# Power Xpert®Release trip units for Power Defense molded case circuit breakers



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# Contents

# 1. Introduction to the Power Xpert® Release trip unit

The Power Xpert Release (PXR) trip unit has features and flexibility that allow configuration for a wide variety of protection applications. Communication options support integration into supervisory systems to monitor performance and, if desired, control the circuit breaker. Advanced metering of current, voltage, energy and power allow monitoring of real-time energy use.

The PXR trip unit is available in multiple models from 15 A (60 A frame) through 2500 A in MCCBs. All PXR trip units share common features including configuration of their protective functions, cause-of-trip information, built in secondary injection for testing and a USB port for connection to configuration and monitoring software. Certain models include energy metering with 1% accuracy, network connectivity, multi-language display and advanced protection features.

The PXR trip unit, with its current sensors and a trip actuator, is the subsystem of a circuit breaker that provides a wide variety of protective functions. The PXR analyzes signals from the current sensors; if current level and time delay settings are exceeded then the PXR will trip the circuit breaker. The overload and short circuit tripping characteristics for a specific circuit breaker are determined by the current rating and user selected protection settings.

Metering uses those same current sensors to monitor and record current. In models that include voltage metering, a full set of power and energy data is available with 1% accuracy. Additionally the PXR supports a waveform capture mechanism by which you can monitor your systems currents and voltages.

The communication systems provide real-time status and data from the PXR for integration with business information systems, control schemes or other systems used by service personnel. The PXR trip units support several field-busses including ModbusRTU, ethernet Modbus TCP and ProfibusDP. Ethernet communications also includes an advanced web-interface for use with phone, tablet or PC browsers.

Certain models have a LCD display to make set-up and system monitoring possible from the face of the MCCB. Other models have rotary switches to set the available protection settings. Regardless of the interface on the PXR trip units, all aspects of the configuration and performance are available using PXPM software.

This manual covers the Power Xpert Release family in the Power Defense line of molded case circuit breakers. Instruction leaflets (IL) are provided with each circuit breaker that covers the installation. Both this manual and circuit breaker instruction leaflets should be consulted when applying the PXR trip unit. Please access www.eaton.com/powerdefense for full details.

## 1.1 Protection settings overview

The following table shows an overview of protection functionality available in the PXR family trip units in Power Defense circuit breakers. Detailed information for each trip unit and circuit breaker are in Section 10: Available protection settings. Note that external control voltage is not required for protection functionality.

# 1. Introduction to the Power Xpert® Release trip unit

| Line protection settings | | PXR 10 | PXR 20 | PXR 20D and 25 | Units |
|---|---|---|---|---|---|
| | Available protection styles | LI<br>LSI | LSI<br>LSIG,<br>LSI with ARMS<br>LSIG with ARMS | LSI<br>LSIG,<br>LSI with ARMS<br>LSIG with ARMS | |
| **Overload protection (L)** | | | | | |
| $I_r$ | Pickup | 10 settings | 10 settings | Variable | Amps |
| $t_r$ | Time delay @ 6 x $I_r$ | Fixed at 10 | 10 settings | Variable from 0.50 | Seconds |
| | Time delay slope | $I^2t$, $I^4t$ | $I^2t$, $I^4t$ | $I^2t$, $I^4t$ | |
| | Thermal memory | Enable/disable | Enable/disable | Enable/disable | |
| **Short circuit protection (S)** | | | | | |
| | Enable/disable (OFF position) | Yes | Yes | Yes | |
| $I_{sd}$ | Pickup | 6 settings 2.0 to 10 | 9 settings from 1.5 | Variable from 1.5 | x $I_r$ |
| $t_{sd}$ | Time delay flat | 2 settings 0.15 or 0.30 | 7 settings from 0.05 to 0.50 | Variable from 0.05 to 0.50 | Seconds |
| | Time delay $I^2t$ @ 8 x $I_r$ | 0.30 | 3 settings 0.07, 0.15, 0.30 | Variable from 0.07 to 0.30 | |
| | Zone selective interlock | Not available | Enable/disable | Enable/disable with visual indication | |
| **Instantaneous protection (I)** | | | | | |
| $I_i$ | Pickup | 10 settings | 10 settings | Variable from 2.0 | x $I_n$ |
| **Ground (Earth) fault protection (G)** | | | | | |
| | Enable/disable (OFF position) | Not available | Enable/disable | Enable/disable | |
| $I_g$ | Pickup - trip | | 6 settings from 0.2 to 1.0 (up to 1200A) | Variable from 0.2 to 1.0 (up to 1200A) | x $I_n$ |
| | Pickup - alarm only | | 3 settings 0.20, 0.50, 1.0 | Variable from 0.2 to 1.0 (up to 1200A) | |
| $t_g$ | Time delay flat | | 7 settings from 0.10, to 1.0 | Variable from 0.10 to 1.0 | Seconds |
| | Time delay $I^2t$ @1.0 x $I_n$ | | 3 settings 0.07, 0.15, 0.30 | Variable from 0.07 to 0.30 | |
| | Alarm contact | | Optional / configurable | Included / configurable | |
| | Thermal memory | | Enable/disable | Enable/disable | |
| **Neutral protection** | | | | | |
| | 4th pole or external neutral trip | 3 settings 60% 100% off | 3 settings 60% 100% off | 3 settings 60% 100% off | x $I_r$ |
| **Maintenance mode protection (ARMS)** | | | | | |
| | Maintenance mode with visual indication | Not available | Local OFF w/ remote enable -or- local ON | Local OFF w/ remote enable -or- local ON | |
| | Pickup | | 5 settings 2.5, 4.0, 6.0, 8.0, 10 | 5 settings 2.5, 4.0, 6.0, 8.0, 10 | x $I_n$ |
| | Status contact | | Optional / configurable | Optional | |
| **General** | | | | | |
| | Cause-of-trip | Stored in memory | Stored in memory | Stored in memory | |
| | | Available through PXPM | LED indication | LED indication | |
| | High load alarm 1 Pickup | Not available | 85% | Variable 50% to 120% | x $I_r$ |
| | High load alarm 2 Pickup | | 105% | | |
| | High load alarm Contact | | Optional / configurable | Configurable | |
| | Temperature trip | 105 °C / 220 °F | 105 °C / 220 °F | 105 °C / 220 °F | |

**Notes:**

Section 9 contains a detailed list of all available settings for each trip unit and breaker frame combination.
Light gray shaded settings are only configurable through the USB with PXPM software.

| Motor protection settings | | PXR 10 -MP | PXR 25 -MP | Units |
|---|---|---|---|---|
| **Motor overload protection (L)** | | | | |
| $I_e$ | Full load amps (FLA) | 10 settings | Variable | Amps |
| $t_e$ | Motor trip class | 5 settings 5 to 30 | Variable from 5 to 30 | Seconds |
| | Thermal memory | Enable/disable | Enable/disable | |
| **Short circuit protection (S)** | | | | |
| $I_{sd}$ | Pickup | 10 settings 3.0 to 13 | Variable from 3 to 13 | x $I_e$ |
| $t_{sd}$ | Time selay dlat | 3 settings 0.05, 0.15 or 0.30 | Variable from 0.05 to 0.50 | Seconds |
| | Zone selective interlock | Not available | Enable/disable with visual indication | |
| **Instantaneous protection (I)** | | | | |
| $I_i$ | Pickup | Fixed (see settings tables) | Variable from 3.0 | x $I_n$ |
| **Ground (earth) fault protection (G)** | | | | |
| $I_g$ | Pickup – trip, alarm only or OFF | Not available | Variable from 0.20 | x $I_n$ |
| $t_g$ | Time delay flat | | Variable from 0.10 to 1.0 | Seconds |
| | Thermal memory | | Enable/disable | |
| **Motor protection voltage functions** | | | | |
| **Over voltage** | Pickup | not available | Variable, 180 to 720 | Volts |
| | Time | | Variable, 1 to 300 | Seconds |
| **Under voltage** | Pickup | not available | Variable, 60 to 670 | Volts |
| | Time | | Variable, 1 to 300 | Seconds |
| **Voltage unbalance** | Pickup | not available | Variable, 5 to 25 | % of Volts |
| | Time | | Variable, 1 to 300 | Seconds |
| **Current unbalance** | Pickup | variable, 5 to 35 | Variable, 5 to 25 | % of Amps |
| | Time | variable, 1 to 300 | Variable, 1 to 300 | Seconds |
| **Phase loss** | Pickup | Yes - use the current Unbalance function | Fixed at 75 | % of Amps |
| | Time | | Variable, 1 to 240 | Seconds |
| **Phase rotation** | Configuration | Not available | ABC or CBA | Sequence |
| | Time | | Fixed at 200 | Milliseconds |
| **Reverse power** | Pickup | Not available | Variable, 1 to 65,500 | kW |
| | Time | | Variable, 1 to 300 | Seconds |
| Each function can be set to: a) trip the breaker, b) alarm only, or c) be disabled (OFF) | | | | |
| **Neutral protection (N)** | | Described in line protection table above | | |
| **General protection Functions** | | | | |

Section 9 contains a detailed list of all available settings for each trip unit and breaker frame combination.
Light gray shaded settings are only configurable through the USB with PXPM software.

## 1.1.1 Time current curves

Time current curves (TCC) for every Power Defense circuit breaker within the PXR family of trip units are available at www.eaton.com/powerdefense.

# 1. Introduction to the Power Xpert® Release trip unit

## 1.2  Metering features

The following table shows the electrical system information which is metered by the trip unit.  It is available for viewing in PXPM, on the display (if equipped) or for reading via communication channels.

| Metering data | PXR 10 | PXR 20 | PXR 20D | PXR 25 |
|---|---|---|---|---|
| Current | * | * | * | * |
| Current maximum and minimum | | * | * | * |
| Voltage line to line and line to neutral | | | | * |
| Voltage maximum and minimum ( L-L and L-N ) | | | | * |
| Power  kW (real, demand, peak) | | | | * |
| Power  kVAR (reactive, demand, peak) | | | | * |
| Power  kVA (apparent, demand, peak) | | | | * |
| Energy kWh (total, fwd, rev) VARh (net), VAh (net) | | | | * |
| Frequency | | | | * |
| Power factor | | | | * |

### 1.2.1  Metered data specifications
Metered data accuracy is as follows:

| Metered value | Range of conditions (units) | PXR 10 | PXR 20 | PXR 20D | PXR 25 |
|---|---|---|---|---|---|
| Current (I) | 5 to 10 % of In (A) | na | Na | 1.00% | 1.00% |
| | 10 to 20 % of In (A) | na | 5.00% | 0.50% | 0.50% |
| | 20 to 120% of In (A) | 5.00% | 2.00% | 0.50% | 0.50% |
| Voltage (V) | 60 to 102 (V) | | | | 1.00% |
| | 102 to 690 (V) | | | | 0.50% |
| | 690 to 750 (V) | | | | 1.00% |
| Power (kW) Energy (kWh) | 5% to 10% of In (A) 102 to 690 (V) Power factor = 1 | | na | | 1.50% |
| | 10 to 120 % of In (A) 102 to 690 V Power factor = 1 | | | | 1.00% |
| Power (kW) Energy (kWh) | 10 to 20 % of In (A) 102 to 690 (V) Power factor = 0.5 inductive or 0.8 capacitive | | | | 1.50% |
| | 20 to 120% of In (A) 102 to 690 (V) Power factor = 0.5 inductive or 0.8 capacitive | | | | 1.00% |
| Note: | Accuracy is expressed as % of reading, currents are RMS, voltages are RMS line-to-line. Where na trip may report data with a higher lower than 5% accuracy or Zero and should not be used for measuring purposes. All protections will still function as intended.. | | | | |

In addition to the electrical system information metered for line protection, the following data is available from the motor protection function in the PXR 25 -MP.  It is viewed on the display, in PXPM, or via communication channels.

| Metered data | Description | Units |
|---|---|---|
| Voltage unbalance | Difference between the maximum and minimum of the 3 voltage readings (Vab, Vbc, Vca) | Volts |
| Current unbalance | Difference between the maximum and minimum of the 3 current readings (Ia, Ib, Ic) | Amps |
| Total harmonic distortion  (THD) | Voltage, line-to-line (Vab, Vbc, Vca) | |
| | Voltage, line-to-neutral (Van, Vbn, Vcn) | |
| | Current (Ia, Ib, Ic, In) | |
| Harmonic content | | % |
| (1st through 35th at 50 Hz) | | |
| (1st through 29th at 60 Hz) | Voltage, line-to-line (Vab, Vbc, Vca) | |
| | Voltage, line-to-neutral (Van, Vbn, Vcn) | |
| | Current (Ia, Ib, Ic, In) | |

## 1.3  Health monitor

The PXR 20, 20D, and 25 trip units utilize an innovative algorithm to determine a health status. The health status is continuously updated as overloads and interruption events occur.  To view the factors that affect the health monitor, select the "Diagnostics" menu. The summary screen shown below is 100% of life with all four bars shaded. Each bar is approximately 25% of breaker health according to the algorithm. As the life is decreased, the shading in the leading bars will disappear. In the PXR 20 the alarm will be generated at 25% of health remaining. In the PXR 20D and PXR 25 the alarm can be adjusted from 0% - 50% percent with a default of 25%.
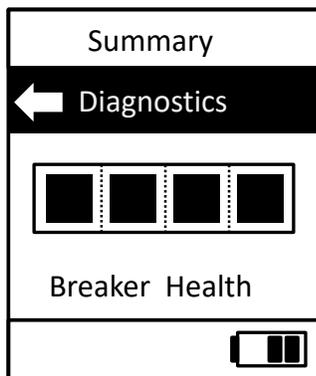


See Chapter 8 Health monitor

## 1.4 Communication features

The PXR 20, 20D, and 25 trip units feature options for built-in communications. Standard embedded serial communications (optional on the PXR 20) and optional Communications Adapter Modules (CAM) allow for easy connections over the serial protocol Modbus-RTU, Ethernet protocols such and Modbus-TCP (CAM), or industrial protocols such as Profibus-DP (CAM).

The communication features in conjunction with the metering, health, and control functions can be utilized in IOT based systems, thus allowing for greater visibility in to the facility, process, or machine, and adhering to the Design Principles of Industry 4.0.

## 1.5 Control features

The PXR trip units allow for full control of the breaker. This control is available using communications, discrete I/O or both. This allows the PXR to be easy integrated in to larger control schemes.

Discrete I/O options for Undervoltage Release (UVRs), Shunt Trips, and relays that can be configured for a wide range of functions such as trips and alarms, to monitoring of features like Maintenance Mode or Breaker Health.

Communications capabilities allow options to control even more features, such as the ability to open the breaker, control configurable relays, enable Maintenance Mode, reset trips, health, counters, metering and other diagnostic data.

# 2 PXR user interface

The PXR trip unit interface is common across all frame sizes of the Power Defense family of circuit breaker frames. This common user interface ensures rapid configuration and makes it easier to train service personnel. In each frame size, the elements of the interface are easily recognized even when compressed into smaller fames or mounted horizontally.

The PXR 10 has the simplest user interface (UI), including the essential protection settings and status. The PXR 20D and PXR 25 have the richest UI, providing setting and operational information at a glance. Refer to the front panel illustrations of the PXR 10, PXR 20, PXR 20D and PXR 25 to determine which user interface elements are provided.

There is a setting for the PXR 20D and PXR 25 to rotate the text in the display for breakers that are mounted horizontally in a panelboard.

