USER MANUAL

DIAGNOSTIC MODULE

PS3500-DM

PEPPERL+FUCHS
PROTECTING YOUR PROCESS

With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

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1 Safety

1.1 Validity

This document contains information that you must read for your own personal safety and to avoid property damage. Depending on the hazard category, the warning signs are displayed in descending order as follows:

1.2 Symbols Used

Safety Symbols

Danger!

Danger notices emphasize that hazardous conditions may exist in the equipment, or may be associated with its use. Failure to comply with danger notices may result in serious personal injury or death.

Warning!

Warning notices indicate a warning about a possible fault or danger.

Failure to comply with warning may result in personal injury or equipment damage.

Caution!

Caution notices indicate a warning about a possible fault.

Ignoring the devices and any connected facilities or systems may cause interruption, or complete failure of components or the entire system.

Informative Symbols

Note!

Notes call attention to information that is especially significant to understanding or operating the diagnostic module.

Action

This symbol indicates a paragraph with instructions.

1.3 Target Group/Personnel

The plant owner is responsible for the planning, installation, commissioning, operation, maintenance, and disassembly.

Mounting, installation, commissioning, operation, maintenance, and disassembly of any device must be performed by trained, qualified personnel only. The instruction manual must be read and understood.

1.4 Reference Documentation

Laws, standards, or directives applicable to the intended use must be observed. In relation to hazardous areas, Directive 1999/92/EC must be observed.

The corresponding data sheets, Declarations of Conformity, EC type-examination certificates, certificates and control drawings, if applicable (see data sheet), are an integral part of this document. This information can be found at www.pepperl-fuchs.com.

Due to constant revisions, this documentation is subject to continual change. Please refer only to the most up-to-date version at www.pepperl-fuchs.com.

1.5 Delivery, Transport, and Storage

Check the packaging and contents for damage.

Make sure the item received is the correct item ordered.

Keep the original packaging. Always store and transport the device in the original packaging.

Always store the device in a clean and dry environment. The permitted storage temperature (see data sheet) must be considered.

1.6 Marking

Examine the diagnostic module model number nameplate to identify the appropriate approvals, area classification, and type, as shown in Figure 1.1.

Figure 1.1 Identification Label

1.7 Intended Use

The housing of PS3500-DM meets the degree of protection class IP 20. It is intended for mounting on the PS3500 backplane PS3500-TB-*.

The diagnostic module is used to monitor the input parameters, internal parameters, and output parameters of the PS3500 power supply system.

The device is only approved for appropriate and intended use. Ignoring these instructions will void any warranty and absolve the manufacturer from any liability.

The device must only be operated in the ambient temperature range and at the relative humidity (non condensing) specified.

Protection of the operating personnel and the overall system is not ensured if the product is not being used according to its intended purpose.

The PS3500 product range may be installed in Zone-2 or Class-I/Division-2 hazardous areas. Type of protection is Ex ic nA nC (non-arcing, sealed device) for Zone-2 Gas Groups IIC, and non-incendive for use in Class-I Division-2 Gas Groups A, B, C and D. Please consult local electrical codes for hazardous location installation guidelines. NOTE: This equipment is suitable for use in Class-I, Division-2; Groups A, B, C, D and Class-I, Zone-2; Group-IIC or non-hazardous locations only.

The Declaration of Conformity, Certificate of Compliance, and data sheet are considered an integral part of this user manual. The data sheets contain the electrical data of the Declaration of Conformity and the Certificate of Compliance. Laws and/or regulations governing the use or intended use must be observed.

The PS3500 products are only approved for proper professional use in accordance with the intended purposes. Improper handling will void any claim made under the warranty as well as any manufacturer's liability. The PS3500 diagnostic module can only be operated by trained professionals in accordance with this manual.

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2 General Description

The diagnostic module enables users to monitor operating parameters of the PS3500 power supply systems.

The diagnostic module is a completely independent component and does not control, or otherwise affect, the operation of the power supply modules.

The diagnostic module displays values for various measurement points, along with warning and alarm messages, whenever values exceed defined ranges. Some measurements are taken within the power supplies and reported to the diagnostic module, while other points are measured directly by the diagnostic module.

The diagnostic module reports the following from each power supply: output voltage, output current, temperatures, usage, and fault conditions.

The diagnostic module takes measurements on the primary (input) side of the power supplies for slots 1, 3, and 5 and generates the following: input voltage, input current, and noise spike counts.

The diagnostic module reads measurements on the secondary (output) side of the power supply modules for slots 1, 3, and 5 and reports the following: output voltage and output noise.

Note!

Odd slots (1, 3, and 5) are independently monitored; almost all N+1 and N+N configurations can be set up and adjusted through these independent monitors. Refer to Figure 2.1.

2.1 General System Layout

The PS3500 system consists of the PS3500 diagnostic module and PS3500 power supply modules on either a 3-position or 6-position backplane. Figure 2.1 shows an example of a 6-position backplane installation.

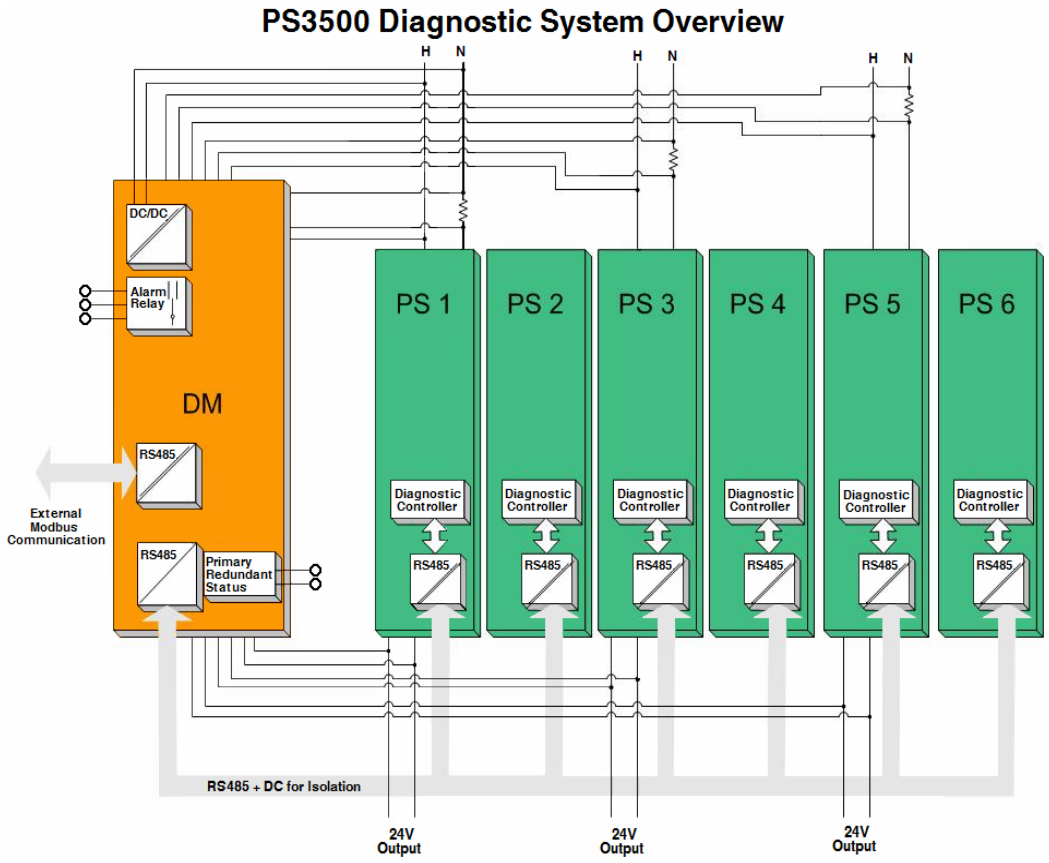

Figure 2.1 PS3500 6-Position Backplane Diagnostic System Overview

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3 Product Description

3.1 General Overview

The PS3500-DM is a part of the PS3500 power supply system. Other components include the PS3500-PM-1.24.15 power supply and the PS3500-TB-3 and PS3500-TB-6 backplanes. The key features of the system are:

- Nominal output 24 V/15 A per module
- Nominal input of 90 VAC ... 250 VAC/90 VDC ... 300 VDC per module
- High efficiency (up to 91 %)
- Fanless system
- Module output voltage is adjustable at the backplane from 22.5 V ... 30 V
- Basic module failure alarming via relay contact (normally open/close configurable)
- Monitors operating parameters and sets warnings/alarms for out-of-tolerance values

3.1.1 Component Overview

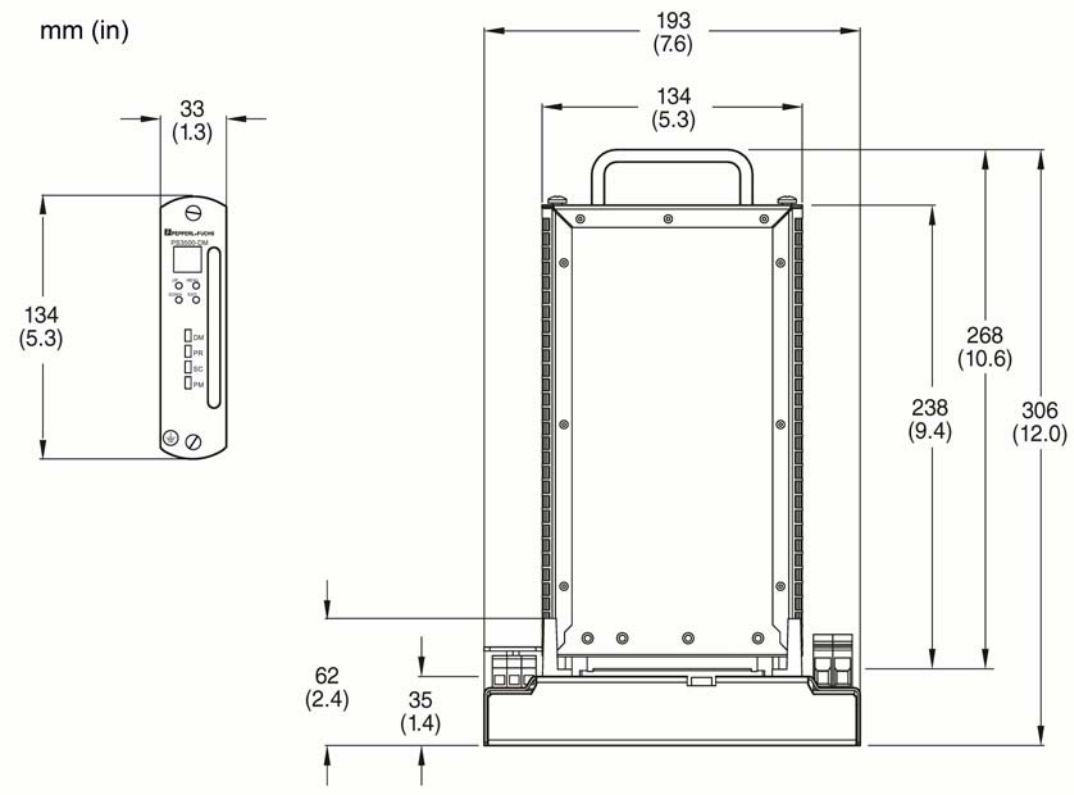


Figure 3.1 Diagnostic Module Dimension Diagram

3.2 Technical Data

3.2.1 Diagnostic Module Specifications

Table 3.1 Diagnostic Module Specifications

Input	
Voltage	90 VAC ... 250 VAC, 44 Hz ... 66 Hz; 90 VDC ... 300 VDC
Connection	Diagnostic module slot hard wired to power supply module slot 1
Current	100 mA
Output	
Current	1 A @ 30 VDC (max) 0.6 A @ 50 VDC (max)
Voltage	50 VDC
Alarm Output	Form C Relay
Electrical Isolation	
Primary Side	To DM isolation: 4.25 kVDC External RS485 to isolation: 4.25 kVDC Internal RS485 to isolation: 4.25 kVDC
Secondary Side	To DM isolation: 2.12 kVDC External RS485 to isolation: 2.12 kVDC Internal RS485 to isolation: 2.12 kVDC
Input/Output	4.25 kVDC
Input/Ground	2.12 kVDC
Output/Ground	2.12 kVDC
Interface/Power Supply	Internal communication: RS485, non isolated External communication: RS485, isolated
Measurement	
Primary Side Monitoring	■ Monitor voltage: 300 Vpk, 0 kHz DC coupled ... 3 kHz DC coupled ■ Monitor current: 52 Apk, 0 kHz DC coupled ... 3 kHz DC coupled ■ Monitor noise events: 200 Vpk, 3 kHz DC coupled ... 100 kHz AC coupled ■ Monitor voltage accuracy: ± 4 % over full operational temperature range ■ Monitor current accuracy: ±4 % over full operational temperature range

Secondary Side Monitoring	■ Monitor voltage: 0 VDC ... 33 VDC, 0 kHz DC coupled ... 3 kHz DC coupled ■ Monitor noise: 0 Vpk - p ... 3 Vpk - p, 3 Hz AC coupled ... 100 Hz AC coupled ■ Monitor accuracy: ± 4 % over full operational temperature range
Communication	
Type	RS485, isolated, HART Protocol
Ambient Conditions	
Ambient Temperature	-25 °C ... +70 °C (-4 °F... +158 °F)
Storage Temperature	-40 °C ... +85 °C (-40 °F... +185 °F)
Shock Resistance	15 g, 11 ms
Vibration Resistance	1 g, 58 Hz ...150 Hz
Relative Humidity	< 95 % non condensing
Mechanical Specification	
Protection Degree	IP20
Weight	Approximately1.1 kg (2.456 lb)
Certification	
ATEX	DEMKO 12 ATEX 1103387X
IECEx	UL 13.0082X
Markings	Ex II 3G Ex ic nA nC IIC T4 Gc
Standards	EN 60079-0:2009 EN 60079-11:2012 EN 60079-15:2010

3.2.2 Diagnostic Module Power Source

The diagnostic module is powered from the primary terminal SL1.1 of the backplane. This connection is hardwired to the backplane.

3.2.3 Hot Swapping

Hot swapping allows the replacement of a diagnostic module under power without any visible functional impact to the power supplies. Hot swapping is allowed only in an environment where no hazardous materials are present. The hot swapping feature is not permitted in a Class I/Division 2 area or Zone 2 area unless under a hot work permit.

Remove the top and bottom screws securing the diagnostic module to the backplane. Grab the handle on the front of the diagnostic module and carefully pull it straight out off of the backplane. Install a new diagnostic module.

3.2.4 Communication

3.2.4.1 Internal Communication

Internal communication is proprietary. The diagnostic module communicates with each power supply module through a galvanically isolated RS485 physical layer.

3.2.4.2 External Communication

External communication is achieved through a galvanically isolated RS485 physical layer that supports the HART® protocol. Refer to Section 6.3, HART (Highway Addressable Remote Transducer) Communication Protocol.

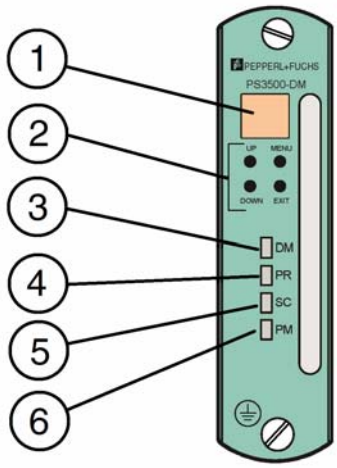
3.2.5 User Interface

The user interface allows independent configuration and troubleshooting, provides access to diagnostic information, and reads the output and input voltages and currents of each individual power supply module.

3.3 LED Indication

Four LEDs provide a visual status of the system; one LED for the diagnostic module, one for the primary (AC group) monitors, one for the secondary (DC group) monitors, and one for the power supply module.

Figure 3.2 shows the location of the four LEDs on the face of the diagnostic module, and Table 3.2 shows all of the LED options.



1 LCD Status Screen
2 Status Screen Navigation Buttons
3 Diagnostic Module LED
4 Primary (AC Input) Monitors LED
5 Secondary (DC Output) Monitors LED
6 Power Supply Module LED

Figure 3.2 LED Identification

Table 3.2 LED Indicators/Settings

Diagnostic Module LED (DM)	
Green	Diagnostic module status OK.
Yellow	Diagnostic module parameter in warning.
Red	Diagnostic module parameter in alarm.
Primary Monitor LED (PR)	
Green	Primary monitor status OK.
Yellow	Primary monitor parameter in warning.
Red	Primary monitor parameter in alarm.
Secondary Monitor LED (SC)	
Green	Secondary monitor status OK.

Yellow	Secondary monitor parameter in warning.
Red	Secondary monitor parameter in alarm.
Power Supply Module LED (PM)	
Green	Power supply status OK.
Yellow	Power supply parameter in warning.
Red	Power supply parameter in alarm.

3.4 Redundant Power Supply

3.4.1 Module Grouping

Module groupings are required to manually set up redundancy configurations.

The backplane can be divided into a maximum of three groups. A group consists of a number of power supplies modules where the outputs have been connected in parallel.

- Group A
- Group B
- Group C

Three groups have been provided to allow three N+1/N+N groups in a 6-position backplane. Other configurations may not require all groups.

3.4.2 Redundancy

A redundant power supply is secondary (backup) power consisting of either single (N+1) or multiple (N+N) power supply modules that take over and supply power in the event a primary power supply module or group of modules fail. Refer to Section 3.5, Power Supply Group Configurations.

