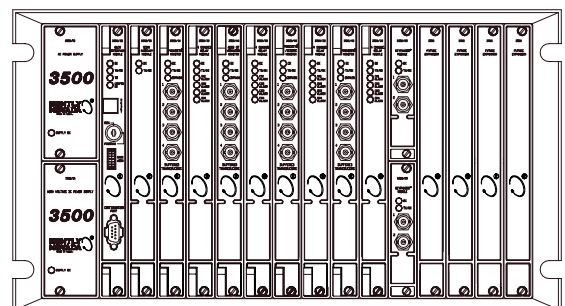


3500/22M Transient Data Interface

Operation and Maintenance Manual



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Contacting Bently Nevada

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Additional Information

Note:

This manual does not contain all the information required to operate and maintain the 3500/22M Transient Data Interface. Refer to the following manuals for other required information.

3500 Monitoring System Rack Installation and Maintenance Manual (129766-01)

- general description of a standard system.
- general description of a Triple Modular Redundant (TMR) system
- Instructions for installing and removing the module from a 3500 rack

3500 Monitoring System Rack Configuration and Utilities Guide (129777-01)

- guidelines for using the 3500 Rack Configuration software for setting the operating parameters of the module
- guidelines for using the 3500 test utilities to verify that the input and output terminals on the module are operating properly

3500 Monitoring System Computer Hardware and Software Manual (128158-01)

- instructions for connecting the rack to 3500 host computer
- procedures for verifying communication
- procedures for installing software
- guidelines for using Data Acquisition / DDE Server and Operator Display Software
- procedures and diagrams for setting up network and remote communications

3500 Field Wiring Diagram Package (130432-01)

- diagrams that show how to hook up a particular transducer
- lists of recommended wiring

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1 Receiving and Handling Instructions

1.1 Receiving Inspection

Visually inspect the module for obvious shipping damage. If shipping damage is apparent, file a claim with the carrier and submit a copy to Bently Nevada.

1.2 Handling and Storing Considerations

Circuit boards contain devices that are susceptible to damage when exposed to electrostatic charges. Damage caused by obvious mishandling of the board will void the warranty. To avoid damage, observe the following precautions in the order given:

Application Alert

Host communication and rack configuration capabilities will be lost when this module is removed from the rack.

- Do not discharge static electricity onto the circuit board. Avoid tools or procedures that would subject the circuit board to static damage. Some possible causes include ungrounded soldering irons, nonconductive plastics, and similar materials.
- Personnel must be grounded with a suitable grounding strap (such as 3M Velostat No. 2060) before handling or maintaining a printed circuit board.
- Transport and store circuit boards in electrically conductive bags or foil.
- Use extra caution during dry weather. Relative humidity less than 30 % tends to multiply the accumulation of static charges on any surface.

1.3 Disposal Statement

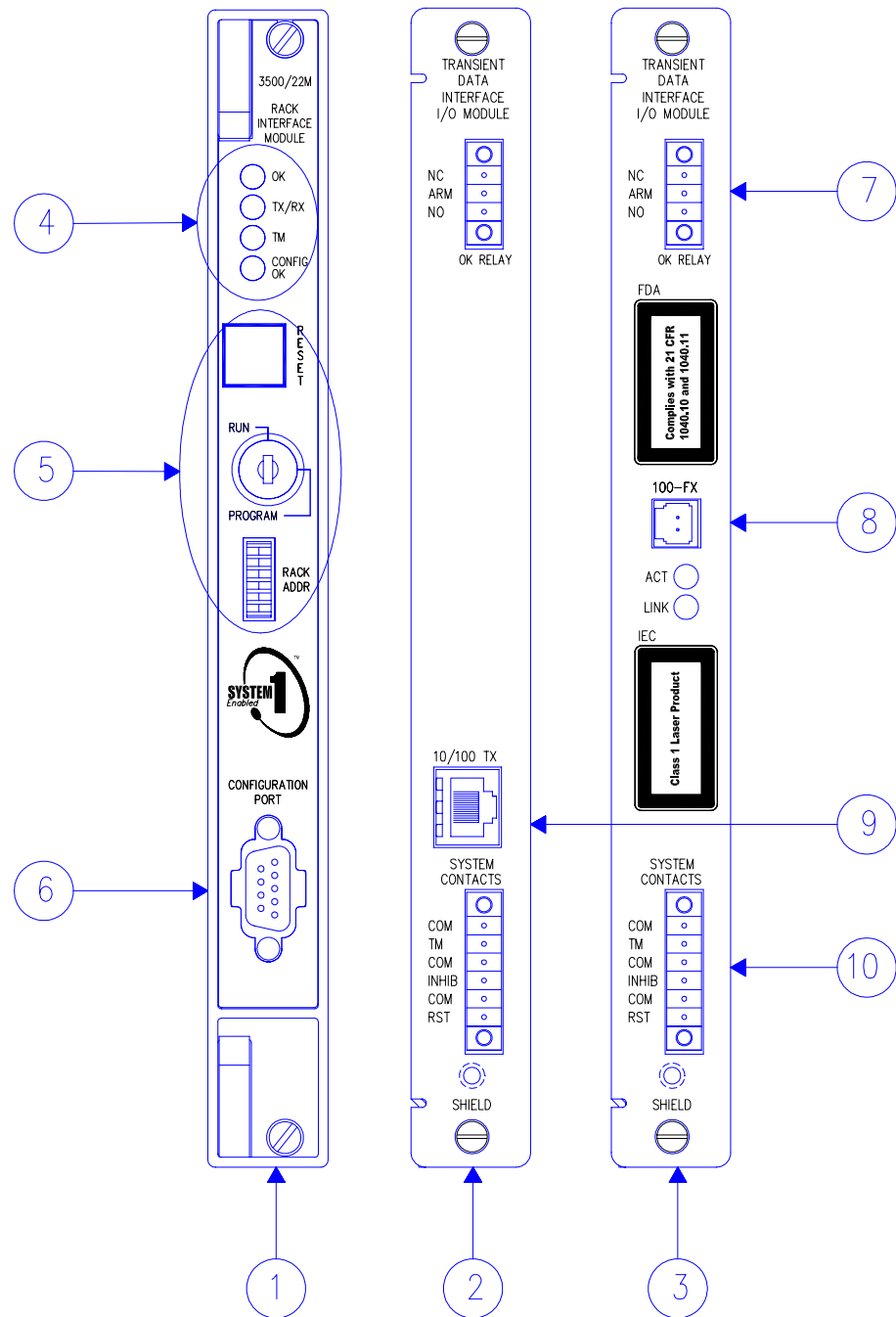
Customers and third parties that are in control of the product at the end of its life or at the end of its use are solely responsible for proper disposal of product. No person, firm, corporation, association, or agency that is in control of the product shall dispose of it in a manner that is in violation of United States state laws, United States federal laws, or any applicable international laws. Bently Nevada is not responsible for disposal of product at the end of its life or at the end of its use.

2

General Information

The Transient Data Interface (TDI) is the primary interface into the 3500 rack. It supports a Bently Nevada proprietary protocol used to configure the rack and retrieve machinery information. TDI has two primary functions: configuration of the protection system and data retrieval for Bently Nevada machine management systems.

The TDI must be located in slot 1 of the rack (next to the power supplies). Although the TDI does provide certain functions common to the entire rack, the TDI is not part of the critical monitoring path. The TDI's operation (or non-operation) has no effect on the proper, normal operation of the overall monitoring system.



- (1) Main Module
- (2) 10/100 Base T Ethernet I/O Module
- (3) 100 Base FX Ethernet I/O Module
- (4) LEDs: Indicates the operating status of the module
- (5) Hardware Switches
- (6) Configuration Port: Configure or retrieve machinery data using RS-232 protocol

- (7) OK Relay: Indicates the OK status of the rack
- (8) Fiber Optic Ethernet Port: For configuration and data collection
- (9) RJ45 Ethernet Port: For configuration and data collection
- (10) System Contacts

2.1 TDI Features

2.1.1 Contacts

- Rack Reset
- Trip Multiply
- Alarm Inhibit
- OK Relay

2.1.2 Security

- Password
- Key Switch

2.1.3 Communications Ports

- Front Panel Configuration Port, RS-232
- Rear Panel Host Port, Ethernet

2.1.4 Event Lists

- Alarm Event List
- System Event List

2.2 Triple Modular Redundant (TMR) Description

For TMR applications, the 3500 system requires a TMR version of the TDI. In addition to all the standard TDI functions, the TMR TDI also performs "monitor channel comparison." The 3500 TMR configuration executes monitoring voting using the setup specified in the monitor options. Using this method the TMR TDI continually compares a specified output of 3 redundant monitors. If the TMR TDI detects that the information from one of those monitors is no longer equivalent (within a configured percent) to the remaining two, it will flag the monitor as being in error and place an event in the System Event List.

2.3 Status

The Transient Data Interface returns both module and channel status. This section describes the available statuses and where they can be found.

2.3.1 Module Status

2.3.1.1 OK

This indicates if the Transient Data Interface is functioning correctly. A not OK status is returned under any of the following conditions:

- Hardware Failure in the module
- Node Voltage Failure
- OK Relay coil check Failed
- Communication Failure with any module
- If any of the following security options have been configured and their conditions met:
 - Rack Address is changed while the TDI is in Run Mode.
 - A module was inserted into or removed from the rack.
 - The Key Switch was changed from Run to Program Mode.

If the Module OK status goes not OK then the system OK Relay on the Rack Interface I/O Module will be driven not OK.

2.3.1.2 Configuration Fault

This indicates if the Transient Data Interface configuration is invalid.

2.3.2 Channel Status

2.3.2.1 OK

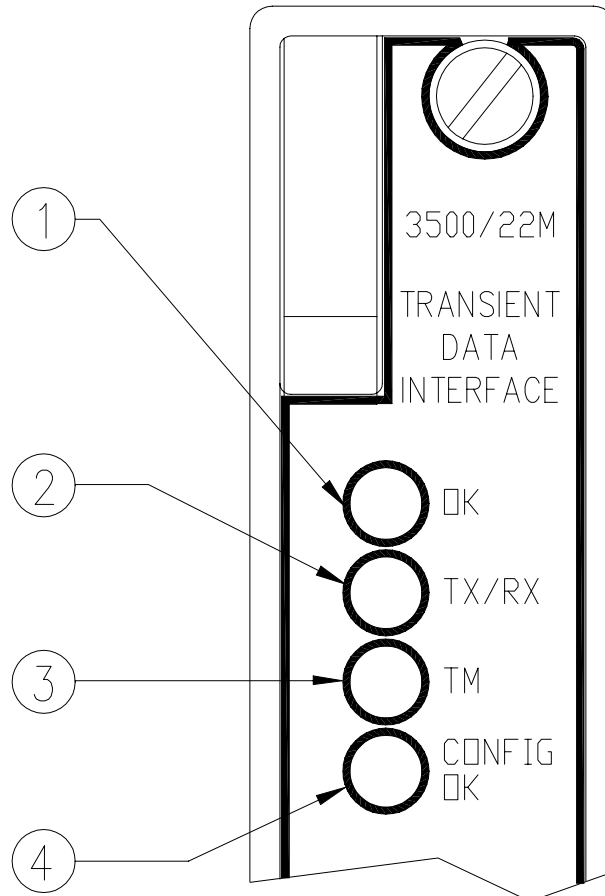
This indicates whether or not a fault has been detected on the channel or within the module. If the Channel OK status goes not OK then the system OK Relay on the Rack Interface I/O Module will be driven not OK.

The following table shows where the statuses can be found.

Status Locations	Communication Gateway Module	Rack Configuration Software	Operator Display Software
Module OK	X	X	
Module Configuration Fault		X	
Channel OK	X	X	

2.4 LED Descriptions

The LEDs on the front panel of the Transient Data Interface indicate the operating status of the module as shown in the following figure. Refer to Section 7.2 “LED Fault Conditions” for all of the available LED conditions.



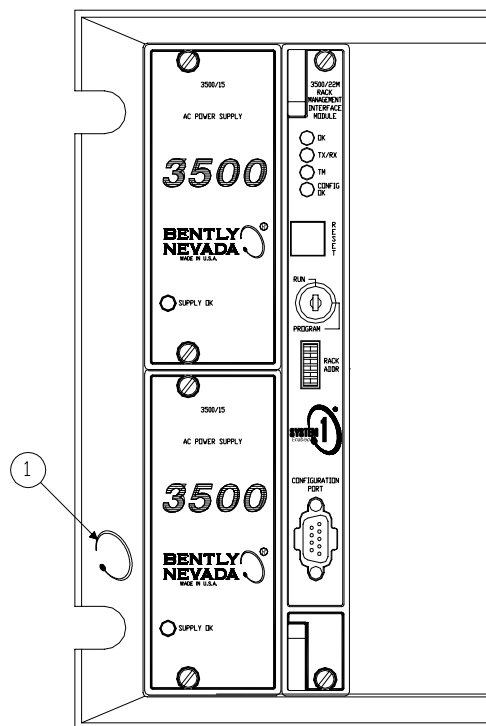
- (1) **OK:** Indicates that the Transient Data Interface and the I/O modules are operating correctly.
- (2) **TX/RX:** Flashes at the rate that messages are sent.
- (3) **TM:** Indicates whether the rack is in the Trip Multiply mode.
- (4) **Config OK:** Indicates that Any module in the rack is unconfigured or has a configuration error or the stored configuration of the Transient Data Interface does not match the physical configuration of the rack or a security option condition was not met.

2.5 Requirements

For TDI there two levels of requirements. The first level is for functioning as the interface module for interfacing with 3500 Rack Configuration and 3500 Data Acquisition software. The second level is for data collection for interfacing with System 1 software.

2.5.1 Hardware

TDI requires a management ready 3500/05 rack. The management ready racks are identified by the presences of an Orbit on the left hand side of the bezel.