## 2.1 Key interface elements

### 2.1.1 Status indicator

All PXR trip units have an indicator in the top left labeled "STATUS". During normal operation, this indicator blinks green (on and off approximately once each second), indicating that the trip unit is operating normally.

The status indicator blinks red if the trip unit detects an internal problem. This indicates a problem with the trip actuator coil, a firmware error, or a mechanism error. Take immediate action to replace the trip unit or breaker.

When the status indicator remains off, there is no auxiliary power applied or insufficient primary current to power the trip unit. PXR trip units in MCCB will self-power around 20% of the circuit breaker frame In. For example if a PXR Frame Rating (In) is 60A and the Long Delay Pickup (IR) is set to 15A the unit will still require 12A ... 20% of 60A to be self powered. It is recommend to use Aux power if lower power levels are normal, this will insure that non-protection oriented features such as communication, status indicator and display remain functional.

### 2.1.2 USB – test and configuration port

The lower right corner of all PXR trip units has a standard micro-B USB connector. PXPM software uses the USB port to configure, test and monitor the trip unit. Download the installation package for PXPM software from www.eaton.com/pxpm.

A USB cable connection from a host PC will power the trip unit when the trip unit is not harvesting sufficient energy from the mains or there is no auxiliary power applied. Commercially available battery packs can also power the trip unit. This connection is intended for temporary use while a user is configuring, monitoring or testing the trip unit.

### 2.1.3 Pickup/cause-of-trip indicators

All PXR family trip units record the cause-of-trip (CoT) in memory. The CoT is available by using PXPM software and via the communication networks.

There are four pickup/cause-of-trip indicators labeled "LONG", "SHORT", "INST", and "GND" on all except the PXR 10. The appropriate indicator blinks when a current level pickup setting is exceeded. After a trip event, the appropriate indicator flashes (0.25 second on, three seconds off) and is annunciated on the display.

- "LONG" – Long delay or over temperature
- "SHORT" – Short delay
- "INST" – Instantaneous, override or maintenance mode
- "GND" – Ground fault

### 2.1.4 Reset

The button labeled "RESET" can be pressed using a small tool. When pressed, it clears the cause-of-trip indicators, clears any latched alarms on the configurable relays and clears the ZSI "check mark" on the display (illuminates after a ZSI input signal is detected).

### 2.1.5  Battery

For PXR units, which have cause-of-trip indicators, within the trip unit is a small tray that holds the battery. The battery supports the cause-of-trip indicators for 20 days when the trip unit is not powered. The battery plays no part in the protection functions of the trip system. On the initial installation of the circuit breaker, remove and discard the insulating tab to enable the battery. This battery is a standard CR type "coin-cell", for replacement use: CR1216. The battery also holds the power for the real time clock chip for time and date information. After replacing the battery, the time and date should be reprogrammed.

The "RESET" button can be pressed and held for two seconds to test the battery. If OK, the "LONG" LED will illuminate green, if the battery should be replaced it will illuminate yellow, and if the battery is either low or missing it will blink yellow. For PXR 20D and PXR 25 the battery status is also indicated in the lower right corner of the display.

### 2.1.6  High load indicator

On the PXR 20D and PXR 25, the indicator labeled "Alarm1/Alarm2" (high-load indicator) is illuminated yellow based on the configured load setting. The LED will be solid when above the high load warning (Alarm1) pickup, and the LED will blink when above the high load alarm (Alarm2) pickup. Note that high load alarm (Alarm2) (blink) takes precedence over high load warning (Alarm1) (solid).

On the PXR 20, the indicator labeled "85%Ir/105%Ir" (high-load indicator) is illuminated yellow based on fixed setting. The LED will be solid when above the the 85% of Ir fixed load setting, and the LED will blink when above the 105% of Ir fixed load setting. Note that fixed laod setting 105% Ir (blink) takes precedence over fixed load setting 85% Ir (solid).

### 2.1.7  Maintenance Mode switch

When supplied, the PXR trip unit incorporates the Arc Flash Reduction Maintenance System™. The switch is labeled "Maintenance Mode" and has two positions labeled "OFF/Remote" and "ON". A blue light next to the Maintenance Mode switch illuminates when the Arc Flash Reduction Maintenance System protection is enabled.

- "ON" – Arc Flash Reduction Maintenance System is enabled locally and cannot be disabled remotely
- "OFF/Remote" – Arc Flash Reduction Maintenance System is OFF, or can be remotely controlled by a dry contact, communications or PXPM. See Section 3.6: Maintenance Mode protection for complete details

### 2.1.8  Push to trip

A red button on the front of the trip unit or circuit breaker provides a mechanical means of tripping the circuit breaker. Use a small tool to depress it and trip the breaker mechanism.

### 2.1.9  Tamper proof cover

A clear plastic cover allows the settings to be viewed but not changed. Controlling physical access is a key element in your comprehensive security policy. Unauthorized access to change settings is prevented by insertion of a standard sealing wire through the security holes in order to meet applicable tamper-proof requirements.

### 2.1.10  Password security

Protecting your system from cyber security threats is very important. In addition to the tamper-proof cover, PXR trip units have a four-digit password used to secure certain settings and to enable secondary injection testing. To change a setting, which is not set by a physical switch, will require you to enter the four-digit password. Authorization to make changes will timeout after 10 seconds of inactivity. Password security is also enforced when using the display, PXPM software and when another device attempts a change via a communication network.

Changing the factory default password is a key element of a comprehensive cyber security policy. From the factory the default is '0-0-0-0'. Upon installation of the PXR, the password should be changed (under the settings menu) and only made available to those individuals who require it.

For additional information and cyber security best practices, please go to www.eaton.com/cybersecurity.  Detailed guidance is under the "Documentation" tab on this cybersecurity home page.

### 2.1.11  Catalog number and $I_n$ rating

Trip unit family and protection functionality are printed in the upper right of the front panel. The rated $I_n$ values are printed near the test port.  The catalog number is also printed on the front, it starts with "PD" and the last three digits define the factory configuration options. See Section 10.1: Identifying the trip unit for a full list of options.

### 2.1.12 QR code

The 2D barcode (QR code) on the front of each trip unit encodes the trip unit catalog and serial number. This can be used to look-up product information that is available on-line from Eaton.

## 2.2  PXR 25, PXR 25 Motor Protection, and 20D display with keypad
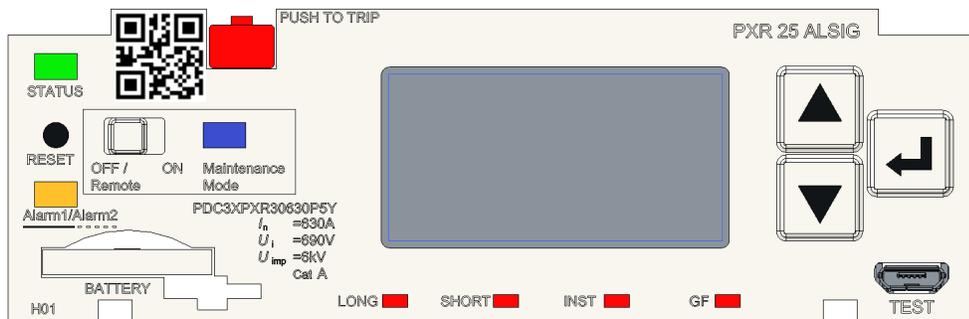
The PXR 20D and PXR 25 user interface (UI) has a display and keypad on the front of the trip unit.  This display provides information regarding the operation of the trip unit and the method to select configuration options.  The keypad provides for navigation through the menu structures.  Information is presented on the display in English, Chinese, German, Spanish, or up to two additional languages (loaded by PXPM).  To provide for easier reading of the display with the circuit breaker mounted on its side, the display is configurable to rotate 90 degrees left or right.

There are three navigation buttons near the display used to control the information shown on the display and to select configuration options:

**Up arrow button** - Used to move up in the menu display screen or increase an adjustment value.

**Down arrow button** - Used to move down in the menu screens or decrease an adjustment value.

**Enter button** - Used to enter a menu or configuration setting or to go back to the previsions menu.
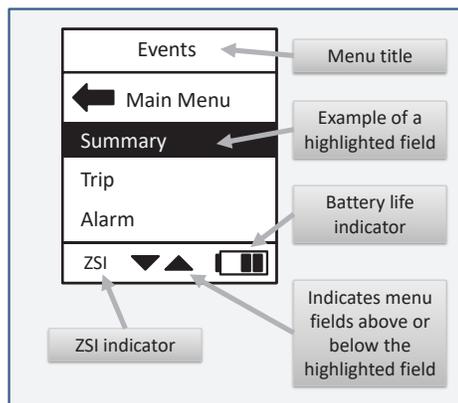
Each trip unit style has configurable settings for protection and other features.  They can be configured using either the front panel or by using PXPM software.  Details regarding the available protection settings for each frame are found in Section 9: Available protection settings.

When the PXR trip unit is initially powered-up, the display will briefly show a loading screen and then change to the main menu.  During this time, the trip unit is already functioning and performing protection operations.  Depending on the trip unit style, there are up to 12 submenu selections from the main menu.
Each is accessed by pressing the down arrow or up arrow buttons to highlight the appropriate submenu, then pressing the enter button

Back lighting is included on the display with a power saver feature that after two minutes of inactivity will extinguish the backlight.  In addition, after 20 minutes of inactivity, the display will enter an idle-screen mode that scrolls through the most important status information and settings.  Pressing any button will light the backlight and, if active, stop automatic scrolling, allowing you to navigate the menu structure.  With the tamper-proof cover secured, only the up arrow and down arrow buttons are accessible, pressing either will light the backlight, stop the automatic scrolling and allow you to navigate and view status and setting information.

## 2.3  PXR 20 with rotary switches
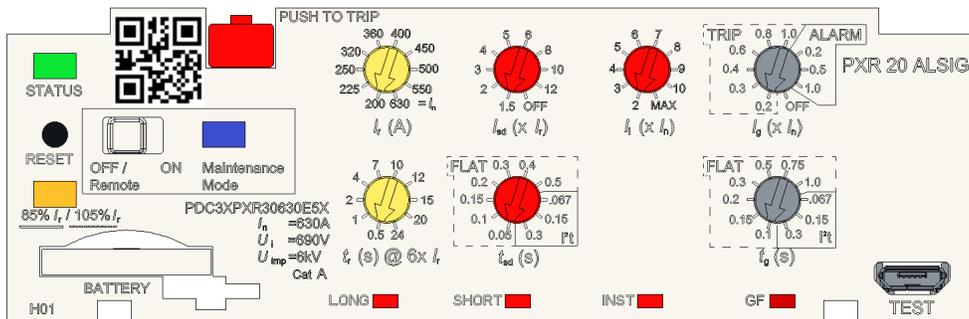


Depending on the trip unit style, up to seven rotary switches can be found on the trip unit's front panel.  The switches are color-coded and set protection settings using a surrounding legend indicating the value of that setting.  These are the core protection settings, other configurable settings can be set using PXPM.  Details regarding the available protection settings for each frame are found in Section 9: Available protection settings.

Each switch has ten positions and is set to achieve the appropriate trip-curve response. The yellow color switches set the overload configuration, red switches set the short circuit behavior and grey switches set the ground fault behavior.  The "PICKUP" switches set the levels as a function of the breaker ratings.  The "TIME" switches set the response in seconds.  Each switch can be set using a small screwdriver, the arrow pointing to the selected value.

## 2.4  PXR 10 simplified  rotary switches
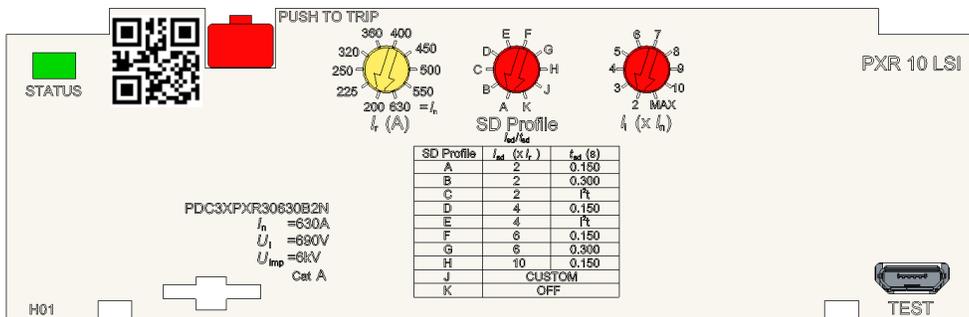


The PXR 10 trip curve configuration is simple, using the switches on the front panel.  LSI trip units have three rotary switches, while the LI version has only two, eliminating the center "SD Profile" switch.  For all, the yellow color rotary switch sets the $I_r$ and the red switches define short circuit behavior.  Details regarding the available protection settings for each frame are found in Section 9: Available protection settings.

## 2.5  PXR 10 motor protection simplified rotary switches
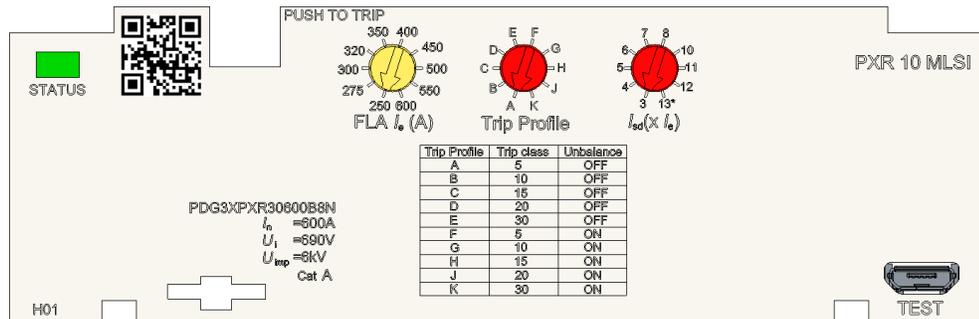


The PXR 10 motor protection trip curve configuration is simple, using the switches on the front panel.  MLSI trip units have three rotary switches.  The yellow color rotary switch sets the full load amps FLA $I_e$ (A) and the red switches trip profile and Instantaneous $I_{sd}$(X le). Details regarding the available protection settings for each frame are found in Section 9: Available protection settings.

# 3  Protection setting description

The PXR trip unit protection settings are easily customized to any application.  Settings for long delay pickup, long delay time, short delay pickup, short delay time, instantaneous pickup, ground fault pickup, and ground fault time are all configurable.  These functions are set using PXPM software, or rotary switches or the UI on the front of the trip unit.

Maximum and minimum settings will vary by trip unit style and breaker frame.  A summary of the available settings by PXR model and breaker frame is shown in Section 1.1, please consult the detailed tables within Section 9: Available protection settings.

Before placing any circuit breaker in operation, set each trip unit protection setting to the values specified by the engineer responsible for the installation.
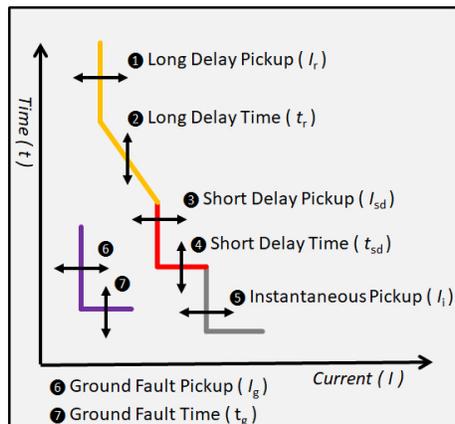


## 3.1  Long delay pickup and time setting

The PXR trip unit offers a wide range of settings for long delay pickup (LDPU or $I_r$).  The actual pickup value for long delay will be 110% of the set point value with a +/- 5% tolerance to ensure that the circuit breaker can carry the full rating of ($I_r$), without tripping.

