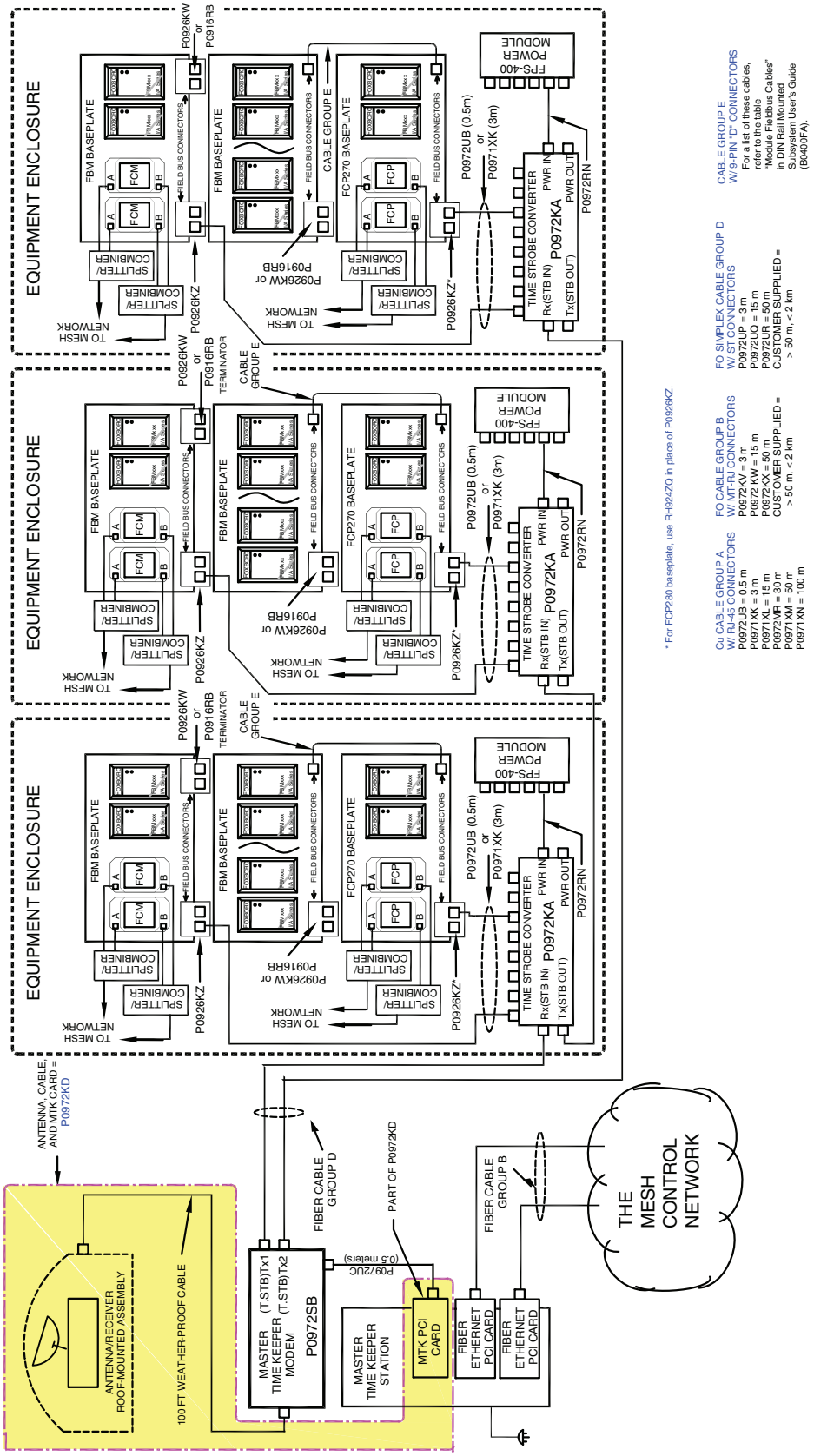



**Figure A-4. FCP270 with Wire Antenna Connection, Non-redundant Cabling**

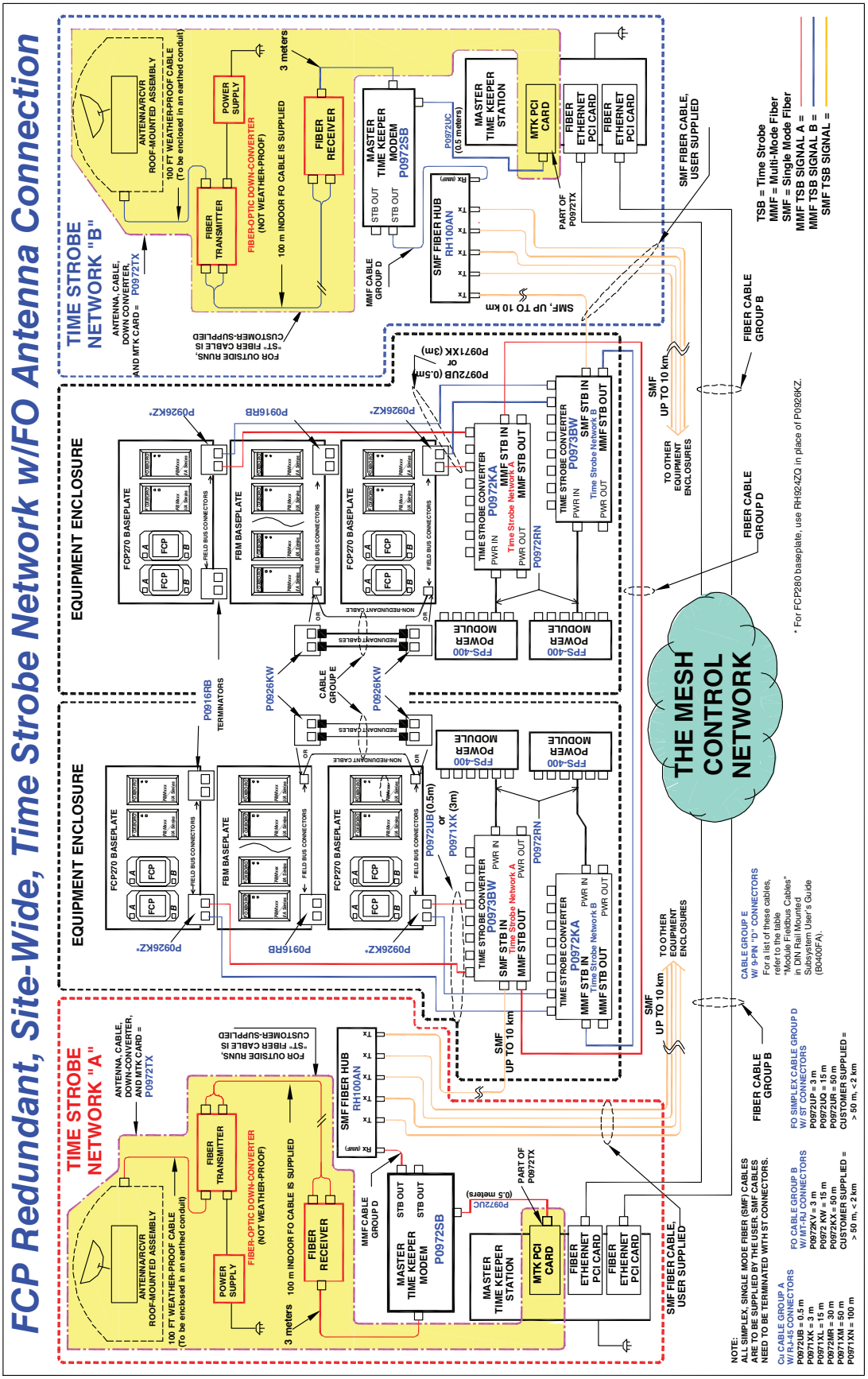