(1) Management Ready Rack Indicator

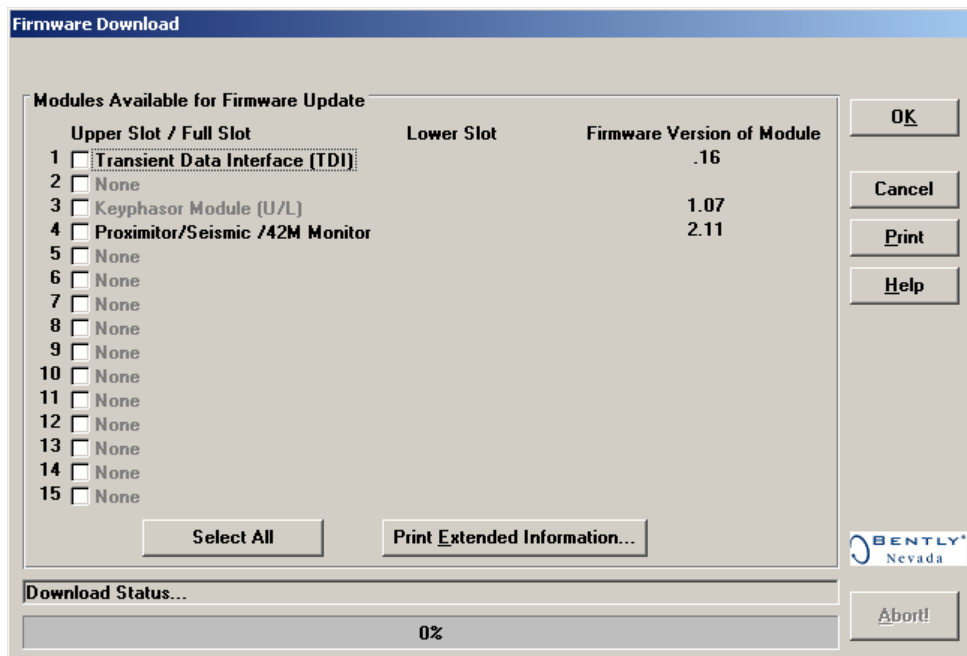
To provide waveforms to System 1, TDI requires M series monitors with PWA revisions of G or higher. These are monitors that have an M suffix to the catalog number and include 3500/40M, 42M, 44M, 46M, 64M, 72M and 77M.

To handle multi-event per revolution speed signals, TDI requires a Keyphasor module with a PWA number of 149369-01.

Determine the PWA revision of the monitors in the rack by executing the following steps:

1. Launch 3500 Configuration Software

2. Select Update Firmware from the Utilities pull down menu



3. On the firmware update screen:

- Select the modules of interest
- Click on Print Extended Information

A textual file displays the PWA revision for the modules.

TDI supports static value data collection from any 3500 monitor, including older 3500/40, 42 and 44 monitors that are not capable of providing waveform data.

2.5.2 Software

TDI support requires the following software revisions:

- 3500 Configuration revision 3.30 or higher,
- 3500 Data Acquisition revision 2.40 or higher,
- 3500 Display revision 1.40 or higher, and
- System 1 Release 3.0 or higher.

2.5.3 Limitations

TDI will not support the following:

- TDI will not interface to a TDxnet, TDIX, or DDIX,
- TDI does not support DM2000, and
- TDI will not permit 3500 Configuration software to access the rack through a 3500/92 Communications Gateway.

3 Data Collection

The Transient Data Interface is an integral communication processor that collects and stores information from the 3500 monitors and transmits this information to a host computer. This section describes how the data collection functions.

3.1 Overview

Data collected from a machine has several forms. This data includes static data, dynamic data, status information and speed data. All of these forms of data are acquired by TDI as a result of various stages of operation for a machine: steady state, transient (start-up & coast-down) and when alarms occur. TDI collects, stores and transmits the data sets from the 3500 monitors to the data acquisition computer. The data acquisition computer, in turn, provides the data to the database and display stations.

TDI organizes data collection using structures called Collection Groups. Channels (measurement points) that are related to each other should be placed in the same collection group. Groups are created and channels added to them until all of the channels of the monitoring system are associated with their respective collection group. All of the channel's data within the collection group are collected together and synchronized with each other. Collection Groups are created by using System 1 configuration.

TDI attempts to move data to the host computer at the earliest opportunity, so data collected as part of an event is identified as related to the event and then sent using the network connections of the TDI. If TDI is unable to send the data it will store the data and send it when it is able to do so.

3.2 Definitions

Channels: The connection of a transducer to the system.

Collection Group: A group of channels (transducers) that are collected together. This is used for collection of data for alarms and during transient events.

Collection Group Enabler: A speed region that is configured by the user and is used by TDI to enter into transient collection mode.

Collection Control Parameter: A parameter that defines when to collect transient data.

Delta RPM: The difference, expressed in CPM, between subsequent samples in RPM based transient buffers.

Delta Time: The difference, in time, between the subsequent samples in time based transient buffers. After a sample is collected, the delta time value is added to the current time to determine the next time a data set is captured.

M-Series Monitors: 3500 vibration monitors that support collection of machinery management data. The label on a M-Series monitor has an M

added to the end of the catalog number. All vibration monitors are now M-series.

Static Values: Values extracted from the transducer signal with some signal conditioning applied.

Synchronous Sample Rate: The number of samples taken for each revolution of the shaft for synchronous data. This is set in the host software (System 1). The fastest sample rate will give the best waveform and orbit presentation, but the lowest spectral resolution, whereas the slowest sample rate will give the lowest waveform and orbit resolution but the highest spectral resolution.

Transient Mode: A state of operation wherein data is collected based on parameter changes, such as speed. This mode is entered when the value of a collection point enters the enabler region of a collection group.

3.3 Communication

TDI communicates with the data acquisition computer using Ethernet. It can support the following physical media: 10BASE-T, 100BASE-TX or 100BASE-FX. TDI is designed to work as a standard network device and should be compatible with any Ethernet structure.

3.4 Data Content

3.4.1 Static Values

Static values represent values extracted from the transducer signal with some signal conditioning applied. Examples of the conditioning can be linearizing, scaling, determining the average or peak-to-peak value, or extracting the once per turn amplitude and phase. Within the 3500 TDI system there are three sources of static values: protection values, management values, and software variables. Protection values are generated and used by the monitors, compared against setpoints, and used to protect the machine by use of relays based on the results. TDI uses the dynamic waveform information, applies signal conditioning and generates additional static values. Lastly, the software system retrieves the dynamic waveform information and generates additional values after applying software calculations and signal conditioning.

3.4.1.1 Protection Values

All of the static values configured or enabled using 3500 monitor configuration are available through TDI. TDI does not re-compute or replace any values that are measured by the monitors. These static values are available from all of the 3500 monitors regardless of the type of monitor and whether it is designed to support TDI ("M" vs. non "M" series). Although both support static values, one difference between non-M series and M series monitors is the M series are capable of faster static value updates than their non-management ready counterparts.

3.4.1.2 Management Values

The 3500 TDI takes the dynamic waveform from the management ready (M series) monitors and processes it to provide additional static values. These values computed by TDI are nX static values that return amplitude and phase* information of the vibration related to an order (nX) of running speed. Up to four nX values can be calculated and are available through the System 1 software.

The nX values require a speed input to the 3500 rack. The nX options available are based on the synchronous sampling rate used for waveform sampling. NX values are adjustable by 0.01x steps.

NX Range	Synchronous Sampling Rate	Maximum Machine Speed
.1x to 7x, steps of 0.01x	16x	100,000 rpm
.1x to 15x, steps of 0.01x	32x	60,000 rpm
.1x to 31x, steps of 0.01x	64x	30,000 rpm
.1x to 63x, steps of 0.01x	128x	15,000 rpm
.1x to 127x, steps of 0.01x	256x	7,500 rpm
.1x to 179x, steps of 0.01x	360x*	5333 rpm
.1x to 255x, steps of 0.01x	512x	3,750 rpm
.1x to 359x, steps of 0.01x	720x*	2666 rpm
.1x to 511x, steps of 0.01x	1024x	1,875 rpm

*Phase information for nX values derived from 360x or 720x sample rates will be marked invalid.

3.4.1.3 Software Variables

The static variables available from the monitor and from the TDI are augmented by software variables. The software calculates these variables after retrieving a waveform from the TDI, and performing a series of calculations on the data. Alarm data capture may be driven by the software based on the values of these variables, however a protection alarm (relay closure) cannot be issued.

3.4.2 Dynamic Data

Dynamic data, also known as waveform data or dynamic waveform data, is available from any "M" series monitor and is *not* available for non-M series monitors. TDI is capable of collecting waveform data for up to 12 monitors (48 channels). TDI collects waveform data that is both synchronous to the rotation of the machine and asynchronous to machine rotation for each channel. Each of the two waveforms is composed of 2048 samples of 16 bit data. Waveforms for all channels on a shaft are sampled simultaneously and that allows for Orbit presentations, modal analysis and better determination of a fault's location.

The number of dynamic channels configured determines the maximum machine speed that can be supported by TDI. The following table list the available speed ranges:

Number of Channels	Minimum Machine Speed	Maximum Machine Speed
1 to 16	1 rpm	100,000 rpm
17 to 24	1 rpm	60,000 rpm
25 to 48	1 rpm	30,000 rpm

3.4.2.1 Synchronous Data

Synchronous data requires a once-per-turn input to the rack. The data sampling is relative to this once-per-turn reference signal and uses a predictive algorithm to assist in sampling systems with changing speeds. The user configures the TDI to collect a defined number of samples for each rotation of the shaft generally trading off between spectral resolution and waveform detail. The upper sampling rates available are limited by the speed of the machine. The following table lists the sampling rates and the maximum machine speed supported by the sampling rate.

Sampling Rate	Revolutions per Waveform	Maximum Machine Speed
16x	128	100,000 rpm
32x	64	60,000 rpm
64x	32	30,000 rpm
128x	16	15,000 rpm
256x	8	7,500 rpm
360x	5	5333 rpm
512x	4	3,750 rpm
720x	2	2666 rpm
1024x	2	1,875 rpm

3.4.2.2 Asynchronous Data

Simultaneously with the synchronous data, TDI also collects waveforms using a fixed-frequency sampling rate. It will collect a 2048 sample data set that can be used to display as a waveform or an 800 line spectrum. The data collected in this manner is anti-alias filtered. Sampling of channel pairs within a monitor is synchronized, except for the 64kHz sampling rate, and the data can be viewed using full spectrum plots. The following table shows the sampling rate, corresponding spectral frequency span and the number of spectral lines.

Sample Rate	Frequency Span	Number of Spectral Lines	Spectral Resolution
25.6 Hz	10 Hz	800	0.0125 Hz
51.2 Hz	20 Hz	800	0.025 Hz
128 Hz	50 Hz	800	0.0625 Hz
256 Hz	100 Hz	800	0.125 Hz
512 Hz	200 Hz	800	0.25 Hz
1.28 kHz	500 Hz	800	0.625 Hz
2.56 kHz	1 kHz	800	1.25 Hz
5.12 kHz	2 kHz	800	2.5 Hz
12.8 kHz	5 kHz	800	6.25 Hz
25.6kHz	10 kHz	800	12.5 Hz
51.2 kHz*	20 kHz	800	25 Hz
64 kHz*	30 kHz	960	31.25 Hz

* For 51.2 kHz and 64 kHz the number of channels allowed in a collection group is limited to 24.

3.4.2.3

Integration

TDI can be configured to return integrated waveform data. All of the waveform and nX values will be returned as integrated data if integration is selected in the protection system configuration.

3.5 Status Inputs

TDI is constantly informed of the status of the monitors in the rack and reports this status back to the host computer. Operational status is reported at a channel level including the alarm status and transducer OK status as well as the TDI entering and leaving operating modes. Monitor health is also reported as part of the ongoing voltage and performance checks within the monitor with exceptions reported as a monitor event message.

3.6 Speed Inputs

TDI accepts from one to four speed signals that are the same as available for the rest of the 3500 System. TDI uses speed inputs to sample data while acquiring synchronous waveforms and computing nX values. The speed inputs are also used to collect transient data. TDI can use either once per revolution Keyphasor signals, Multiple Event per revolution speed signals, or Recip Multi-Event Wheels.

3.6.1 Multiple Event Keyphasor Signals

TDI supports the use of multiple event-per-revolution speed inputs. The Keyphasor Module must be configured to output a once per revolution signal to the 3500 modules. When configured for multiple event signals TDI will mark all phase related data as invalid.

3.6.2 Recip Multi-Event Wheel

There is special configuration selection to support the Recip Multi-Event Wheel. This speed reference provides a combination of a multi-event input for improved sampling along with a once per indication for phase reference.

3.7 Data Collection Modes

Data is delivered by the TDI to the host software for different causes. In some instances data is delivered upon request from the software such as current values requests. In other instances the TDI determines that data collection should occur based on the existing monitoring situation such as a monitor going into alarm. The following sections list the different causes of data collection. In each case the data content consists of the types of data described above but taken at varying density and frequency and sometimes with historical content.

3.7.1 Current Values

Application Advisory

Collection and storage of waveform data is an optional software feature that must be purchased, and then activated in the TDI.

TDI returns static values and waveforms when requested from the host computer. This data is used to provide both real time data displays and is used to establish historical trend and reference data. The static values are collected at 1-second intervals across the machine train by the software to build historical trend plots. Historical waveform data is collected and stored by the host computer at a user-defined interval. This collection is used in static, steady state and transient software operation.

3.7.2 Alarm Data

TDI will store a set of data occurring before and after an alarm event that occurs within the 3500 rack for all the measurement points in the collection group. To provide the data prior to the event, TDI records a running time window of static and waveform data and when an alarm occurs this data is associated with the event and transmitted to the host computer. TDI will then collect additional data after the alarm event, associate it with the alarm and transmit this data to the host. Since all of the data is collected from a collection group all of the waveform data between channels is time-coherent, as is the steady state data.