The long delay time setting value represents the clearing times when the current value equals six times ($I_r$).  All times are referenced from the top of the tolerance band, ensuring that the time never exceeds that maximum setting.

$I_r$ is also the base for the short delay current setting.

# 3 Protection setting description

### 3.1.1 Long delay slope selection

The $I^2t$ setting is the factory default curve for long delay. Certain styles of trip unit offer other slope selections. The curve can be changed using PXPM software or the UI to better match application requirements for protection and coordination.

- $I^2t$ - Inverse time current curve, used in standard distribution protection (factory default).

- $I^4t$ - Extremely inverse time current curve, for coordination with fuses or special types of loads.

### 3.1.2 Long delay thermal memory

In addition to the standard long delay protection, a long time memory (LTM) function is supported. This protects load circuits from the effects of repeated overload conditions. LTM is enabled from the factory but can be reconfigured using the UI or by using PXPM software.

As an example, if a circuit breaker is closed soon after a long delay trip, and the current again exceeds the long delay setting ($I_r$), the LTM automatically reduces the time to trip to allow for the fact that the load conductor temperature is already higher than normal because of the prior overload condition. When the load current returns to normal, below pickup, the LTM will begin to reset (after about ten minutes it will have reset fully) so the next long delay trip time will again correspond to cold start on the curve. In certain applications and when doing repetitive field testing, it may be desirable to disable the LTM function.

## 3.2 Short delay pickup and time settings

Settings for short delay pickup (SDPU or $I_{sd}$) are expressed as multiples of the long delay pickup current setting ($I_r$).

The short delay time ($t_{sd}$) is selected in conjunction with one of two short delay slopes, flat, or $I^2t$. The $I^2t$ response curve will provide a longer time delay for currents below eight times $I_r$ as compared with a flat response curve. For currents greater than eight times $I_r$, the $I^2t$ response reverts to a flat response.

The optional zone selective interlocking (ZSI) feature may affect the tripping times for the short delay protective function. Please refer to the section on ZSI.

## 3.3 Instantaneous pickup setting

The instantaneous ($I_i$) setting is expressed as multiples of the circuit breaker frame rating ($I_n$). The instantaneous protection trips the breaker with no intentional time delay.

## 3.4 Ground fault settings

When the PXR 20, 20D or 25 trip unit includes ground fault protection features, the distribution system characteristics (such as system grounding, number of sources, and number and location of ground points) must be considered along with the manner and location in which the circuit breaker is applied to the system. To ensure correct ground fault equipment performance and compliance, you must conduct the field testing required to comply with country or regional requirements.

### 3.4.1 Ground fault pickup

The PXR trip unit provides flexibility in detecting and acting on ground currents. A ground fault alarm can provide an early warning of a ground fault condition and a ground fault trip can provide protection under these conditions. Three modes of operation are selectable from the front of the trip unit.

- The ground detection may be turned off by selecting "OFF".

- The ground fault detection pickup level with an alarm only action can be used by selecting "Alarm". Multiple levels of pickup are available depending on the trip unit style.

- The ground fault detection pickup level with an action of trip may also be used by selected "Trip". If a ground fault causes the circuit breaker to trip.

### 3.4.2  Ground fault time

The PXR trip unit provides selection for two different ground fault slopes: a fixed time (flat) or $I^2t$ response.  The slope should be chosen to match coordination needs.  The $I^2t$ slope response provides a longer time delay for coordination of currents below 1.0 x $I_n$ frame.  After 1.0x the response reverts to a fixed time (flat) response.  The time delay and slope are selected using PXPM or the user interface (UI).

### 3.4.3  Ground fault thermal memory

In addition to standard ground fault protection, the PXR trip unit also has a ground fault memory.  This protects load circuits from the effects of intermittent ground faults over a short period of time.  Ground fault memory is enabled from the factory but can be reconfigured using the UI or by using PXPM software.

Consider an example where there is "sputtering" ground fault.  With ground fault memory, the trip unit "remembers" the sputtering ground current.  When the ground current returns to normal, below pickup, the memory will begin to reset (after about ten minutes it will have reset fully).  The next ground trip time will again correspond to the curve.  Without this function enabled, ground fault protection memory resets each time the arc goes out, so that a sputtering fault may not trip the circuit breaker.

### 3.4.4  Ground fault relay

If the ground fault alarm option is selected, a red ground alarm indicator will illuminate to show the presence of ground current in excess of the ground alarm setting.  The optional relays in the trip unit can be configured to energize an alarm relay upon this condition.  The indicator and relay will reset automatically when the ground current reduces to a value less than the ground fault pickup setting.

If the ground fault trip option is selected, the trip unit can indicate when the circuit breaker has tripped on a ground fault.  You must then push the "RESET" button in order to reset the relay contact.

### 3.4.5  Ground fault sensing

The PXR 20/25 trip unit provides for three modes of sensing to detect ground fault currents: residual, source ground, and zero sequence.  The mode is selected using the UI or by using the configuration software.

See Section 3.5: Special consideration for ground fault test for guidance when testing ground fault functionality.

***Residual current sensing***

Residual sensing is the standard mode of ground fault sensing in PXR based circuit breakers.  This mode uses one current sensor on each phase conductor and one on the neutral for a four-wire system.  If the system neutral is grounded, but phase to neutral loads are not used, the PXR trip unit includes all of the components necessary for ground fault protection.  This mode of sensing sums the outputs of the three or four individual current sensors.  If the sum is zero, then no ground fault exists.  Residual ground fault sensing features are adaptable to main and feeder circuit breaker applications.  If an external neutral sensor is used with reverse feed breaker applications, the proper polarity of the neutral needs to be considered.

***Source ground / zero sequence sensing***

These two methods are only available on Power Defense frames five and six.  The source ground return method is usually applied when ground fault protection is desired only on the main circuit breaker in a simple radial system.  This method is also applicable to double-ended systems where a mid-point grounding electrode is employed.

For this mode of sensing, a single current sensor mounted on the equipment-bonding jumper will directly measure the total ground current flowing in the grounding electrode conductor.  Setting the ground fault type will enable this protection.

# 3 Protection setting description

Zero sequence sensing also referred to as vectoral summation, available in certain styles, is applicable to mains, feeders, and special schemes involving zone protection.

| Ground (Earth) sensing method | Frame | Sensor catalog # |
|---|---|---|
| Residual | PD2 – 60, 63, 100 Amp w/o bus-bar | PDG2XNCTD0100 |
| | PD2 – 150, 160, 200, 225, and 250 Amp w/o bus-bar | PDG2XNCTD0225 |
| | PD2 – 60, 63,100 Amp for cable | PDG2XNCTB0100 |
| | PD2 – 150, 160, 200, 225, and 250 Amp for cable | PDG2XNCTB0225 |
| | PD3 for bus-bar | PDG3XNCTB0600 |
| | PD4 for bus-bar | PDG4XNCTB0800 |
| | PD5 for bus-bar | PDG5XNCTB1200 |
| | PD6 for bus-bar | PDG6XNCTB2500 |
| Source ground / zero sequence | PD5 and PD6 | Tbd |

### 3.4.6  Special consideration for ground fault test

#### 3.4.6.1  NEC requirements and UL standards

The National Electric Code (NEC) under Article 230-95-C requires that any ground-fault protection system be performance tested when first installed.  UL Standard 489 amd 1053 specify that instructions for ground fault testing accompany each ground fault protection system.  Please consult Instruction leaflet number IL012125EN available at www.eaton.com/powerdefense to aid you in ground fault testing the Power Defense circuit breaker.

## 3.5  Motor Protection settings description

The PXR trip unit motor protection settings are easily customized to any application. Available protection features and specific settings will vary by trip unit style and breaker frame.  Before placing any circuit breaker in operation, set each trip unit protection setting to the values specified by the engineer responsible for the installation.

Overload and short circuit protection setting details for each trip unit and frame combination are found in in section 9 -  Detailed Protection Settings.

### Overload Protection

Protection of motor loads is accomplished by the trip unit determining when a motor is drawing currents over its rated current. An overload is a condition in which currents above the rated value are present, but unlike a fault current, overloads may be of just a few amperes over the rated current. Nevertheless, overloads can cause irreversible damage due to the amount of heat released.  Overload protection has a time delay. This has the purpose of allowing short-duration overcurrent conditions, which are normal in the operation of some types of equipment.

### Short Circuit & Instantaneous Protection

Protection against short circuits and instantaneous is the same as line protection. Both can be configured to meet a wide variety of motor protection applications.

### Motor Protection Specific Functions

Motor protection circuit breakers include additional protection features which can be used to protect equipment during certain system events, such as under/over voltage (sag/swell) and phase current anomalies. See the table Additional Motor Protection Settings. The protection functions have set points and/or  time delays which should be matched to the specific needs of the load. Each protection function is configured by accessing the menu system using the LCD and buttons or by using Eaton's Power Xpert Protection Manager software (PXPM).

***Protection Function Actions***

The protection functions can also be configured to take one of 3 actions;

1.  Trip the breaker with alarm
2.  Alarm only, do not trip
3.  Be totally disabled

**Hint:**   On the PXR25 LCD, use **Main Menu > Settings > Motor > Feature** to set one of the 3 actions. Or in PXPM for both the PXR 10 and PXR 25, use the drop-down menus under the setpoint configuration.

***Protection Function: Over Voltage***

Line-to-line RMS voltages (Vab, Vbc, Vca) are continuously monitored. If any line-to-line voltage is greater than the pickup setpoint for the specified time delay, then the configured protection action will be taken.

***Protection Function: Under Voltage***

If any line-to-line voltage is less than the pickup setpoint for the specified time delay, then the configured protection action will be taken.

**Note:**   Setpoint ranges for under voltage and overvoltage overlap. If both are used in an application, under voltage pickup should always be set less than over voltage pickup. If under voltage pickup is set higher than overvoltage pickup and the breaker is closed, the trip unit will see one or both conditions pickup satisfied, begin timing and trip.

***Protection Function: Voltage Unbalance***

If the difference between the maximum and minimum of any of the 3 line-to-line voltages is greater than the pickup for the specified time delay, then the configured protection action will be taken. Action will be taken only when at least one line-to-line voltage is greater than 84 V.

The calculation for the voltage unbalance pickup is:  $\dfrac{\text{Max(Vab,Vbc,Vca)-Min(Vab,Vbc,Vca)}}{\text{Max(Vab,Vbc,Vca)}} \times 100\%$

***Protection Function: Current Unbalance***

The RMS current in each of the phases (Ia, Ib, Ic) is continuously monitored. Unbalance protection will protect against partial or full loss of one or two phases. If the difference between the maximum and minimum of any of the 3 phase currents is greater than the pickup for the specified time delay, then the configured protection action will be taken. The Long Delay indicator on the front panel will illuminate. Action will be taken only when at least one phase current is greater than 50% of the FLA setting ($0.5 \times I_e$ ).

The calculation for the current unbalance and phase loss pickup is: $\dfrac{\text{Max(Ia,Ib,Ic)-Min(Ia,Ib,Ic)}}{\text{Max(Ia,Ib,Ic)}} \times 100\%$

***Protection Function: Phase Loss***

Phase loss protection is used for complete loss of one or two phases. If the difference between the maximum and minimum of any of the 3 phase currents is greater than 75%, for the specified time delay, then the configured protection action will be taken. Action will be taken only when at least one phase current is greater than 50% of the FLA setting ($0.5 \times I_e$ ).

***Protection Function: Phase Rotation***

The phase relationship of the line-to-line voltages is continuously monitored. If the phase sequence is different from the setting, then after the fixed time delay, the configured protection action will be taken. Action will be taken only when at least one line-to-line voltage is greater than 84 V.

### Protection Function: Reverse Power

Power flowing through the breaker is continuously monitored. If the reverse real power is greater than the pickup for the specified time delay, then the protection action will be taken.

## 3.6 Maintenance Mode protection

The PXR trip units support Eaton's Arc Flash Reduction Maintenance System, also known as Maintenance Mode. When maintenance is being performed and the Arc Flash Reduction Maintenance System is enabled, the trip unit will trip the breaker with no intentional delay whenever the configured pickup level is exceeded. The Maintenance Mode protection over-lays the LSI protection functions and operates in parallel. If Maintenance Mode causes the circuit breaker to trip, the "INST" indicator will be illuminated and the "Maintenance Mode Trip" message will be displayed if the style of trip unit has a display. A verification check of the remote Arc Flash Reduction Maintenance System feature is recommend as part of standard work practices relating to maintenance / service of electrical equipment that incorporates circuit breakers with remote Arc Flash Reduction Maintenance System feature.

The Maintenance Mode pickup level setting is configured using the UI or PXPM software. They range from 2.5 (most protective) to 10, expressed as a multiplier of In. The adjustable current settings allow for different levels of protection. A higher level may be needed when, for example, another load fed from the Arc Flash Reduction Maintenance System protected breaker may contain motors that are being started and create large inrush currents over the lowest trip current level. The selection of one of the reduction settings should be deter-mined and selected by a person who is experienced in power system analysis.

### 3.6.1 Actuating and indicating Maintenance Mode protection
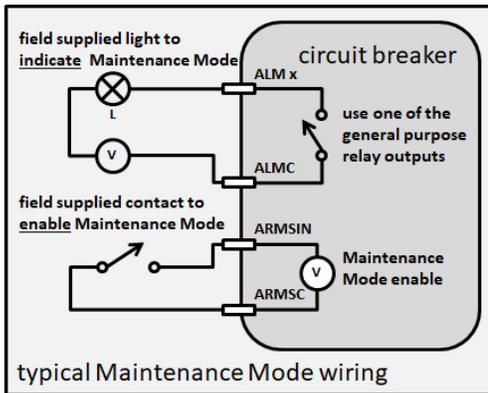


There are three ways to actuate the Maintenance Mode function, locally, remotely using a contact, or remotely using communications. A blue LED on the trip unit always illuminates to confirm when the function is enabled.

- For locally actuating the Maintenance Mode function, use the slide switch on the front of the trip unit. When in the "ON" position, Maintenance Mode is enabled locally and cannot be turned-off remotely or by communications. This method does not require auxil-iary power to the trip unit, and the blue LED on the face of trip unit will light when the trip unit is self-powered.

- Maintenance Mode can be remotely actuated by an external contact wired to the breaker when the local switch is in the "OFF/Remote" position. See Section 5.1: Wiring table for details regarding the contact and wiring length. When Maintenance Mode is enabled by an external contact, it must also be disabled via the external contact. Moving the local switch from "OFF/Remote" to "ON" and back to "OFF/Remote" will not disable Maintenance Mode. Auxiliary power (24 V DC) is required for Maintenance Mode remote activation

- A third method to actuate Maintenance Mode is via communications. This can be done through a modbus register, a communications adapter module (CAM) or by the configura-tion software using the USB port. When Maintenance Mode is enabled by communica-tions, it must also be disabled via communications. Moving the local switch from "OFF/

Remote" to "ON" and back to "OFF/Remote" will not disable Maintenance Mode. Auxiliary power (24 V DC) is required for communications functionality, including maintenance mode remote activation.