Once module groups have been configured, each configured group can be placed in one of three arrangements.

- Stand-alone - no redundancy or backup
- N+1 - one additional power supply module serving as backup
- N+N - an equal number of modules serving as backup

A 6-position backplane is used as reference in this section. Each power supply module delivers 15 Amps of current.

3.4.2.1 Stand-alone Configuration (No Redundancy)

In a stand-alone (no redundancy) configuration, the diagnostic module adds up all SOA current limits for power supply modules assigned to the group. The resulting value is the group current limit. There is no module backup available in this configuration.

3.4.2.2 N+1 Configuration

N+1 stands for the number of power supply modules required to handle an adequate supply of power for essential connected systems, plus one more module to serve as redundant (backup) power.

In an N+1 group configuration, the diagnostic module adds together the number of power supply modules in the group and subtracts one module (15A) to serve as redundant (backup) power for that group.

The group current limit is the sum of the current outputs from the remaining power supply modules.

The diagnostic module compares the sum of the actual current for all modules in the group against the calculated limit. If the actual current is greater than the calculated current limit, an alarm is generated.

The group current alarms cannot be disabled.

3.4.2.3 N+N Configuration

N+N stands for the number of power supply modules required to handle an adequate supply of power for essential connected systems, plus an equal number of additional power supply modules to serve as redundant (backup) power.

An N+N configuration provides for a 100 % backup of current output.

In an N+N configuration, the diagnostic module adds together the number of power supply modules assigned to the group and subtracts half of those modules to serve as backup current for that group.

The group current limit is the sum of the current outputs from the remaining power supply modules.

The diagnostic module compares the sum of the actual current for all modules in the group against the calculated limit. If the actual current is greater than the calculated current, an alarm is generated.

The group current alarms cannot be disabled.

3.4.3 Communication Status

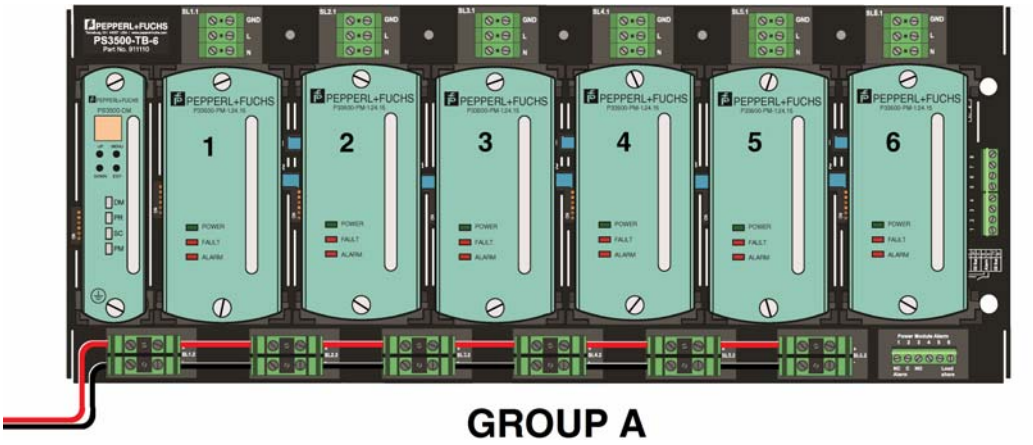
If a power supply module is assigned to group and fails to communicate or is missing, a communication status alarm is set. The alarm cannot be disabled.

3.4.4 Group Current Alarms

Group current alarms are used to monitor multiple supplies in an N+1 or N+N configuration for total output current violations. The diagnostic module calculates the maximum current limit for each power supply based on the published SOA curve (see Figure 8.1). Power supply modules that are not populated or do not have communication with the diagnostic module have their SOA current limit set to zero Amps.

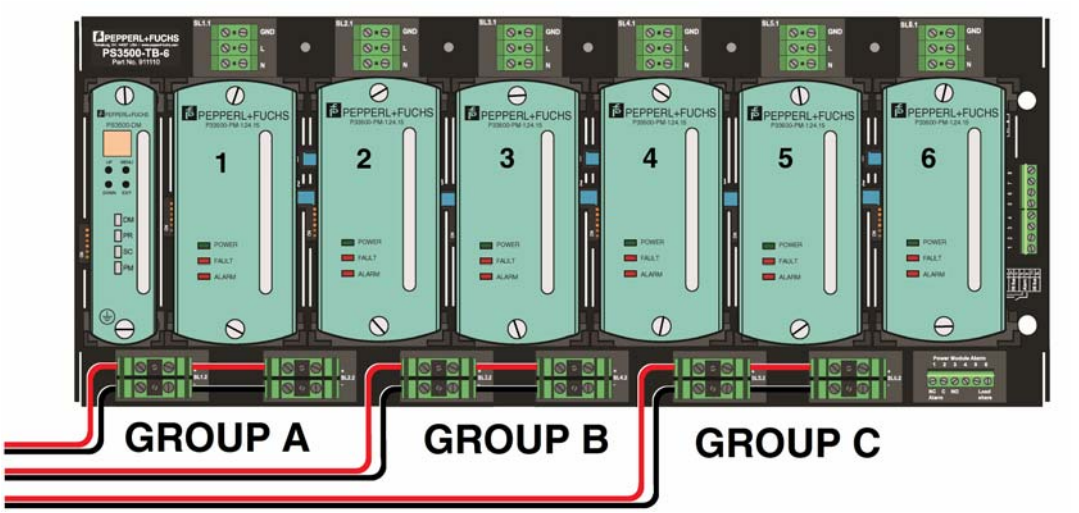
3.5 Power Supply Group Configurations

Figure 3.3, Figure 3.4, and Figure 3.5 show three visual representations of the more common configurations for a 6-position backplane.



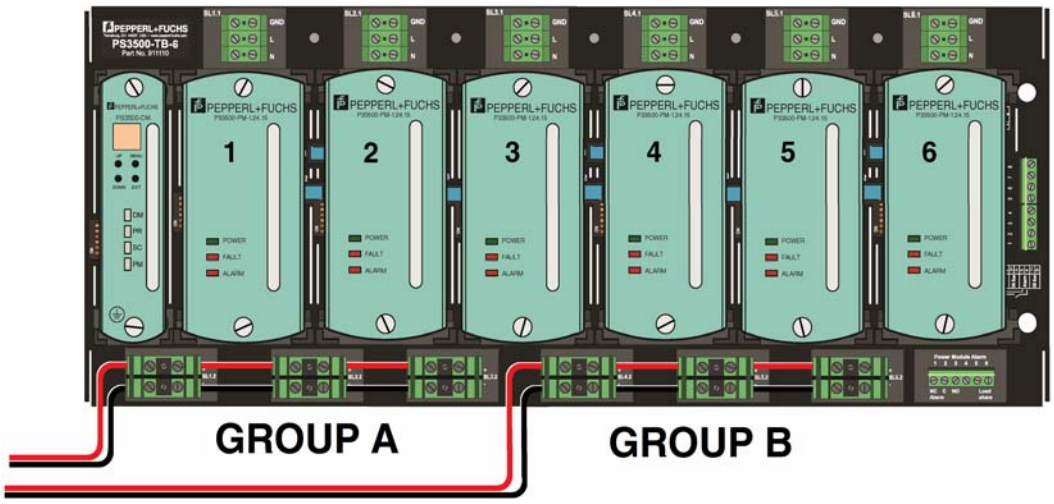
Configuration	Group A: 6 Modules	Group B	Group C
No Redundancy	Modules 1 through 6: Group current limit: 6 modules x 15 A = 90 A Backup: none	N/A	N/A
N+1	Modules 1 through 6: Group current limit: 5 modules x 15 A = 75 A Backup: 1 module = 15 A	N/A	N/A
N+N	Modules 1 through 6: Group current limit: 3 modules x 15 A = 45 A Backup: 3 modules x 15 A = 45 A	N/A	N/A

Figure 3.3 Configuration Example 1



Configuration	Group A: 2 Modules	Group B: 2 Modules	Group C: 2 Modules
No Redundancy	Modules 1 and 2: Group current limit: 30 A Backup: none	Modules 3 and 4: Group current limit: 30 A Backup: none	Modules 5 and 6 Group current limit: 30 A Backup: none
N+N or N+1	Modules 1 and 2: Group current limit: 15 A Backup: 15 A	Modules 3 and 4: Group current limit: 15 A Backup: 15 A	Modules 5 and 6: Group current limit: 15 A Backup available: 15 A

Figure 3.4 Configuration Example 2



Configuration	Group A: 3 Modules	Group B: 3 Modules	Group C
No Redundancy	Modules 1, 2, 3: Group current limit: 45 A Backup: none	Modules 4, 5, 6: Group current limit: 45 A Backup: none	N/A
N+1	Modules 1, 2, 3: Group current limit: 30 A Backup: 15 A	Modules 4, 5, 6: Group current limit: 30 A Backup: 15 A	N/A
N+N	Modules 1, 2, 3: Group current limit: 15 A Backup: 30 A	Modules 4, 5, 6: Group current limit: 15 A Backup: 30 A	N/A

Figure 3.5 Configuration Example 3

4 Hardware Installation

4.1 Mounting/Installation

4.1.1 Introduction

Make yourself familiar with the device and carefully read the instruction manual prior to mounting, installation, and commissioning of the device.

The Statement of Conformity and Certificate of Compliance of the PS3500 Power Supply System must be observed. It is especially important to pay attention to any special conditions for safe use that are indicated.

Avoid electrostatic discharges while operating the installed device.

If devices have already been operated in general electrical systems, they may subsequently no longer be installed in electrical systems used in combination with hazardous areas.

The installation instructions in accordance with IEC/EN 60079-14 must be observed.

Connection or disconnection of energized non intrinsically-safe circuits is only permitted in the absence of a hazardous atmosphere.

4.1.2 Installing the PS3500-DM Diagnostic Module

Perform the following steps to install the diagnostic module onto the backplane.

1. Refer to Figure 4.1. Remove the two (2) screws (item 1) securing the clear plastic protective cover (item 2) to the connector. Discard the screws and protective cover.

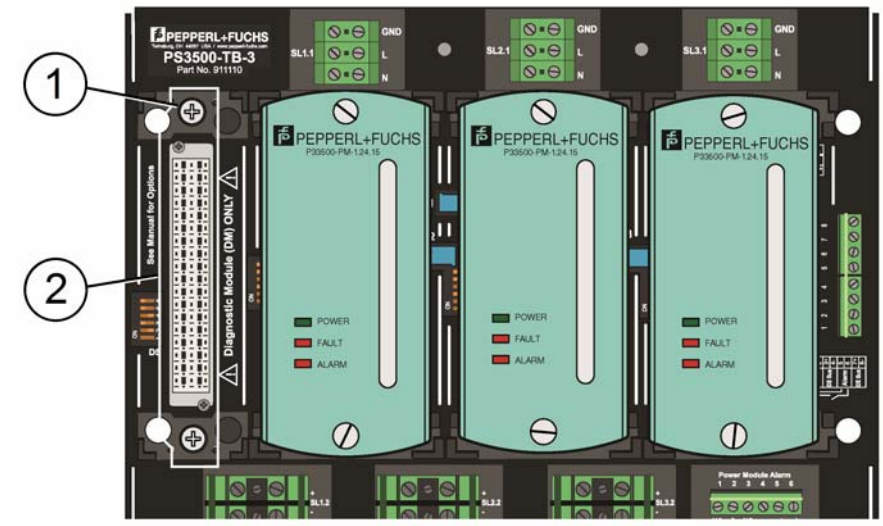


Figure 4.1 Connector Cover Removal

2. Refer to Figure 4.2. Carefully center and mate the connector on the back of the diagnostic module (item 1) to the backplane connector, and press firmly on the module until it is seated.
3. Screw in the top and bottom mounting screws on the diagnostic module to secure the module in the slot.

The bottom mounting screw (item 2) serves as the grounding screw for the system, and must be properly secured to the backplane to ensure proper grounding.

4. The diagnostic module is hot swappable; it can be replaced without shutting down the system. See Hot Swapping, Section 3.2.3.

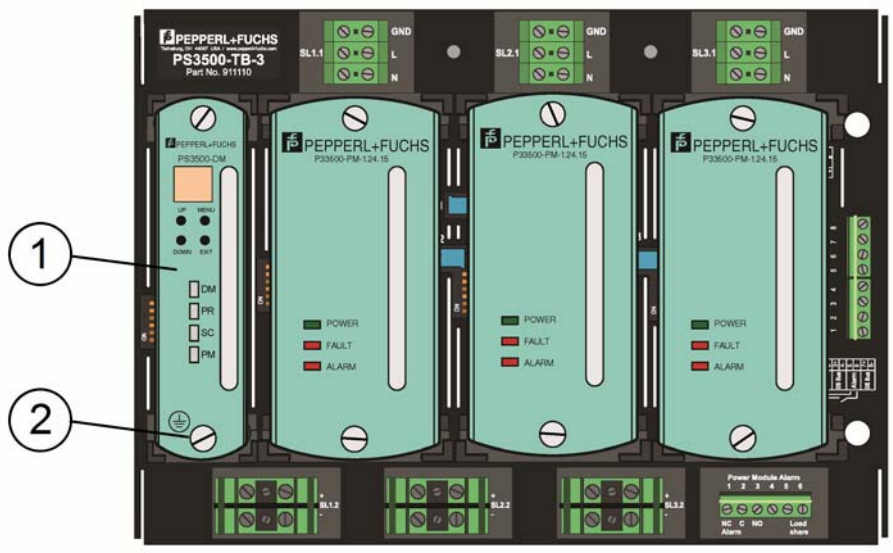


Figure 4.2 Diagnostic Module on a 3-position Backplane

4.2 Operation

Do not plug and power modules on the backplane before checking all the systems as recommended.

4.2.1 Supply line checks

1. Connect and firmly secure grounding conductor to the GND terminals.
2. Protect input lines by appropriately sized fuses or sectioning circuit breakers (turning them off).
3. Line conductors must be of adequate size. Secure them firmly with no exposed conductors risking contacts with the backplane or short circuits.
4. Supply line voltage must meet power module rating. (Check side label.)

4.2.2 Output lines check

1. The PS3500-DM is for monitoring incoming and outgoing power. There are dry relay contacts and a 5 VDC low-current output that stay on the backplane to supply opto-coupler power for the 6 power supplies communication with the PS3500-DM.

4.2.3 Alarm lines check

1. Alarm circuit to be correctly wired and conductors firmly secured with no exposed conductors risking contact with the backplane or short circuits.
2. Alarm dip switches configuration set.

4.3 Maintenance, and Repair

Diagnostic modules are not repairable. Do not attempt to repair, alter, or manipulate a defective module. Defective diagnostic modules must be replaced.

- Supply systems do not require special maintenance except normal periodic functional checks and cleaning.
- Keep power supply module air inlets and outlets free from dust or particles that may obstruct air circulation through the cabinet and inside the enclosure. The accumulation of dust on a heat-dissipating surface limits heat exchange with the surrounding air, reducing heatsinking capabilities.
- Annually check and record the output voltage value to capture any long term deviation.
- PS3500 power supply products operated in conjunction with hazardous areas must not be modified. Defective products must always be replaced. Defective housing parts must be replaced with OEM parts only. Refer to the respective data sheet for detailed information. Tasks for eliminating malfunctions must be performed only by qualified specialists.

4.4 Disposal

Disposing of devices, packaging material, and possibly contained batteries must be in compliance with the applicable laws and guidelines of the respective country.

4.5 Wiring

The PS3500 system has separate input/output terminal blocks for simple configuration.

Connect ground terminals to the mains ground, otherwise lethal voltages may occur. Permanent power module damage will result in case of input voltage overload.

Consult the respective data sheets and the document, ***PS3500 N+1 Redundant Power Supply Installation and Operation Manual*** (part number 912759) for information concerning the wiring and configuration of the PS3500 series backplanes (PS3500-TB-3 and PS3500-TB-6).

4.5.1 Special Conditions of Use

- To be installed in end-use system ATEX/IECEx approved system, providing fire, impact, grounding, and accessibility protection, the PS3500 system must be installed in an ATEX/IECEx Certified, IP54 enclosure. Alternatively, the system can be installed in an IP4X enclosure, having adequate protection against the entry of solid foreign objects or water capable of impairing safety.
- The PS3500 system must be installed in a locked enclosure for any hazardous locations (Class I/Division 2, Zone 2).
- Secure the diagnostic module to a system using screws requiring tools for removal.
- For indoor use only; do not subject to UV exposure from luminaires.
- Ambient ratings for operation are -25 °C ... +70 °C (-13 °F... +158 °F).
- The PS3500 system is designed for use in Pollution Degree 2 environments.
- For use with Class 1 conductors or equivalent.
- For use with CU conductors or equivalent.
- Use 14 AWG conductors or equivalent.

- Use conductors rated 75 °C (167 °F) minimum or equivalent.

4.5.2 Input Supply Line

The power line voltage is 90 VAC ... 250 VAC (90 VDC ... 300 VDC). Check the supply line voltage to meet the power module supply requirements. Plan for disconnecting capability and over-current protection by adequately sized fuses or circuit breakers on the lines.