**Figure A-5. Site-Wide Network-FCP270 with Wire Antenna, Redundant Fiber Cabling**

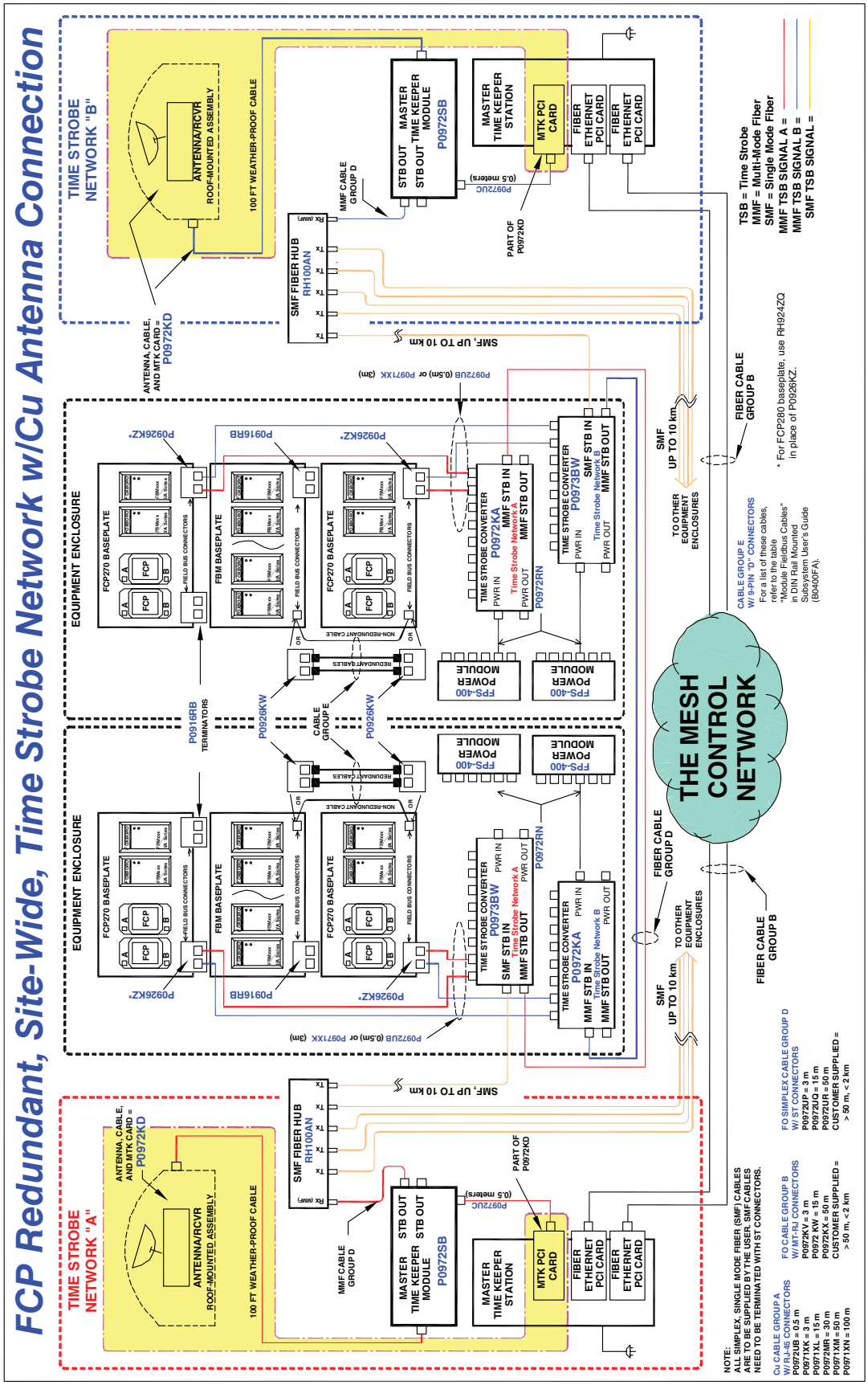