Any of the configurable relay contacts can be used to remotely indicate when Maintenance Mode is active. Auxiliary power (24 V DC) is required for the remote indication via a relay contact.

## 3.7 Override

The PXR trip unit provides an override trip function that will trip the circuit breaker at the withstand rating of the circuit breaker frame. This function is factory set and reacts to the peak current level. It is always active regardless of the user's instantaneous adjustment selection. The instantaneous ("INST") indicator shows this cause-of-trip.

## 3.8 Zone selective interlocking (ZSI)

The zone selective interlocking (ZSI) function is an option when ordering the circuit breaker. ZSI functions in conjunction with the short delay and ground fault protection functions. ZSI provides the fastest possible tripping for faults within the zone of protection of the circuit breaker and also provides positive coordination among all circuit breakers in the system (mains, ties, feeders, and downstream circuit breakers). Application note (AP02602002E) is available and has additional detail.

When ZSI is enabled, a fault within the zone of protection will immediately trip the breaker and send a signal to upstream trip units to restrain them from tripping immediately. The restraining signal causes the upstream circuit breakers to follow their set coordination time delays so that the service is interrupted to the isolated fault area only while the fault is cleared in the shortest time possible.

The ZSI is wired using a set of three wires labeled zone in (Zin), zone out (Zout), and zone common (Zcom). These signals are compatible will all Eaton circuit breakers which have the ZSI function. The zone out signal is sent whenever a ground fault pickup or short delay pickup is exceeded. This provides maximum selectivity for coordination with larger upstream circuit breakers.



typical Zone Selective Interlock wiring
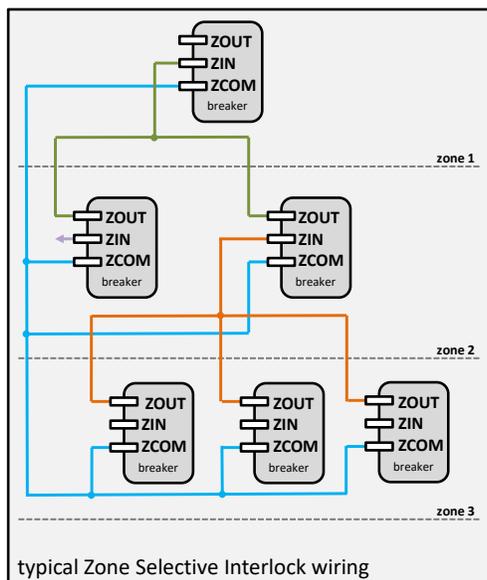
Motor protection circuit breakers are used in the final breaker (lowest zone) in a complete ZSI enabled system. The zone out (Zout) signal is sent whenever a short circuit delay protection or ground fault protection pickup is exceeded. This indicates to the circuit breaker in

the zone above that the fault has been seen and will be acted upon. For all motor protection circuit breakers, the zone in (Zin) signal is not used.

ZSI in the PXR trip unit is fully compatible with ZSI in the Digitrip for Magnum, Digitrip for NRX, OPTIM and 310+ Series C and Series G trip units. If a PXR trip unit has the ZSI option but it is not needed in an application, it may be disabled using the Power Xpert Protection Manager software or the menus on the UI, or the Zout and Zin may be connected to "self-interlock" the unit.



**Zone Selective Interlock - showing Zin on the Motor Protection Breakers not used**
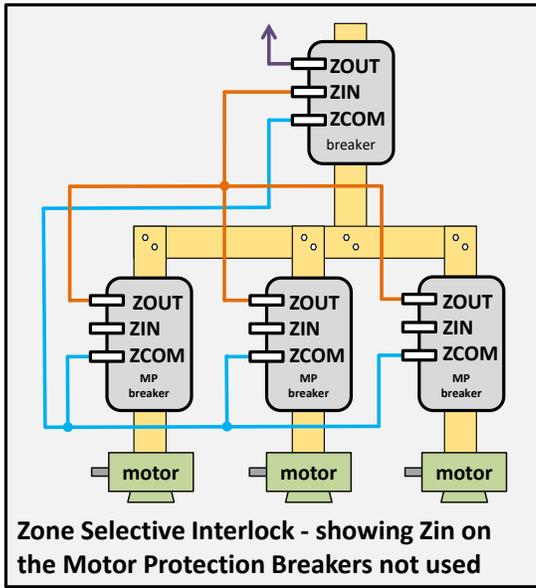
PXR trip units with a display have a visual indication of the ZSI system being active and connected to the other breakers in the ZSI system. A small check-mark will appear next to the ZSI when the trip unit receives a ZSI-IN signal. The general-purpose, configurable, relay contacts may also be programmed to indicate ZSI signals and status.

## 3.9 Operating temperature

All models of trip units are designed for commercial/industrial circuit breaker environments. The frames are rated for load and temperature per individual circuit breaker. As an additional protection, if temperatures in the PXR trip-unit exceed 105 °C (220 °F), a factory-set over-temperature protection feature will trip the circuit breaker to protect the internal electronic components.

# 4 Communication functionality

The PXR family of trip units offers wide support for communications. A USB port is present on all PXR family trip units. All PXR 20, 20D and 25 support external communication adapter modules (CAM) while certain models have built-in Modbus-RTU.

## 4.1 Integrated Modbus - remote terminal unit (RTU)

A Modbus communication port is integrated into the PXR trip unit for certain styles. Breaker status (closed/tripped/open), set points and operating information are all available via Modbus. The trip unit responds to messages from the master using the remote terminal unit (RTU) protocol. Modbus port configuration can be viewed and set using the user interface (UI) or using Power Xpert Protection Manager software. The trip unit uses Modbus function codes 02, 03, 04, 06, 08, and 16 and supports up to 122 registers (244 bytes) in a single Modbus transaction.

The detailed Modbus register map is shown in Section 10: Modbus communication port register map. Auxiliary power (24 V DC) is required for integrated Modbus communications

## 4.2  USB port

The PXR includes a micro-B form USB port on the front of the trip unit.  This USB connection is used in conjunction with your PC running the PXPM software to configure, control, and test the trip unit.  The USB host-side also supplies power to the electronics for configuration when the circuit breaker is not carrying current or when no auxiliary power is applied and for trip unit testing (both trip and no-trip).  A commercial USB battery supply may also be used.

The USB port is covered by the clear, lockable cover to prevent unauthorized modification to settings.  Controlling physical access to the USB port is a key element in your comprehensive cyber security plan.

## 4.3  External communications adapter modules (CAMs)

The PXR 20, 20D and 25 trip units are equipped to handle a flexible and modular system of communication adapter modules (CAMs).  These modules provide communication from the trip unit to a field bus network.  These modules mount on a DIN rail and wired into the trip unit.  Auxiliary power (24 V DC) is required for CAM module communications.

The following networks are supported at the time of manual publication:

| Network | Module name | Instruction leaflet | Wiring harness |
| --- | --- | --- | --- |
| ETHERNET (Modbus TCP) | PXR-ECAM – MTCP | IL0131132EN | Field wired |
| PROFIBUS | PXR-PCAM | IL120009EN | Field wired |

Please consult the respective instruction leaflet for details.

Please visit www.eaton.com/powerdefense and search for communications adapter modules for current offerings.

# 5 External wiring of the trip unit

The PXR family has a rich set of options for integrating the trip unit into a larger system. Wires exit the breaker at the rear through a trough on both the left and right side. The wiring functionality and color coding is identical throughout the family and frames.

## 5.1 Wiring table

Wire colors and function are consistent across all PXRs in the Power Defense family. The styles and options ordered determine which of the following wires are provided.

| PXR trip unit | | | base/ stripe | Wiring side (PD 2, 3, 4 & 5), Terminal (PD6) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Feature | Short name | Color | | PD2 | PD3 | PD4 | PD5 | PD6 | Notes | | |
| Aux Power | AUX +24v | Orange | O | left | left | left | left | C12 | 24 VDC 0.1A 2.4 VA is required. Eaton's PSG family of 24 Vdc output, globally rated power supplies are recommended. | | |
| | AUX 0v | Orange / black | O/Bk | left | left | left | left | C13 | | | |
| ZSI | ZIN | Yellow / black | Y/Bk | left | left | left | left | D1 | Connect to other ZSI enabled breakers in the system. Maximum length of 75 meters (250 feet) using AWG # 22 wire. See PXR for PowerDefense™ User Manual (MN012007EN) Zone Selective Interlocking (ZSI). | | |
| | ZOUT | Yellow / red | Y/R | left | left | left | left | D4 | | | |
| | ZCOM | Yellow | Y | left | left | left | left | D2 | | | |
| Neutral current sensor | N1 | Grey | Gy | left | left | left | left | D5 | Connect to the external neutral current sensor secondary terminals labeled Grey & White. Observe source/Load polarity mark on the neutral current sensor, see IL012302EN.. | | |
| | N2 | White | W | left | left | left | left | D4 | | | |
| Neutral voltage | NV | White/grey | W/Gy | right | right | right | left | D13 | Connect to the neutral voltage sensor module and then the neutral bus ( see IL012316EN). | | |
| Source ground sensor | SGS (dot) | Blue/black | Bl/Bk | na | na | na | left | D6 | Connect to the Ground Fault Secondary Transformer Module. Refer to IL012309EN for module details. | as labeled on module | Output (J2-1) |
| | SGS | Blue/yellow | Bl/Y | na | na | na | left | D7 | | | Output (J2-2) |
| Configurable relays | RLY1 | Black /white | | | | | | | Normally open contacts, closed when the associated function is active. Contacts rated (resistive): PD2 = 0.3A@120/240Vac or 1A@30Vdc, PD3, 4, 5, 6 = 2A@120/240Vac or 2A@30Vdc. See PXR for PowerDefense™ User Manual (MN012007EN) General Purpose Relay Mapping for a detailed list of functions supported. | | |
| | RLY2 | Black / red | | | | | | | | | |
| | RLY3 | Black / violet | | | | | | | | | |
| | RLYC | Black | | | | | | | | | |
| Form C AUX contact | NC_AUX_C | Blue | Bl | right | na | na | na | na | One 1NO/1NC (Form C) auxiliary contact is automatically factory installed for all Frame 2 Power Defense breakers with electronic trip units. Contacts rated (resistive): 6A@120/240Vac or 2A@30Vdc. | | |
| | NO_AUX_C | Red | R | right | na | na | na | na | | | |
| | COM_AUX_C | Black | Bk | right | na | na | na | na | | | |
| Modbus RTU | RTU_D(+) | Green / black | Gn/Bk | left | left | left | right | D8 | Modbus network, max. 32 nodes, max. length 1200 meters (4000 ft.). Cable: twisted-pair foil shield w/ drain, 120 ohms impedance, rated for the application (typical Belden 3105A or | as labeled on PXG & PXDB | B(+) |
| | RTU_D (-) | Green / red | Gn/R | left | left | left | right | D9 | | | A(-) |
| | RTU_GND | Green | Gn | left | left | left | right | D10 | | | CMN |
| Maintenance Mode | MM | Brown /white | Br/W | na | left | left | right | C1 | Remotely activate ARMS using an external dry contact, use one contact for per breaker. This is a low-voltage signal, high quality gold contact required, max length 3 meters (15 feet). | | |
| | MM (RTN) | Brown | Br | na | left | left | right | C2 | | | |
| Communication adapter (CAM) link | CMMC (GND) | Violet | V | right | left | left | right | C5 | Connect directly to selected CAM module. Use 2x twisted pair cable w/ shield and drain, max. length 3 meters (3.2 ft.). Refer to CAM Instruction Leaflets for detail (ECAM: IL0131132EN,Profibus: IL120009EN). | as labeled on CAM module | 0v/C/AGND (TC-2) |
| | CMM1 | Violet / green | V/W | right | left | left | right | C7 | | | RX+/CMM1 (TC-3) |
| | CMM2 | Violet / yellow | V/R | right | left | left | right | C6 | | | RX-/CMM2 (TC-4) |
| | CMM3 | Violet / white | V/Gr | right | left | left | right | C3 | | | TX+/CMM3 (TC-5) |
| | CMM4 | Violet / green | **V/Y** | right | left | left | right | C4 | | | TX-/CMM4 (TC-6) |

Note: Available wiring connections depend on optional features selected.
PD2 wires are 0.205 mm2 (24 AWG) size, PD3, 4, 5, 6 wires are 0.326 mm2 (22 AWG).
Wires are 0.75 meters (30 inches) long.

## 5.2  Auxiliary power

Providing auxiliary power to the PXR trip unit will provide full functionality and communications even when the circuit breaker is open or when the circuit breaker is under very light load such that the self-powering current transformer cannot provide sufficient energy to fully power the trip unit.

The power requirements are: 24 VDC +/- 10%, 1.00 mA.  The Eaton PSG family of power supplies with 24 V output are recommended.  One supply can feed multiple PXR trip units if desired. Please reference figure in section 5.3

**REMEMBER**: Auxiliary power is not required to provide current protection features. Protection is active well before any overload.  The trip unit begins to power-up at very low levels of current (approximately 20% of the frame rating).  For single-phase applications, self-power occurs at a higher current threshold (approximately 30% of the frame rating.  Aux power is required to provide Modbus RTU / ECAM communications and for Programmer relay functionality.