4.6 Backplane Electrical Connections

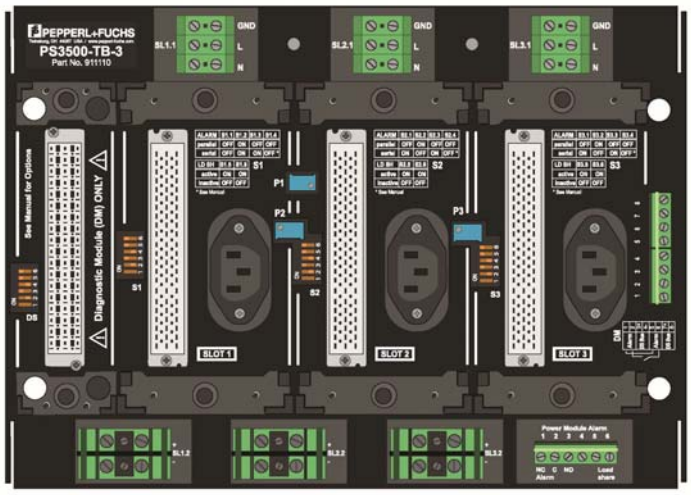


Figure 4.3 Empty PS3500-TB-3 Backplane

The PS3500-DM mounts to the backplane in the first position (left). Note the marking on the backplane on this slot, *Diagnostic Module (DM) ONLY.*

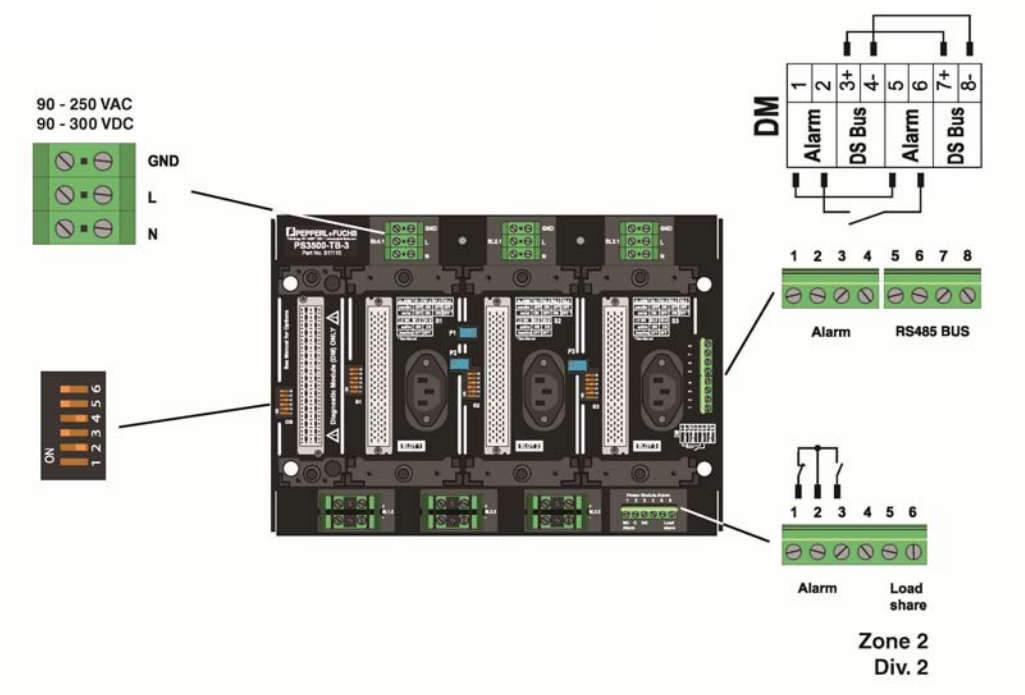


Figure 4.4 Terminal Blocks for Wiring

The diagnostic module receives its power from the SL1.1 terminal blocks. This is also the AC supply for the first power supply (slot 1).

Depending on the DIP switch settings, the alarm settings are connected to either the terminal blocks on the lower right of the backplane, or to the terminal blocks located on the far right center of the backplane. These connections are made using the backplane's internal wiring.

When the alarms are configured to the lower right terminals, as shown in Figure 4.5, there are two configurations, parallel alarm or serial alarm. When configured as a parallel alarm relay, contacts one (1) and two (2) close during an alarm situation. When configured as a serial relay, contacts two (2) and three (3) open during an alarm situation.

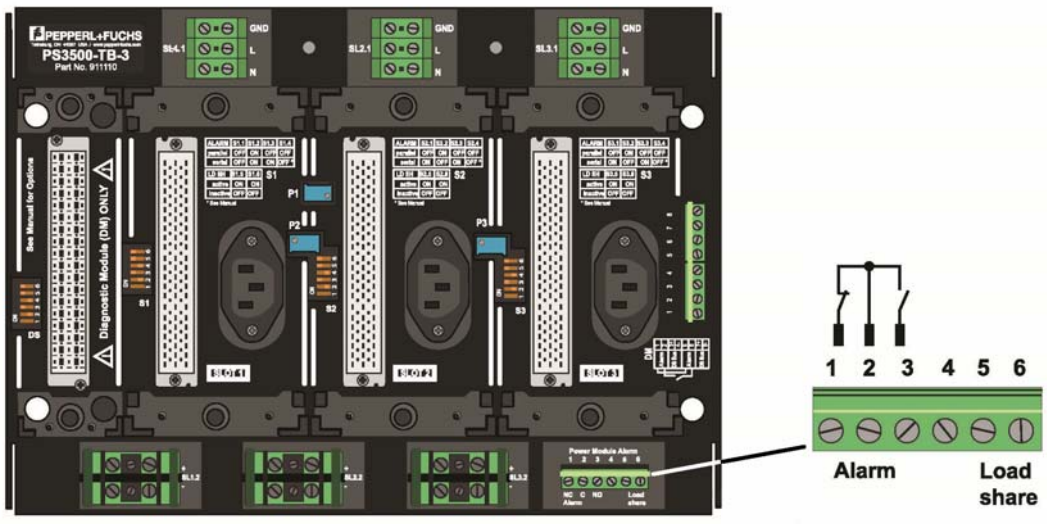


Figure 4.5 Alarm Configuration, Power Module Alarm Terminal

The terminals are internally connected when the alarms are configured to the center far right terminals, as shown in Figure 4.6. Terminals one (1) and five (5) are a normally closed contact for the alarm, while two (2) and six (6) are normally open contacts for the alarm.

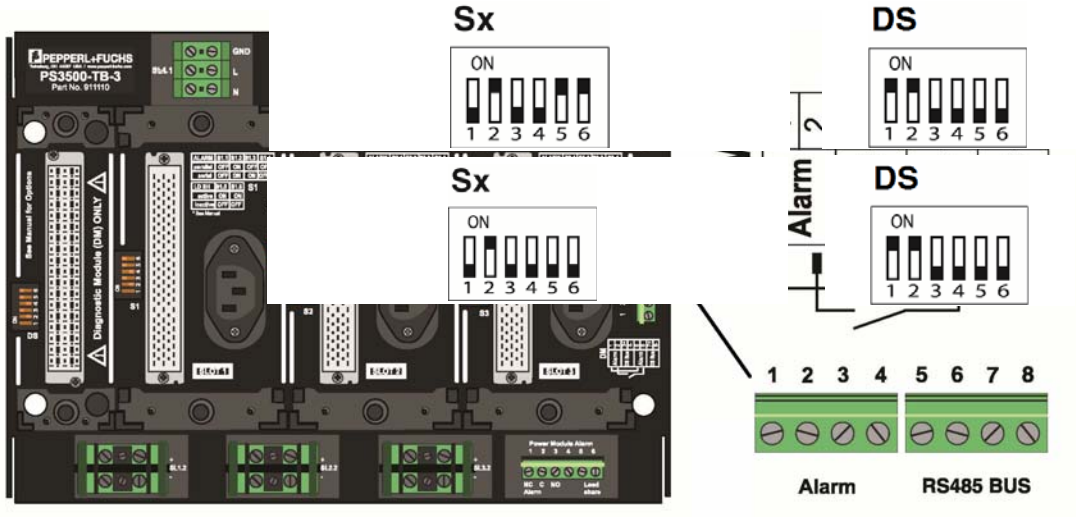


Figure 4.6 Alarm Configure

4.7 Communication

RS485 bus terminals three (3) and seven (7) are connected together, and terminals four (4) and eight (8) are connected together. This allows alarms to be wired in series.

All signals generated by the power supply modules are available through the RS485 communication bus. All other signals are provided by the backplane as analog signals.

4.8 Alarm Configuration

4.8.1 Parallel Alarm

Refer to Figure 4.7. Connect in parallel the normally closed (NC) alarm contacts on all power modules, and refer to Figure 4.7 for parallel alarm DIP switch configuration.

When any specific relay on a module de-energizes under alarm condition, including power off, the circuit closes and activates an alarm (at terminals 1-2 of the alarm terminal block).

Pulling a power module out of the backplane activates an alarm if the diagnostic module has group and redundancy options configured (see Section 5.3, Section 5.4, and Section 6.7.10).

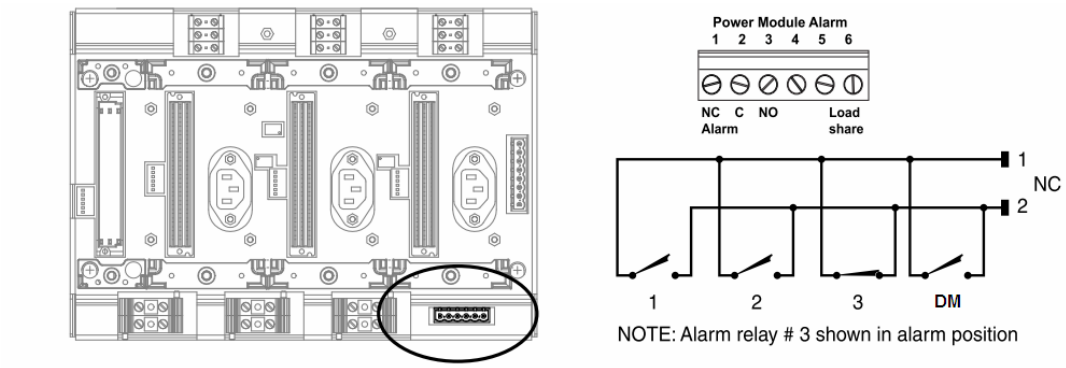


Figure 4.7 Parallel Alarm

PS3500-DM

PEPPERL+FUCHS

Table 4.1 Parallel DIP Switch Settings

Alarm Configuration	Module	No Module (Empty Slot)	Diagnostic Module
Parallel with Load Share			
Parallel Without Load Share			

4.8.2 Serial Alarm

Refer to Figure 4.8. Connect in series the normally open (NO) alarm contacts on all power modules, and refer to Figure 4.9 for serial alarm DIP switch configuration.

The power module alarm common connection must be jumpered to the DM terminal block alarm NO connection.

When any specific relay on a module de-energizes under alarm condition, the circuit will open and cause an alarm.

Removing a module or the diagnostic module activates an alarm. Any slot without a module will need to have DIP switch Sx 4 closed. The diagnostic module alarm can be disabled by closing PM switch number 6.

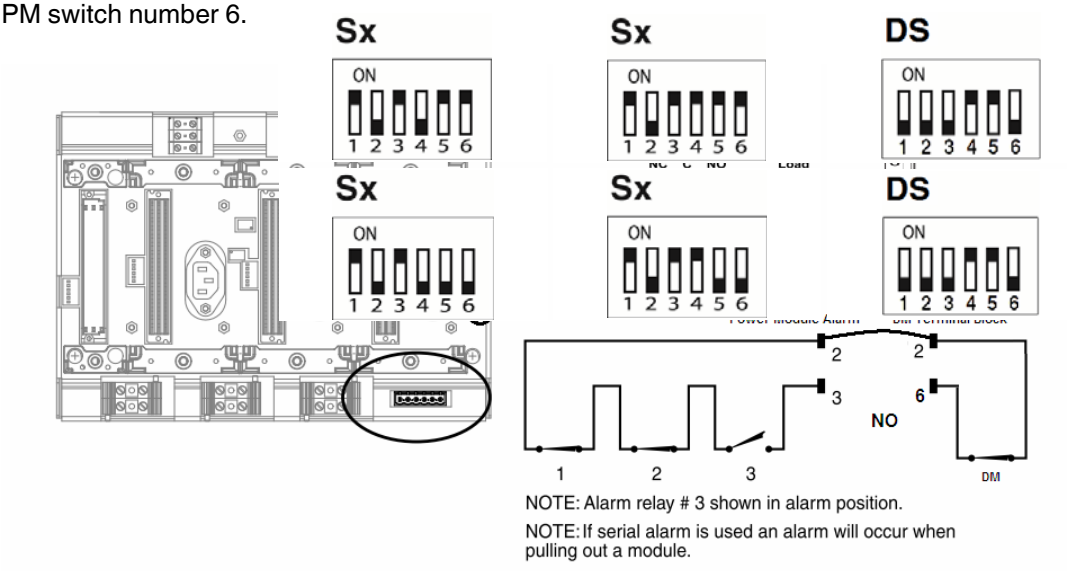


Figure 4.8 Serial Alarm (without Group Configurations)

See Figure 4.9. The wiring can be simplified if module group configurations are set up in the diagnostic module (see Section 5.3, Section 5.4, and Section 6.7.9). The relay opens under the same conditions that cause the individual power supply relays to open, and detect when modules have been inappropriately removed from the system.

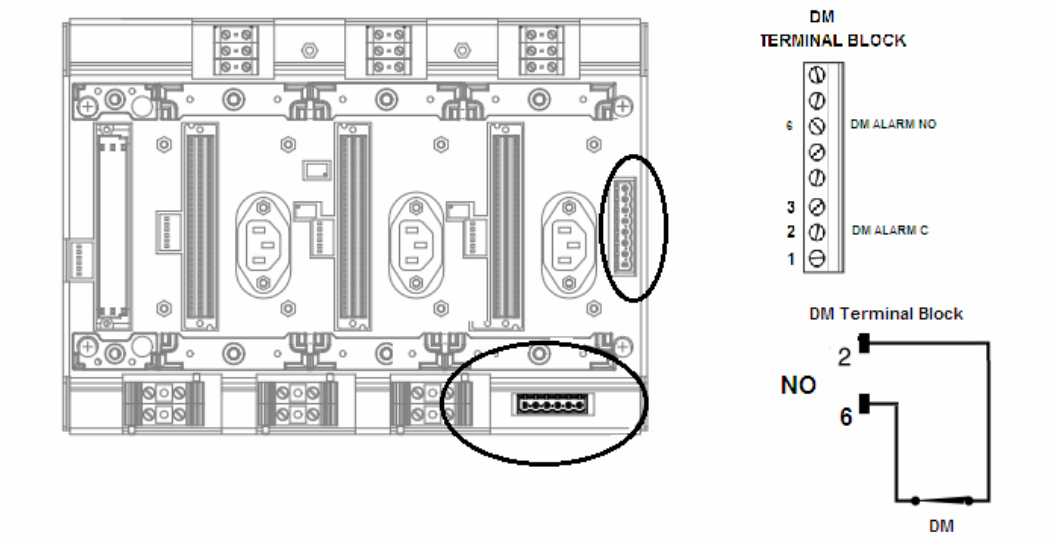


Figure 4.9 Serial Alarm (with Group Configurations)

Table 4.2 Serial DIP Switch Settings

Alarm Configuration	Module	No Module (Empty Slot)	Diagnostic Module
Serial with Load Share			
Serial without Load Share			

5 Main Controller LCD Interface

Parameters available through the HART interface can be accessed through the LCD display on the diagnostic module (refer to Figure 5.1). The LCD has a four-digit display and an 8 x 30 dot matrix display. Navigation through a menu structure is accomplished by four buttons: Up Arrow, Down Arrow, ESC, and OK (enter).

Figure 5.1 Four Selector Buttons

The display pages used to select modules or monitors indicate a warning or alarm by showing an asterisk prior to the module or monitor number.

Module parameters in a warning or alarm state are indicated by the following symbols at the beginning of the text line on each display page (refer to Figure 5.2):

$\overline{W}$ = Over Range Warning

$\underline{W}$ = Under Range Warning

$\overline{A}$ = Over Range Alarm

$\underline{A}$ = Under Range Alarm

Figure 5.2 LCD Warning and Alarm Symbols

The LCD is organized into the structure shown in Figure 5.3, with the large rectangle showing the contents of the four digit display, the smaller rectangle shows the contents of the dot matrix display, and the text below each box corresponds with the labeling of the case statement inside the controlling code.

Warnings and alarms can be quickly identified on the LCD display by first identifying any warning or alarm indications on the LED display, then following the LCD indications to individual parameters.

For example, if the secondary output slot 3 has a high output voltage activating a warning, the SC LED will blink amber. The user can then locate the SC screen on the LCD and press enter.

Pressing the down arrow key, the *Select SC3* is preceded by an asterisk. Pressing OK shows the parameters of SC3, and the SC3 Volts [V] preceded with an *over-bar-W* along with the actual reading of the parameter.