**Figure A-6. Site-Wide Network-FCP270 with Wire Antenna, Redundant Copper Cabling**

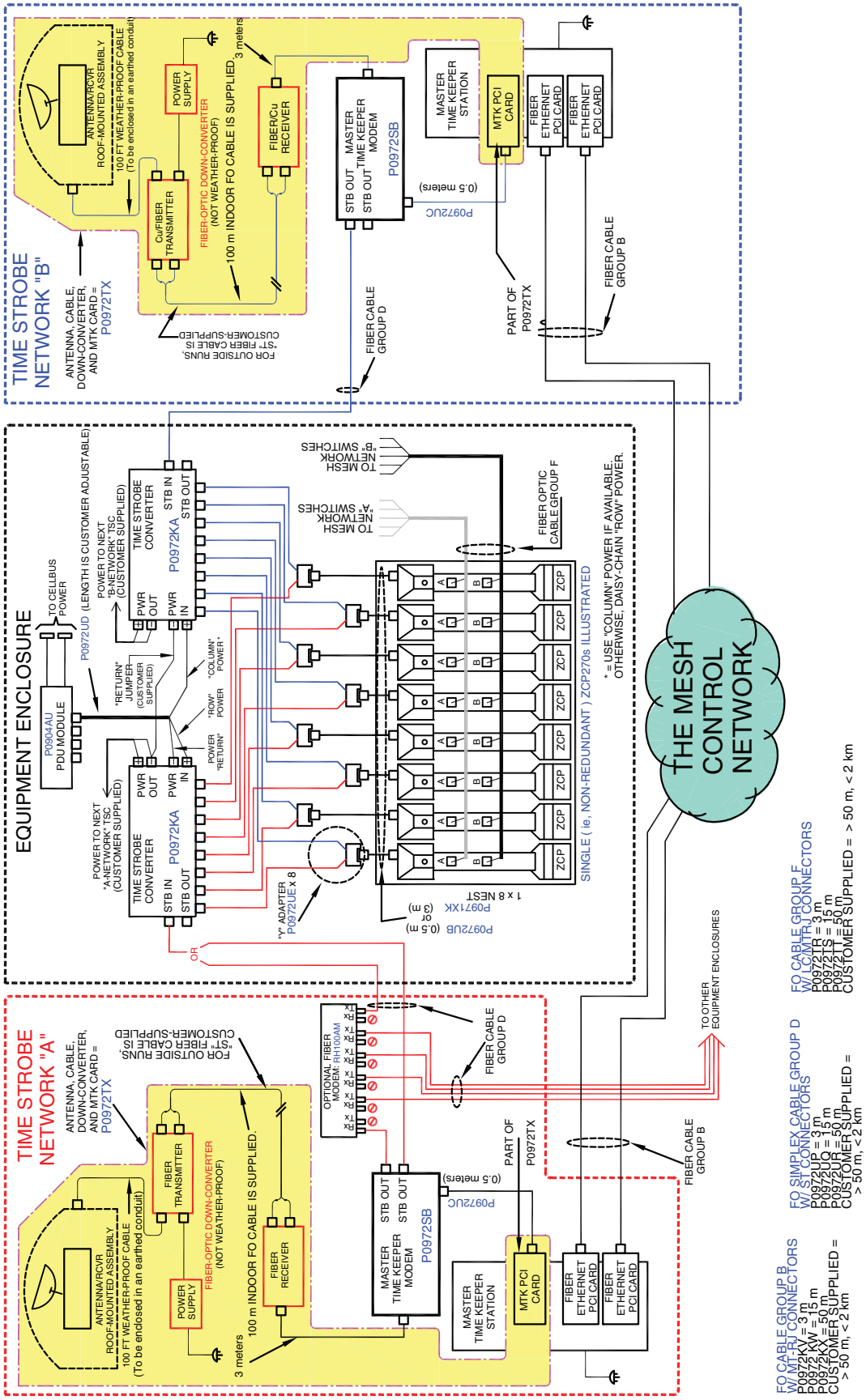



**Figure A-7. ZCP270 with Fiber Antenna