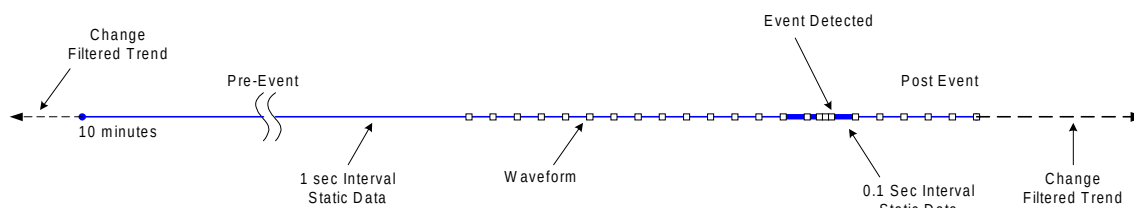
Alarm data collection is initiated by one of two methods:

- First, if any static value within a collection group goes into alarm the alarm data for all points in the collection group will be collected. Alarm collection will occur for both alert and danger alarms.
- Second, System 1 software can initiate an alarm event. This can occur if 1) a software alarm occurs for one of the points within the collection group or 2) a point in another rack that is associated by being in the same collection group goes into alarm.

Alarm data is not collected when leaving the alarm state such as going from danger to alert, or from alert to no alarm.

The data set for an alarm event on a dynamic point will typically consist of the following:

- 20 seconds of 0.1 sec interval static data just prior to the event (200 static data points);
- 1 from the time the event was detected;
- 10 minutes of 1 sec interval static data from before the event (580 static data points);
- 2.5 minutes of 10 sec interval waveforms from before the event (15 waveforms);
- 10 seconds of 0.1 sec interval static data from after the event (100 static data points);
- 1 minute of 1 sec interval static data from after the event (50 static data points);
- 1 minute of 10 sec interval waveforms from after the event (6 waveforms).



Data for a static only point such as temperature will be the same except there will be no waveform data, and the time resolution is limited to once per second.

3.7.2.1 Issues With Alarm Collection

The time between the event and the first set of historical data can vary based on when the data was sampled and when the alarm occurred. Therefore the time interval from the event to the first of the pre-waveforms can be anywhere between 0 to 10 seconds. The older waveforms will be ten seconds apart.

Because of machine speed or sampling rate a waveform may take longer than 10 seconds to acquire. In this case the next waveform will begin at the end of the previous one and will be greater than 10 seconds between them. Because of this there can be less than 15 waveforms for the pre-event data and less than 6 waveforms of post event data.

Once data is sent to the host the same data will not be sent again. Therefore, if there are multiple closely spaced alarms for a collection group, each alarm will not cause a full set of data to be sent. However, all of the data representing the event will be available at the software.

The alarm list indicates when the rack detects alarms; any alarm events sent to the rack by the software are not logged in the event list. There is no event list for the collection of the data.

3.7.3 Transient Data

Application Advisory

This feature is an optional software feature that must be purchased and activated to enable the capability.

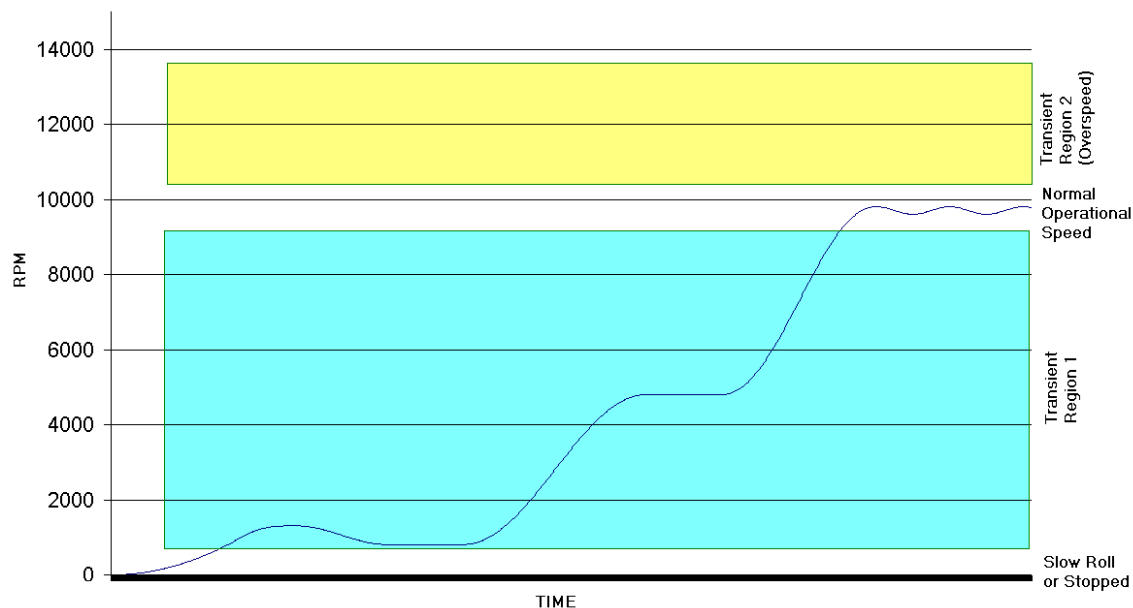
TDI has a special mode of operation for collecting data during transient operation of the machine. TDI collects transient data based on changes in machine speed and at a configurable time interval. Speed based and time based data collection is always ongoing inside the TDI. The data is temporarily saved but not sent to the host until the machine is detected as going into a transient mode of operation. When this happens the last 200 data collection sets are transmitted to the host and the TDI continues to send new data sets until the end of transient conditions are met.

To configure the data collection during transient events the user has to do the following in System 1 Configuration:

- Place all of the channels into a collection group.
- Place a Keyphasor into the same collection group.
- Define the Collection Group Enablers; these determine how TDI will detect that a machine is in transient operation.
- Define the Collection Control Parameters; these determine when TDI will collect data.

3.7.3.1 Collection Group Enablers

Collection Group Enablers are rules defined by the user based on machine speed that determine when the machine has entered a transient mode of operation. When the speed of the machine is detected as within the region defined by the enabler, TDI enters into transient collection mode. There are two collection group enablers available for each collection group. These enablers define a speed range with a lower and upper speed. Normally one enabler range is set between slow roll (or stop) and running speed to capture machine starts and shut downs. The second enabler is intended to be set above normal operational speed to catch over speed events. The shaded regions in the following figure show sample rpm ranges for the two collection group enablers.



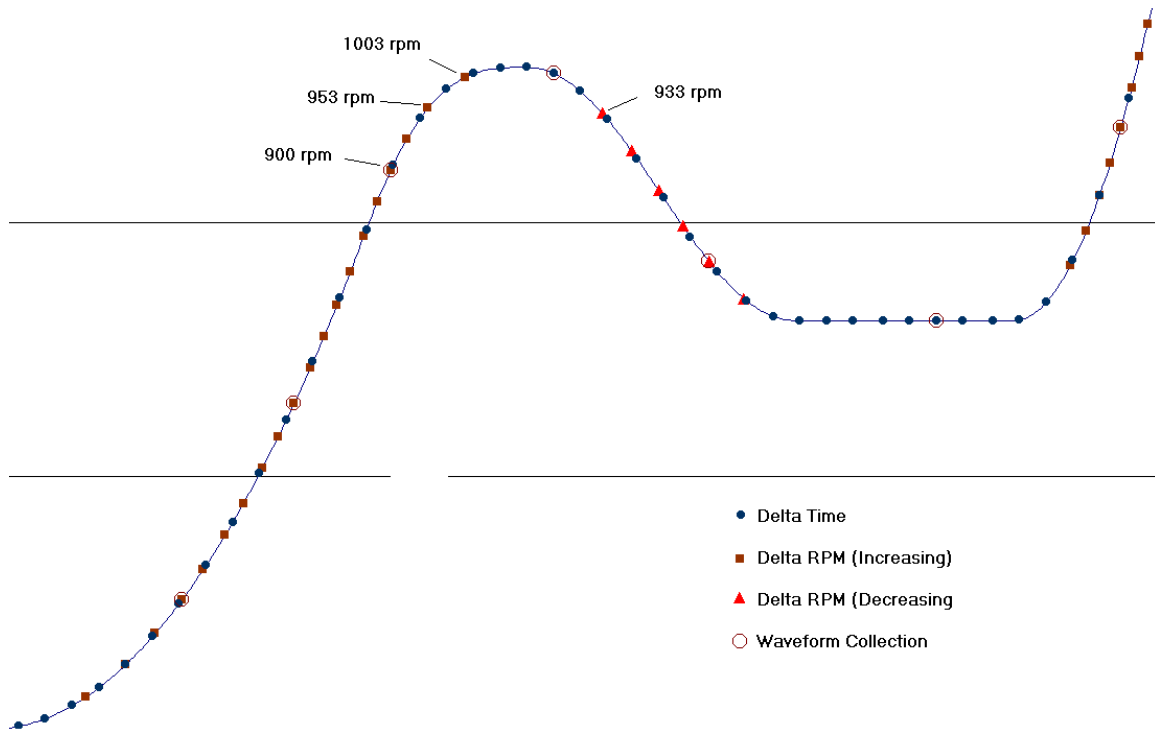
Once in transient mode TDI will stay in the mode until the Host software tells it to exit transient mode. This occurs at a configured time interval after the TDI exits the Collection Group Enabler range.

Another way for TDI to enter transient mode is using direct user intervention. At the Host software the user can issue a command for TDI to enter transient mode. This action bypasses the collection group enablers and goes immediately into transient mode. TDI will then stay in transient mode until manually removed from transient mode.

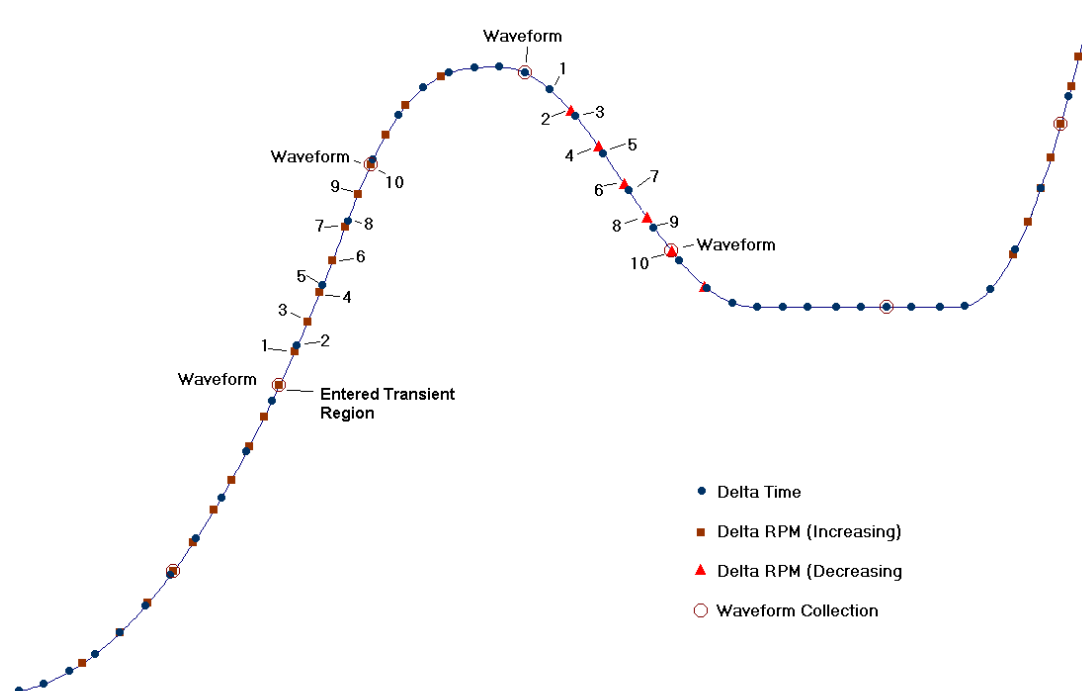
3.7.3.2 Collection Control Parameters

The Collection Control Parameters (CCP) are used to define when the TDI will capture data. There are two types of parameters: delta RPM and delta time. Both of these types of parameters function simultaneously. For each collection group the following selections are available: increasing delta rpm, decreasing delta rpm and time interval. All three of these can be active simultaneously for a collection group. The increasing and decreasing delta rpm are individually programmable.

The time interval CCP defines a fixed time period that will cause a data set to be taken. The time interval CCP will initiate data collection at the configured interval regardless of the speed of the machine. The RPM based CCP forces data collection based on changes in machine speed in either increasing or decreasing speed. Once a data set is collected at a given speed, the delta rpm values are added (subtracted) and two target rpm values calculated, one for increasing and one for decreasing speeds. When either of the target values are reached or exceeded data collection occurs and the next target rpm values calculated. Since the target values are determined by using the current speed and because data may be collected at slightly higher or lower rpm values, even though the delta speed may be set to 50 rpm intervals (for example) the resulting data may be at slightly different intervals.



When TDI detects that it has entered into a transient region it will immediately collect a waveform and static data set. TDI will collect one complete set of static data for all points in the collection group each time a CCP detects a collection event. Every ten events TDI will collect a waveform data set for all of the dynamic points in the collection group. The events can consist of both RPM CCPs and time CCP collection. Therefore, if there had been 6 RPM based events (increasing or decreasing) detected and 4 time interval events since the last waveform collection, a new waveform will be collected.



3.7.3.3 Issues With Transient Collection

If the software tells TDI to exit while it is in a transient region it will terminate transient collection. It will re-enter transient mode only when the speed exits the enabler region then re-enters the region or enters another enabler region.