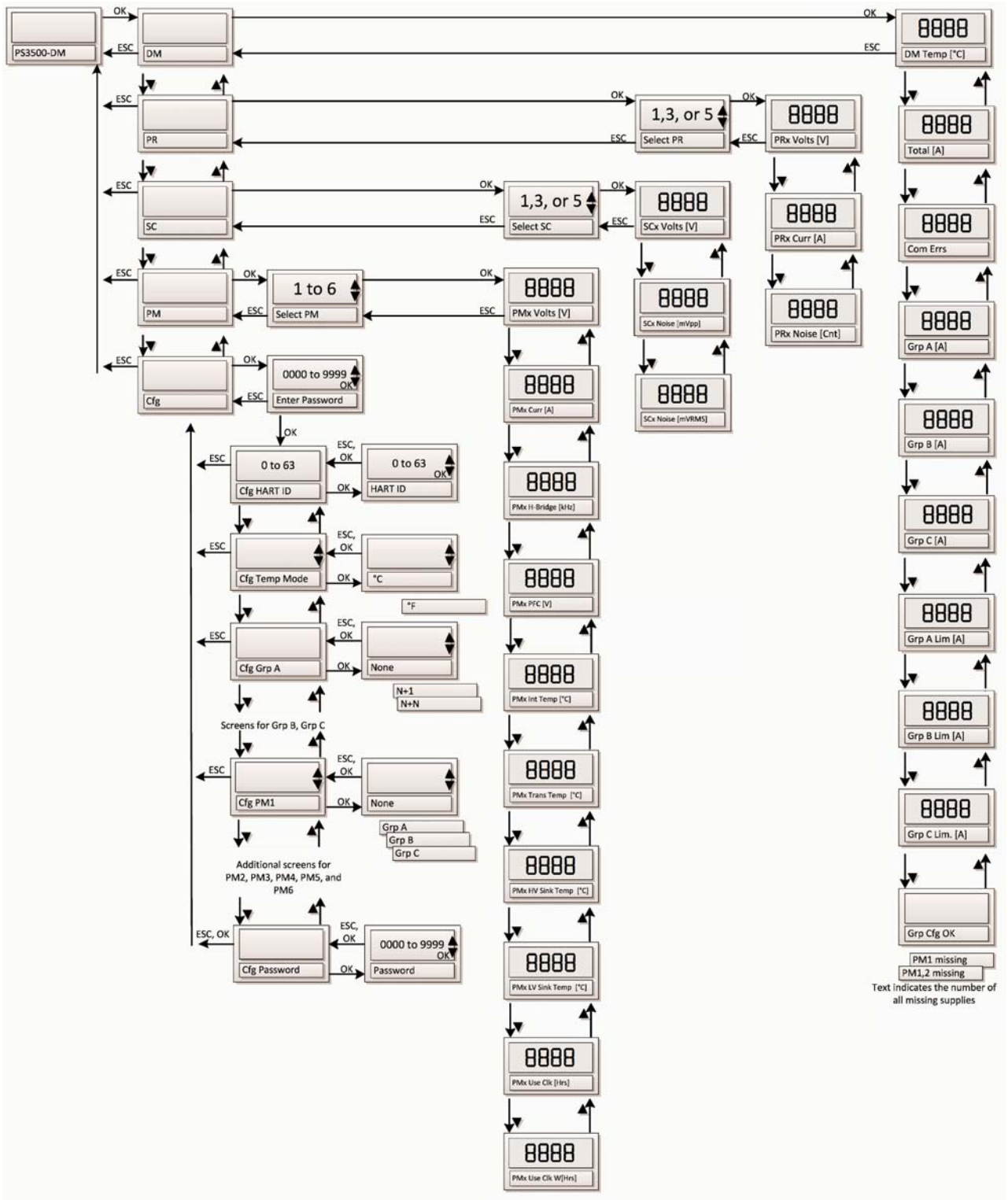


Figure 5.3 LCD Menu Structure

5.1 Module Configuration Through LCD

If the diagnostic module is being used with asset management system connected through the HART interface, proceed to Section 6.7.1Assign the HART ID (Short Address/Polling Address) for configuration, otherwise proceed below.

5.2 Temperature Setting: Celsius or Fahrenheit

Perform the following steps to set the temperature preference to either Celsius or Fahrenheit.

1. From the *LCD Main Menu* screen, press the OK button to access the *Diagnostic Module* screen.
2. Press the DN (down) arrow button until the *Cfg* (configure) screen appears.
3. Press the OK button to access the *Enter Password* screen.
4. Type in the four-digit numeric password (factory default is 0000) by using the UP and DN arrow buttons to locate each number and selecting it with the OK button.
5. If the diagnostic module recognizes the password as correct, the screen will advance to the *Cfg HART ID* screen when the OK button is pushed for the last number in the password.

   If the password is incorrect, the LCD screen will not advance to the *Cfg HART ID* screen when that OK is pushed for the last number in the password.
6. From the *Cfg HART ID* screen, press the DN button to advance to the *Cfg Temp Mode* screen.
7. Press the OK button to open the *Set Temp* screen.
8. Use the UP/DN arrows to show the desirable reading (C or F), and press the OK button to select it and return to the *Cfg Temp Mode* screen.
9. Press the ESC button to return to the *Cfg* screen.
10. Press the ESC button to return to the *Main Menu* screen.

5.3 Configuring Power Supply Module Groups

Module grouping must be manually entered. A group is created for each set of power supply modules that have their outputs wired in parallel. Refer to Module Grouping, Section 3.4.1 and Redundancy, Section 3.4.2.

Each group must be set to one of three redundancy configurations: *None* (no redundancy), *N+1*, or *N+N*.

Unused groups require no configuration.

Perform the following steps to set the configuration for each group.

1. From the *LCD Main Menu* screen, press the OK button to access the *Diagnostic Module* screen.
2. Press the DN (down) arrow button until the *Cfg* (configure) screen appears.
3. Press the OK button to access the *Enter Password* screen.
4. Type in the four-digit numeric password by using the UP and DN arrow buttons to locate each number and selecting it with the OK button.
5. If the diagnostic module recognizes the password as correct, the screen will advance to the *Cfg HART ID* screen when the OK button is pushed for the last number in the password.

   If the password is incorrect, the LCD screen will not advance to the *Cfg HART ID* screen when the OK button is pushed for the last number in the password.

6. From the *Cfg HART ID* screen, press the DN button to advance to the *Cfg Group A* screen. The redundancy configuration will be selected. The redundancy configuration has a default of *None*.
7. Press the OK button to set the redundancy configuration for Group A.
8. Use the UP/DN buttons to select between an N+1 or an N+N configuration.
9. Press OK to finalize the selection.
10. Press the DN button to advance to the Group B, and then Group C, and set the configuration for both groups.
11. When group configurations are complete, press to return to the *Cfg* screen.
12. Press ESC to return to the *LCD Main Menu*.

5.4 Assigning Power Supply Modules to a Specific Group

Perform the following steps to assign each power supply module to a specific group.

1. From the *LCD Main Menu* screen, press the OK button to access the *Diagnostic Module* screen.
2. Press the DN arrow button until the *Cfg* (configure) screen appears.
3. Press the OK button to access the *Enter Password* screen.
4. Type in the four-digit numeric password by using the UP and DN arrow buttons to locate each number and selecting it with the OK button.
5. If the diagnostic module recognizes the password as correct, the screen will advance to the *Cfg HART ID* screen when the OK button is pushed for the last number in the password.

   If the password is incorrect, the LCD screen will not advance to the *Cfg HART ID* screen when that OK is pushed for the last number in the password.
6. From the *Cfg HART ID* screen, press the DN button to advance to the *Cfg PM1* screen.
7. Press OK.
8. Use the UP and DN arrows to find the desired group (A, B, or C).
9. Press OK to select the group and return to the *Cfg PM1* screen.
10. Press the DN arrow button to advance to each of the remaining power supply modules and set the desired group for each.
11. When all modules have been assigned to a group, press Esc to return to the *Cfg* screen, and press Esc again to return to the *LCD Main Menu* screen.

5.5 Diagnostic Parameters

Parameters available through the LCD interface (as shown in Figure 5.3) are described in Section 8. Warning and alarm levels and states cannot be modified through the LCD interface.

6 AMS/EDDL Integration

6.1 AMS (Asset Management Software)

The AMS Device Manager is plant asset management software from Asset Optimization (a business unit of Emerson Process Management). It provides a single application for predictive diagnostics, documentation, calibration management, and device configuration for managing field instruments and digital valve controllers. AMS Device Manager is based on open communication standards, and is a core component of the PlantWeb digital plant architecture.

6.2 EDDL (Electronic Device Description Language)

EDDL is a specific computer language used to create computer readable files describing data in a field device. Host applications read these files to learn how to retrieve information from these field devices. EDDL technology eliminates the need for special, proprietary, and operating system-specific host application files. EDDL technology allows devices of different types to interoperate with a single host, or a single device to interoperate with different hosts.

6.3 HART (Highway Addressable Remote Transducer) Communication Protocol

HART Protocol is an interface program that allows two-way field communication to take place and makes it possible for information to be communicated to and from a field instrument. System integration is done through the external RS485 interface.

6.4 User Interface

A simple display and menu-driven user interface is available for easy and independent configuration, as well as local troubleshooting.

6.5 Warning and Alarm Symbols

No Error:
The value is within limits.

Out of Specification:
The value exceeds the specification limits.

Fault:
A power supply module, a slot monitor, or the diagnostic module has a parameter that is out of specification, or a general fault has been detected by the diagnostic module.

6.6 Diagnostic Parameters

Parameters available through the HART interface are described in Section 8. The HART interface allows configuration of alarm and warning levels and states.

6.7 Configure and Setup

The diagnostic module comes with factory preset limits based on the PS3500 system components. These limits are suitable for most applications, but can be adjusted as necessary.

Note!
Make sure the screens are in the Configure/Setup mode (refer to Figure 6.1).

Note!
The HART ID must be properly assigned to allow HART communication with the diagnostic module. The HART ID is assigned through the LCD interface (refer to Section 6.1).

Perform these procedures first and in the order shown.

- Assign the HART ID to the diagnostic module (Section 6.7.1)
- Set the current date and time (Section 6.7.5)
- Set the temperature preference (Section 6.7.6)
- Set the language preference (Section 6.7.7)
- Assign groups and redundancy types (Section 6.7.9)

6.7.1 Assign the HART ID (Short Address/Polling Address)

Each diagnostic module is identified by a unique ID number (also known as a short address or polling address). HART uses this number for initial identification of the diagnostic module on the RS485 link. The RS485 link can contain other HART devices, including multiple diagnostic modules, as long as all devices on the link have unique HART IDs.

New diagnostic modules have the HART ID set to 0 (zero). After installation, the user can reassign the ID number to the diagnostic module using its LCD screen and four buttons (refer to Figure 5.1). The LCD menu structure flow chart in Figure 5.3 can guide the user step-by-step through all procedures using the LCD display.

Note!
HART IDs can only be assigned using the diagnostic module's LCD screen and four buttons.

Perform the following steps to set the HART ID for a particular diagnostic module.

1. From the *LCD Main Menu* screen, press the OK button to access the diagnostic module screen.
2. Press the DN (down) arrow button until the *Cfg* (configure) screen appears.
3. Press the OK button to access the *Enter Password* screen.
4. Type in the four-digit numeric password (factory default is 0000) by using the UP and DN arrow buttons to locate each number and selecting it with the OK button.
5. If the diagnostic module recognizes the password as correct, the screen will advance to the *Cfg HART ID* screen when the OK button is pushed for the last number in the password.

   If the password is incorrect, the LCD screen will NOT advance to the *Cfg HART ID* screen when OK is pushed for the last number in the password. Correct the password.
6. From the *Cfg HART ID* screen, press the OK button to advance to the *HART ID* screen.
7. Type in the two-digit HART ID by using the UP and DN arrow buttons to locate each character and selecting it with the OK button.The HART ID can be set to any number from 0 to 63.
8. The screen will return to the *Cfg HART ID* screen when the OK button is pressed for the last number in the ID.
9. Press the ESC button to return to the *Cfg* screen.

   Before pressing the ESC button, the user may want to take the opportunity to initially set the temperature readout to either Celsius (default) or Fahrenheit.

   1. From the *Cfg HART ID* screen, press the DN arrow button to advance to the *Cfg Temp Mode* screen.
   2. Press the OK button to open the *Set Temp* screen.
   3. Use the UP/DN arrows to show the desirable reading (C or F), and press the OK button to select it and return to the *Cfg Temp Mode* screen.
   4. Press the ESC button to return to the *Cfg* screen.
10. From the *Cfg* screen, press the ESC button to return to the *LCD Main Menu* screen.

6.7.2 Diagnostic Screen

A password is required to gain access to the diagnostic screen to change basic settings. Make sure the screen is in Configure/Setup, as shown in Figure 6.1.

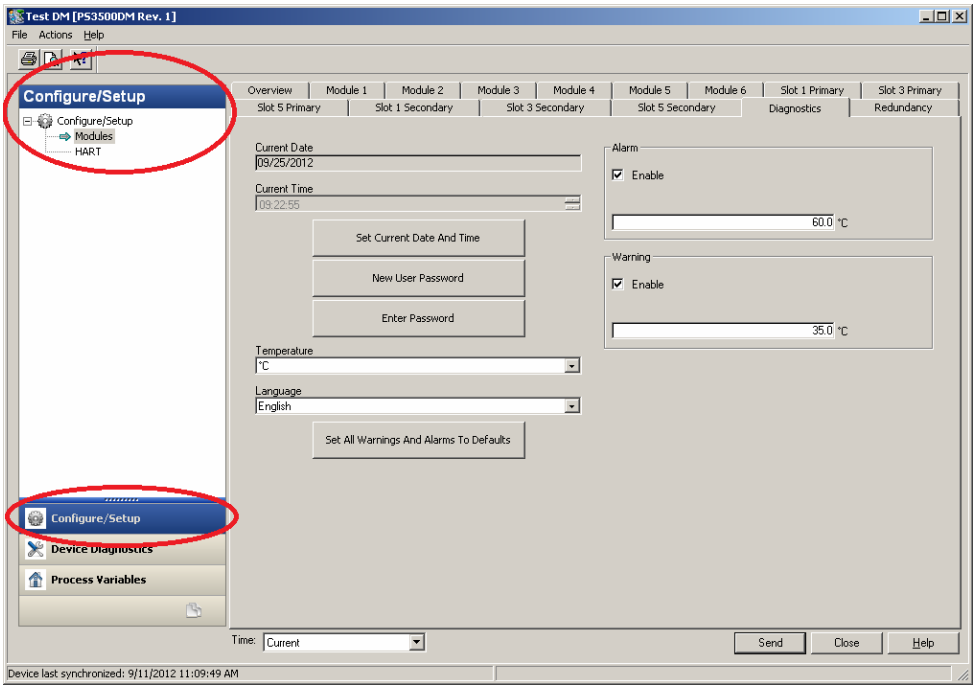


Figure 6.1 Configure/Setup - Diagnostics Screen

6.7.3 Password Protection

The diagnostic module comes with a factory preset, case-sensitive password: **managers**

This password may be used indefinitely or changed to a new password. Once the password is changed, the factory preset password is no longer valid.

The user must type a password prior to changing alarm limits, warning limits, group settings, redundancy options, or any changes that affect the configuration of the diagnostic module.

6.7.4 New User Password

New user passwords are a maximum of eight (8) case-sensitive alphanumeric characters.

6.7.5 Set Current Date and Time

The date and time are not automatically read from the computer and must be manually set in AMS system. The date is set to MM/DD/YYYY. The time is set in 24-hour (military) time only.

6.7.6 Set Temperature Preference

This field allows the user to set a temperature preference of either Celsius and Fahrenheit. This can be changed without using a password.

Changes made to temperature preference in either the LCD or the AMS will change the other.

6.7.7 Set Language Preference

This field allows the user to select a language other than the default. Language changes will not change the software. The language changes will only be reflected on the hardware. This can be changed without using a password. Please note: This feature is currently not supported.

Note!

After making changes to either temperature or language settings, press the SEND button to commit the changes to the hardware.

6.7.8 Set Device to Default Configuration

This will return all settings (including passwords, tags, and descriptors) back to factory default.

6.7.9 Assign Groups and Redundancy Types

Module grouping must be manually entered. A group is created for each set of power supply modules that have their outputs wired in parallel. Refer to Section 3.4.2. Each group must be set to one of three redundancy types: *None* (no redundancy), *N+1*, or *N+N*.

Refer to Figure 6.2 and perform the following steps.

1. Assign each power supply module to a specific group.
2. Set the *Redundancy Type* (None, N+1, or N+N) for each group used.
3. Click SEND to finalize the settings in HART.