## 5.3  General purpose relay mapping

The PXR family supports optional general purpose relay contacts (1 to 3 relays depending on the PXR model and the breaker frame).  Any relay in the PXR can be configured to any one of the functions.  The mapping is conveniently done using the Power Xpert Protection Manager software.  Relays require auxiliary power to operate.

| Function name | Description of relay operation: | |
| --- | --- | --- |
| | "The relay will close when..." | "The Relay will open when..." |
| Aux contact | breaker is closed. | breaker is open. |
| Bell contact | breaker is tripped. | breaker is not tripped (open or closed). |
| Trip alarm - overload | there is a long or over-temperature trip. | RESET button is pressed or communications reset command received. |
| Trip alarm - neutral current | there is a neutral current trip. | RESET button is pressed or communications reset command received. |
| Trip alarm - short delay | there is a short delay trip. | RESET button is pressed or communications reset command received. |
| Trip alarm - instantaneous | there is an instantaneous trip. | RESET button is pressed or communications reset command received. |
| Trip alarm - short circuit | there is a short, inst or override trip. | RESET button is pressed or communications reset command received. |
| Trip alarm - ground fault | there is a ground fault trip. | RESET button is pressed or communications reset command received. |
| Trip alarm - (ARMS) Maintenance Mode | there is a Maintenance Mode trip. | RESET button is pressed or communications reset command received. |
| Trip alarm - all trips | there is any type of protective current (all the above) trip. | RESET button is pressed or communications reset command received. |
| Alarm - high load alarm 2 | current flow is greater than set point (adjustable from 50% to 120% of Ir). Note: alarm1/alarm2 LED will BLINK. | current flow falls 5% below the set point. |
| Alarm - high load alarm 1 | current flow is greater than set point (adjustable from 50% to 120% of Ir). Note: the alarm1/alarm2 LED will ON. | current flow falls 5% below the set point. |
| Alarm - high temperature | temperature exceeds 5C below the level of the temperature trip setting. | temperature falls 5C below the trip setting. |
| Alarm -ground fault pre alarm | ground current is greater than the set point (adjustable from 50% to 100%). | ground current falls 5% below the set point. |
| Alarm - thermal memory | the thermal memory value is >75%. | the thermal memory value is <70%. |
| Alarm - watchdog and aux power | auxiliary power is active and the trip unit is healthy and operating. | there is an error in the trip unit from any of the self-diagnostics. |
| Alarm - low battery | the battery is below 1 bar (25%). | the battery value is 1 bar (25%) or higher. |
| Fault - internal | there is an internal fault detected. | RESET button is pressed or communications reset command received. |
| Fault - health | the health value is below 25%. | the health value is at or above 25%. |
| Fault -communication | any external communications error occurs. | RESET button is pressed or communications reset command received. |
| Alarm - all fault alarms | any of the above 4 faults are active. | all of the above four faults are inactive. |
| Maintenance Mode active | the trip unit is in the Maintenance Mode. | when the trip unit exits Maintenance Mode. |
| ZSI active | the ZSI function active. | ZSI is not active. |
| ZSI input received | a ZSI INPUT signal is received. | RESET button is pressed or communications reset command received. |
| ZSI output sent | a ZSI OUTPUT signal is sent. | RESET button is pressed or communications reset command received. |
| COMM open breaker pulsed | an OPEN breaker command from any of the communications channels is received. | two seconds after the OPEN breaker command is received. |

# 5 External wiring of the trip unit

| Function name | Description of relay operation:<br>"The relay will close when..." | "The Relay will open when..." |
|---|---|---|
| Output | an output ON command is received on any of the communications channels. | an output OFF command is received on any of the communications channels. |

**Additional relay operation for motor protection PXR25**

| Function name | "The relay will close when…" | "The Relay will open when…" |
|---|---|---|
| Trip alarm - Over Voltage | voltage is greater than pickup for longer than the pickup time (See setpoint Group 5 configuration) | RESET button is pressed or communications reset command received. |
| Trip alarm - Under Voltage | voltage is less than pickup for longer than the pickup time (See setpoint Group 5 configuration) | RESET button is pressed or communications reset command received. |
| Trip alarm - Voltage Unbalance | difference between the max and min voltages of all three phases is greater than pickup for longer than the pickup time (See setpoint Group 5 configuration) | RESET button is pressed or communications reset command received. |
| Trip alarm - Current Unbalance | difference between the max and min Current of all three phases is greater than pickup for longer than the pickup time (See setpoint Group 5 configuration) | RESET button is pressed or communications reset command received. |
| Trip alarm - Reverse Power | reverse real power is greater than the pickup for longer than pickup time (See setpoint Group 5 configuration) | RESET button is pressed or communications reset command received. |
| Trip alarm - Phase Reversed | phase reversed for >200ms (See setpoint Group 5 configuration) | RESET button is pressed or communications reset command received. |
| Trip alarm - Phase Loss | phase is less than 75% of other phases for longer than pickup time (See setpoint Group 5 configuration) | RESET button is pressed or communications reset command received. |
| Alarm - Over Voltage | voltage is greater than pickup for longer than the pickup time (See setpoint Group 5 configuration) | voltage falls below the setpoint |
| Alarm - Under Voltage | voltage is less than pickup for longer than the pickup time (See setpoint Group 5 configuration) | voltage rises above the setpoint |
| Alarm - Voltage Unbalance | difference between the max and min voltages of all three phases is greater than pickup for longer than the pickup time (See setpoint Group 5 configuration) | min an max voltage difference are within pickup |
| Alarm - Current Unbalance | difference between the max and min Current of all three phases is greater than pickup for longer than the pickup time (See setpoint Group 5 configuration) | min an max currents difference are within pickup |
| Alarm - Reverse Power | reverse real power is greater than the pickup for longer than pickup time (See setpoint Group 5 configuration) | reverse power is less than the pickup |
| Alarm - Phase Reversed | phase reversed for >200ms (See setpoint Group 5 configuration) | phase has been corrected |
| Alarm - Phase Loss | phase is less than 75% of other phases for longer than pickup time (See setpoint Group 5 configuration) | phase loss has been restored |

Relay Default settings:

Relay #1 - if the trip unit has Arc Flash Reduction Maintenance System then this is programmed to be Maintenance Mode Active

Relay #1 - if there is no Arc Flash Reduction Maintenance System then this relay is programmed to be Alarm - ALL TRIPS

Relay #2 - if the unit is has ground fault protection - Ground Fault Alarm (pre alarm)

Relay #2 - if the unit has no ground fault protection – Alarm HighLoad1

+  24VDC ± 10%   3

Control power

RLY1   RLY2   RLY3

RLYC   Bk   Bk/R   Bk/W   Bk/Y   O   O/Bk

② ② ②

| Color code | Wire colors PD 2, 3, 4 & 5 | Terminal PD6 only | Name |
|---|---|---|---|
| Bk | Black | C11 | RLYC |
| Bk/R | Black/Red | C8 | RLY1 |
| Bk/W | Black/White | C9 | RLY2 |
| Bk/Y | Black/Yellow | C10 | RLY3 |
| O | Orange | C12 | AUX24V |
| O/Bk | Orange/Black | C13 | AUX0V |

Power Defense MCCB

**Notes:**
1. All relays can be mapped to different functions.

2. Factory default:

   RLY 1 = Remote Indicator/Maintenance Mode indication.

   RLY 2 = High Load alarm/Ground Fault alarm.

   RLY 3 = Trip
   Relay contact rating (resistive):
   PD2 = 0.3A@120/240Vac or 1A@30Vdc
   PD3, 4, 5, 6 = 2A@120/240Vac or 2A@30Vdc

3. The trip unit should be fed from a separate galvanically isolated + 24 voltage DC supply.

| Frame | Relays | Field kit cat # |
|---|---|---|
| PD2 w/modbus | 1 | PDG2XMODRTURELAY |
| PD2 w/o modbus | 2 | PDG2XRELAYS |
| PD3 | 2 | na |
| PD4 | 2 | na |
| PD5 | 3 | PDG56XRELAYS |
| PD6 | 3 | PDG56XRELAYS |

**Auxiliary power and relay wiring**

## 5.4 Neutral voltage sensor

For applications with a neutral conductor external to the circuit breaker, a small module is provided. This module has wire leads and must be used between the neutral conductor and the voltage sensor input to the trip unit. The neutral voltage provides a reference to accurately measure voltages in "Y" connected power system.

| Color code | Wire colors PD 2, 3, 4 & 5 | Terminal PD6 only | Name |
|---|---|---|---|
| Gy | Grey | D5 | N1 |
| W | White | D4 | N2 |
| W/Gy | White/Grey | D13 | NV |

| Frame | Connection | Catalog# | Trip unit rating where used |
|---|---|---|---|
| PD2 | Cable type | PDG2XNCTD0100 | 60A, 63A, 100A |
| PD2 | Cable type | PDG2XNCTD0225 | 150A, 160A, 225A, 250A |
| PD2 | Busbar type | PDG2XNCTB0100 | 60A, 63A, 100A |
| PD2 | Busbar type | PDG2XNCTB0225 | 150A, 160A, 225A, 250A |
| PD3 | Busbar type | PDG3XNCTB0600 | 125A, 250A, 400A, 600A, 630A |
| PD4 | Busbar type | PDG4XNCTB0800 | 800A, 1000A |
| PD5 | Busbar type | PDG5XNCTB1200 | 800A, 1200A, 1600A |
| PD6 | Busbar type | PDG6XNCTB2500 | 1600A, 2000A, 2500A |

**Notes:**
1. Sensor is customer wired to sense neutral currents. This is required for 3-phase, 4-wire residual ground fault (applicable for trip units having G protection).
2. See Instruction Leaflet IL012302EN.
3. Voltage sensor is customer wired to neutral bus.
4. See Instruction Leaflet IL012316EN.
5. The External Neutral Sensor is not included. It must be purchased separately using the catalog numbers in the adjacent table.
6. The Voltage Sensor Module is included.

**External neutral sensing**

**IMPORTANT:** This module contains circuitry to reduce the line voltage to levels accepted by the trip unit. Failure to use this module for neutral sensing may cause permanent damage to the trip unit.

# 6  Power Xpert® Protection Manager - configuration software

Eaton's PXPM is a Microsoft® Windows-based software that configures, controls, monitors and tests Eaton PXR trip units.  The user can create, modify, and save configurations for a PXR trip unit.  The software further allows user to reset trip units, adjust trip unit's date and time, capture current or voltage waveforms, and perform trip or no-trip tests.

The software is available as a download from the following link: www.eaton.com/PXPM.

The Power Xpert Protection Manager provides two key features.  You may choose set point configuration to create, modify and save configurations for PXR trip units.  The remote control and test offers users the ability to reset trip units, adjust trip unit time, capture current or voltage waveforms, perform trip or no-trip tests and generate test reports.

## 6.1  Set point configuration through PXPM

Key to configuring your trip unit is the configuration screen, which allows users to view and edit set points.

Typical actions available from the configuration screens include:

- View and edit set points - For each set point, its range, step size and description are shown in the tooltip when a user hovers the mouse cursor over that set point. A blank space for a set point indicates that user may work in offline mode, and cannot edit the read-only set point.
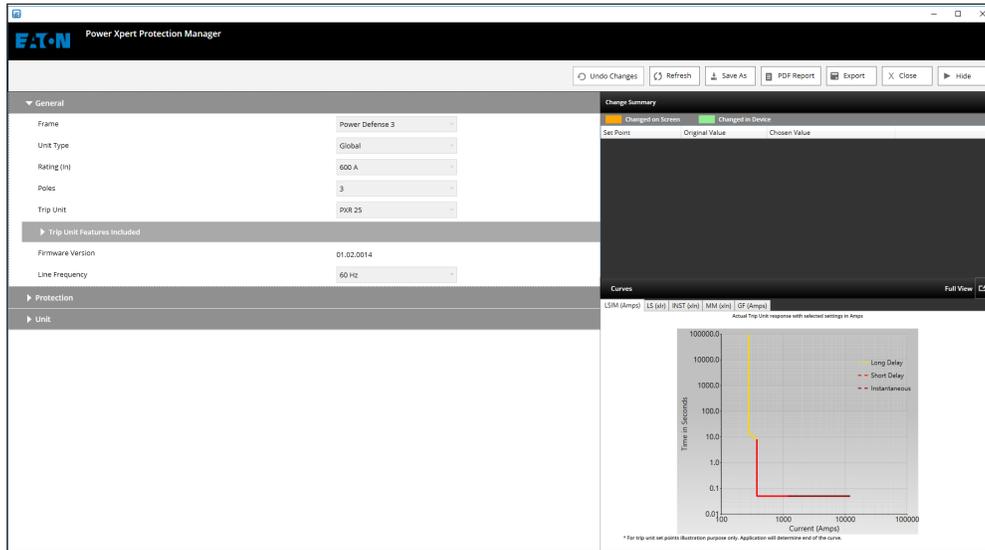


- Change trip unit - Takes user back to "Create New Offline Setting Screen" to modify trip unit's settings.

- Save (visible in open settings) - Saves changes in set points. Note that if set points have already been saved to a file, click save button will overwrite the file with new set points.

- Save as - Saves set points to a configuration file. Users will be prompted to select a location and a name for the configuration file.

- Export - Sends the set points to a trip unit. The trip unit must be connected to the computer through a USB to Micro-USB cable for successful operation.

- Curves - Shows a dynamic representation of the trip-curve as you are configuring the set points. It displays long and short delay protection curves, as well as ground (earth) and instantaneous protection curves.
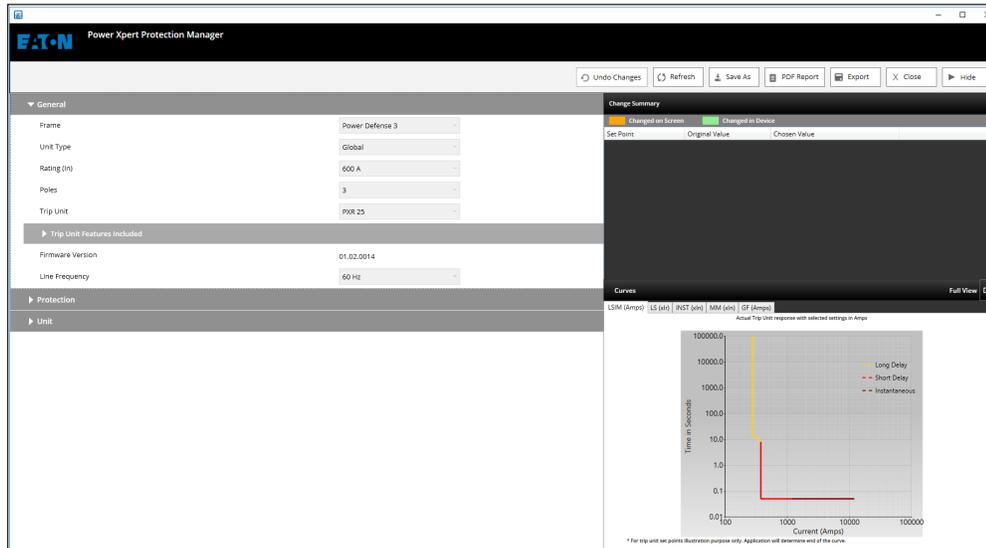
- Change summary - Displays a summary of set points that have been changed in the present session.  Both original and changed values are displayed.

- Extract to PDF - Exports all set points to a portable document format (PDF) file.  Modified set point parameters are highlighted in the exported PDF file.

- Undo all changes - Resets all set points to their original values.

## 6.2  Remote control

The remote control section allows users to reset trip unit, change trip unit date and time, and capture waveforms.

- Reset trip unit - The internal record of causes of trip, diagnostics, health and metering data can be reset in this set of screens.

- Change trip unit date and time - The internal clock that keeps track of time can be set to the desired date and time.