Under startup conditions or after reconfiguration of the TDI the historical buffer may not be full at the time of the event and only a partial data set will be returned.

Care needs to be taken when configuring the Collection Control Parameters for transient data collection. TDI can collect a large amount of data in a short time and unless the system can handle transferring it to the software the TDI's memory will eventually fill up. The following guideline should help in optimizing the TDI configuration.

System 1 / TDI can transfer a waveform set at a rate of 1 set per second. If 2 TDIs are connected to a single DAQ and both TDIs are in transient mode then the computer takes 2 seconds to collect a waveform set.

In addition to its alarm data storage and pre-transient data storage TDI can hold 35 waveform sets internally.

The optimum Delta RPM value is set using the following equation:

$$\text{Delta RPM} \geq [(\text{Maximum Speed} - \text{Minimum Speed}) / (35 + \text{Ramp Time} / \text{Transfer Rate})] / 10$$

Example:

Machine ramps from 100 rpm to 15,000 rpm in 2 minutes.

The DAQ computer is supporting 3 TDIs.

$$\text{Delta RPM} \geq [(15,000 - 100) / (35 + 120 \text{ sec} / 3 \text{ sec})] / 10$$

$$\text{Delta RPM} \geq 19.8 \text{ rpm}$$

During the event the system would collect 752 static set and 75 waveforms sets. Plus it will have stored the 200 static set and 20 waveform sets acquired before entering transient mode.

4 Configuration Information

There are two steps to configure the 3500/22M. The first step is configuring it to function as the Rack Interface Module. The second step is configuring the data collection system. Configuring the Rack Interface Module is covered in this manual; and, the configuration of data collection is covered in the System 1 help system.

This section describes how the Transient Data Interface is configured using the 3500 Rack Configuration Software. It also describes configuration restrictions associated with this module. Refer to the 3500 Monitoring System Rack Configuration and Utilities Guide and the Rack Configuration Software for the details on how to operate the software.

4.1 Transient Data Interface Considerations

4.1.1 3500 Rack Configuration

The Rear Port I/O option and the Power Supply option specified on the Transient Data Interface option screen must match the physical components of the system. If a configuration mismatch is found, the rack will not accept the downloaded configuration.

Initial setting of the Ethernet parameters must be done using the RS-232 port on the front panel.

A Keyphasor or Tachometer module must be in the rack for TDI to collect synchronous data. If a channel is assigned to a Keyphasor signal and the module is not in the rack, the configuration will be disallowed.

TDI requires that the same backup Keyphasor channel is selected for every channel using a given primary Keyphasor channel. If the backup Keyphasor assignment is inconsistent, the configuration will be disallowed.

The rack file is used by System 1 as part of the configuration process and must agree with the configuration in the physical rack, otherwise data collection will not be initiated.

4.1.2 System 1

If more than 24 channels are in a collection group then 20 kHz and 30 kHz are not available as asynchronous frequency spans in that group. Other smaller collection groups can still use 20 kHz or 30 kHz.

Waveform collection for a collection group is either Transient or Steady-State. The two types of collection can not be mixed within a collection group. Static only points can be assigned to collection groups with either transient or steady-state collection.

All channels that do not have a Keyphasor association within the 3500 Rack Configuration have to be manually placed in a collection group within System 1 Configuration. Points with Keyphasor association will be automatically assigned to a collection group.

Care should be taken in setting the collection control parameters. If a delta rpm of 0.1 is used for a machine that runs at 30,000 rpm, an excessive amount of data will be collected during a startup.

If the protection system configuration is changed, then data collection for the rack will stop until the System 1 configuration is updated to match the changes.

If a new monitor is added, it will be ignored by the management system until it is configured in System 1.

If a monitor channel is configured for integration, using 3500 Rack Configuration, then all of the management data for the channel will be integrated.

TDI can support up to a maximum of 12 "M" series monitors (3500/40M, 42M, 44M, 46M, 64M, 72M and 77M).

To view full spectrum data from asynchronous sampling the two channels must be from the a single monitor channel pair and the sampling rate must be 20 kHz or slower.

When configured with a Shaft Absolute channel type, TDI will return the waveforms from the displacement waveform on the first channel and the shaft absolute waveform on the second channel.

4.2 Configuration Process Overview

The initial configuration of TDI involves several steps. The following list of steps is the recommended method for installing a TDI.

1. Install TDI in the 3500 Rack
2. Use the front port to configure the TDI's Ethernet options
3. Finish configuring the 3500 Rack via the front port or Ethernet port
4. Save the rack file after downloading
5. Use System 1 Configuration to add a 3500 Rack to the DAQ
6. Import the rack file
7. Configure the sampling configuration*
8. Configure the collection configuration*

* These processes are covered in the System 1 help screens.

4.3 Transient Data Interface Configuration

This section describes the options available on the Transient Data Interface configuration screen.

Configuration ID: A unique six character identifier, which is entered when a configuration is downloaded to the 3500 rack.

4.3.1 Rear Port

I/O Option: The I/O field lets you identify the type of I/O Module that is attached to the module (The option selected must agree with the I/O module installed). These choices are:

- 10/100 BASE T
- 100 BASE FX

4.3.2 Ethernet (Rear Port)

The primary communication interface for TDI is Ethernet utilizing TCP/IP. Several parameters need to be configured to allow usage of the communication interface.

Network Device Name: Use this parameter to give the rack a name it will be known as on the Network. The name has to be 20 characters or less and cannot contain any spaces.

Rack IP Address: The IP Address is a number that identifies the device on the network at a software level. Entered as a string containing 4 numbers between 0 and 255. An IP Address is used to identify and connect to a rack across an Ethernet WAN or LAN.

Note: IP Addresses of 0.0.0.0 and 255.255.255.255 are not valid.

When configuring a new TDI, see your network administrator to obtain a valid IP Address.

Rack Subnet Mask: String used to mask against the IP Address. In the form of 255.255.0.0, 255.255.255.0 etc...

Gateway Address: The IP Address of the Gateway server. The Gateway server is used to access addresses outside the local network. For networks where the Host Computer and the TDI are on the same local area network a Gateway is not needed. Contact your network administrator to obtain the gateway address.

4.3.3 Front Port

The port on the front of the Transient Data Interface labeled CONFIGURATION PORT is primarily used to configure the 3500 rack with a personal computer. This port may also be used to retrieve machinery data for display using the Data Acquisition/DDE Server Software and the Operator Display Software. This port supports RS-232 only and provides access to only one rack.

External Modem: The following external modems are directly supported by the Transient Data Interface:

- None
- Hayes Ultra 9600
- Hayes Optima 9600
- Motorola FasTalkII 14400
- US Robotics 56k
- Custom

Initialization String: The command that sets up and starts the modem. If you select a modem from the list, the default initialization string will be displayed in this field. If you select Custom, enter an initialization string from information found in the modem's documentation.

Byte Timeout: The number of byte times which the communication line must be idle before a communication is considered complete. One byte time is a function of the baud rate selected. The range of values is 3 to 255.

4.3.4 Passwords

Connect Password: Provides read only access to the 3500 rack. If the password entered in this field does not match the password entered in the Rack Configuration Software "Connect" screen or in the Data Acquisition/DDE Server Software "Setup" screen, no communication with the 3500 rack will be allowed. This password is stored in non-volatile memory in the Transient Data Interface.

Configuration Password: Provides configuration write access to the 3500 rack. If the password entered in this field does not match the password entered in the Rack Configuration Software "Download" screen, the 3500

rack will not accept new configurations. This password is also required to change setpoints in the 3500 rack from the Operator Display Software. This password is stored in non-volatile memory in the Transient Data Interface.

4.3.5 Rack Mounting Option

Select the type of 3500 rack that is installed or is going to be installed. Refer to the 3500 Monitoring System Rack Installation and Maintenance Manual for a description of the various mounting options.

4.3.6 Power Supply

Select the power supply options for both the upper and lower power supply positions.

Top: The following power supplies can be installed in the upper 3500 Power Supply Slot:

- No Power Supply
- AC High Voltage
- AC Low Voltage
- DC High Voltage
- DC Low Voltage

Bottom: The following power supplies can be installed in the upper 3500 Power Supply Slot:

- No Power Supply
- AC High Voltage
- AC Low Voltage
- DC High Voltage
- DC Low Voltage

4.3.7 Agency Approvals

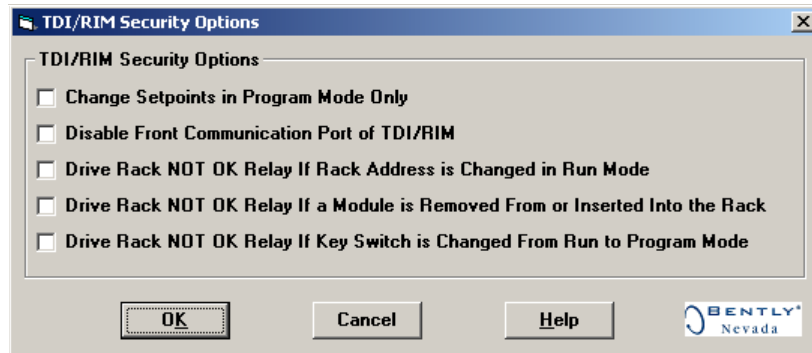
The following Agency Approvals are available for the 3500 rack:

- None
- CSA-NRTL/C

CE Approval: Select this box if the CE mark is applicable to the rack's installation.

4.4 Security Options Configuration

This Section describes the options available on the Transient Data Interface Security Option Configuration screen.



Change Setpoints in Program Mode Only: This will only allow changes to setpoints in any of the monitors if the keylock is in the program mode position. If the key is in the run position, setpoint changes will not be allowed.

Disable Front Communication Port of TDI: This option disables all write functions through the front communication port on the Transient Data Interface when selected. When in this mode the Rear Communication Port is still active.

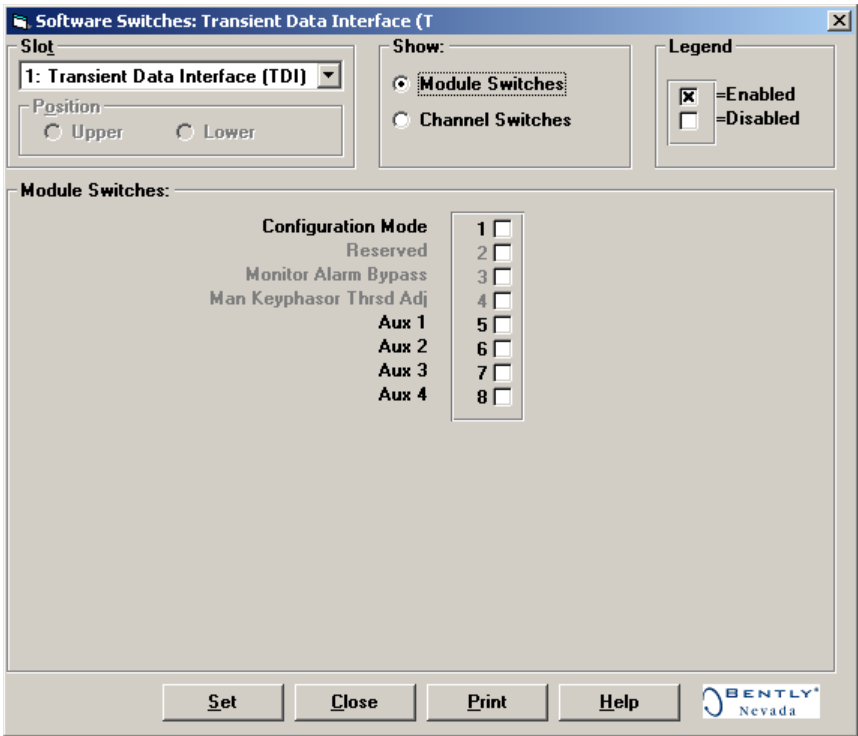
Drive Rack NOT OK Relay if Rack Address is Changed in Run Mode: With this option selected the NOT OK Relay will go into a NOT OK state if the Rack Address is changed at any time while the key switch is in the run position.

Drive Rack NOT OK Relay if a Module is Removed From the Rack: When selected this option will force the NOT OK Relay into a NOT OK state if any module is removed from its slot in the Rack.

Drive Rack NOT OK Relay if Key Switch is Changed From Run to Program Mode: The Rack NOT OK Relay will go into a NOT OK state any time that the key switch is changed from Run to Program mode when this option is selected.

4.5 Software Switches

Switches let you control the operation of the 3500 rack and control access to the configuration of the rack. This section lists the software and hardware switches that are available for the Transient Data Interface.



No changes will take effect until the **Set** button is pressed.

4.5.1 Module Switch

Configuration Mode: A switch that allows the rack to be configured. To set the rack in configuration mode, enable (☑) this switch and set the key switch on the front of the Transient Data Interface in the PROGRAM position. When downloading a Transient Data Interface configuration, this switch will automatically be enabled and disabled by the Rack Configuration Software. If the connection to the rack is lost during the configuration process, use this switch to remove the module from Configuration Mode.

The module switch number is used in the Communication Gateway Module.

Module Switch Number	Switch Name
1	Configuration Mode

4.6 Hardware Switches

The Transient Data Interface has three hardware switches that are found on the front panel.

4.6.1 Key Switch

The Key Switch is used to prevent unauthorized changes to the configuration settings. When the switch is in the RUN position, the 3500 rack cannot be configured. When the switch is in the PROGRAM position, the 3500 rack can be configured and the rack continues to operate normally. By removing the key, you can lock the Transient Data Interface in the RUN or PROGRAM position.

4.6.2 Rack Reset

Note:

An I/O Module must be installed for the Rack Reset switch to function correctly.

When the Rack Reset switch is pressed, any monitors in the rack will clear latched alarms and reset Timed OK Channel Defeat indications. If the Configuration LED is blinking at 5 Hz, it will be stopped. This switch performs the same function as the Rack Reset contact on the Rack Interface I/O Module.