Connection, Redundant Cabling**

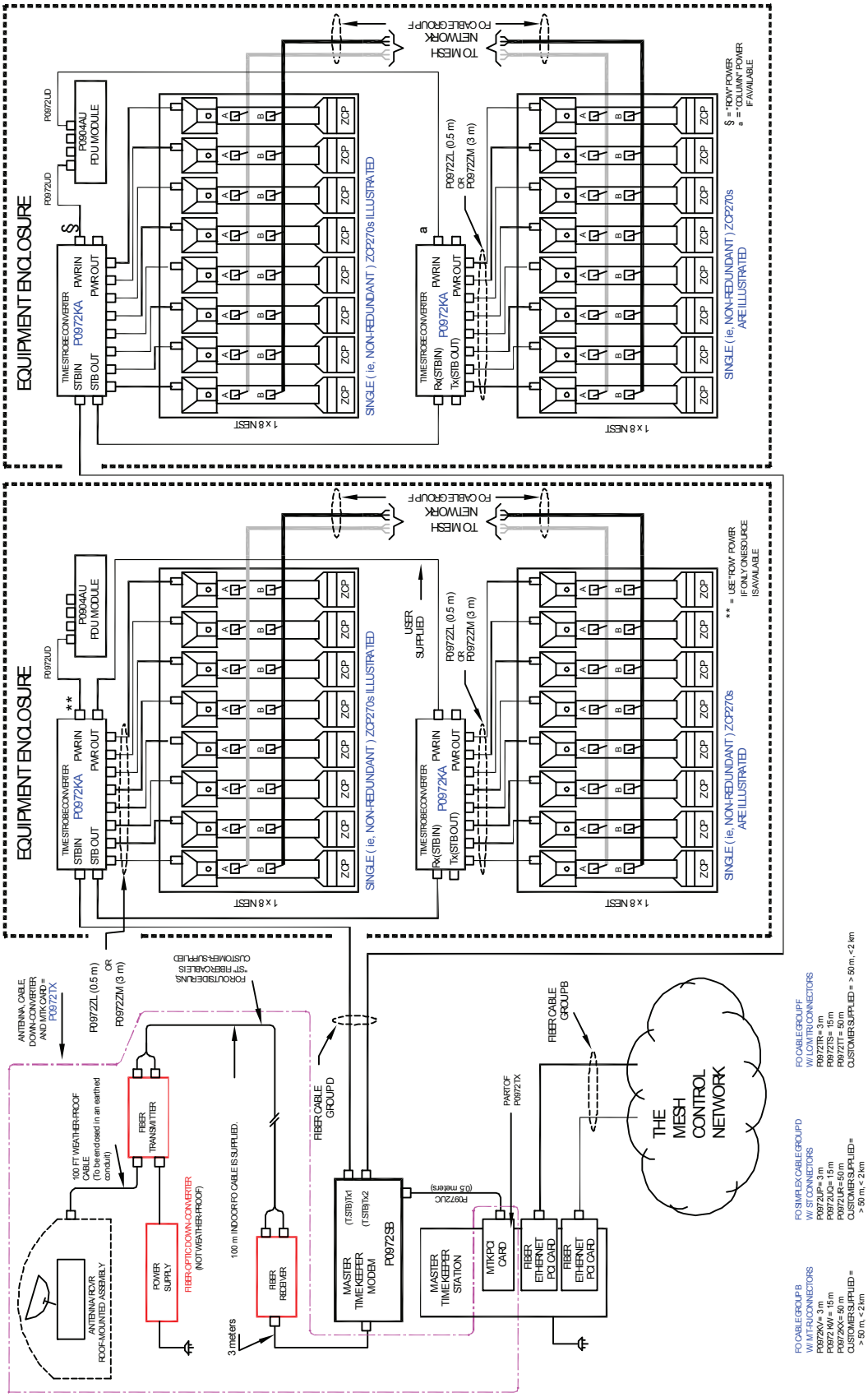



**Figure A-8. ZCP270 with Fiber Antenna Connection, Non-redundant Cabling**