- Capture waveform (license required) – The PXR trip units allow user to manually capture both current and voltage waveforms by simply clicking the mouse.  A full-cycle of waveform is captured, and displayed in the PXPM software.
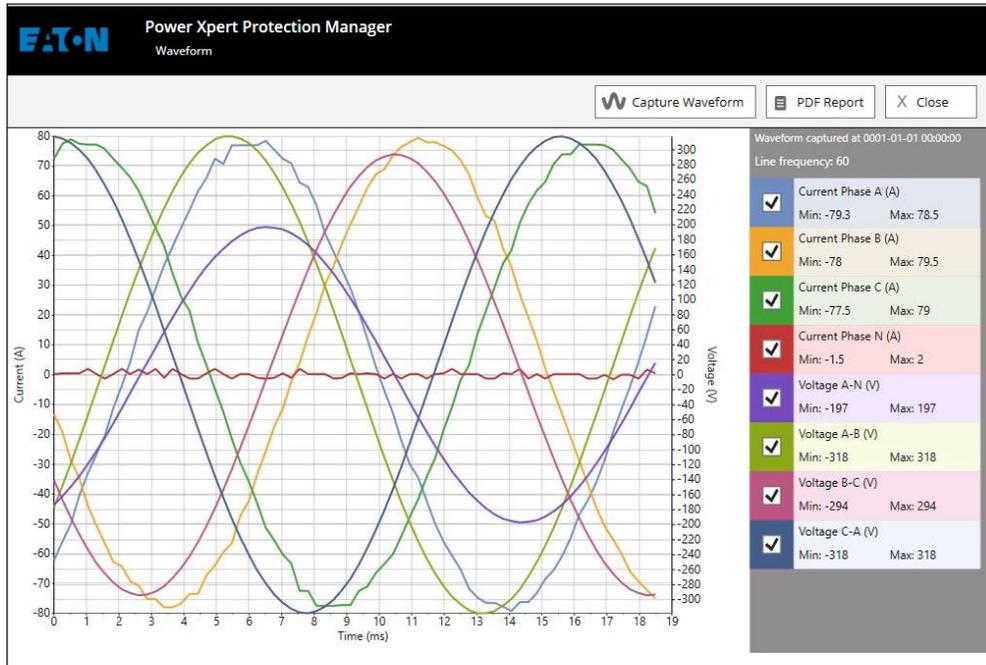
## 6.3 Testing the breaker and trip unit

The test functions require no extra equipment, and provide a battery of testing possibilities via the USB communication. The PXR trip unit has four built-in test modes available for use. The built-in test modes are secondary injection, simulated, open breaker, and current sensor continuity. Secondary injection, and simulated test can be configured to optionally open the breaker. To perform any of these test procedures, a four-digit password, factory set to 0-0-0-0 is required. The password may be changed by the user.
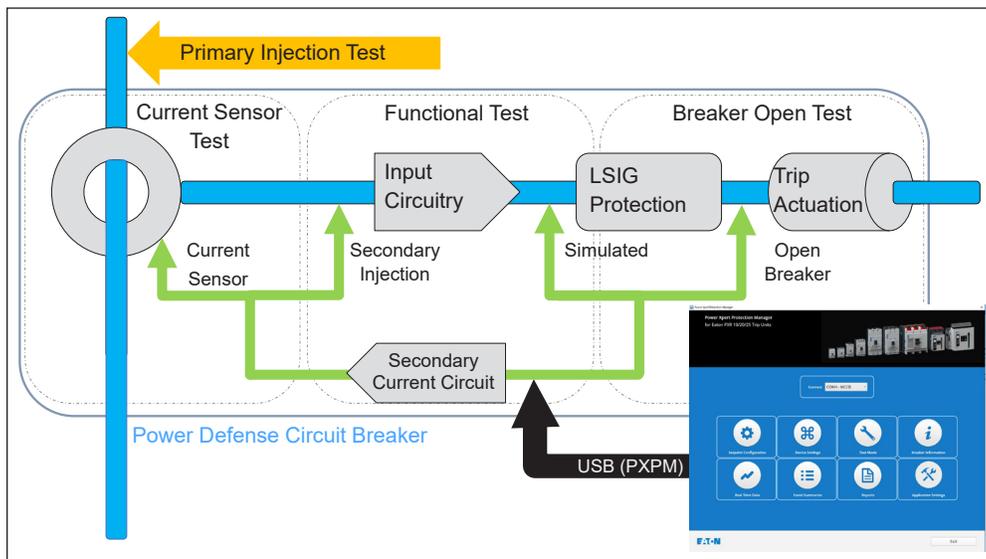
### 6.3.1 Functional Test – Secondary Injection (License Required)

Secondary injection utilizes a separate circuit that injects a signal in parallel with the output of the current sensor, representing the output of the sensor. All the built-in protection circuitry, and routines respond per the settings in the breaker. The PXPM software initiates the testing of long delay trip, short delay trip, instantaneous trip, maintenance mode, and ground (earth) fault trip via the USB communication. The software allows for testing on any phase, including neutral. The trip unit's display, or communications can be used to observe the current being injected, and the elapsed time until trip. Complete testing of the trip unit can be accomplished when a current sensor continuity test is used in conjunction with secondary injection test. The complete testing of the breaker may be an acceptable alternative to a primary injection test of the breaker. Secondary injection testing and current sensor continuity testing when used in place of primary injection testing will result in less wear on the breaker.

**Tip:** If the trip unit is equipped with ground fault protection, and another function is being tested, temporarily turn off the ground fault functionality in the settings of the trip unit. Failure to do so may result in unintentional ground trip during testing. Remember to turn it back on after completing the testing.

### 6.3.2 Functional Test – Simulated (License Required)

Simulated functional testing sets values within the trip unit to the level desired via PXPM. Simulation can be helpful to verify various points on the time current curve, and operation of the breaker based on different situations. Simulation mode is also helpful for verifying correct communications settings, and scaling when used in conjunction with an operator interface, PLC, SCADA, or other devices that are reading the real-time data from the PXR trip unit.

### 6.3.3 Current Sensor Continuity Test for Frames 3-6 (License Required)

The current sensor test utilizes a separate circuit to create a signal that is directed though the Rogowski coil. This signal will verify continuity and functionality of the Rogowski coil.

### 6.3.4 Open Breaker Test

The open breaker test will exercise the electrical and mechanical hardware required to physically open the breaker.

### 6.3.5 Primary Injection Test

Primary injection testing may be performed on a breaker equipped with PXR trip units. Please be aware that health monitor within the trip unit will register such a test, and this may result in a lower health status value. Please see chapter 8 Health Monitor for more details on the Health Monitor and how to reset.

### 6.3.6 Testing

When beginning a test session, parameter values for "As Found" are captured. Selecting various test options, setting the current to be injected, executing the tests, and recording the results can be done in multiple passes within one test session. Parameter values for "As Left" are captured when the test operation is stopped. Any difference between "As Found" and "As Left" parameter values will be highlighted.

The Generate Report function will record the testing results in a PDF file. The user can input information regarding the customer and breaker's location, environment, condition, etc. as part of the report. The report includes the settings and results of all tests run during that session.

## 6.4  Record keeping

The Power Xpert Protection Manager software provides PDF reports of configuration and test results.  If desired, make a copy and attach it to the interior of the circuit breaker cell door or another visible location.  This information should be used and maintained by those personnel in your organization that have the responsibility for protection equipment.

# 7 Event, alarm, and trip recording with waveform capture
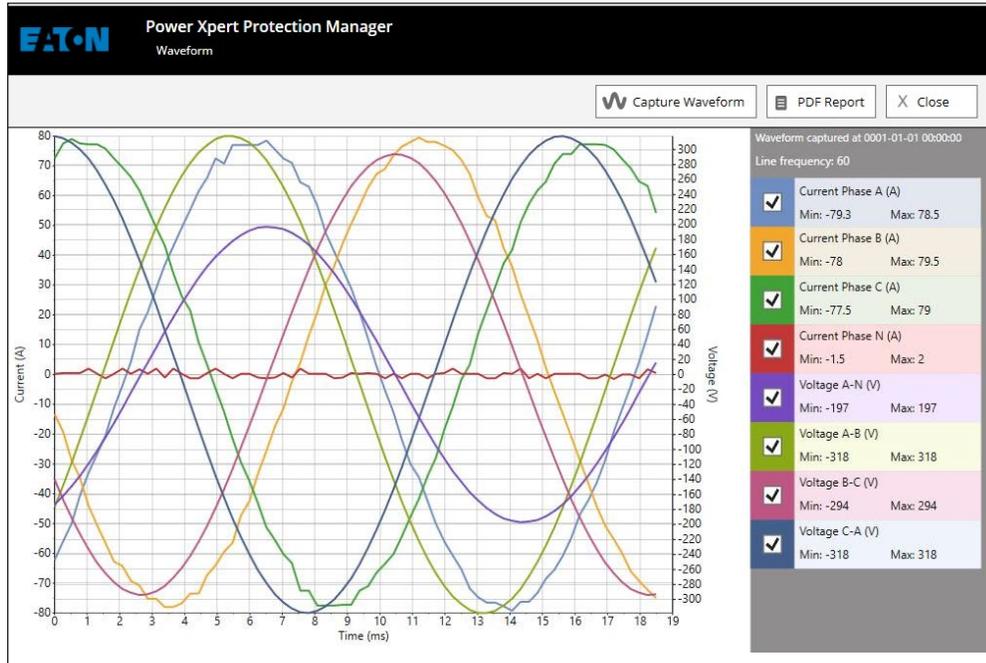


The PXR trip unit will record information surrounding events, alarms, and trips into a set of logs. The information is easily viewed using PXPM software. For simple events, only the reason and a time-stamp (based on the trip unit's real-time clock) are stored. Important events additionally store a snap-shot of real-time values (currents and voltages). The most important events store additional information, storing waveforms of current and voltage experienced during the event as long as auxiliary power is applied. For a trip waveform, ten cycles (six pre-event, four post-event) are saved for review using PXPM software.

Each log can store a set number of events and is managed as a first-in first-out buffer (FIFO). As the information is stored for the most recent event, the information from the oldest event is eliminated.

## 7.1 Trigger and data log matrix

| What triggers a capture: | Event cause Time-stamp | Current: IA, IB, IC, IN, IG / Voltages: VAB, VBC, VCA, VAN, VBN, VCN (PXR 25 only) / Power and demand: watts, Vars, VA (PXR 25 only) / Power factor (PXR 25 only) / Line frequency / Breaker operations count / Trip unit internal temperature | Waveform of: IA, IB, IC, IN, IG / Waveform of: VAB, VBC, VCA, VAN, VBN, VCN (PXR25) | |
|---|:---:|:---:|:---:|---|
| Event - power up - clock ok | ● | | | |
| Event - power up - clock bad | ● | | | |
| Event - set points download | ● | | | |
| Event - Enter test mode | ● | | | |
| Event - exit test mode | ● | | | |
| Event - test complete | ● | | | |
| Event - enter maintenance mode | ● | | | Indicator also illuminates |
| Event - exit maintenance mode | ● | | | |
| Event - time change (if > 60 seconds) | ● | | | Previous time is recorded |
| Alarm - calibration | ● | | | |
| Alarm - set points fault | ● | | | |
| Alarm - battery low voltage | ● | | | |
| Alarm - low control voltage | ● | | | |
| Alarm - RTC error | ● | | | |
| Alarm - NV memory error | ● | | | |
| Alarm - watchdog timer | ● | | | |
| Alarm - long delay pickup (test mode) | ● | ● | | |
| Alarm - ground fault (test mode) | ● | ● | | |
| Alarm - trip actuator fault | ● | | | |
| Alarm - operations count | ● | | | |
| Alarm - long delay pickup | ● | ● | ● | |
| Alarm - ground fault | ● | ● | ● | |
| Alarm - high load | ● | ● | ● | |
| Alarm - neutral current | ● | ● | ● | |
| Trip - over temperature | ● | ● | | |
| Trip - test | ● | ● | | |
| Trip - long delay | ● | ● | ● | |
| Trip - short delay | ● | ● | ● | |
| Trip - instantaneous | ● | ● | ● | All trips include four cycles before trip and six cycles after the trip and can be displayed in the waveform capture. |
| Trip - ground | ● | ● | ● | |
| Trip - maintenance mode | ● | ● | ● | |
| Trip - neutral | ● | ● | ● | |

# 8 Health Monitor

## 8.1 Health Monitor description and function

The PXR 20, 20D, and 25 trip units include an innovative algorithm to determine health Status. The parameters that are monitored by this algorithm include short-circuits, overloads, operations, temperature, and run-time. These parameters can provide a host of individual insights while the combination of all of them provide an overall picture of the condition of the breaker that can be used for predictive maintenance and furthermore system reliability. This Health monitor is a tool and is not a replacement for establish breaker maintenance or replacement practices.

The Heath of the breaker can be accessed through Power Xpert Protection Manager (PXPM). A programable relay can also be configured to close at a user defined level. Depending on options, reading the % health over communications, as well as from the LCD screen on the PXR 20D and 25 is also possible.
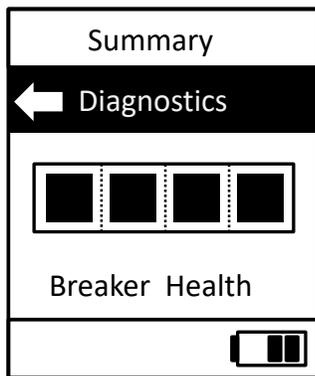


When the summary of life is indicating 25% or less, the breaker should be inspected for possible replacement.

## 8.2 Health Monitor values

Please see available counters and data in 11.3.2 Modbus Register Map Real-time data object registers

## 8.3 Health Monitor Reset procedure

The counters in the Health monitor can be reset. The reset procedure can reset all health counters or subsets of counters. It is highly recommended that the Health counters are only reset by someone with knowledge of the power system. Resetting counters on a unit that has encountered multiple high power events could lead to false indication of breaker health.

### 8.3.1 Power Xpert Protection Manager (PXPM)

Go to Device Settings:



Reset Trip Unit::



Choose counters to reset:
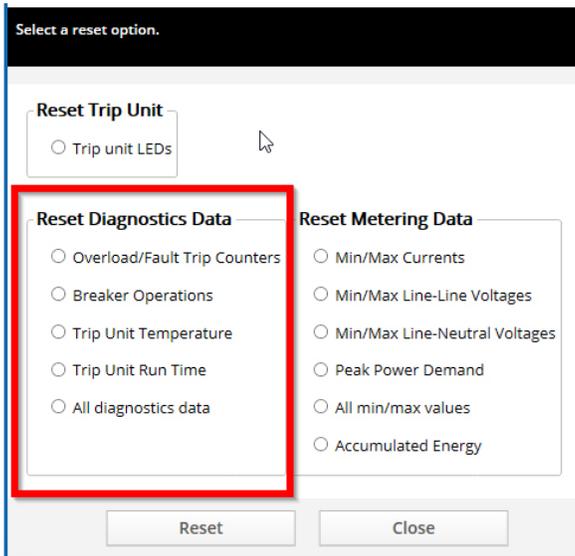
Press Reset then enter password (Default is 0-0-0-0), then OK and confirm.
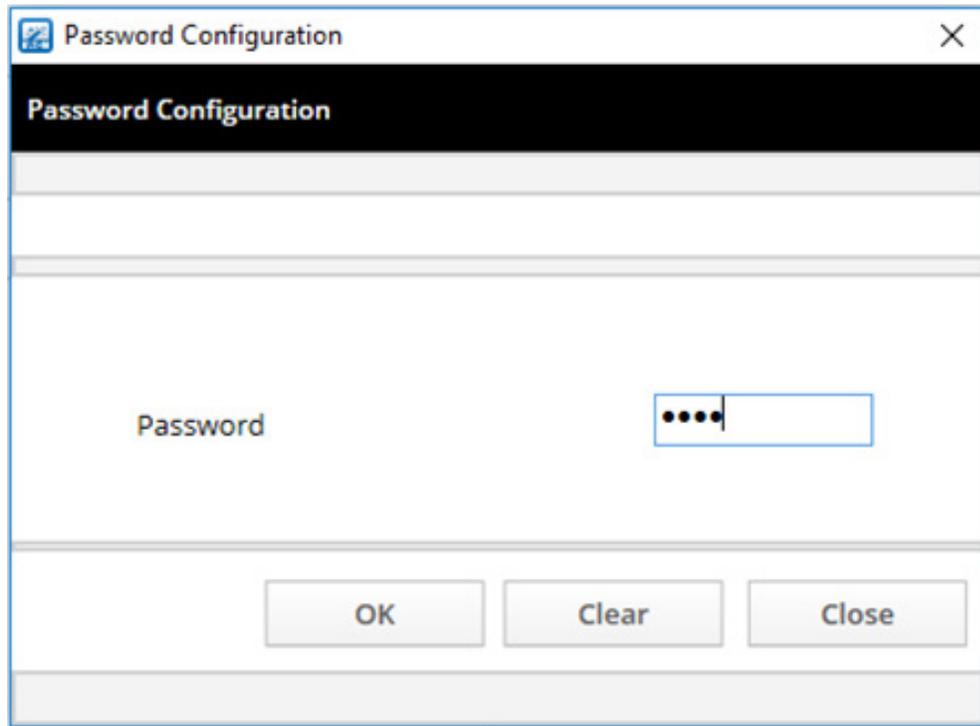


### 8.3.2  Display PXR20D/25 Front

Main menu => Diagnostics => Reset => Enter Password =>Trips/Operations/Temperature/Runtime/All Diag.