4.6.3 Rack Address

The Rack Address is used to identify individual 3500 Racks on the network. Set the rack address by using a 7-position DIP switch, which provides for 127 possible addresses. All racks on a local area network should have a unique rack address. The following diagram and table show how to select the address 0110001 (49 decimal).

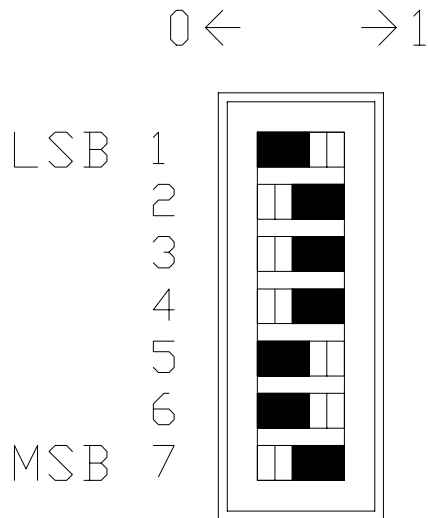


Figure 4-1. Rack Address Switch

LSB - Least Significant Bit
MSB - Most Significant Bit

The white area shows the direction of the switch.

Table 4-1: Available Rack Address

Switch Addresses	Switch Addresses	Switch Addresses
MSB LSB	MSB LSB	MSB LSB
<u>7654321</u> _____	<u>7654321</u> _____	<u>7654321</u> _____
0000000 1*	0101011 43	1010110 86
0000001 1	0101100 44	1010111 87
0000010 2	0101101 45	1011000 88
0000011 3	0101110 46	1011001 89
0000100 4	0101111 47	1011010 90
0000101 5	0110000 48	1011011 91
0000110 6	0110001 49	1011100 92
0000111 7	0110010 50	1011101 93
0001000 8	0110011 51	1011110 94
0001001 9	0110100 52	1011111 95
0001010 10	0110101 53	1100000 96

0001011 11	0110110 54	1100001 97
0001100 12	0110111 55	1100010 98
0001101 13	0111000 56	1100011 99
0001110 14	0111001 57	1100100 100
0001111 15	0111010 58	1100101 101
0010000 16	0111011 59	1100110 102
0010001 17	0111100 60	1100111 103
0010010 18	0111101 61	1101000 104
0010011 19	0111110 62	1101001 105
0010100 20	0111111 63	1101010 106
0010101 21	1000000 64	1101011 107
0010110 22	1000001 65	1101100 108
0010111 23	1000010 66	1101101 109
0011000 24	1000011 67	1101110 110
0011001 25	1000100 68	1101111 111
0011010 26	1000101 69	1110000 112
0011011 27	1000110 70	1110001 113
0011100 28	1000111 71	1110010 114
0011101 29	1001000 72	1110011 115
0011110 30	1001001 73	1110100 116
0011111 31	1001010 74	1110101 117
0100000 32	1001011 75	1110110 118
0100001 33	1001100 76	1110111 119
0100010 34	1001101 77	1111000 120
0100011 35	1001110 78	1111001 121
0100100 36	1001111 79	1111010 122
0100101 37	1010000 80	1111011 123
0100110 38	1010001 81	1111100 124
0100111 39	1010010 82	1111101 125
0101000 40	1010011 83	1111110 126
0101001 41	1010100 84	1111111 127
0101010 42	1010101 85	

* The address 0000000 is reserved for the host. Setting the switches to 0000000 will select a Rack Address of 1 just as 0000001 will.

5 I/O Module Description

The Transient Data Interface requires one I/O module and supports an optional second I/O module. The Transient Data Interface I/O Module is required and is used to connect the TDI to a network using Ethernet. The second module is the Buffered Signal Output Module and provides the buffered signals from the vibration monitors.

This section describes how to use the connectors on the I/O modules, lists what cables to use, and shows the pin outs of the cables.

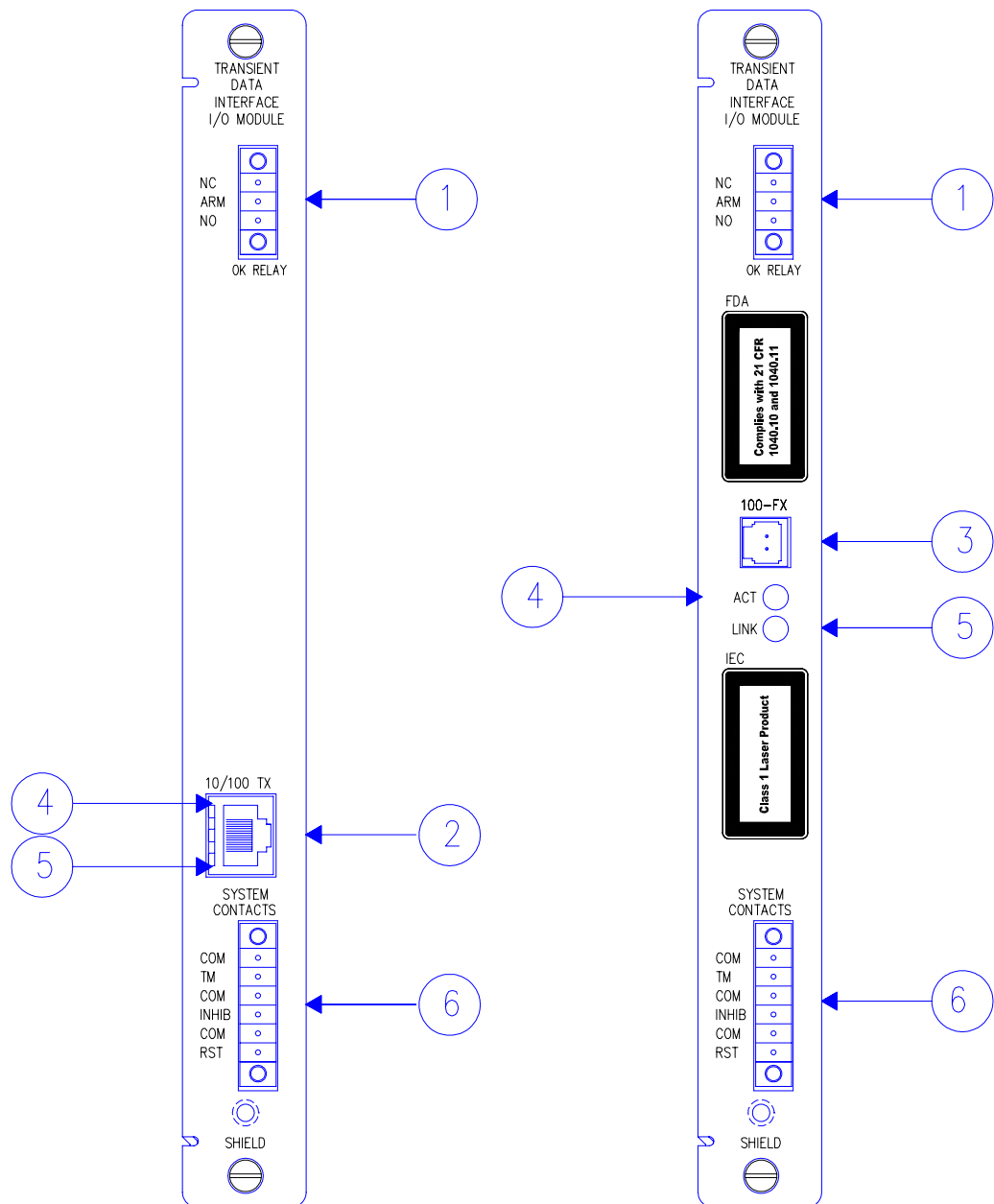
Only one Transient Data Interface I/O Module can be installed at a time behind the Transient Data Interface (in a Rack Mount or a Panel Mount rack) or above the Transient Data Interface (in a Bulkhead rack).

Also, one Buffered Signal Output Module may be installed between the Power Input Modules and the Transient Data Interface I/O.

5.1 Transient Data Interface Input/Output (I/O) Modules)

The two types Transient Data Interface I/O Modules that are available for the 3500 Monitoring System. They are the 10/100 BASE T Ethernet I/O (RJ-45) and the 100 BASE FX Ethernet I/O (Fiber Optic).

The Transient Data Interface I/O module must be installed behind the Transient Data Interface (in a Rack Mount or Panel Mount rack) or above the Transient Data Interface (in a Bulkhead rack).



- (1) OK RELAY: The OK Relay is normally energized and is used to indicate whether the 3500 Monitoring System is OK.
- (2) RJ-45 Ethernet Connector: Used to connect to a Host computer system with Ethernet.
- (3) MT-RJ FIBER OPTIC Connector: Used to connect to a Host computer system with Ethernet.
- (4) ACTIVITY LED: This amber LED will flicker if the TDI detects network activity.

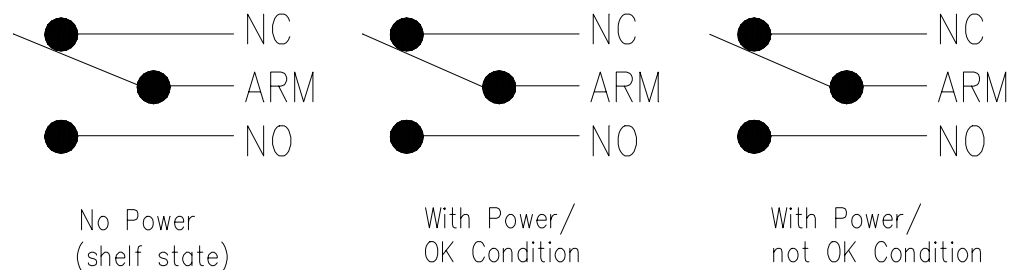
- (5) LINK LED: This green LED will illuminate if the TDI is connected to an active network.
- (6) EXTERNAL CONTACTS:
 - Trip Multiply
 - Rack Alarm Inhibit
 - Rack Reset

OK RELAY

The following items will cause the OK Relay to go NOT OK:

- Removing the Transient Data Interface from the 3500 rack
- Plugging a module into the 3500 rack (during self-test)
- Transducer going not OK (except Keyphasor transducer)
- Hardware failure within a module
- Configuration Failure
- Slot ID Failure, (a module is unable to determine what slot it is in)
- Any module in the 3500 rack which has detected a fault
- Communication Failure with any module.
- If any of the following security options have been configured and their conditions met:
 - Rack Address is changed while the TDI is in Run Mode.
 - Any module is inserted or removed from the rack.
 - The Key Switch is changed from Run Mode to Program Mode.

The following diagrams show the different ways the OK Relay can be wired:



NO means Normally Open.

ARM means Armature.

NC means Normally Closed.

Note:

OK relays are normally energized

Communications Interface

The TDI Ethernet port connects the 3500 rack to a 10 or 100 Mega-bit Ethernet local area network to which the host computer is also connected. This connection can either use the RJ45 10/100Base-T connector or the 100Base-FX connector. The TDI supports standard LAN architectures and can be routed to the host via hubs and switches.

10/100 BASE T: A RJ-45 port used to connect the TDI to the host computer through an Ethernet network. Connection requires UTP Category 5 network cabling with RJ-45 connectors. This port supports a maximum cable length of 100 m (328 ft) .

100 BASE FX: A MT-RJ fiber optic port used to connect the TDI to the host computer through an Ethernet network. Connection requires MT-RJ Multimode fiber optic network cabling. Maximum length supported is 400 m (1312 ft).

EXTERNAL CONTACTS

These require dry contact inputs. To enable a specific function, short the desired contact to a system common (COM).

Trip Multiply (TM): When active, places the entire rack in Trip Multiply.

Rack Alarm Inhibit (INHB): Used to prevent an alarm from being declared for any monitor or relay in the 3500 rack. This is typically used when performing maintenance functions. When active, monitors in alarm will be taken out of alarm and the rack OK relay will be in the not OK state.

Rack Reset (RST): Used to signal when the modules in the 3500 rack are to be reset. This contact has the same function as the Rack Reset switch on the front panel of the Transient Data Interface.

5.1.1 Wiring Euro Style Connectors

To remove a terminal block from its base, loosen the screws attaching the terminal block to the base and then grip the block firmly and pull. Do not pull the block out by its wires because this could loosen or damage the wires or connector.

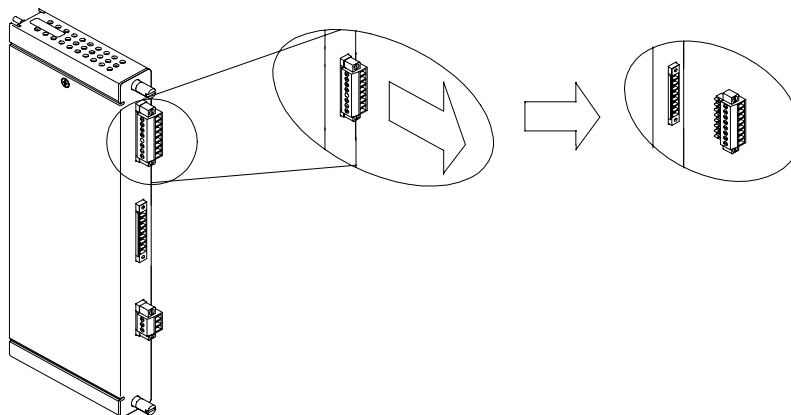
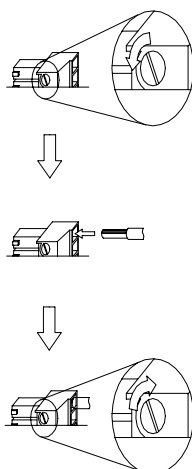


Figure 5-1. Typical I/O module

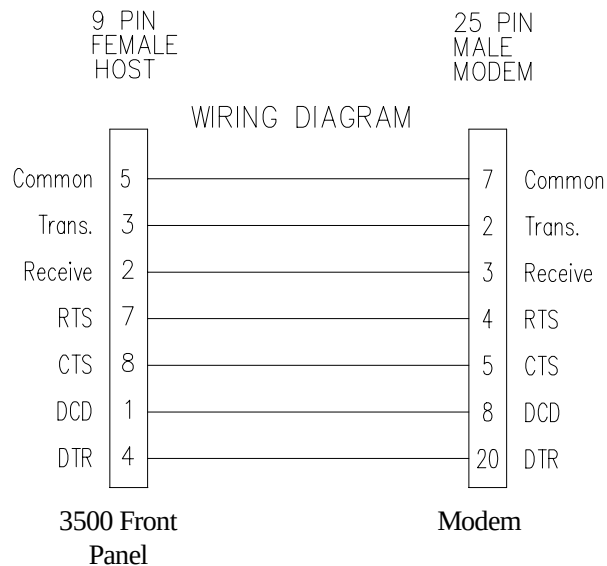
Refer to the 3500 Field Wiring Diagram Package for the recommended wiring. Also, do not remove more than 6 mm (0.25 inches) of insulation from the wires.