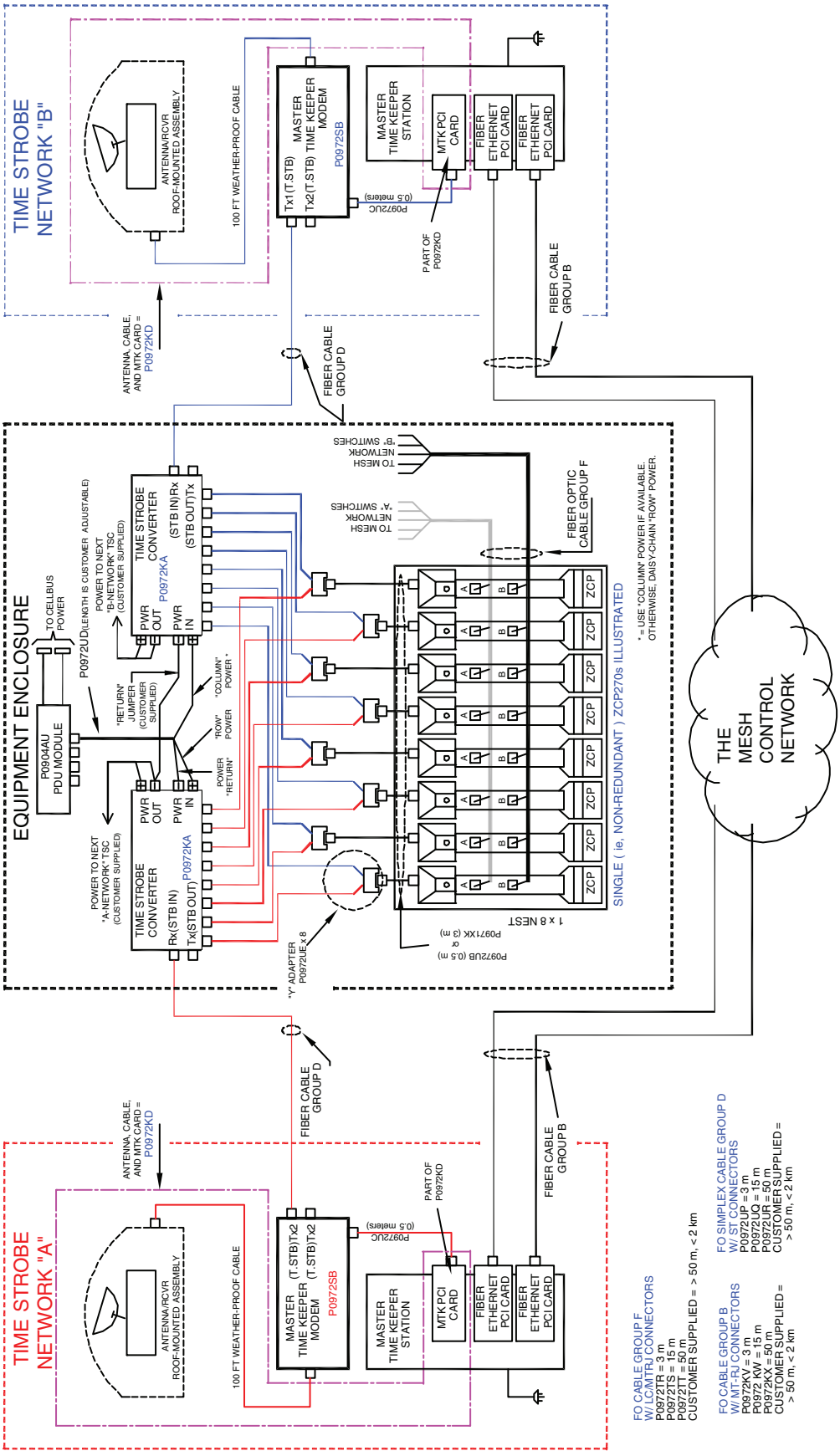



**Figure A-9. ZCP270 with Wire Antenna Connection, Redundant Cabling**

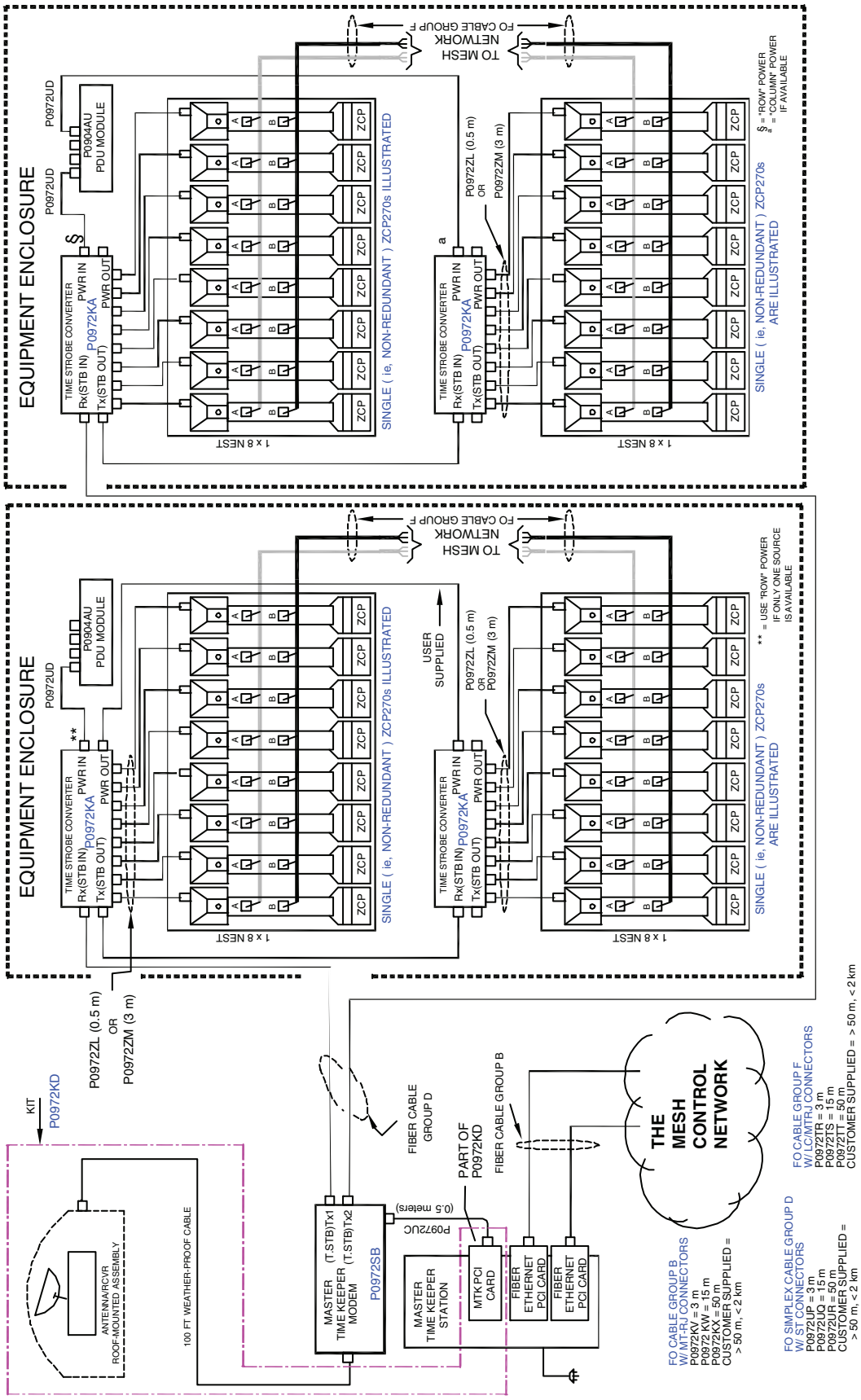