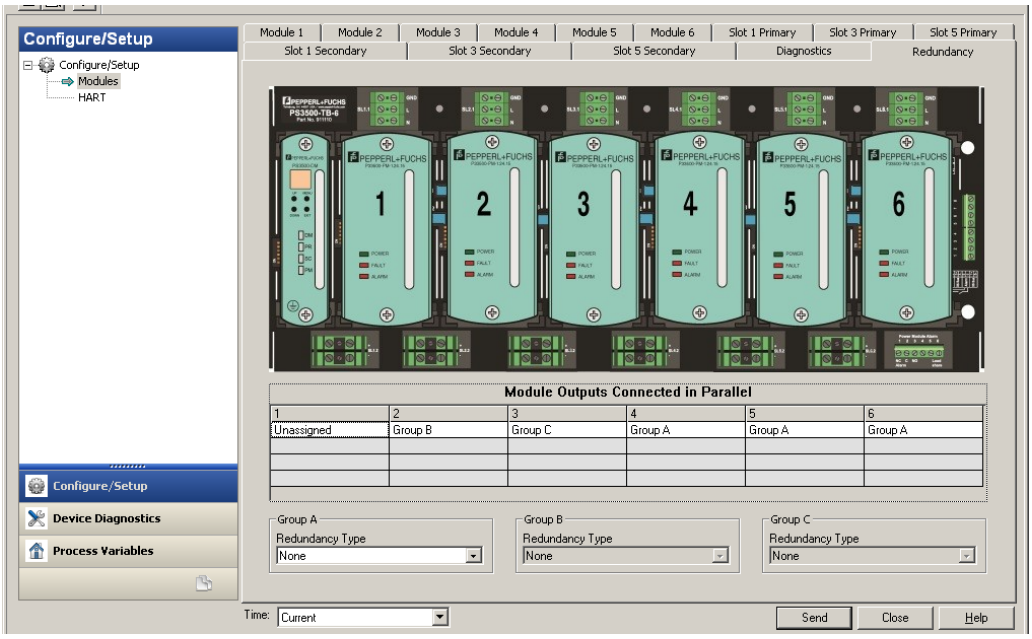


Figure 6.2 Configure/Setup - Redundancy Screen

6.7.10 Configure Warning and Alarm Limits

Warning and alarm limits are factory preset based on the PS3500 system components. These limits are suitable for most applications, but can be adjusted as necessary. Prior to changing warning or alarm limits and states, a user password must be supplied (refer to Section 6.7.3).

Parameters that exceed either the warning or alarm limits are shown with an *Out of Specification* symbol in the *Device Diagnostics* tabs (refer to Section 6.5 and Section 6.9). After making any changes, click SEND to finalize the settings in HART.

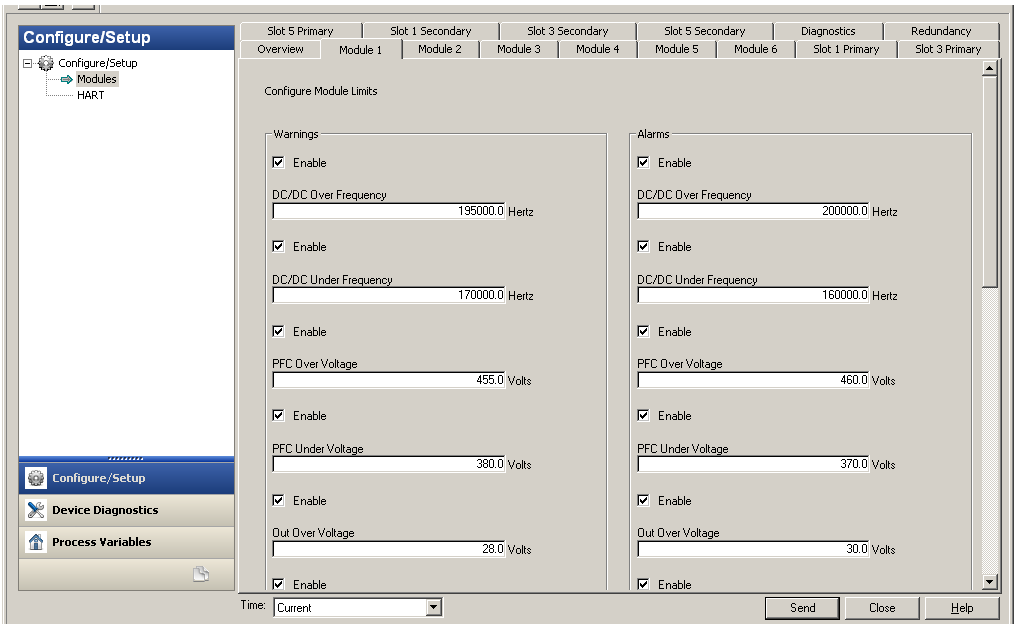


Figure 6.3 Configure/Setup - Module 1 Screen

6.8 HART Online Variables

The device information tab allows the user to enter descriptive information about the specific diagnostic module. Some of the fields, such as model and manufacturer, are read only.

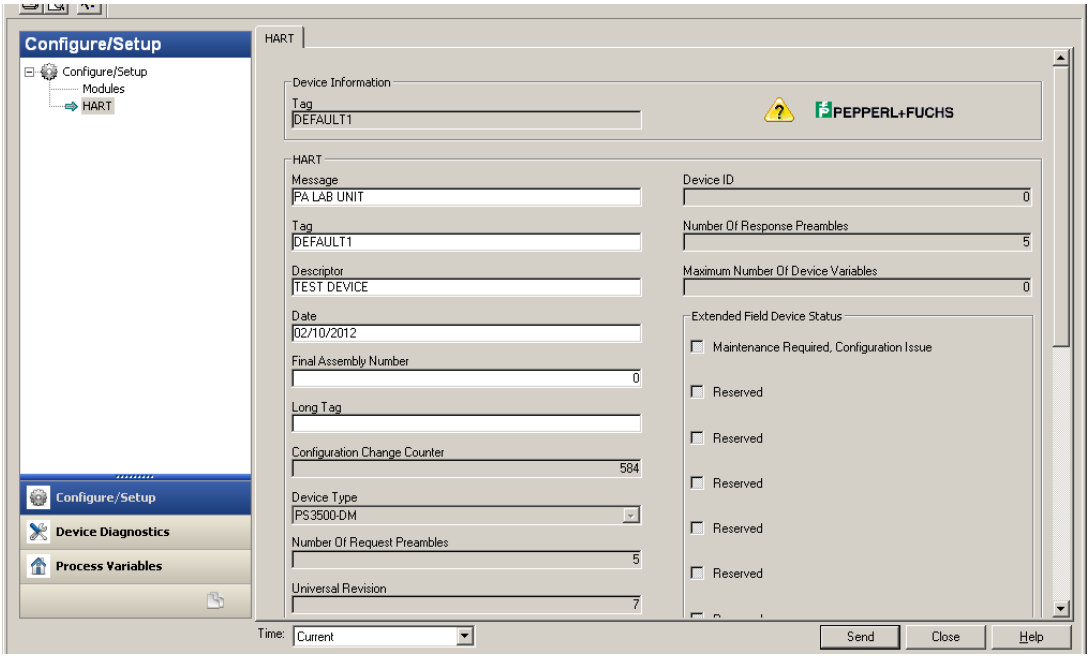


Figure 6.4 Configure/Setup/HART - Screen

6.9 Device Diagnostics

6.9.1 Diagnostics Overview Screen

Refer to Figure 6.5. The overview screen shows the general condition of the power supply system, and alerts the user to any out-of-limit issues, hardware failures, or lost communication issues. These are all considered as a failure status.

The status overview area provides a quick glance at the status of four main areas; module, slot, diagnostic, and device. A symbol change quickly identifies whether the problem is an out-of-limit issue or a hardware failure. Refer to Warning and Alarm Symbols, Section 6.5.

When a symbol changes for a specific status, the tab for that status changes color to red. This helps direct the user to the specific screen that requires attention.

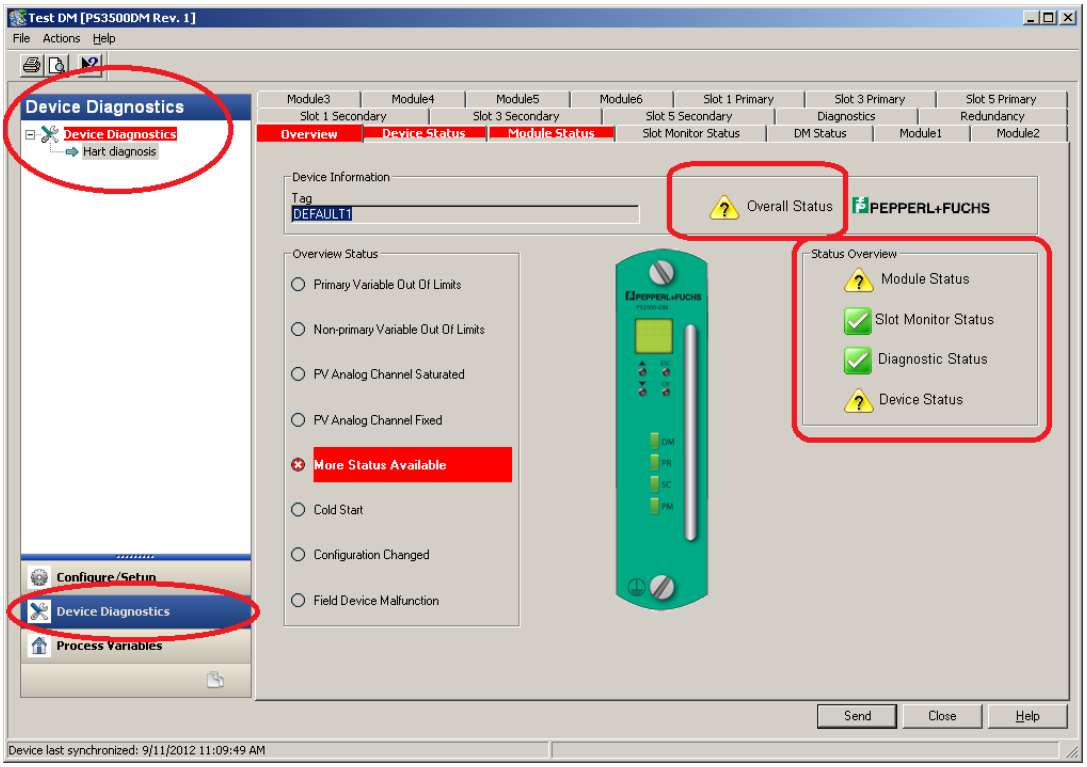


Figure 6.5 Device Diagnostics - Overview Screen

6.9.2 Device Status

6.9.2.1 Standardized Status

Standardized status is provided for all devices using the HART Protocol. Not all standardized status alarms are supported in the diagnostic module.

6.9.2.2 Password Status

Password status uses a warning/alarm to alert the user that the device is unlocked, either by a user or by the factory. The *Device Unlocked* indicator acts as an alarm state to prevent someone from unintentionally leaving the system unlocked. Refer to Figure 6.6.

6.9.2.3 Extended Field Device Status

Extended field device status is provided for all devices using the HART Protocol. Not all extended field device status alarms are supported in the diagnostic module.

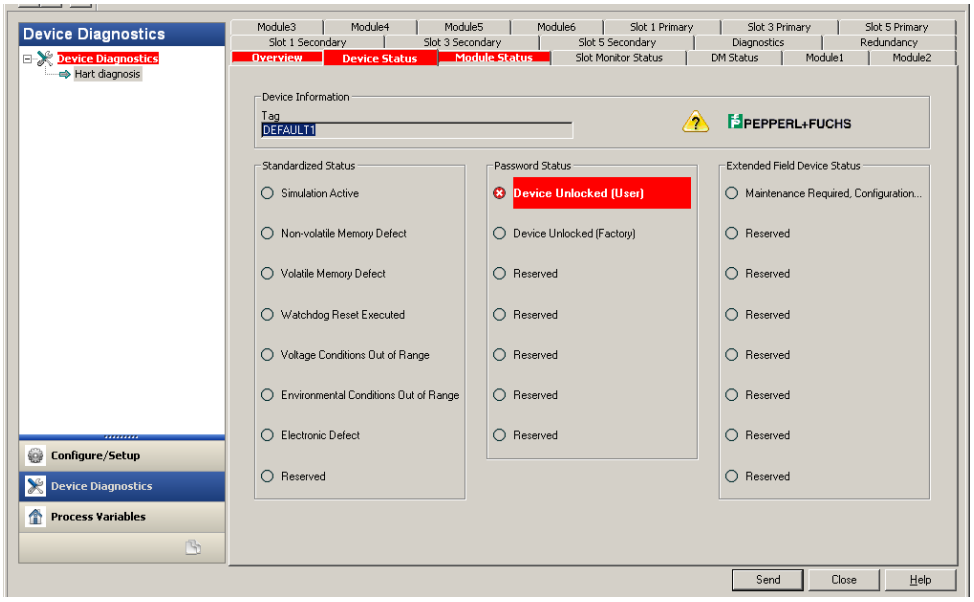


Figure 6.6 Device Diagnostics - Device Status Screen

A *Maintenance Required* alarm indicates a firmware/hardware mismatch. Please contact the factory for updates.

6.9.3 Module, Monitor, and DM Status Screens

The diagnostic module's specific status screens allow the user to identify the source of alarms and warnings. A specific module, monitor, or diagnostic module parameter that is out of specification is reflected in these status pages, turning the tab red to indicate a warning/alarm condition.

Figure 6.7 shows the *Module Status* screen, indicating that an alarm or warning condition exists for module 2. The *Module2* tab can then be viewed to see the parameter that is out of specification.

Note that the individual module, monitor, diagnostics, and redundancy tabs do not turn red when containing out of tolerance parameters.

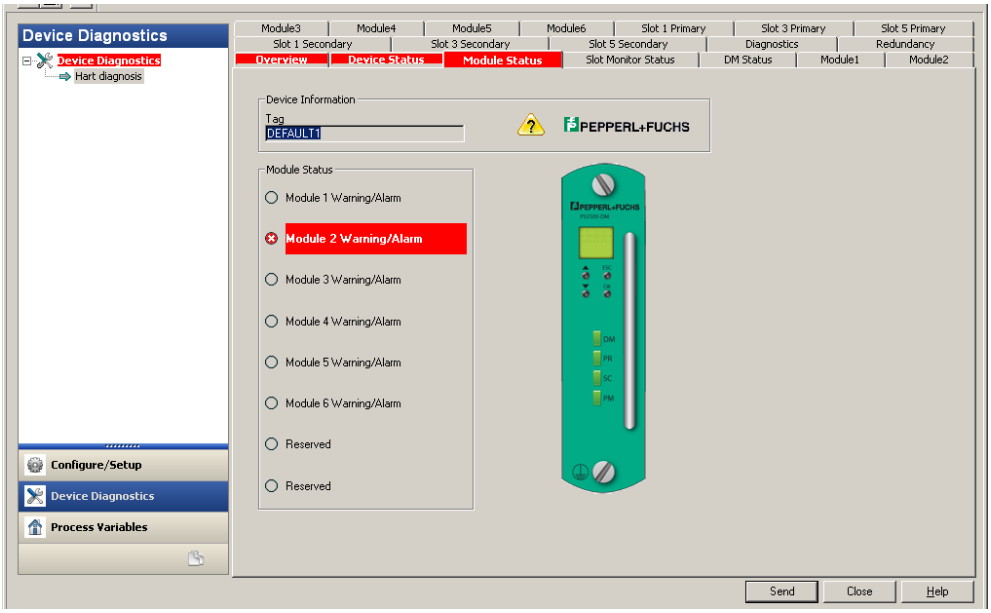


Figure 6.7 Device Diagnostics - Module Status Screen

6.9.4 Module, Monitor, Diagnostics, and Redundancy Parameter Screens

These screen tabs show live system parameters. The alarm/warning status of each parameter is indicated with either a *No Error* or an *Out of Specification* graphic as described in Section 6.5. Each parameter is described in Section 8.

- Section 8.1: Module1 through Module6 tabs.
- Section 8.2: Diagnostics and Redundancy tabs.
- Section 8.3: Slot 1 Primary through Slot 5 Primary tabs.
- Section 8.4: Slot 1 Secondary through Slot 5 Secondary tabs.

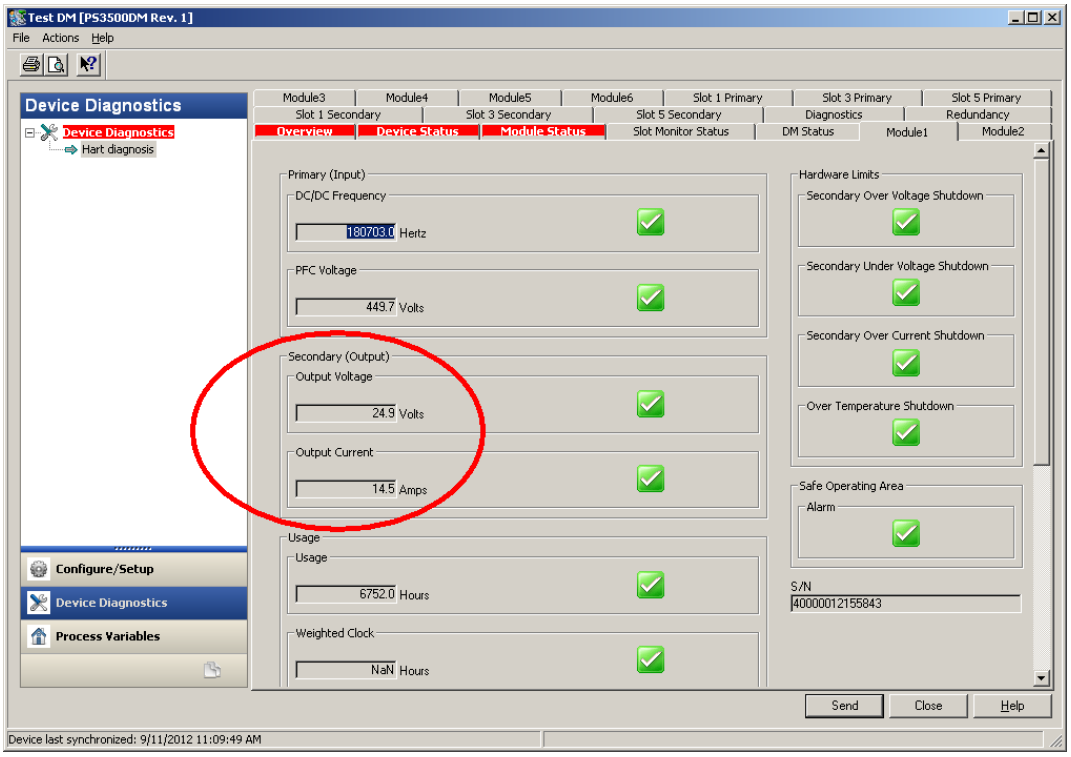


Figure 6.8 Device Diagnostics - Module1 Screen, View 1 of 2

6.10 Process Variables

The process variables indicate the following.