5.1.2 Cable Pin Outs

Cable Number 02290860

Host Computer (or Transient Data Interface) to External Modem Cable



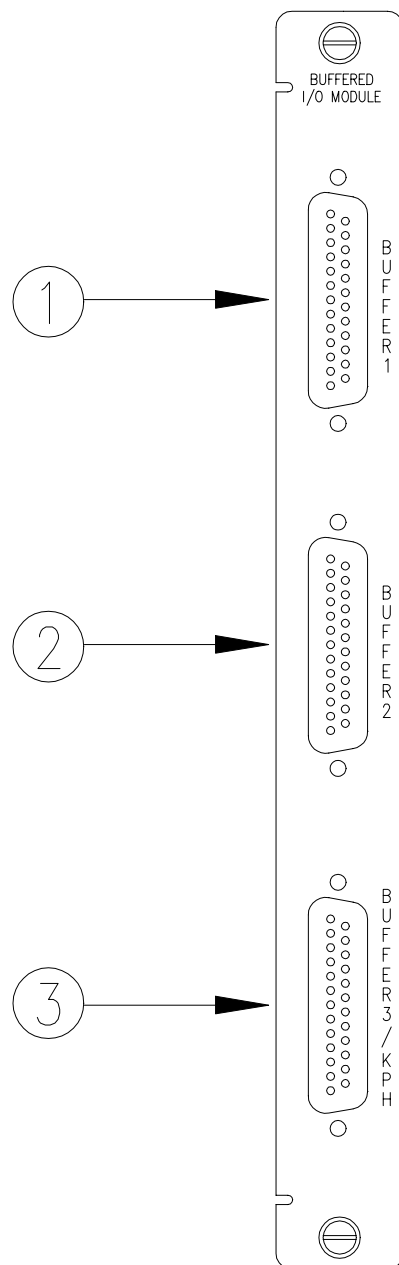
Cable Number 130118-XXXX-XX

Host Computer to 3500 Rack RS-232 Interface Cable

5.2 Buffered Signal Output Module

The Buffered Signal Output Module is an optional module that allows access to all of the buffered signals from the monitors. Additionally, access to the conditioned Keyphasor signal is available through this module. The module must be installed behind the Power Supplies between the Power Input Modules and the Transient Data Interface I/O Module (in a Rack Mount or a Panel Mount rack) or above the Power Supplies between the Power Input Modules and the Transient Data Interface I/O Module (in a Bulkhead rack). There are three connectors:

1. The first connector access the buffered signals for the first 6 monitor slots (2-7).
2. The second connector provides access for the next 6 slots (slots 8-13). and
3. The third connector allows access to the last two slots (slots 14 & 15) and the four conditioned Keyphasor signals.



- (1) Buffered Signals for slots 2 through 7
- (2) Buffered Signals for slots 8 through 13
- (3) Buffered Signals for slots 14 & 15 and Conditioned Keyphasors 1 through 4

Note:

This I/O module does not support connection to DDIX, TDIX or TDXnet.

5.2.1 Signal Pin Out

Table 5-1: Dynamic Connector 1

Slot	Channel	Pin Number
2	1	7
	2	14
	3	18
	4	16
3	1	11
	2	21
	3	25
	4	23
4	1	2
	2	9
	3	4
	4	6
5	1	20
	2	3
	3	19
	4	5
6	1	24
	2	10
	3	13
	4	12
7	1	15
	2	22
	3	17
	4	8
Common		1

Table 5-2: Dynamic Connector 2

Slot	Channel	Pin Number
8	1	7
	2	14
	3	18
	4	16
9	1	11
	2	21
	3	25
	4	23
10	1	2
	2	9
	3	4
	4	6
11	1	20
	2	3
	3	19
	4	5
12	1	24
	2	10
	3	13
	4	12
13	1	15
	2	22
	3	17
	4	8
Common		1

Table 5-3: Dynamic Connector 3

Slot	Channel	Pin Number
14	1	2
	2	16
	3	4
	4	14
15	1	3
	2	17
	3	5
	4	15
Keyphasor 1		22
Keyphasor 2		10
Keyphasor 3		24
Keyphasor 4		12
Common		1

6

Maintenance

This section shows how to verify that the Transient Data Interface and the I/O modules are operating correctly.

When performed properly, this module may be installed into or removed from the rack while power is applied to the rack. Refer to the Rack Installation and Maintenance Manual (part number 129766-01) for the proper procedure.

6.1 Verification

Use the TDI Host Port Test Utility to verify that the HOST ports on the Transient Data Interface and the TDI I/O Module are operating properly. Before running the TDI Host Port Test Utility, connect the host to the rack with either a RS-232 cable to the front of the TDI.

Refer to the 3500 Monitoring System Rack Configuration and Utilities Guide and the Rack Configuration Software for the details of this utility.

6.2 Performing Firmware Upgrades

Occasionally it may be necessary to upgrade the original firmware that is shipped with the 3500/22M TDI. The following instructions describe how to upgrade the existing firmware using the 3500 Configuration software.

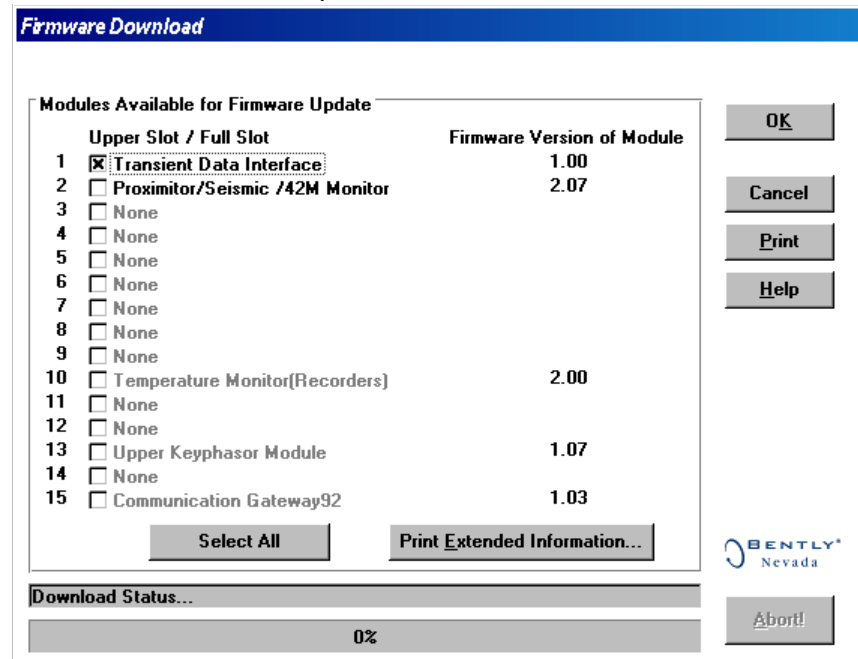


CAUTION

During the following procedure power to the rack cannot be interrupted and the monitor that is being upgraded cannot be removed from the rack. If either of these occurs the monitor may become inoperable.

1. Close System 1 Data Acquisition.
2. Start the 3500 Configuration software and connect to the rack. Use the Ethernet port for upgrading due to the length of the files that have to be downloaded.
3. Upload and save the current configuration of the module. Although the module retains the current configuration during the upgrade, saving the present configuration will help if there are any problems in the upgrade process.
4. Under the **Utilities** menu option select **Update Firmware**.

5. Select the module to be updated and click on the **OK** button.



6. The software will request the file to be downloaded. Select the file and click on the **Open** button.
7. The software will now download the file. If the process fails, the module will revert to its old code. Under no circumstances should the monitor be removed until it has finished the process.
8. After the download is completed, the module will restart and the software will disconnect.
9. Once the module has completed its startup, reconnect.
10. The software will request for DSP code files to be downloaded. There will be four files. Select each file and click on the **Open** button.
11. The software will now download the files.

Cycle power to the module, either by removing and reinstalling the module or by removing power from the rack.

7 Troubleshooting

This section describes how to troubleshoot a problem with the Transient Data Interface or the I/O modules by using the information provided by the verification screen, the LEDs, the System Event List, and the Alarm Event List. You can display the verification screen and the two event lists by using the Rack Configuration Software.

7.1 Verification

To perform the Transient Data Interface's verification:

1. Connect a computer running the Rack Configuration Software to the 3500 rack (if needed).
2. Select **Utilities** from the main screen of the Rack Configuration Software
3. Select **Verification** from the Utilities menu.
4. Select the Transient Data Interface and select the channel you want to verify.
5. Press the **Verify** button.
6. Select the Front Port or the Rear Port to get the status.
7. The Module OK State will show the Transient Data Interface's status and the Channel OK State will show the channel's status.

7.2 LED Fault Conditions

The following table shows how to use the LEDs to diagnose and correct problems.

OK LED	TX/RX	Condition	Solution
1 Hz	1 Hz	Transient Data Interface is not configured or in Configuration Mode.	Reconfigure the Transient Data Interface.
5 Hz	Don't Care	Transient Data Interface has detected an internal fault and is not OK.	Check the System Event List.
ON	Flashing	Transient Data Interface is operating correctly.	No action is required.
Don't Care	Not Flashing	Transient Data Interface not operating correctly.	Check the System Event List.

TM LED	Condition	Solution
ON	Rack is in Trip Multiply (due to hardware or software).	No action is required.
OFF	Rack is not in Trip Multiply.	No action is required.

Config OK LED	Condition	Solution
ON	Configuration information for every module in the rack is valid.	No action is required.
5 Hz	One of the selected security options has had its condition met.	Check the System Event List. Press the Rack Reset switch to clear.
OFF	At least one module has a configuration fault. A non-configured active Power Supply is present in the rack.	Check System Event List for which module(s) need to be reconfigured. OR Reconfigure module(s) that are flashing OK and TX/RX LEDs at 1 Hz. Remove Power Supply or change TDI configuration to include additional Power Supply.

7.3 System Event List Messages

This section describes the System Event List Messages that are entered by the Transient Data Interface.

Example of a System Event List Message

Sequence Number	Event Information	Event Number	Class	Event Date DDMMYY	Event Time	Event Specific	Slot
0000000123	Device Not Communicating	32	1	02/01/90	12:24:31:99		5L

Sequence Number: Number of the event in the System Event List (for example 123).

Event Information: The name of the event (for example Device Not Communicating).

Event Number: Code that identifies a specific event.

Class: Number used to display the severity of the event. The following classes are available:

Class Value	Classification
0	Severe/Fatal Event
1	Potential Problem Event
2	Typical Logged Event
3	Reserved

Event Date: The date the event occurred.

Event Time: The time the event occurred.

Event Specific: Provides additional information for the events that use this field.

Slot: Identifies the module that the event is associated with. If a half-height module is installed in the upper slot or a full-height module is installed, the field will be 0 to 15. If a half-height module is installed in the lower slot, then the field will be 0L to 15L. For example, the module is installed in the lower position of slot 5 (5L).

The following System Event List Messages may be placed in the list by the Transient Data Interface and are listed in numerical order. If an event marked with an asterisk (*) occurs...

- the host link on the back of the Rack Interface I/O Module supplying the message will not communicate with the host computer

If you are unable to resolve a problem, contact your nearest Bently Nevada office.

Flash Memory Failure:

Event Number: 11

Event Classification: Potential Problem

Action: Replace the Transient Data Interface as soon as possible.

Real Time Clock Failure :

Event Number: 12

Event Classification: Severe/Fatal Event

Action: Replace the Transient Data Interface as soon as possible.

Internal Network Failure:

Event Number: 30

Event Classification: Severe/Fatal Event

Action: Replace the Transient Data Interface immediately.

Resync Internal Network(Resynchronize Internal Network):

Event Number: 31

Event Classification: Potential Problem

Action: Check to see if one of the following components is faulty:

- the Transient Data Interface or
- the rack backplane

Device Not Communicating:

Event Number: 32

Event Classification: Potential Problem

Action: Check to see if one of the following components is faulty:

- the module installed in the slot or
- the rack backplane

Device Is Communicating:

Event Number: 33

Event Classification: Potential Problem

Action: Check to see if one of the following components is faulty:

- the module installed in the slot or
- the rack backplane

Config Token Acquired(Configuration Token Acquired):

Event Number: 50

Event Classification: Typical logged event

Event Specific:

- Front,
- Back,

The specified port can download configuration, change setpoints, set software switches, enable/disable Rack Alarm Inhibit, enable/disable Trip Multiply, or perform Rack Reset.

Action: No action required.

Config Token Released(Configuration Token Released):

Event Number: 51

Event Classification: Typical logged event

Event Specific:

- Front,
- Back,

The specified port can no longer download configuration, change setpoints, set software switches, enable/disable Rack Alarm Inhibit, enable/disable Trip Multiply, or perform Rack Reset.