**Figure A-10. ZCP270 with Wire Antenna Connection, Non-redundant Cabling**

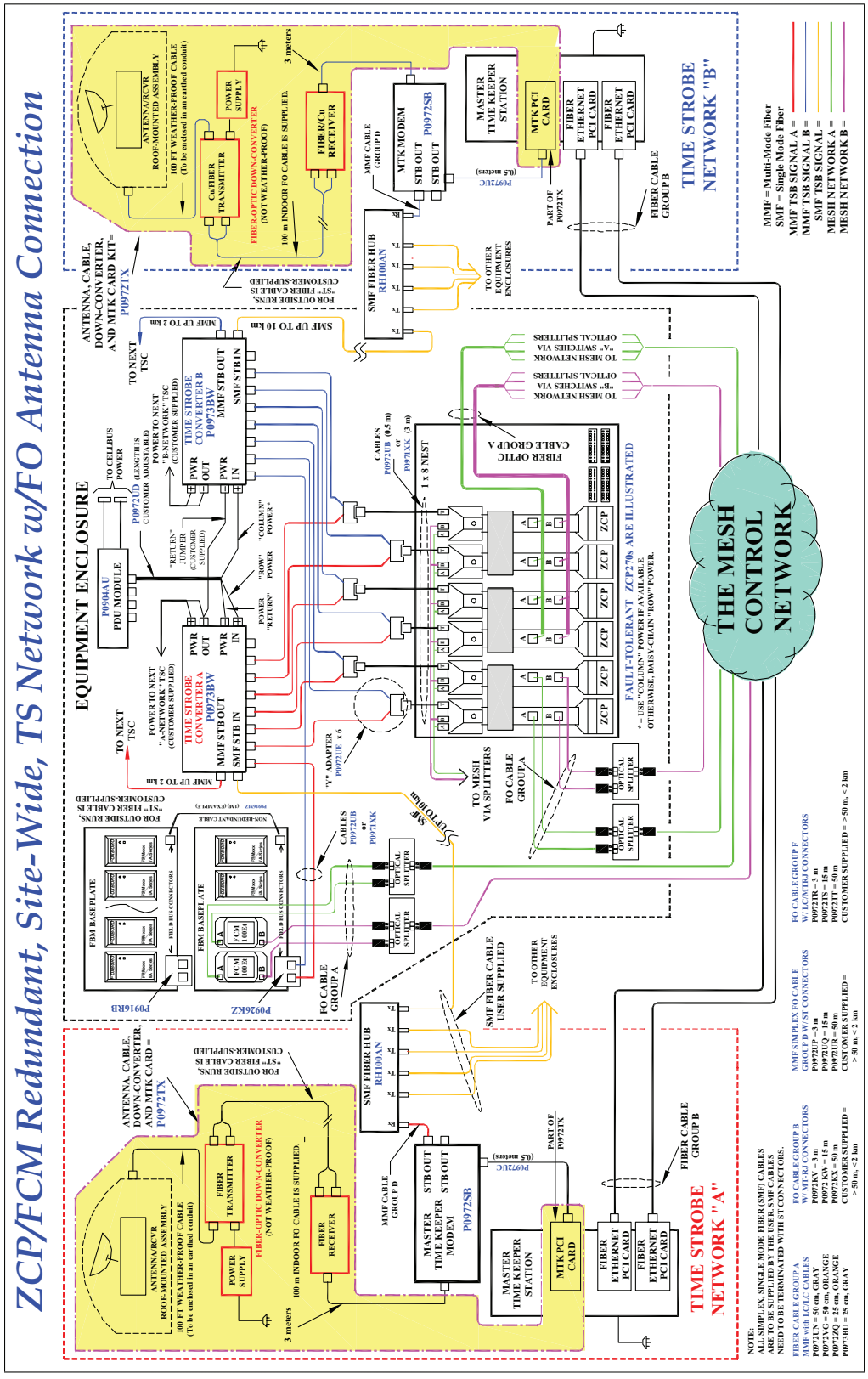



**Figure A-11. Site-Wide