- Minimum Current: The power supply current of the power supply that is least loaded.
- Maximum Current: The power supply current of the power supply that has the highest current demand.
- Minimum Voltage: The power supply output voltage of the power supply that has the lowest output voltage.
- Maximum Voltage: The power supply output voltage of the power supply that has the highest output voltage.
- Loop Current: Loop current is required by the HART specification, even for devices that do not support the HART Protocol on a 4-20mA current loop. For the diagnostic module, the loop current is not applicable and will always be read at 4.0mA.

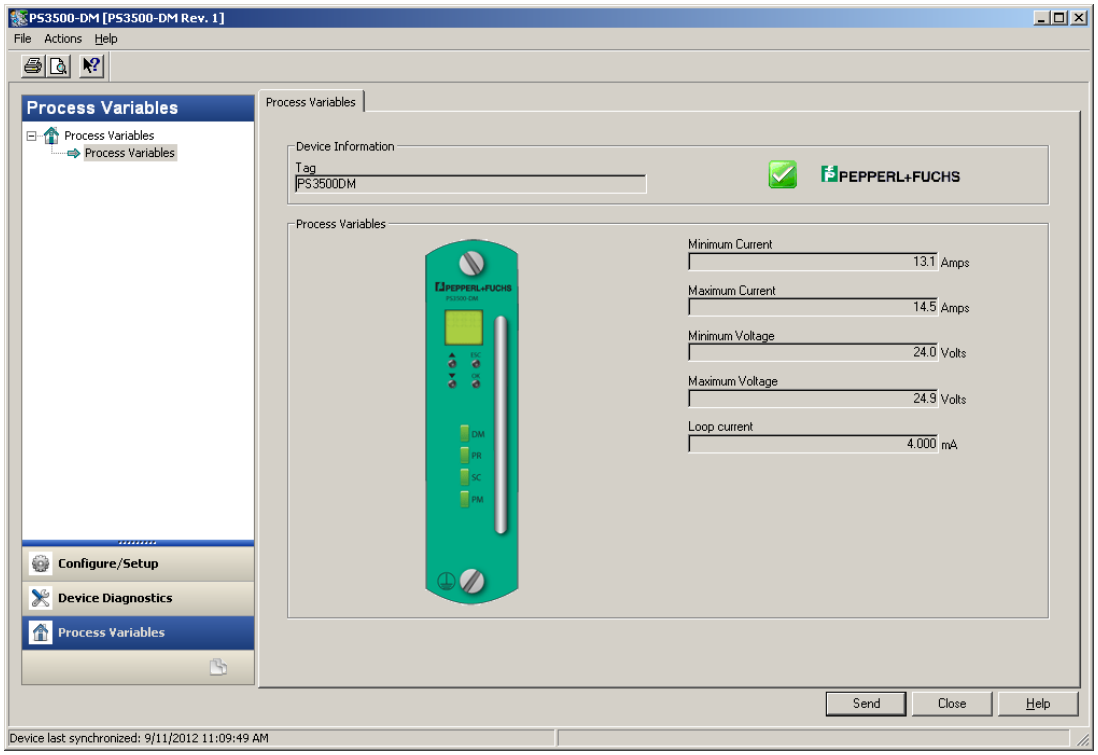


Figure 6.9 Process Variables Screen

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7 PS3500DM iDTM & PACTware

The following chapter describes the PS3500-DM for use with an iDTM on a PC that does not have PACTware installed.

7.1 PC Software Setup

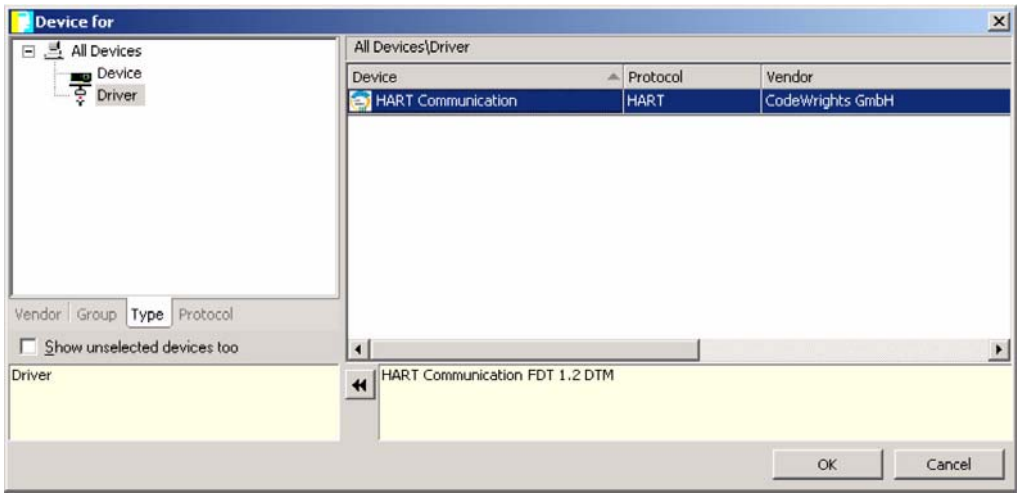
1. Download PACTware:
   http://www.pepperl-fuchs.us/usa/en/classid_163.htm?view=productdetails&prodid=45160#301
2. Open the “1831481g.zip” file and double click on the “Setup.exe” file.
3. Click “Next” through the installation.
4. Download the HART modem:
   http://www.pepperl-fuchs.us/usa/en/classid_1804.htm?view=productdetails&prodid=32796
5. Open the “1831009c.zip” file and double click on the “Setup.exe” file.
6. Click “Next” through the installation.
7. Download the PS3500-DM iDTM:
   http://files.pepperl-fuchs.com/selector_files/navi/productInfo/118/1180113.zip
8. Open the “1180113.zip” file and double click on the “Setup.exe” file.
9. Click “Next” through the installation.

7.2 Hardware Connections

1. Connect the COM port of the PC to RS-485 adapter and make note of the COM port number (COM1, COM3, etc.).
2. Connect the PS3500 backplane to the RS-485 adapter.
3. Power the PS3500-DM in the backplane.

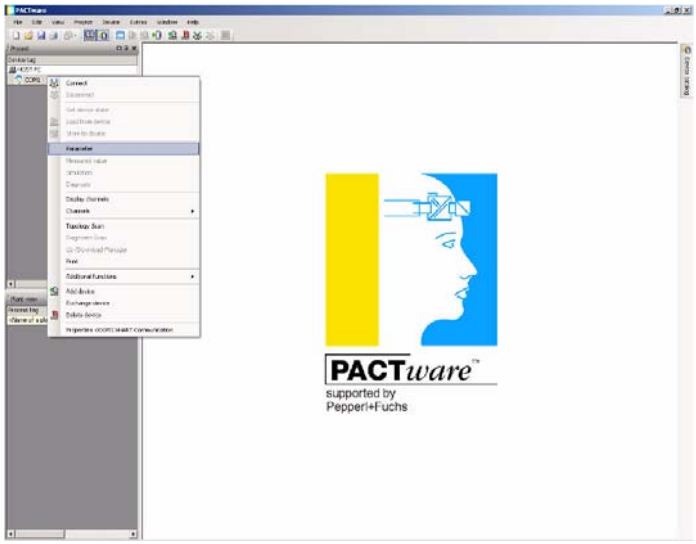
7.3 PACTware Setup

1. Start the PACTware software.
2. From PACTware > Device > Add Device select “HART Communication”.
3. Click OK.

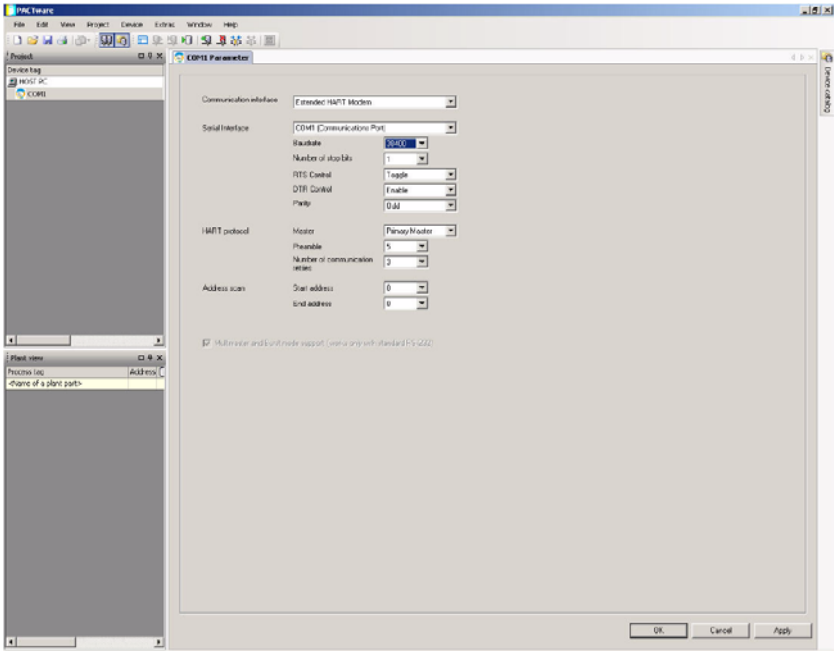


4. Select “COM1”.

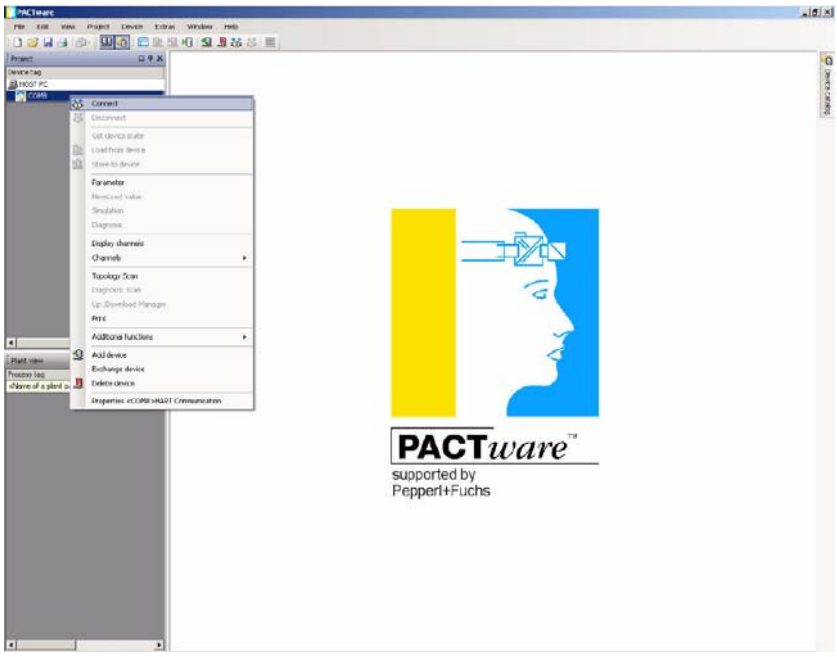
5. Right Click and select “Parameter”.



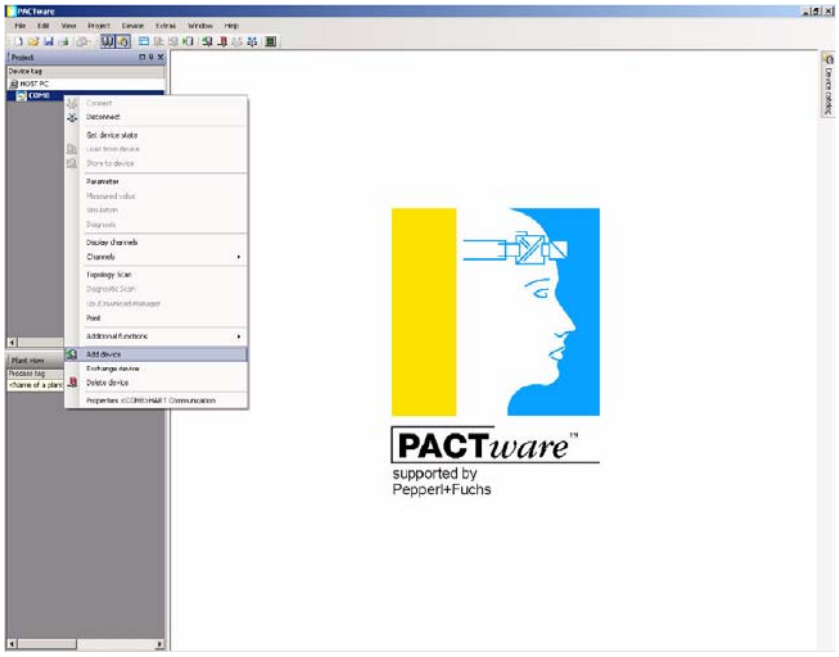
6. Change the communication interface to “Extended HART modem”.
7. Change the baud rate to 38400.
8. Open the drop down box on the “Serial Interface” to select the correct COM port.
9. Click OK.



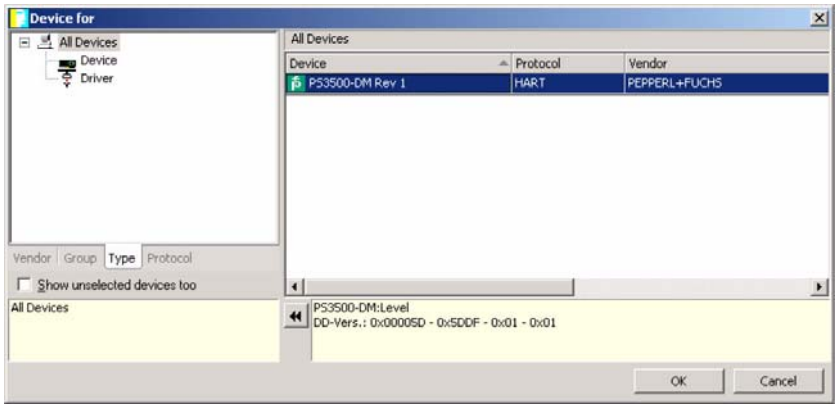
10.Right click on the COM port and press “connect”.



11.Right click on COM port and select “Add device”.

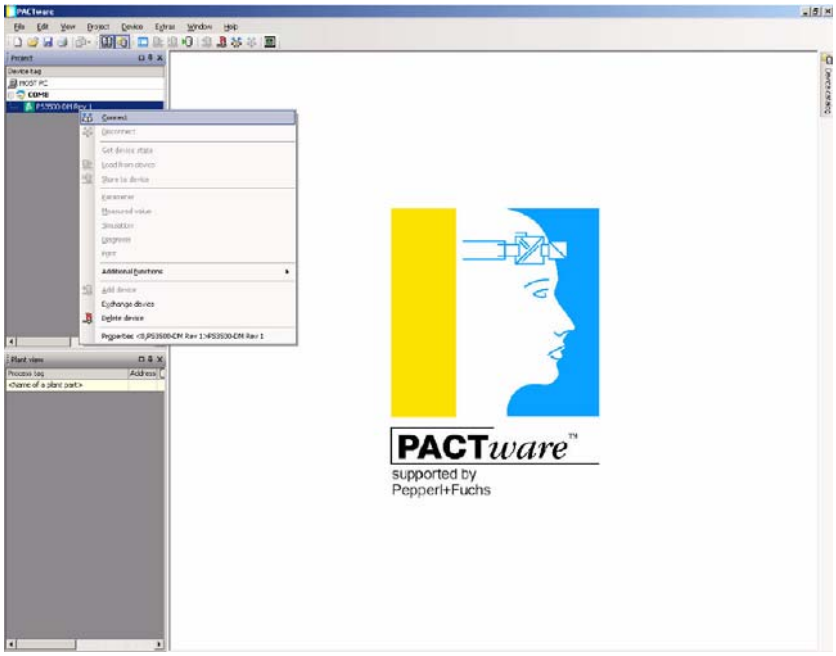


12.Select the PS3500-DM and press OK.



13.Right click on the PS3500-DM.

14.Click on “Connect”.



8 Measured Values/Parameters

8.1 Power Supply Modules

8.1.1 Parameter: DC/DC Frequency

Type: Analog value with user configurable warning and alarm indication.

Units: Hertz

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Under Range Warning	100,000	170,000, Enabled	300,000
Over Range Warning	100,000	195,000, Enabled	300,000
Under Range Alarm	100,000	160,000, Enabled	300,000
Over Range Alarm	100,000	200,000, Enabled	300,000

Source: Generated in the power supply and read through the diagnostic module.

Description: The power supply internally converts a high voltage PFC voltage down to 24 Volts through a high frequency step down transformer. This parameter monitors the frequency of transformer switching.