### 8.3.3 Communications

See section 10.3.6 Remote control for options on resetting health registers using communications.

## 9  Maintenance of the trip unit

Minimal maintenance is required.  Keep the clear plastic cover in place regardless of if you lock it or not to help keep the front of the unit clear of dirt.  Do not insert any foreign objects into the USB port; this may damage the connector's contacts.  Do not subject the trip unit to any harsh chemicals or gasses to preserve the original look and feel of the unit.

### 9.1  Replacing the battery

The battery is provided in certain PXR styles to maintain the LED indication of the cause-of-trip.  A battery icon at the bottom of the display indicates remaining battery life.  The battery plays no part in the protection function of the trip system.  The battery can be replaced at any time, even while the circuit breaker is in-service, without affecting the operation of the circuit breaker or its protection functions.

The 3 V lithium battery, type CR1216 ("coin-cell"), is easily removed and replaced; pull to remove the battery tray, remove the old battery from the holder, replace with new one (observe proper polarity as marked on the tray), and then re-insert the battery tray into the slot on the trip unit.  In the PD2, remove the cover above the handle and pockets using a small screwdriver to access the battery.  Accidentally installing the battery in the reverse direction will not harm the battery or the trip unit, but will defeat the function of the battery.

### 9.2  Replacing the ETU

Although not typically needed, certain styles of the PXR trip unit can be changed in the field to add features.  The Instruction Leaflet for each trip unit includes instructions for possible replacement and/or addition of features.

## 10  Available protection settings

Available settings for any circuit breaker are a function of the frame and trip unit.  Please consult the following information to help identify the frame, trip unit and available settings.

### 10.1  Identifying the trip unit

The catalog numbers for circuit breakers that include the PXR trip units use the following schema:
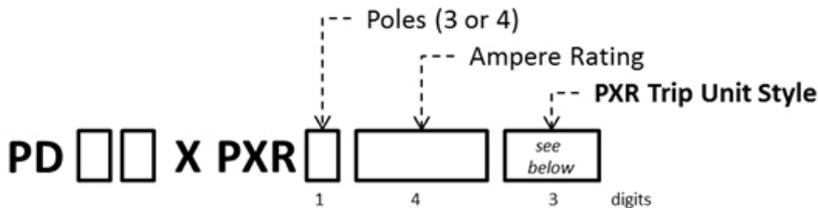
The PXR trip unit style codes are shown in the table:

| Trip unit style | Trip unit model and protection function | Communication, relay, maintenance mode, zone interlock (options) |
|---|---|---|
| B1N | PXR10 LI | |
| B2N | PXR10 LSI | |
| E2N | PXR20 LSI | |
| E2R | PXR20 LSI | Relays |
| E2Z | PXR20 LSI | ZSI and relays |
| E2M | PXR20 LSI | Modbus and relays |
| E2C | PXR20 LSI | CAM and relays |
| E2W | PXR20 LSI | ZSI and Modbus (and relays) |
| E2X | PXR20 LSI | ZSI and CAM (and relays) |
| E3R | PXR20 LSIG | Relays |
| E3Z | PXR20 LSIG | ZSI and relays |
| E3M | PXR20 LSIG | Modbus and relays |
| E3C | PXR20 LSIG | CAM and relays |
| E3W | PXR20 LSIG | ZSI and Modbus (and relays) |
| E3X | PXR20 LSIG | ZSI and CAM (and relays) |
| E4R | PXR20 LSI ARMS | Relays |
| E4Z | PXR20 LSI ARMS | ZSI and relays |
| E4M | PXR20 LSI ARMS | Modbus and relays |
| E4C | PXR20 LSI ARMS | CAM and relays |
| E4W | PXR20 LSI ARMS | ZSI and Modbus (and relays) |
| E4X | PXR20 LSI ARMS | ZSI and CAM (and relays) |
| E5R | PXR20 LSIG ARMS | Relays |
| E5Z | PXR20 LSIG ARMS | ZSI and relays |
| E5M | PXR20 LSIG ARMS | Modbus and relays |
| E5C | PXR20 LSIG ARMS | CAM and relays |
| E5W | PXR20 LSIG ARMS | ZSI and Modbus (and relays) |
| E5X | PXR20 LSIG ARMS | ZSI and CAM (and relays) |
| D2M | PXR20D LSI | Modbus and relays |
| D2D | PXR20D LSI | Modbus and CAM (and relays) |
| D2W | PXR20D LSI | ZSI and Modbus (and relays) |
| D2Y | PXR20D LSI | ZSI, Modbus, and CAM (and relays) |
| D3M | PXR20D LSIG | Modbus and relays |
| D3D | PXR20D LSIG | Modbus and CAM (and relays) |
| D3W | PXR20D LSIG | ZSI and Modbus (and relays) |
| D3Y | PXR20D LSIG | ZSI, Modbus, and CAM (and relays) |
| D4M | PXR20D LSI ARMS | Modbus and relays |
| D4D | PXR20D LSI ARMS | Modbus and CAM (and relays) |
| D4W | PXR20D LSI ARMS | ZSI and Modbus (and Relays) |
| D4Y | PXR20D LSI ARMS | ZSI, Modbus, and CAM (and relays) |
| D5M | PXR20D LSIG ARMS | Modbus and relays |
| D5D | PXR20D LSIG ARMS | Modbus and CAM (and relays) |
| D5W | PXR20D LSIG ARMS | ZSI and Modbus (and relays) |
| D5Y | PXR20D LSIG ARMS | ZSI, Modbus, and CAM (and relays) |
| P2M | PXR25 LSI | Modbus and relays |
| P2D | PXR25 LSI | Modbus and CAM (and relays) |
| P2W | PXR25 LSI | ZSI and Modbus (and relays) |
| P2Y | PXR25 LSI | ZSI, Modbus, and CAM (and relays) |
| P3M | PXR25 LSIG | Modbus and relays |
| P3D | PXR25 LSIG | Modbus and CAM (and relays) |
| P3W | PXR25 LSIG | ZSI and Modbus (and relays) |

| Trip unit style | Trip unit model and protection function | Communication, relay, maintenance mode, zone interlock (options) |
|---|---|---|
| P3Y | PXR25 LSIG | ZSI, Modbus, and CAM (and relays) |
| P4M | PXR25 LSI ARMS | Modbus and relays |
| P4D | PXR25 LSI ARMS | Modbus and CAM (and relays) |
| P4W | PXR25 LSI ARMS | ZSI and Modbus (and relays) |
| P4Y | PXR25 LSI ARMS | ZSI, Modbus, and CAM (and relays) |
| P5M | PXR25 LSIG ARMS | Modbus and relays |
| P5D | PXR25 LSIG ARMS | Modbus and CAM (and relays) |
| P5W | PXR25 LSIG ARMS | ZSI and Modbus (and relays) |
| P5Y | PXR25 LSIG ARMS | ZSI, Modbus, and CAM (and relays) |
| B8N | PXR10 LSI motor | |
| P8M | PXR25 LSI motor | Relay ready and Modbus ready |
| P8D | PXR25 LSI motor | Relay ready, Modbus ready, CAM onboard |
| P8W | PXR25 LSI motor | Relay ready, Modbus ready, ZSI onboard |
| P8Y | PXR25 LSI motor | Relay ready, Modbus ready, CAM onboard, ZSI onboard |
| P9M | PXR25 LSIG motor | Relay ready and Modbus Ready |
| P9D | PXR25 LSIG motor | Relay ready, Modbus ready, CAM onboard |
| P9W | PXR25 LSIG motor | Relay ready, Modbus ready, ZSI onboard |
| P9Y | PXR25 LSIG motor | Relay ready, Modbus ready, CAM onboard, ZSI onboard |

## 10.2  Detailed settings tables

The following set of tables details the settings available in each PXR and circuit breaker frame style.

### 10.2.1 PDG2 PXR 10 Settings (LI)

| Frame | 60 A | 100 A | 150 A | 225 A | All | 60 A | 100 A | 150 A | 225 A |
|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | Instantaneous | | | |
| Dial | Ir (A) | | | | | Ii (x In) | | | |
| Setting | Pickup Ir (amps) | | | | Time (s) at 6x (Ir) | Pickup Ii = nx (In) | | | |
| A | 15 | 32 | 50 | 80 | 10 | 2 | 2 | 2 | 2 |
| B | 16 | 35 | 60 | 90 | 10 | 3 | 3 | 3 | 3 |
| C | 20 | 40 | 63 | 100 | 10 | 4 | 4 | 4 | 4 |
| D | 25 | 50 | 70 | 110 | 10 | 5 | 5 | 5 | 5 |
| E | 30 | 60 | 80 | 125 | 10 | 6 | 6 | 6 | 6 |
| F | 35 | 63 | 90 | 150 | 10 | 8 | 7 | 8 | 7 |
| G | 40 | 70 | 100 | 160 | 10 | 10 | 8 | 10 | 8 |
| H | 45 | 80 | 110 | 175 | 10 | 12 | 9 | 12 | 9 |
| J | 50 | 90 | 125 | 200 | 10 | 15 | 10 | 13 | 9 |
| K | 60 | 100 | 150 | 225 | 10 | 18.3 | 11 | 14 | 9.3 |
| | | | | | | Instantaneous override | | | |
| | | | | | | 1100 A | | 2100 A | |

## 10.2.2  PDG2 PXR10 settings (LSI)

| Frame | 60 A | 100 A | 150 A | 225 A | All | All | | 60 A | 100 A | 150 A | 225 A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | Short delay | | Instantaneous | | | |
| Dial | Ir (A) | | | | | SD profile | | Ii (x In) | | | |
| Setting | Pickup Ir (amps) | | | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | |
| A | 15 | 32 | 50 | 80 | 10 | 2.0 | 0.150 | 2 | 2 | 2 | 2 |
| B | 16 | 35 | 60 | 90 | 10 | 2.0 | 0.300 | 3 | 3 | 3 | 3 |
| C | 20 | 40 | 63 | 100 | 10 | 2.0 | $I^2t$ | 4 | 4 | 4 | 4 |
| D | 25 | 50 | 70 | 110 | 10 | 4.0 | 0.150 | 5 | 5 | 5 | 5 |
| E | 30 | 60 | 80 | 125 | 10 | 4.0 | $I^2t$ | 6 | 6 | 6 | 6 |
| F | 35 | 63 | 90 | 150 | 10 | 6.0 | 0.150 | 8 | 7 | 8 | 7 |
| G | 40 | 70 | 100 | 160 | 10 | 6.0 | 0.300 | 10 | 8 | 10 | 8 |
| H | 45 | 80 | 110 | 175 | 10 | 10.0 | 0.150 | 12 | 9 | 12 | 9 |
| J | 50 | 90 | 125 | 200 | 10 | 2.0-10.0 | 0.05 to 0.30 | 15 | 10 | 13 | 9 |
| K | 60 | 100 | 150 | 225 | 10 | OFF | - | 18.3 | 11 | 14 | 9.3 |
| Configurable using PXPM software | | | | | | | | Instantaneous override | | | |
| | | | | | | | | 1100A | | 2100A | |

## 10.2.3  PDG2 PXR10 – Motor protection settings

| Frame | 60 A | 100 A | 150 A | 200 A | All | | 60 A | 100 A | 150 A | 200 A | All |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Overload | | | | | | Short delay | | | | |
| Dial | FLA Ie (A) | | | | Trip profile | | Isd (nxIe) | | | | PXPM |
| Setting | Pickup Ie (full load amps) | | | | Trip class at 6x (Ie) | Phase unbal. % | Pickup Isd = nx (Ie) | | | | tsd (s) |
| A | 15 | 32 | 50 | 70 | 5 | No | 3 | 3 | 3 | 3 | Instantaneous, 0.15s, 0.30s |
| B | 16 | 35 | 60 | 80 | 10 | | 4 | 4 | 4 | 4 | |
| C | 20 | 40 | 63 | 90 | 15 | | 5 | 5 | 5 | 5 | |
| D | 25 | 50 | 70 | 100 | 20 | | 6 | 6 | 6 | 6 | |
| E | 30 | 60 | 80 | 110 | 30 | | 7 | 7 | 7 | 7 | |
| F | 35 | 63 | 90 | 125 | 5 | Yes 5 to 35 % 1 to 200 sec | 8 | 8 | 8 | 8 | |
| G | 40 | 70 | 100 | 150 | 10 | | 10 | 10 | 10 | 10 | |
| H | 45 | 80 | 110 | 160 | 15 | | 11 | 11 | 11 | 11 | |
| J | 50 | 90 | 125 | 175 | 20 | | 12 | 12 | 12 | 12 | |
| K | 60 | 100 | 150 | 200 | 30 | | 13 | 13 | 13 | 13 | |
| Configurable using PXPM software | | | | | | | Instantaneous override: | | | | |
| | | | | | | | 1100 A | | 2100 A | | |
| | | | | | | | Pickup (Isd) limited by Max Instantaneous | | | | |

### 10.2.4  PDC2 PXR10 settings (LI)

| Frame | 63 A | 100 A | 160 A | 200 A | 250 A | All | 63 A | 100 A | 160 A | 200 A | 250 A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | Instantaneous | | | | |
| Dial | Ir(A) | | | | | | Ii (x In) | | | | |
| Setting | Pickup Ir (amps) | | | | | Time (s) at 6x(Ir) | Pickup Ii = nx (In) | | | | |
| A | 16 | 25 | 40 | 50 | 63 | 10 | 2 | 2 | 2 | 2 | 2 |
| B | 18 | 32 | 50 | 63 | 80 | 10 | 3 | 3 | 3 | 3 | 3 |
| C | 20 | 40 | 63 | 80 | 100 | 10 | 4 | 4 | 4 | 4 | 4 |
| D | 25 | 50 | 70 | 90 | 125 | 10 | 5 | 5 | 5 | 5 | 5 |
| E | 32 | 55 | 80 | 100 | 150 | 10 | 6 | 6 | 6 | 6 | 6 |
| F | 40 | 63 | 90 | 125 | 160 | 10 | 8 | 7 | 8 | 7 | 6.5 |
| G | 45 | 70 | 100 | 150 | 175 | 10 | 10 | 8 | 10 | 8 | 7 |
| H | 50 | 80 | 125 | 160 | 200 | 10 | 12 | 9 | 12 | 9 | 7.5 |
| J | 55 | 90 | 150 | 175 | 225 | 10 | 15 | 10 | 13 | 10 | 8 |
| K | 63 | 100 | 160 | 200 | 250 | 10 | 17.4 | 11 | 13.1 | 10.5 | 8.4 |
| | | | | | | | Instantaneous override | | | | |
| | | | | | | | 1100 A | | 2100 A | | |