Network - ZCP270 with Wire Antenna, Redundant Fiber Cabling**

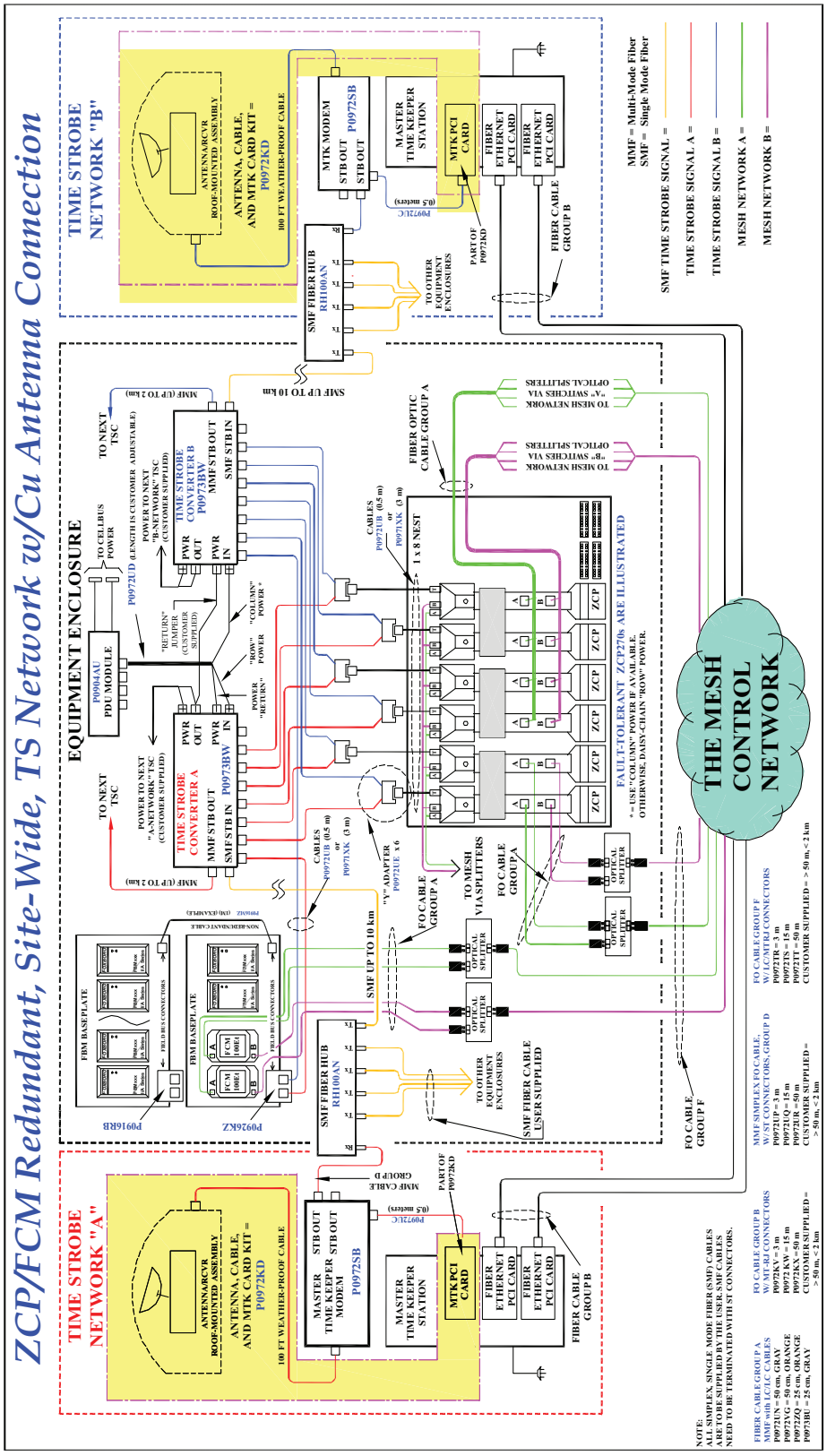



**Figure A-12. Site-Wide Network - ZCP270 with Wire Antenna, Redundant Copper Cabling**

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***W***

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