Notes: If the power supply is removed or unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

At very low or no output load, the transformer switching can be suspended by the power supply for short durations in order to properly maintain the output voltage. When intentionally operating supplies without a load, users can prevent nuisance indications by disabling the under range warning and alarm.

8.1.2 Parameter: PFC Voltage

Type: Analog value with user configurable warning and alarm indication.

Units: Volts

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Under Range Warning	300	380, Enabled	500
Over Range Warning	300	455, Enabled	500
Under Range Alarm	300	370, Enabled	500
Over Range Alarm	300	460, Enabled	500

Source: Generated in the power supply and read through the diagnostic module.

Description: The Power Factor Correction (PFC) circuit is used to align the phase of the input current to the input voltage that maximizes the useful power available to the supplies and minimizes power lost in the distribution system. Internal to the supply, the PFC circuit generates a high DC voltage used to drive a high frequency step down transformer.

Notes: If the power supply is removed or unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

At very low or no output load, the PFC voltage may drop to a low value for short durations in order to properly maintain the power supply output voltage. When intentionally operating supplies without a load, users can prevent nuisance indications by disabling the under range warning and alarm.

8.1.3 Parameter: Secondary Output Voltage

Type: Analog value with user configurable warning and alarm indication.

Units: Volts

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Under Range Warning	0	22, Enabled	50
Over Range Warning	0	28, Enabled	50
Under Range Alarm	0	20, Enabled	50
Over Range Alarm	0	30, Enabled	50

8.1.4 Parameter: Secondary Output Current

Type: Analog value with user configurable warning and alarm indication.

Units: Amps

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Over Range Warning	0	13.5, Enabled	20
Over Range Alarm	0	15, Enabled	20

Source: Generated in the power supply and read through the diagnostic module.

Description: The power supply output current measured at an internal point within the power supply.

Notes: If the power supply is removed or unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

8.1.5 Parameter: Usage Clock

Type: Analog value with user configurable warning and alarm indication.

Units: Hours

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Over Range Warning	0	43,800, Disabled	300,000
Over Range Alarm	0	87,600, Disabled	300,000

Source: Generated in the power supply and read through the diagnostic module.

Description: The power supply counts the hours of operation. The value is stored in non volatile memory within the power supply and is maintained if power to the supply is cycled.

Notes: If the power supply is removed or unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

8.1.6 Parameter: Weighted Usage Clock

Type: Analog value with user configurable warning and alarm indication.

Units: Hours

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Over Range Warning	0	43,800, Disabled	300,000
Over Range Alarm	0	87,600, Disabled	300,000

Source: Generated in the power supply and read through the diagnostic module.

Description: The power supply counts the hours of operation, but weights usage based on load current and internal temperatures. Power supply operation under high temperatures and/or high loads cause the weighted usage clock to increment at a higher rate to indicate long term unit stress.

Notes: This feature is not currently implemented within the supplies and is always presented as *NaN* (Not a Number).

8.1.7 Parameter: Internal Temperature

Type: Analog value with user configurable warning and alarm indication.

Units: Degrees Celsius or degrees Fahrenheit

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Over Range Warning	-50 °C/-58 °F	45 °C/113 °F, Enabled	150 °C/302 °F
Over Range Alarm	-50 °C/-58 °F	70 °C/158 °F, Enabled	150 °C/302 °F

Source: Generated in power supply and read through diagnostic module.

Description: The internal temperature of the power supplies. This monitoring point is not attached to any electrical component.

Notes: If the power supply is removed or unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

8.1.8 Parameter: Transformer Temperature

Type: Analog value with user configurable warning and alarm indication.

Units: Degrees Celsius or degrees Fahrenheit

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Over Range Warning	-50°C/-58°F	100 °C/212 °F, Enabled	150 °C/302 °F
Over Range Alarm	-50 °C/-58 °F	110 °C/230 °F, Enabled	150 °C/302 °F

Source: Generated in power supply and read through diagnostic module.

Description: The temperature of the high frequency isolation transformer.

Notes: If the power supply is removed or unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

8.1.9 Parameter: Low Voltage (LV) Heatsink Temperature

Type: Analog value with user configurable warning and alarm indication.

Units: Degrees Celsius or degrees Fahrenheit

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Over Range Warning	-50 °C/-58 °F	90 °C/194 °F, Enabled	150 °C/302 °F
Over Range Alarm	-50 °C/-58 °F	100 °C/212 °F, Enabled	150 °C/302 °F

Source: Generated in power supply and read through diagnostic module.

Description: The temperature monitored on the low voltage heatsink within the supply. The heatsink contains the components that rectify the secondary side of the isolation transformer.

Notes: If the power supply is removed or unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

8.1.10 Parameter: High Voltage (HV) Heatsink Temperature

Type: Analog value with user configurable warning and alarm indication.

Units: Degrees Celsius or degrees Fahrenheit

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Over Range Warning	-50 °C/-58 °F	90 °C/194 °F, Enabled	150°C/302°F
Over Range Alarm	-50 °C/-58 °F	100 °C/212 °F, Enabled	150 °C/302 °F

Source: Generated in power supply and read through diagnostic module.

Description: The temperature monitored on the high voltage heatsink within the supply. The heatsink contains the components that convert a high DC voltage from the PFC circuit into a high frequency AC signal that is passed through the isolation transformer.

Notes: If the power supply is removed or unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

8.1.11 Parameter: Secondary Over Voltage Shutdown

Type: Digital alarm.

Source: Generated in power supply and read through diagnostic module.

Description: The power supply monitors its output voltage prior to the auctioneering diode and shuts down if the internal voltage is higher than 30 VDC.

Notes: Since this alarm condition causes the supply to shut down (thus removing the over voltage condition), the user should never see this alarm even if the supply could be adjusted above the over voltage set point. This alarm would likely indicate an O-ring diode failure and the supply output driven through some external source.

8.1.12 Parameter: Secondary Under Voltage Shutdown

Type: Digital alarm.

Source: Generated in power supply and read through diagnostic module.

Description: The power supply monitors its output voltage prior to the auctioneering diode and shuts down if the internal voltage is lower than 22 VDC.

Notes: This alarm can be triggered by a supply with a load exceeding the specified power supply current ratings.

8.1.13 Parameter: Secondary Over Current Shutdown

Type: Digital alarm.

Source: Generated in power supply and read through diagnostic module.

Description: The power supply monitors its output current and shuts down if this value is higher than 15 A.

Notes: This alarm can be triggered by a supply with a load exceeding the specified power supply current ratings.

8.1.14 Parameter: Secondary Over Temperature Shutdown

Type: Digital alarm.

Source: Generated in power supply and read through diagnostic module.

Description: The power supply monitors the temperature of its isolation transformer and shuts down if the transformer reaches 140 °C/284 °F.

8.1.15 Parameter: Safe Operating Area (SOA)

Type: Digital alarm.

Source: Generated in diagnostic module, from parameters supplied from the diagnostic module and the power supplies.

Description: The diagnostic module calculates the maximum current limit for each power supply based on the ambient temperature (the ambient temperature is monitored within the diagnostic module). This alarm is set when the power supply load current exceeds the safe operating current limit for the ambient temperature.

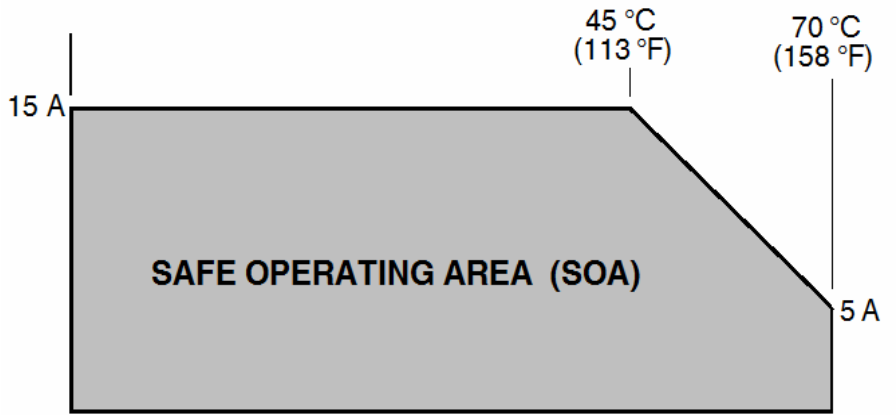


Figure 8.1 Default SOA Curve

8.1.16 Parameter: Power Supply Serial Number

Type: Digital data.

Source: Generated in power supply and read through diagnostic module.

Description: Power supply serial number indicates the same 14 digit number that appears on the back of supply.

Notes: If the power supply is removed or unpowered, the diagnostic module reports this parameter as *Slot Empty*.

8.2 Diagnostic Module Parameters (Diagnostics and Redundancy)

8.2.1 Parameter: Overall Secondary Current

Type: Analog value.

Source: Generated in the diagnostic module from data read from the power supplies.

Description: The diagnostic module adds up all the module output currents and displays the sum.

8.2.2 Parameter: Communication Errors

Type: Digital value.

Source: Generated in the diagnostic module.

Description: The diagnostic module adds up all communication errors it has with either the external (HART) bus or internal communications with the individual power supplies or Channel Monitors.

8.2.3 Parameter: Diagnostic Module Temperature

Type: Analog value with user configurable warning and alarm indication.

Units: Degrees Celsius or degrees Fahrenheit

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Over Range Warning	-50 °C/-58 °F	45 °C/113 °F, Enabled	150 °C/302 °F
Over Range Alarm	-50 °C/-58 °F	60 °C/140 °F, Enabled	150 °C/302 °F

Source: Generated in diagnostic module.

Description: The temperature of the high frequency isolation transformer. This monitoring point is not attached to any electrical component.

8.2.4 Parameter: Group Output Current (Redundancy)

Type: Analog value with alarm indication.

Units: Amps

Source: Generated in diagnostic module from parameters read from power supplies.

Description: The total of all module currents within a group. The value is in alarm if the total exceeds the Group Current Limit.

8.2.5 Parameter: Group Current Limit (Redundancy)

Type: Analog value.

Units: Amps

Source: Generated in diagnostic module.

Description: The calculated current limit for all power supplies in a group based on the Safe Operating Area (SOA) for the ambient temperature. The limit is set conforming to requirements of the None, N+1, or N+N redundancy settings for the group.

8.2.6 Parameter: Module (Redundancy)

Type: Digital value with alarm.

Source: Generated in diagnostic module.

Description: When a power supply is assigned to a group, the diagnostic module sets this alarm if communication to the supply is lost (either the supply is disconnected from the primary or the supply is removed from the backplane).

Notes: This alarm can be used to detect when a supply is removed from the system.

8.2.7 Parameter: Date and Time

Type: Digital value.

Source: Generated in diagnostic module.

Description: Date and Time (Military format).

Notes: The date and time are maintained with an internal battery backup and can function for an extended time without power applied to the unit. The unit does not self-adjust for daylight savings time.

8.2.8 Parameter: Diagnostic Module Serial Number

Type: Digital value.

Source: Generated in diagnostic module.

Description: Diagnostic module serial number indicates the same 14 digit number that appears on the back of diagnostic module.

Notes: If the power supply is removed or unpowered, the diagnostic module reports this parameter as *Slot Empty*.

8.2.9 Parameter: Temperature Mode

Type: User value.

Source: User selectable value.

Description: Diagnostic module can display temperatures in either degrees Celsius or degrees Fahrenheit. This parameter is used to set the display units.

Notes: Internally the diagnostic module used degrees Celsius, and converts the specific points for user display.

8.2.10 Parameter: Language

Type: User value.

Source: User selectable value.

Description: Diagnostic module can display text in various languages.

Notes: Only English is currently supported.

8.3 Primary Slot Monitors

8.3.1 Parameter: Input RMS Voltage

Type: Analog value with user configurable warning and alarm indication.

Units: Volts

For a DC Input:

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Under Range Warning	0	100, Enabled	500
Over Range Warning	0	240, Enabled	500
Under Range Alarm	0	90, Enabled	500
Over Range Alarm	0	250, Enabled	500

For an AC Input:

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Under Range Warning	0	100, Enabled	500
Over Range Warning	0	290, Enabled	500
Under Range Alarm	0	90, Enabled	500
Over Range Alarm	0	300, Enabled	500

Source: Generated through monitoring of primary slots within the diagnostic module.

Description: The diagnostic module performs real time RMS calculations of the incoming input voltage.

Notes: If the particular backplane slot is unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

8.3.2 Parameter: DC Input

Type: Digital value.

Source: Generated through monitoring of primary Slots within the diagnostic module.

Description: The Slot is being supplied with a DC voltage: Diagnostic module does not detect an alternating current on this slot.

Notes: The alarm conditions for an AC input voltage and a DC input voltage are evaluated against different set points. This allows Power Supplies to be switched from an AC source or a DC source without generating lingering nuisance alarms.

8.3.3 Parameter: Input RMS Current

Type: Analog value with user configurable warning and alarm indication.

Units: Amps

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Over Range Warning	0	2.5, Enabled	10
Over Range Alarm	0	3, Enabled	10

Source: Generated through monitoring of primary slots within the diagnostic module.

Description: The diagnostic module performs real time RMS calculations of the incoming input current.

Notes: If the particular backplane slot is unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

8.3.4 Parameter: Input Spikes

Type: Digital value with user configurable warning and alarm indication.

Units: Counts per Time Window

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Over Range Warning	0	1, Enabled	30,000,000
Over Range Alarm	0	10, Enabled	30,000,000

Source: Generated through monitoring of primary slots within the diagnostic module.

Description: The diagnostic module detects short lived input voltage aberrations (spikes) and counts these events. The voltage threshold for detection and the frequency at which the count is reset are user selectable through configuration parameters. Figure 8.2 shows an example of how the spike data is generated. The primary input has noise riding on the input waveform.

Notes: If the particular backplane slot is unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

This parameter is used in conjunction with the input spikes time window and input spikes voltage threshold.

Figure 8.2 Input Waveform with Spikes (detail)

The input voltage waveform is filtered to remove the low frequency component of the 50-60Hz input, leaving only high frequency information. Refer to Figure 8.3.

Once the low frequency information is removed, if a voltage spike is greater than the input spike voltage threshold (user set parameter in 7.3.6), a count is made. The threshold is used for both positive and negative going spikes. Counts are tallied in 100mS intervals.

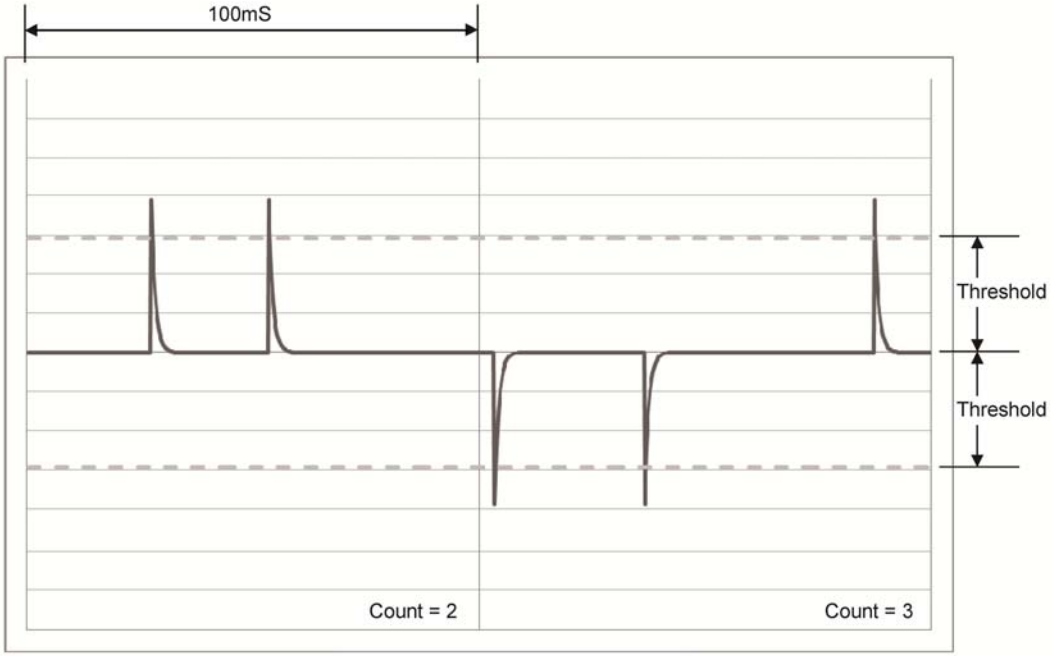


Figure 8.3 Noise Counts (detail)

A number of the 100mS tallies are added together as specified by the Input spikes time window (user set parameters in 7.3.5). A one second window will keep a rolling tally of ten 100mS counts. Refer to Figure 8.4.