Action:No action required.

Config Token Expired(Configuration Token Expired):

Event Number: 52

Event Classification: Potential Problem

Action:Check to see if one of the following components is faulty:

- the connection between the Transient Data Interface and the computer running the Rack Configuration Software;
- the Transient Data Interface; or
- the computer running the Rack Configuration Software.

Config Token Override(Configuration Token Override):

Event Number: 53

Event Classification: Typical Logged Event

Action:No action required.

Fail Relay Coil Sense:

Event Number: 55

Event Classification: Potential Problem

Action:Check to see if the Rack Interface I/O Module is installed. If installed, check to see if one of the following components is faulty:

- the Transient Data Interface, or
- the Rack Interface I/O Module

Pass Relay Coil Sense:

Event Number: 56

Event Classification: Potential Problem

Action: Check to see if the Rack Interface I/O Module is installed. If installed, check to see if one of the following components is faulty:

- the Transient Data Interface, or
- the Rack Interface I/O Module

I/O Module Mismatch:

Event Number: 60

Event Classification: Potential Problem

Action: Verify that the Rack Interface I/O Module installed matches the Rack Interface I/O Module selected in the Rack Configuration Software. If the correct Rack Interface I/O Module is installed, there could be a fault with the installed Rack Interface I/O Module.

Rack Type Mismatch:

Event Number: 61

Event Classification: Potential Problem

Action: Verify that the rack selection jumper, installed on the rack backplane, matches the rack type selected in the software. If the jumper is installed in the correct position, there could be a fault with the rack backplane.

HW Rack Alm Inh Active(Hardware Rack Alarm Inhibit Active):

Event Number: 70

Event Classification: Typical Logged Event

Action: No action required.

HW Rack Alm Inh Inactive(Hardware Rack Alarm Inhibit Inactive):

Event Number: 71

Event Classification: Typical Logged Event

Action: No action required.

HW override of SW Inh(Hardware override of Software Inhibit):

Event Number: 72

Event Classification: Typical Logged Event

Action: No action required.

HW Trip Multiply Active(Hardware Trip Multiply Active):

Event Number: 73

Event Classification: Typical Logged Event

Action:No action required.

HW Trip Mult Inactive(Hardware Trip Multiply Inactive):

Event Number: 74

Event Classification: Typical Logged Event

Action:No action required.

HW override of SW TM(Hardware override of Software Trip Multiply):

Event Number: 75

Event Classification: Typical Logged Event

Action:No action required.

HW Rack Reset Active(Hardware Rack Reset Active):

Event Number: 76

Event Classification: Typical Logged Event

Action:No action required.

HW Rack Reset Inactive(Hardware Rack Reset Inactive):

Event Number: 77

Event Classification: Typical Logged Event

Action:No action required.

SW Rack Alm Inh Active(Software Rack Alarm Inhibit Active):

Event Number: 78

Event Classification: Typical Logged Event

Action:No action required.

SW Rack Alm Inh Inactive(Software Rack Alarm Inhibit Inactive):

Event Number: 79

Event Classification: Typical Logged Event

Action:No action required.

SW Trip Multiply Active(Software Trip Multiply Active):

Event Number: 80

Event Classification: Typical Logged Event

Action:No action required.

SW Trip Mult Inactive(Software Trip Multiply Inactive):

Event Number: 81

Event Classification: Typical Logged Event

Action:No action required.

SW Rack Reset (Software Rack Reset):

Event Number: 82

Event Classification: Typical Logged Event

Action:No action required.

Rack Address changed:

Event Number: 90

Event Classification: Typical Logged Event

Action:No action required.

Key Switch in Run Mode:

Event Number: 91

Event Classification: Typical Logged Event

Action:No action required.

Key Switch in Prgm Mode(Key Switch in Program Mode):

Event Number: 92

Event Classification: Typical Logged Event

Action:No action required.

Fail Main Board +5V-A(Fail Main Board +5V - upper Power Supply):

Event Number: 100

Event Classification: Potential Problem

Action:Verify that noise from the power source is not causing the problem.
If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface, or
- the Power Supply installed in the upper slot

Pass Main Board +5V-A(Pass Main Board +5V - upper Power Supply):

Event Number: 101

Event Classification: Potential Problem

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface, or
- the Power Supply installed in the upper slot

Fail Main Board +5V-B(Fail Main Board +5V - lower Power Supply):

Event Number: 102

Event Classification: Potential Problem

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface, or
- the Power Supply installed in the lower slot

Pass Main Board +5V-B(Pass Main Board +5V - lower Power Supply):

Pass Main Board +5V-B

Event Number: 103

Event Classification: Potential Problem

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface, or
- the Power Supply installed in the lower slot

*** Fail Main Board +5V-AB(Fail Main Board +5V - upper and lower Power Supplies):**

Event Number: 104

Event Classification: Severe / Fatal Event

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface,
- the Power Supply installed in the lower slot, or
- the Power Supply installed in the upper slot.

Pass Main Board +5V-AB(Pass Main Board +5V - upper and lower Power Supplies):

Event Number: 105

Event Classification: Severe / Fatal Event

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface,
- the Power Supply installed in the lower slot, or
- the Power Supply installed in the upper slot.

Fail Main Board +15V-A(Fail Main Board +15V - upper Power Supply):

Event Number: 106

Event Classification: Potential Problem

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty

- the Transient Data Interface, or
- the Power Supply installed in the upper slot.

Pass Main Board +15V-A(Pass Main Board +15V - upper Power Supply):

Event Number: 107

Event Classification: Potential Problem

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface, or
- the Power Supply installed in the upper slot.

Fail Main Board +15V-B(Fail Main Board +15V - lower Power Supply):

Event Number: 108

Event Classification: Potential Problem

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface, or
- the Power Supply installed in the lower slot.

Pass Main Board +15V-B(Pass Main Board +15V - lower Power Supply):

Event Number: 109

Event Classification: Potential Problem

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface, or
- the Power Supply installed in the lower slot.

*** Fail Main Board +15V-AB(Fail Main Board +15V - upper and lower Power Supplies):**

Event Number: 110

Event Classification: Severe / Fatal Event

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface,
- the Power Supply installed in the lower slot, or
- the Power Supply installed in the upper slot.

Pass Main Board +15V-AB(Pass Main Board +15V - upper and lower Power Supplies):

Event Number: 111

Event Classification: Severe / Fatal Event

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface,
- the Power Supply installed in the lower slot, or
- the Power Supply installed in the upper slot.

Fail Main Board +3V-AB(Pass Main Board +3V - upper and lower Power Supplies):

Event Number: 162

Event Classification: Severe / Fatal Event

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface,
- the Power Supply installed in the lower slot, or
- the Power Supply installed in the upper slot.
-

Pass Main Board +3V-AB(Pass Main Board +3V - upper and lower Power Supplies):

Event Number: 163

Event Classification: Severe / Fatal Event

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface,
- the Power Supply installed in the lower slot, or
- the Power Supply installed in the upper slot.
-

Fail Main Board +2.5V-AB(Pass Main Board +2.5V - upper and lower Power Supplies):

Event Number: 164

Event Classification: Severe / Fatal Event

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface,
- the Power Supply installed in the lower slot, or
- the Power Supply installed in the upper slot.
-

Pass Main Board +2.5V-AB(Pass Main Board +2.5V - upper and lower Power Supplies):

Event Number: 165

Event Classification: Severe / Fatal Event

Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface,
- the Power Supply installed in the lower slot, or
- the Power Supply installed in the upper slot.

Fail Low Rough Supply A(Fail Main Board Rough Supply- upper Power Supply):

Event Number: 174

Event Classification: Potential Problem

Action:Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface, or
- the Power Supply installed in the upper slot.

Fail Low Rough Supply B(Fail Main Board Rough Supply- lower Power Supply):

Event Number: 175

Event Classification: Potential Problem

Action:Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface, or
- the Power Supply installed in the upper slot.

Pass Low Rough Supply A(Pass Main Board Rough Supply- upper Power Supply):

Event Number: 176

Event Classification: Potential Problem

Action:Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface, or
- the Power Supply installed in the lower slot.

Pass Low Rough Supply B(Fail Main Board Rough Supply- lower Power Supply):

Event Number: 177

Event Classification: Potential Problem

Action:Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:

- the Transient Data Interface, or
- the Power Supply installed in the lower slot.

Device Configured :

Event Number: 300

Event Classification: Typical Logged Event

Action: No action required.

Configuration Failure :

Event Number: 301

Event Classification: Severe/Fatal Event

Action: Replace the Transient Data Interface immediately.

Configuration Failure:

Event Number: 301

Event Classification: Potential Problem

Action: Download a new configuration to the Transient Data Interface. If the problem still exists, replace the Transient Data Interface as soon as possible.

Module Entered Cfg Mode(Module Entered Configuration Mode):

Event Number: 302

Event Classification: Typical Logged Event

Action: No action required.

Software Switches Reset :

Event Number: 305

Event Classification: Potential Problem

Action: Download the software switches to the Transient Data Interface. If the software switches are not correct, replace the Transient Data Interface as soon as possible.

Init Real Time Clock(Initialize Real Time Clock):

Event Number: 306

Event Classification: Potential Problem

Action: Replace the Real-Time Clock component in the Transient Data Interface as soon as possible.

Monitor TMR PPL Failed(Monitor TMR Proportional value Failed):

Event Number: 310

Event Classification: Potential Problem

Action: Replace the monitor installed in the slot as soon as possible.

Monitor TMR PPL Passed(Monitor TMR Proportional value Passed):

Event Number: 311

Event Classification: Potential Problem

Action: Replace the monitor installed in the slot as soon as possible.

TMR Hw Settings Conflict:

Event Number: 313

Event Classification: Potential Problem

Action: Check the following:

If configured for TMR there must be two power supplies in the rack.

The jumper on the backplane must be set to the lower position.

TMR Sw Config Conflict:

Event Number: 314

Event Classification:

Action:

Module Reboot:

Event Number: 320

Event Classification: Typical Logged Event

Action: No action required.

Module Removed from Rack:

Event Number: 325

Event Classification: Typical Logged Event

Action: No action required.

Module Inserted in Rack:

Event Number: 326

Event Classification: Typical Logged Event

Action: No action required.

Supply OK/Installed:

Event Number: 330

Event Classification: Potential Problem

Action: Determine if a power supply has been installed. Verify that there is not a problem with the power source. If there are no problems with the power source, replace the power supply as soon as possible.

Supply Faulted/Removed :

Event Number: 331

Event Classification: Potential Problem

Action:Determine if a power supply has been removed. Verify that there is not a problem with the power source. If there are no problems with the power source, replace the power supply as soon as possible.

Rack/TDI Powered Down(Rack or Transient Data Interface Powered Down):

Event Number: 340

Event Classification: Typical Logged Event

Action:No action required.

Rack/TDI Powered Up(Rack or Transient Data Interface Powered Up):

Event Number: 341

Event Classification: Typical Logged Event

Action:No action required.

Modem Reinitialized:

Event Number: 350

Event Classification: Typical Logged Event

Action:No action required.

Device Events Lost:

Event Number: 355

Event Classification: Typical Logged Event

Action:No action required.

Device Alarms Lost:

Event Number: 356

Event Classification: Typical Logged Event

Action:No action required.

Rack Time Changed:

Event Number: 360

Event Classification: Typical Logged Event

Action:No action required.

Module Entered Calibr.(Module Entered Calibration Mode):

Event Number: 365

Event Classification: Typical Logged Event

Action: No action required.

Module Exited Calibr.(Module Exited Calibration Mode):

Event Number: 366

Event Classification: Typical Logged Event

Action: No action required.

Config Password Changed(Configuration Password Changed):

Event Number: 400

Event Classification: Typical Logged Event

Action: No action required.

Connect Password Changed:

Event Number: 401

Event Classification: Typical Logged Event

Action: No action required.

Incompatible Backplane:

Event Number: 402

Event Classification: Potential Problem

Action: Change the TDI's configuration to match the rack.

Loopback Test Failed:

Event Number: 403

Event Classification: Potential Problem

Action: Replace the TDI module.

Management Test Failed:

Event Number: 404

Event Classification: Potential Problem

Action: Replace TDI module

Manage Password Changed:

Event Number: 411

Event Classification: Typical Logged Event

Action: No action required

7.4 Management System Event List Messages

This section describes the System Events returned by the management portion of the TDI. The format of the messages is the same as those used for System Events. The events listed here will not effect the operation of the protection system, but may effect data collection and transmission of the data to System 1.

Speed DSP Faliure.:

Event Number: 1000

Event Classification: Potential Problem

Action: Replace TDI Module.

DSP Code Set Missing.:

Event Number: 1001

Event Classification: Potential Problem

Action: Download DSP Code.

Management KPH Faulted:

Event Number: 1002

Event Classification: Potential Problem

Action: Check Keyphasor signal.

Management KPH Reassigned:

Event Number: 1003

Event Classification: Typical Logged Event

Action: No action required

Management KPH Acquired:

Event Number: 1004

Event Classification: Typical Logged Event

Action: No action required

Clctn Group Enter Transient (Collection Group Entered into Transient Mode):

Event Number: 1006

Event Classification: Typical Logged Event

Action: No action required

Clctn Group Exit Transient (Collection Group Exited from Transient Mode):

Event Number: 1007

Event Classification: Typical Logged Event

Action: No action required

Management Sys. Halted:

Event Number: 1008

Event Classification: Potential Problem

Action: If the event occurred when started System 1 DAQ or changing TDIs configuration no action is required. If it occurs otherwise then replace TDI.

Management Sys. Online:

Event Number: 1009

Event Classification: Potential Problem

Action: If the event occurred when started System 1 DAQ, changing TDIs configuration or during module power up no action is required. If it occurs otherwise then replace TDI.