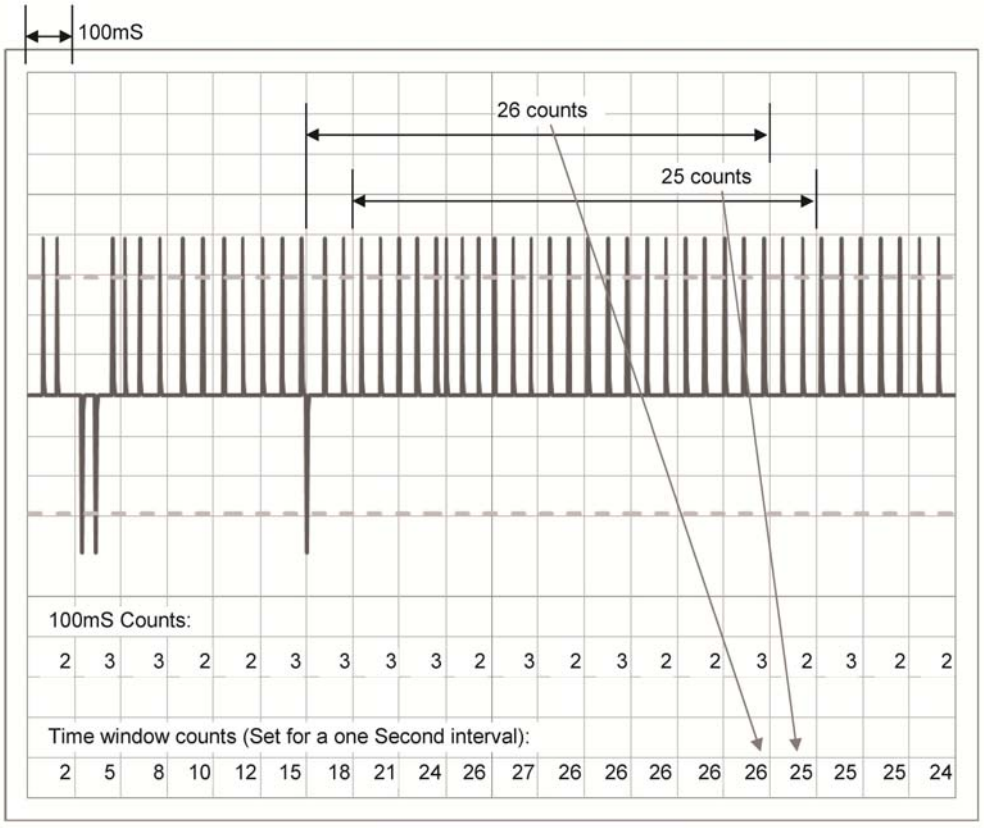


Figure 8.4 Noise Counts

PS3500-DM

8.3.5 Parameter: Input Spikes Time Window

Type: User configurable value.

Units: Seconds

Minimum Setpoint	Default Setpoint	Maximum Setpoint
0.1	1	60

Source: User set point required for input spike measurement.

Description: This parameter sets the time window for monitoring voltage spikes on specific slots of the power supply inputs. The noise measurement is made with a sliding window; a count of noise *events* is taken at 100mS intervals.This parameter indicates how many of these intervals are displayed to the user.

Notes: The time window can be set to a one (1) second period (readings are displayed as events per second) to represent repetitive noise events as a frequency in Hertz. The time window can be extended to longer periods for non repetitive and infrequent events.

8.3.6 Parameter: Input Spikes Voltage Threshold

Type: User configurable value.

Units: Volts

Minimum Setpoint	Default Setpoint	Maximum Setpoint
10	200	300

Source: User set point required for input spike measurement.

Description: This parameter sets the minimum voltage threshold for monitoring voltage spikes on specific slots of the power supply inputs. A single voltage aberration (spike) greater than the set point value increments the input spike counter.

Notes: The noise counter has limits on the frequency of noise that it can detect. The circuit has a high pass filter set with a corner of 1.6kHz (noise spikes a low frequencies are highly attenuated) to prevent nominal AC voltage from being detected as a noise spike. The circuitry cannot detect more than 500,000 noise events per second.

8.4 Secondary Slot Monitors

8.4.1 Parameter: Output Voltage

Type: Analog value with user configurable warning and alarm indication.

Units: Volts

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Under Range Warning	0	22.5, Enabled	50
Over Range Warning	0	28, Enabled	50
Under Range Alarm	0	20, Enabled	50
Over Range Alarm	0	30, Enabled	50

Source: Generated through monitoring of secondary slots within the diagnostic module.

Description: The diagnostic module generates a real time average of the output voltage.

Notes: If the particular backplane slot is unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

8.4.2 Parameter: Ripple and Noise (Peak to Peak)

Type: Analog value with user configurable warning and alarm indication.

Units: mV

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Over Range Warning	0	75, Enabled	5,000
Over Range Alarm	0	100, Enabled	5,000

Source: Generated through monitoring of secondary slots within the diagnostic module.

Description: The diagnostic module generates a peak to peak measurement of the output voltage noise.

Notes: If the particular backplane slot is unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

The DC component of the output is removed through a 100 Hz High Pass filter for this measurement (so output noise lower than 100 Hz is highly attenuated).

8.4.3 Parameter: Ripple and Noise (RMS)

Type: Analog value with user configurable warning and alarm indication.

Units: mV

	Minimum Setpoint	Default Setpoint	Maximum Setpoint
Over Range Warning	0	25, Enabled	5,000
Over Range Alarm	0	35, Enabled	5,000

Source: Generated through monitoring of secondary slots within the diagnostic module.

Description: The diagnostic module generates a RMS measurement of the output voltage noise.

Notes: If the particular backplane slot is unpowered, the diagnostic module reports this parameter as *NaN* (Not A Number) and considers it a normal condition.

The DC component of the output is removed through a 100 Hz High Pass filter for this measurement (so output noise lower than 100 Hz is highly attenuated).

8.5 HART Communication

Manufacturer Name:	Pepperl+Fuchs	**Model Name(s):**	PS3500-DM
Manufacturer ID Code:	93 (5D Hex)	**Device Type Code:**	223 (DF Hex)
HART Protocol Revision	7.0	**Device Revision:**	1
Number of Device Variables	90		
Physical Layers Supported	RS485		
Physical Device Category	Non DC isolated Bus Device		

The following device variables can be transmitted through HART Protocol Revision 7, Command 9:

Device Variable Code	Description	Unit Code	Device Variable Classification Code
00	Module 1: Secondary output voltage	Volts	Emf
01	Module 1: Secondary output current	Amps	Current
02	Module 1: DC/DC converter frequency	Hertz	Frequency
03	Module 1: PFC voltage	Volts	Emf
04	Module 1: Internal temperature	°C or °F	Temperature
05	Module 1: Transformer temperature	°C or °F	Temperature
06	Module 1: HV heatsink temperature	°C or °F	Temperature
07	Module 1: LV heatsink temperature	°C or °F	Temperature
08	Module 1: Usage clock	Hours	Time
09	Module 1: Use clock (weighted)	Hours	Time
10	Module 2: Secondary output voltage	Volts	Emf
11	Module 2: Secondary output current	Amps	Current
12	Module 2: DC/DC converter frequency	Hertz	Frequency
13	Module 2: PFC voltage	Volts	Emf
14	Module 2: Internal temperature	°C or °F	Temperature
15	Module 2: Transformer temperature	°C or °F	Temperature
16	Module 2: HV heatsink temperature	°C or °F	Temperature
17	Module 2: LY heatsink temperature	°C or °F	Temperature
18	Module 2: Usage clock	Hours	Time
19	Module 2: Use clock (weighted)	Hours	Time
20	Module 3: Secondary output voltage	Volts	Emf
21	Module 3: Secondary output current	Amps	Current
22	Module 3: DC/DC converter frequency	Hertz	Frequency

Device Variable Code	Description	Unit Code	Device Variable Classification Code
23	Module 3: PFC voltage	Volts	Emf
24	Module 3: Internal temperature	°C or °F	Temperature
25	Module 3: Transformer temperature	°C or °F	Temperature
26	Module 3: HV heatsink temperature	°C or °F	Temperature
27	Module 3: LV heatsink temperature	°C or °F	Temperature
28	Module 3: Usage clock	Hours	Time
29	Module 3: Use clock (weighted)	Hours	Time
30	Module 4: Secondary output voltage	Volts	Emf
31	Module 4: Secondary output current	Amps	Current
32	Module 4: DC/DC converter frequency	Hertz	Frequency
33	Module 4: PFC voltage	Volts	Emf
34	Module 4: Internal temperature	°C or °F	Temperature
35	Module 4: Transformer temperature	°C or °F	Temperature
36	Module 4: HV heatsink temperature	°C or °F	Temperature
37	Module 4: LV heatsink temperature	°C or °F	Temperature
38	Module 4: Usage clock	Hours	Time
39	Module 4: Use clock (weighted)	Hours	Time
40	Module 5: Secondary output voltage	Volts	Emf
41	Module 5: Secondary output current	Amps	Current
42	Module 5: DC/DC converter frequency	Hertz	Frequency
43	Module 5: PFC voltage	Volts	Emf
44	Module 5: Internal temperature	°C or °F	Temperature
45	Module 5: Transformer temperature	°C or °F	Temperature
46	Module 5: HV heatsink temperature	°C or °F	Temperature
47	Module 5: LV heatsink temperature	°C or °F	Temperature
48	Module 5: Usage clock	HoursS	Time
49	Module 5: Use clock (weighted)	Hours	Time
52	Module 4: Secondary output voltage	Volts	Emf
51	Module 4: Secondary output current	Amps	Current
52	Module 4: DC/DC converter frequency	Hertz	Frequency
53	Module 4: PFC voltage	Volts	Emf
54	Module 4: Internal temperature	°C or °F	Temperature
55	Module 4: Transformer temperature	°C or °F	Temperature
56	Module 4: HV heatsink temperature	°C or °F	Temperature
57	Module 4: LV heatsink temperature	°C or °F	Temperature
58	Module 4: Usage clock	Hours	Time
59	Module 4: Use clock (weighted)	Hours	Time
60	Primary 1: RMS voltage	Volts	Emf
61	Primary 1: RMS current	Amps	Current

Device Variable Code	Description	Unit Code	Device Variable Classification Code
62	Primary 1: AC spikes	Events/ Time	Not classified
63	Primary 3: RMS voltage	Volts	Emf
64	Primary 3: RMS current	Amps	Current
65	Primary 3: AC spikes	Events/ Time	Not classified
66	Primary 5: RMS voltage	Volts	Emf
67	Primary 5: RMS current	Amps	Current
68	Primary 5: AC spikes	Events/ Time	Not classified
69	Secondary 1: output voltage	Volts	Emf
70	Secondary 1: output ripple and noise Pk-Pk	Millivolts	Emf
71	Secondary 1: output ripple and noise RMS	Millivolts	Emf
72	Secondary 3: output voltage	Volts	Emf
73	Secondary 3: output ripple and noise Pk-Pk	Millivolts	Emf
74	Secondary 3: output ripple and noise RMS	Millivolts	Emf
75	Secondary 5: output voltage	Volts	Emf
76	Secondary 5: output ripple and noise Pk-Pk	Millivolts	Emf
77	Secondary 5: output ripple and noise RMS	Millivolts	Emf
78	DM: temperature	°C or °F	Temperature
79	DM: overall current	Amps	Current
80	DM: communication errors	Events	Not classified
81	Group A current	Amps	Current
82	Group B current	Amps	Current
83	Group C current	Amps	Current
84	Group A current limit	Amps	Current
85	Group B current limit	Amps	Current
86	Group C current limit	Amps	Current
87	Minimum output current	Amps	Current
88	Maximum output current	Amps	Current
89	Minimum output voltage	Volts	Emf
90	Maximum output voltage	Volts	Emf
91 - 149	Undefined (NaN)	Not used	Not classified
150	*Module 1: Over Voltage Shutdown Alarm	Not used	Not classified
151	*Module 1: Under Voltage Shutdown Alarm	Not used	Not classified
152	*Module 1: Over Current Shutdown Alarm	Not used	Not classified
153	*Module 1: Over Temperature Shutdown Alarm	Not used	Not classified
154	*Module 1: Safe Operating Area Alarm	Not used	Not classified
155	*Module 1: Configuration Alarm	Not used	Not classified
156	*Module 1: Communication Lost	Not used	Not classified

Device Variable Code	Description	Unit Code	Device Variable Classification Code
157	*Module 2: Over Voltage Shutdown Alarm	Not used	Not classified
158	*Module 2: Under Voltage Shutdown Alarm	Not used	Not classified
159	*Module 2: Over Current Shutdown Alarm	Not used	Not classified
160	*Module 2: Over Temperature Shutdown Alarm	Not used	Not classified
161	*Module 2: Safe Operating Area Alarm	Not used	Not classified
162	*Module 2: Configuration Alarm	Not used	Not classified
163	*Module 2: Communication Lost	Not used	Not classified
164	*Module 3: Over Voltage Shutdown Alarm	Not used	Not classified
165	*Module 3: Under Voltage Shutdown Alarm	Not used	Not classified
166	*Module 3: Over Current Shutdown Alarm	Not used	Not classified
167	*Module 3: Over Temperature Shutdown Alarm	Not used	Not classified
168	*Module 3: Safe Operating Area Alarm	Not used	Not classified
169	*Module 3: Configuration Alarm	Not used	Not classified
170	*Module 3: Communication Lost	Not used	Not classified
171	*Module 4: Over Voltage Shutdown Alarm	Not used	Not classified
172	*Module 4: Under Voltage Shutdown Alarm	Not used	Not classified
173	*Module 4: Over Current Shutdown Alarm	Not used	Not classified
174	*Module 4: Over Temperature Shutdown Alarm	Not used	Not classified
175	*Module 4: Safe Operating Area Alarm	Not used	Not classified
176	*Module 4: Configuration Alarm	Not used	Not classified
177	*Module 4: Communication Lost*	Not used	Not classified
178	*Module 5: Over Voltage Shutdown Alarm	Not used	Not classified
179	*Module 5: Under Voltage Shutdown Alarm	Not used	Not classified
180	*Module 5: Over Current Shutdown Alarm	Not used	Not classified
181	*Module 5: Over Temperature Shutdown Alarm	Not used	Not classified
182	*Module 5: Safe Operating Area Alarm	Not used	Not classified
183	*Module 5: Configuration Alarm	Not used	Not classified
184	*Module 5: Communication Lost	Not used	Not classified
185	*Module 6: Over Voltage Shutdown Alarm	Not used	Not classified
186	*Module 6: Under Voltage Shutdown Alarm	Not used	Not classified
187	*Module 6: Over Current Shutdown Alarm	Not used	Not classified
188	*Module 6: Over Temperature Shutdown Alarm	Not used	Not classified
189	*Module 6: Safe Operating Area Alarm	Not used	Not classified
190	*Module 6: Configuration Alarm	Not used	Not classified
191	*Module 6: Communication Lost	Not used	Not classified
192	*Primary 1: Communication Lost	Not used	Not classified
193	*Primary 3: Communication Lost	Not used	Not classified
194	*Primary 5: Communication Lost	Not used	Not classified
195	*Secondary 1: Communication Lost	Not used	Not classified
196	*Secondary 3: Communication Lost	Not used	Not classified

Device Variable Code	Description	Unit Code	Device Variable Classification Code
197	*Secondary 5: Communication Lost	Not used	Not classified
198 - 244	Undefined (NaN)	Not used	Not classified
245	Loop current	Milliamps	Current
246	Primary variable (minimum current)	Amps	Current
247	Secondary variable (maximum current)	Amps	Current
248	Tertiary variable (minimum voltage)	Volts	Emf
249	Quaternary variable (maximum voltage)	Volts	Emf
250 - 255	Undefined (NaN)	Not used	Not classified

*Digital alarm parameters - only the alarm status bits will change for these parameters. The floating point value is set to NaN.

Glossary

A – Ampere, Amps

AC – Alternating Current

Alarm Level – A maximum setting that triggers an alarm if reached.

AMS – Asset Management Software

Apk – Peak Amperage.

AWG – American Wire Gauge.

Backplane – A group of electrical connectors in parallel with each other used as a backbone to connect several modules together to make a complete system.

°C – Degrees Celsius (temperature measurement)

CCW – Counter-clockwise

cfg – Configuration

CU – Copper

CW – Clockwise

DC – Direct Current

DM – Diagnostic Module

EC – European Commission

EDDL – Electronic Device Description Language

°F – Degrees Fahrenheit (temperature measurement)

HV – High Voltage

HART® – Highway Addressable Remote Transducer Protocol

HART® ID – A unique number assigned to a a device that is used by HART to distinguish between the possible use of multiple diagnostic modules. Also known as a short address and polling address.

Hot Swapping – The ability to replace hardware under power without any visible functional impact on the output side.

IEC – International Electrotechnical Commission

IP54 – IP stand for Ingress Protection. It is a rating that describes the protection a fitting has from intrusion of solid and liquid material.

kHz – Kilohertz (unit of Alternating Current)
kg – Kilogram
kW – Kilowatt (unit of power)

LCD – Liquid Crystal Display
LED – Light Emitting Diode
LV – Low Voltage

N+N – An equal number of modules serving as backup
N+1 – One additional module serving as backup
Noise – Random voltage fluctuations
No Redundancy – No modules serving as backup

OV – Over Voltage
OHT – Over Heat
OC – Over Current

PFC – Power Factor Correction
Pk – Peak
PK-PK – Peak to Peak
Polling Address – A unique number assigned to a a device that is used by HART to distinguish between the possible use of multiple Diagnostic Modules. Also known as a Short Address. See also HART ID.
PS – Power Supply

Ripple –An oscillation of small amplitude imposed on top of a steady value
RMS – Root Mean Square deviation

Short Address – A unique number assigned to a a device that is used by HART to distinguish between the possible use of multiple diagnostic modules. Also known as a polling address. See also HART ID.
Slot – An electrical connector on the backplane that modules attach to
SOA – Safe Operating Area

UV – Under Voltage
UV – Ultraviolet

V – Volt
VAC – Volts AC
VDC – Volts DC
Vpk – Peak voltage

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