Management Cfg. Failure:

Event Number: 1010

Event Classification: Potential Problem

Action: Restart System 1 DAQ, if the problem persists then replace TDI.

Fixed HW/FW Cfg. Failure:

Event Number: 1011

Event Classification: Potential Problem

Action: Restart System 1 DAQ, if the problem persists then replace TDI.

Management Configured:

Event Number: 1012

Event Classification: Typical Logged Event

Action: No action required

DSP Code Downloaded:

Event Number: 1013

Event Classification: Typical Logged Event

Action: No action required

Fixed HW/FW Configured:

Event Number: 1014

Event Classification: Typical Logged Event

Action: No action required

TDI IP Address Changed:

Event Number: 1015

Event Classification: Typical Logged Event

Action: No action required

TDI Gateway Add. Change:

Event Number: 1016

Event Classification: Typical Logged Event

Action: No action required

TDI Network Name Change:

Event Number: 1017

Event Classification: Typical Logged Event

Action: No action required

Invalid Mngmnt Mon Rev:

Event Number: 1018

Event Classification: Potential Problem

Action: Determine which "M" series monitor does not meet the requirements for TDI: PWA revision of G or higher; or Mod 162183. Replace the monitor.

Invalid rack address:

Event Number: 1019

Event Classification: Potential Problem

Action: The rack address has been set to 0 change it to another address.

7.5 Alarm Event List Messages

The following Alarm Event List Messages are returned by the different module types installed in the 3500 rack.

Communication Gateway Module	When the message will occur
Entered not OK	Module went not OK
Left not OK	Module returned to the OK state

Keyphasor Module	When the message will occur
Entered not OK	Module went not OK
Left not OK	Module returned to the OK state

Monitor Module	When the message will occur
Enter Alert/Alarm 1	A static data value in the channel has entered Alert / Alarm 1 and changed the channel Alert / Alarm 1 status
Left Alert/ Alarm 1	A static data value in the channel has left Alert / Alarm 1 and changed the channel Alert / Alarm 1 status
Enter Danger/Alarm 2	A static data value in the channel has entered Danger / Alarm 2 and changed the channel Danger / Alarm 2 status
Left Danger/Alarm 2	A static data value in the channel has left Danger / Alarm 2 and changed the channel Danger / Alarm 2 status
Enter not OK	module went not OK
Left not OK	module returned to the OK state

Transient Data Interface	When the message will occur
Entered not OK	Module went not OK
Left not OK	Module returned to the OK state

Relay Module	When the message will occur
Entered not OK	Module went not OK
Left not OK	Module returned to the OK state
Relay Activated	Condition for driving the relay channel met
Relay Deactivated	Condition for driving the relay channel is not met anymore

8 Ordering Information

8.1 List of Options and Part Numbers

8.1.1 3500/22M TDI Module and I/O

3500/22-AXX-BXX-CXX

*A: Transient Data
Interface Type*

- 0 1** Standard (Use for standard monitoring applications)
- 0 2** TMR (Use only for applications that requires a Triple Modular Redundant Configuration)

B: I/O Module Type

- 0 1** 10/100 Base T Ethernet I/O Module
- 0 2** 100 Base FX (Fiber Optic) Ethernet I/O Module

*C: Agency Approval
Option*

- 0 0** None
- 0 1** CSA/NRTL/C

8.1.2 3500/22M Dynamic Data Enabling Disk

This disk is used to enable the number of channels of dynamic data that the TDI will support; dynamic data refers to the ability to collect waveforms. There are two levels of dynamic data: Steady-State points are channels that collect waveform data either due to a software command or due to an alarm event, and therefore support current values, scheduled waveform capture and alarm data capture. Transient points provide all the function of a Steady-State point with the additional capabilities of waveform collection due to parameter variations such as machine speed.

3500/09-AXXX-BXXX

A: Steady-State Points

0 to 672

B: Transient Points

0 to 672

Note:

The sum of the two fields must be equal or less than 672. One disk can support multiple TDIs.

8.2 Accessories

8.2.1 Host Computer to 3500 Rack Cable, RS232

130118 -AXXX-BXX

A: Cable Length

0 0 1 0	10 feet (3 metres)
0 0 2 5	25 feet (7.5 metres)
0 0 5 0	50 feet (15 metres)
0 1 0 0	100 feet (30.5 metres)

*B: Assembly
Instructions*

0 1	Not Assembled
0 2	Assembled

8.2.2 Ethernet Cables:

Standard 10/100 Base T (Category 5) Cables with RJ-45 connectors (stranded patch cable)

02200230:	6 ft (1.8 m) Length
02200231:	10 ft (3.5 m) Length
02200232:	25 ft (7.5 m) Length

138131-AXXX

10/100 Base T Shielded Category 5 Cable with RJ-45 connectors (solid conductor)

A: Cable Length

0 4 0	40 feet (12 m)
0 5 0	50 feet (15 m)
0 7 5	75 feet (22.5 m)
1 0 0	100 feet (30.5 m)
1 2 0	120 feet (36.6 m)
1 5 0	150 feet (44.8 m)
2 0 0	200 feet (61 m)

2 5 0 250 feet (75 m)

3 2 0 320 feet (97.5 m)

10/100 Base T Shielded Category 5 Cable with RJ-45 connectors (solid conductor)

161756-AXXX

*A: Length (in ft.) up to
1300 ft (400 m) in
length*

10 ft. – 500 ft. in 10 ft increments only

500 ft. – 1300 ft. in 100 ft increments only

8.2.3 Spares

138607-01:	Standard Transient Data Interface Module
138607-02:	TMR Transient Data Interface Module
146031-01:	10/100 Base T I/O Module
146031-02:	100 Base FX (Fiber Optic) I/O Module.
00580441:	Connector Header, Internal Termination, 3-Position, Green
00580436:	Connector Header, Internal Termination, 6-Position, Green

9 3500/22M Specifications

9.1 Inputs

Power Consumption:	10.5 Watts
Data:	
Front panel:	115.2 k baud maximum RS232 serial communications
10/100Base-T I/O:	10BASE-T or 100BASE-TX Ethernet, auto-sensing.
100Base-FX I/O:	100BASE-FX Fiber-Optic Ethernet

9.2 Outputs

Front Panel LEDs:

OK LED:	Indicates when the 3500/22M is operating properly.
TX/RX LED:	Indicates when the 3500/22M is communicating with other modules in the 3500 rack.
TM LED:	Indicates when the 3500 rack is in Trip Multiply mode.
CONFIG OK LED:	Indicates that the 3500 rack has a valid configuration

I/O Module OK Relay:

	Relay to indicate when the 3500 rack is operating normally or when a fault has been detected within the rack. User can select either an "OPEN" or "CLOSED" contact to annunciate a NOT OK condition. This relay always operates as "Normally Energized".
OK Relay:	Rated to 5A @ 24 Vdc/ 120 Vac, 120 Watts/600 VA Switched Power.
Normally closed contacts:	Arc suppressors are provided.

9.3 Controls

Front Panel:

Rack reset button:	Clears latched alarms and Timed OK Channel Defeat in the rack. Performs same function as "Rack Reset" contact on I/O module.
Address switch:	Used to set the rack address; 127 possible addresses.
Configuration Keylock:	Used to place 3500 rack in either "RUN" mode or "PROGRAM" mode. RUN mode allows for normal operation of the rack and locks out configuration changes. PROGRAM mode allows for normal operation of the rack and also allows for local or remote rack configuration. The key can be removed from rack in either position, allowing switch to remain in either RUN or PROGRAM positions. Locking switch in the RUN position allows you to restrict unauthorized rack reconfiguration. Locking switch in PROGRAM position allows remote configuration of a rack at any time.

I/O Module System Contacts:

Trip Multiply:

Description:	Used to place 3500 rack in Trip Multiply.
Maximum Current:	<1 mA dc, Dry Contact to Common.

Alarm Inhibit:

Description:	Used to inhibit all alarms in the 3500 rack.
Maximum Current:	<1 mA dc, Dry Contact to Common.

Rack Reset:

Description:	Used to clear latched alarms and Timed OK Channel Defeat.
Maximum Current:	<1 mA dc, Dry Contact to Common.

9.4 Data Collection

Keyphasor®

Inputs:

- Supports the four 3500 system Keyphasors®. The speed range support is based on the number of dynamic channels enabled:

Number of Channels	Minimum Speed	Maximum Speed
1 to 16	1 rpm	100,000 rpm
17 to 24	1 rpm	60,000 rpm
25 to 48	1 rpm	30,000 rpm

- Supports multiple event per revolution speed inputs up to 20k Hz.

Startup/Coastdown

Data:

- Data collected from speed and time intervals.
- Increasing and decreasing speed interval independently programmable.
- Initiation of transient data collection based on detecting the machine speed within one of two programmable windows.
- The number of transient events that can be collected is only limited by the available memory in the module.

Alarm Data

Collection:

- Pre and post alarm data
- 1 sec static values collected for 10 minutes before the event and 1 minute after the event.
- 100 msec static values collected for 20 seconds before the event and 10 seconds after the event.
- 2.5 minutes of waveform data at 10 second intervals before the alarm and 1 minute collected at 10 second intervals after the alarm.

Static Values Data:

- TDI will collect the static values including the values measured by the monitors.

- TDI provide four nX static values for each point. Amplitude and phase are returned for each of the values.

Waveform Sampling:

- Collection of waveforms for 48 channels
- DC Coupled waveforms.
- Simultaneous Synchronous and Asynchronous data sampled during all operational modes.
- User configurable Synchronous waveform sampling rates:
 - 1024 samples/rev for 2 revolutions,
 - 720 samples/rev for 2 revolutions,
 - 512 samples/rev for 4 revolutions,
 - 360 samples/rev for 4 revolutions,
 - 256 samples/rev for 8 revolutions,
 - 128 samples/rev for 16 revolutions,
 - 64 samples/rev for 32 revolutions,
 - 32 samples/rev for 64 revolutions, and
 - 16 samples/rev for 128 revolutions.
- Asynchronous data sampled to support an 800-line Spectrum at the following frequency spans:
 - 10 Hz,
 - 20 Hz,
 - 50 Hz,
 - 100 Hz,
 - 200 Hz,
 - 500 Hz,
 - 1000 Hz,
 - 2000 Hz,
 - 5000 Hz,
 - 10 k Hz,
 - 20 k Hz, and
 - 30 k Hz.
- Asynchronous data is anti-alias filtered.
- Channel Pairs for providing Orbit or synchronous full spectrum presentations can be split among multiple monitors. For asynchronous full spectrums the channels must be within a monitor channel pair (30k Hz frequency span data will not be phase correlated between channel pairs).

9.5 Communications

Protocols:

BN Host Protocol:	Communication with 3500 Configuration Software and 3500 Data Acquisition and Display Software.
BN TDI Protocol:	Communication with Bently Nevada System 1 Asset Management and Data Collection Software.

Front Panel:

Communications:	RS232
Protocol Supported:	BN Host Protocol.
Baud Rate:	115.2 k baud maximum (auto baud capable).
Cable Length:	30 meters (100 feet) maximum.
Connector:	9 Pin D-Sub.

10/100Base-T Ethernet I/O:

Connection:	Ethernet, 10Base-T and 100Base-TX. Conforms to IEEE802.3
Protocol Supported:	BN Host Protocol & BN TDI Protocol using Ethernet TCP/IP.
Connection:	RJ-45 (telephone jack style) for 10/100Base-T Ethernet cabling.

100Base-FX Ethernet I/O:

Communications:	Ethernet, 100Base-FX Fiber Optic. Conforms to IEEE802.3u.
Protocol Supported:	BN Host Protocol & BN TDI Protocol using Ethernet TCP/IP.
Connection:	MT-RJ Fiber Optic connector for 100Base-FX cabling.

9.6 Environmental Limits

TDI Module and 10/100Base-T I/O:

Operating Temperature:	-30°C to +65°C (-22°F to +150°F).
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Storage Temperature: -40°C to +85°C (-40°F to +185°F).

Humidity: 95%, non-condensing.

100Base-FX I/O:

Operating Temperature: 0°C to +50°C (32°F to +122°F).

Storage Temperature: -40°C to +85°C (-40°F to +185°F).

Humidity: 95%, non-condensing.

9.7 CE Mark Directives

EMC Directives:

Certificate of Conformity: 136669

EN50081-2:

Radiated Emissions: EN 55011, Class A

Conducted Emissions: EN 55011, Class A

EN 61000-6-2:

Electrostatic Discharge: EN 61000-4-2, Criteria B

Radiated Susceptibility: ENV 50140, Criteria A

Conducted Susceptibility: ENV 50141, Criteria A

Electrical Fast Transient: EN 61000-4-4, Criteria B

Surge Capability: EN 61000-4-5, Criteria B

Magnetic Field: EN 61000-4-8, Criteria A

Power Supply Dip: EN 61000-4-11, Criteria A

Radio Telephone: ENV 50204, Criteria A

CE Mark Low Voltage Directives:

Certificate of Conformity:	134036
EN 61010-1:	Safety Requirements

9.8 Hazardous Area Approvals

CSA/NRTL/C:	Class I, Division 2, Groups A through D, T4@ Ta=65°.
	Certification Number BN26744C-18

9.9 Physical

TDI Module:

Dimensions (Height x Width x Depth):	241.3 mm x 24.4 mm x 241.8 mm (9.50 in x 0.96 in x 9.52 in).
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Weight:	0.91 kg (2.0 lbs.).
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I/O Modules :

Dimensions (Height x Width x Depth):	241.3 mm x 24.4 mm x 99.1 mm (9.50 in x 0.96 in x 3.90 in).
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Weight:	0.20 kg (0.44 lb.).
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Rack Space Requirements:

TDI Module:	1 full-height front slot.
I/O Modules:	1 full-height rear slot.