### 10.2.5  PDC2 PXR10 settings (LSI)

| Frame | 63 A | 100 A | 160 A | 200 A | 250 A | All | All | | 63 A | 100 A | 160 A | 200 A | 250 A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | Short delay | | Instantaneous | | | | |
| Dial | Ir (A) | | | | | tr @ 6xIr | SD profile | | Ii (x In) | | | | |
| Setting | Pickup Ii = nx (In) | | | | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | | |
| A | 16 | 25 | 40 | 50 | 63 | 10 | 2.0 | 0.150 | 2 | 2 | 2 | 2 | 2 |
| B | 18 | 32 | 50 | 63 | 80 | 10 | 2.0 | 0.300 | 3 | 3 | 3 | 3 | 3 |
| C | 20 | 40 | 63 | 80 | 100 | 10 | 2.0 | $I^2t$ | 4 | 4 | 4 | 4 | 4 |
| D | 25 | 50 | 70 | 90 | 125 | 10 | 4.0 | 0.150 | 5 | 5 | 5 | 5 | 5 |
| E | 32 | 55 | 80 | 100 | 150 | 10 | 4.0 | $I^2t$ | 6 | 6 | 6 | 6 | 6 |
| F | 40 | 63 | 90 | 125 | 160 | 10 | 6.0 | 0.150 | 8 | 7 | 8 | 7 | 6.5 |
| G | 45 | 70 | 100 | 150 | 175 | 10 | 6.0 | 0.300 | 10 | 8 | 10 | 8 | 7 |
| H | 50 | 80 | 125 | 160 | 200 | 10 | 10.0 | 0.150 | 12 | 9 | 12 | 9 | 7.5 |
| J | 55 | 90 | 150 | 175 | 225 | 10 | 2.0-10.0 | 0.05 to 0.30 | 15 | 10 | 13 | 10 | 8 |
| K | 63 | 100 | 160 | 200 | 250 | 10 | OFF | - | 17.4 | 11 | 13.1 | 10.5 | 8.4 |
| | Configurable using PXPM software | | | | | | | | Instantaneous override | | | | |
| | | | | | | | | | 1100 A | | 2100 A | | |

## 10.2.6  PDC2 PXR10 – Motor protection settings (MLSI)

| Frame | 63 A | 100 A | 160 A | 200 A | 220 A | All | | 63 A | 100 A | 160 A | 200 A | 220A | All |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Overload | | | | | | | Short delay | | | | | |
| Dial | FLA = Ie | | | | | Trip profile | | Isd(x Ie) | | | | | PXPM |
| Setting | Pickup Ie (full load amps) | | | | | Trip class at 6x (Ie) | Phase unbal. % | Pickup Isd = nx (Ie) | | | | | Time (tsd) |
| A | 16 | 25 | 40 | 50 | 63 | 5 | | 3 | 3 | 3 | 3 | 3 | Instanta neous, 0.15s, 0.30s |
| B | 18 | 32 | 50 | 63 | 80 | 10 | No | 4 | 4 | 4 | 4 | 4 | |
| C | 20 | 40 | 63 | 80 | 90 | 15 | | 5 | 5 | 5 | 5 | 5 | |
| D | 25 | 50 | 70 | 90 | 100 | 20 | | 6 | 6 | 6 | 6 | 6 | |
| E | 32 | 55 | 80 | 100 | 125 | 30 | | 7 | 7 | 7 | 7 | 7 | |
| F | 40 | 63 | 90 | 125 | 150 | 5 | | 8 | 8 | 8 | 8 | 8 | |
| G | 45 | 70 | 100 | 150 | 160 | 10 | Yes 5 to 35 % 1 to 200 sec | 10 | 10 | 10 | 10 | 10 | |
| H | 50 | 80 | 125 | 160 | 175 | 15 | | 11 | 11 | 11 | 11 | 11 | |
| J | 55 | 90 | 150 | 175 | 200 | 20 | | 12 | 12 | 12 | 12 | 12 | |
| K | 63 | 100 | 160 | 200 | 220 | 30 | | 13 | 13 | 13 | 13 | 13 | |
| Configurable using PXPM software | | | | | | | | Instantaneous override: | | | | | |
| | | | | | | | | 1100 A | | 2100 A | | | |
| | | | | | | | | Pickup (Isd) limited by Max Instantaneous | | | | | |

## 10.2.7  PDG2 PXR20 settings

| Frame | 60 A | 100 A | 150 A | 225 A | All | All | | 60 A | 100 A | 150 A | 225 A | G styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | Short delay | | Instantaneous | | | | Ground | |
| Dial | Ir (A) | | | | tr(S) @ 6x Ir | Isd (x Ir) | tsd (s) | Ii (x In) | | | | Ig (x In) | tg (s) |
| Setting | Pickup Ir (amps) | | | | Time (s) at 6x (Ir) | Pickup (Isd) Isd = nx (Ir) | tsd (s) | Pickup Ii = nx (In) | | | | Pickup (Ig) Ig = nx (In) | Time (tg) tg (s) |
| A | 15 | 32 | 50 | 80 | 0.5 | 1.5 | 0.050 | 2 | 2 | 2 | 2 | 0.2 | 0.100 |
| B | 16 | 35 | 60 | 90 | 1 | 2.0 | 0.100 | 3 | 3 | 3 | 3 | 0.3 | 0.150 |
| C | 20 | 40 | 63 | 100 | 2 | 3.0 | 0.150 | 4 | 4 | 4 | 4 | 0.4 | 0.200 |
| D | 25 | 50 | 70 | 110 | 4 | 4.0 | 0.200 | 5 | 5 | 5 | 5 | 0.6 | 0.300 |
| E | 30 | 60 | 80 | 125 | 7 | 5.0 | 0.300 | 6 | 6 | 6 | 6 | 0.8 | 0.500 |
| F | 35 | 63 | 90 | 150 | 10 | 6.0 | 0.400 | 8 | 7 | 8 | 7 | 1.0 | 0.750 |
| G | 40 | 70 | 100 | 160 | 12 | 8.0 | 0.500 | 10 | 8 | 10 | 8 | 0.2 | 1.000 |
| H | 45 | 80 | 110 | 175 | 15 | 10.0 | 0.067 | 12 | 9 | 12 | 9 | 0.5 | 0.067 |
| J | 50 | 90 | 125 | 200 | 20 | 12.0 | 0.150 | 15 | 10 | 13 | 9 | 1.0 | 0.150 |
| K | 60 | 100 | 150 | 225 | 24 | OFF | 0.3 | 18.3 | 11 | 14 | 9.3 | OFF | 0.300 |
| | | | | | | Flat | | Instantaneous override | | | | Trip | Flat |
| | | | | | | I²t | | 1100 A | | 2100 A | | Alarm | I²t |

### 10.2.8  PDC2 PXR20 settings

| Frame | 63 A | 100 A | 160 A | 200 A | 250 A | All | All | | 63 A | 100 A | 160 A | 200 A | 250 A | G styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | Short delay | | Instantaneous | | | | | Ground | |
| Dial | Ir (A) | | | | | Tr(S)@6x Ir | Isd (x Ir) | tsd (s) | Ii (x In) | | | | | Ig (x In) | tg (s) |
| Setting | Pickup Ir (amps) | | | | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | | | Pickup (Ig) Ig = nx (In) | Time (tg) tg (s) |
| A | 16 | 25 | 40 | 50 | 63 | 0.5 | 1.5 | 0.050 | 2 | 2 | 2 | 2 | 2 | 0.2 | 0.100 |
| B | 18 | 32 | 50 | 63 | 80 | 1 | 2.0 | 0.100 | 3 | 3 | 3 | 3 | 3 | 0.3 | 0.150 |
| C | 20 | 40 | 63 | 80 | 100 | 2 | 3.0 | 0.150 | 4 | 4 | 4 | 4 | 4 | 0.4 | 0.200 |
| D | 25 | 50 | 70 | 90 | 125 | 4 | 4.0 | 0.200 | 5 | 5 | 5 | 5 | 5 | 0.6 | 0.300 |
| E | 32 | 55 | 80 | 100 | 150 | 7 | 5.0 | 0.300 | 6 | 6 | 6 | 6 | 6 | 0.8 | 0.500 |
| F | 40 | 63 | 90 | 125 | 160 | 10 | 6.0 | 0.400 | 8 | 7 | 8 | 7 | 6.5 | 1.0 | 0.750 |
| G | 45 | 70 | 100 | 150 | 175 | 12 | 8.0 | 0.500 | 10 | 8 | 10 | 8 | 7 | 0.2 | 1.000 |
| H | 50 | 80 | 125 | 160 | 200 | 15 | 10.0 | 0.067 | 12 | 9 | 12 | 9 | 7.5 | 0.5 | 0.067 |
| J | 55 | 90 | 150 | 175 | 225 | 20 | 12.0 | 0.150 | 15 | 10 | 13 | 10 | 8 | 1.0 | 0.150 |
| K | 63 | 100 | 160 | 200 | 250 | 24 | OFF | 0.3 | 17.5 | 11 | 13.125 | 10.5 | 8.4 | OFF | 0.300 |
| | | | | | | | Flat | | Instantaneous override | | | | | Trip | Flat |
| | | | | | | | I²t | | 1100 A | | 2100 A | | | Alarm | I²t |

### 10.2.9  PDG2 PXR25 and 20D settings

| Frame | 60 A | 100 A | 150 A | 225 A | All | All | | 60 A | 100 A | 150 A | 225 A | G styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | Short delay | | Instantaneous | | | | Ground | |
| Setting | Pickup Ir (amps) | | | | Time (s) at 6x Ir | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | | Pickup (Ig) Ig = nx (In) | Time (tg) tg (s) |
| Min | 15 | 25 | 50 | 80 | 0.5 | 1.5 | 0.050 | 2 | 2 | 2 | 2 | 0.2 | 0.100 |
| Max | 60 | 100 | 150 | 225 | 24 | 12.0 | 0.500 | 18.3 | 11 | 14 | 9.3 | 1.0 | 1.000 |
| Min | | | | | 0.5 | | 0.067 | | | | | 0.2 | 0.067 |
| Max | | | | | 7 | | 0.300 | | | | | 1.0 | 0.300 |
| Step | 1 | 1 | 1 | 1 | 0.10 | 0.10 | 0.010 | 0.10 | 0.10 | 0.10 | 0.10 | 0.010 | 0.010 |
| Add'l opt | | | | | | OFF | | | | | | OFF | |
| | I²t | | | | | Flat | | Instantaneous override | | | | Trip | Flat |
| | I⁴t | | | | | I²t | | 1100 A | | 2100 A | | Alarm | I²t |

### 10.2.10  PDG2 PXR25 – Motor protection settings

| Frame | 60 A | 100 A | 150 A | 225 A | All | All | | 60 A | 100 A | 150 A | 225 A | G Styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Overload | | | | | Short delay | | Instantaneous | | | | Ground | |
| Setting | Pickup Ie (full load amps) | | | | Trip class at 6x (Ie) | Pickup (Isd) Isd = nx (Ie) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | | Pickup (Ig) Ig = nx (In) | Time (tg) tg (s) |
| Min | 15 | 25 | 50 | 80 | 0.5 | 3.0 | 0.050 | 3 | 3 | 3 | 3 | 0.2 | 0.100 |
| Max | 60 | 100 | 150 | 225 | 30 | 13.0 | 0.500 | 18.3 | 11 | 14 | 9.3 | 1.0 | 1.000 |
| Min | | | | | | | | | | | | 0.2 | 0.067 |
| Max | | | | | | | | | | | | 1.0 | 0.300 |
| Step | 1.00 | 1.00 | 1.00 | 1.00 | 0.10 | 0.10 | 0.01 | 0.10 | 0.10 | 0.10 | 0.10 | 0.01 | 0.01 |
| Add'l opt | | | | | | OFF | | | | | | OFF | |
| | | | | | | Flat | | Instantaneous override | | | | Trip | Flat |
| | | | | | | | | 1100 A | | 2100 A | | Alarm | |
| | | | | | | Pickup (Isd) limited by Max Instantaneous | | | | | | | |

## 10.2.11  PDC2 PXR25 and 20D settings

| Frame | 63 A | 100 A | 160 A | 200 A | 250 A | All | All | All | 63 A | 100 A | 160 A | 200 A | 250 A | G styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | Short delay | | Instantaneous | | | | | Ground | |
| Setting | Pickup Ir (amps) | | | | | Time (s) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | | | Pickup (Ig) Ig = nx (In) | Time (tg) tg (s) |
| Min | 16 | 25 | 40 | 50 | 63 | 0.5 | 1.5 | 0.050 | 2 | 2 | 2 | 2 | 2 | 0.2 | 0.100 |
| Max | 63 | 100 | 160 | 200 | 250 | 24 | 12.0 | 0.500 | 17.46 | 11.00 | 13.13 | 10.50 | 8.40 | 1.0 | 1.000 |
| Min | | | | | | 0.5 | | 0.067 | | | | | | 0.2 | 0.067 |
| Max | | | | | | 7 | | 0.300 | | | | | | 1.0 | 0.300 |
| Step | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.10 | 0.10 | 0.01 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.01 | 0.01 |
| Add'l opt | | | | | | | OFF | | | | | | | OFF | |
| | | | | | | $I^2t$ | Flat | | Instantaneous override | | | | | Trip | Flat |
| | | | | | | $I^4t$ | | $I^2t$ | 1100 A | | | 2100 A | | Alarm | $I^2t$ |

## 10.2.12  PDG3 PXR10 settings (LI)

| Frame | 125 A | 250 A | 400 A | H250 A | H400 A | H600 A | All | 125 A | 250 A | 400 A | H250 A | H400 A | H600 A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | | Instantaneous | | | | | |
| Dial | Ir (A) | | | | | | | Ii (x In) | | | | | |
| Setting | Pickup Ir (amps) | | | | | | Time (s) at 6x (Ir) | Pickup Li = nx (In) | | | | | |
| A | 45 | 90 | 160 | 90 | 160 | 250 | 10 | 2 | 2 | 2 | 2 | 2 | 2 |
| B | 50 | 100 | 175 | 100 | 175 | 275 | 10 | 3 | 3 | 3 | 3 | 3 | 3 |
| C | 60 | 110 | 200 | 110 | 200 | 300 | 10 | 4 | 4 | 4 | 4 | 4 | 4 |
| D | 63 | 125 | 225 | 125 | 225 | 320 | 10 | 5 | 5 | 5 | 5 | 5 | 5 |
| E | 70 | 150 | 250 | 150 | 250 | 350 | 10 | 6 | 6 | 6 | 6 | 6 | 6 |
| F | 80 | 160 | 275 | 160 | 275 | 400 | 10 | 8 | 8 | 7 | 10 | 8 | 7 |
| G | 90 | 175 | 300 | 175 | 300 | 450 | 10 | 10 | 10 | 8 | 15 | 10 | 8 |
| H | 100 | 200 | 320 | 200 | 320 | 500 | 10 | 15 | 12 | 9 | 20 | 12 | 9 |
| J | 110 | 225 | 350 | 225 | 350 | 550 | 10 | 20 | 15 | 10 | 25 | 15 | 10 |
| K | 125 | 250 | 400 | 250 | 400 | 600 | 10 | 24.0 | 17.6 | 11 | 28.8 | 18 | 12.0 |
| | | | | | | | | Instantaneous override | | | | | |
| | | | | | | | | 3000 A | | 4400 A | | 2100 A | |

## 10.2.13  PDG3 PXR10 settings (LSI)

| Frame | 125A | 250A | 400A | H250 A | H400 A | H600 A | All | All | | 125 A | 250 A | 400 A | H250 A | H400 A | H600 A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | | Short delay | | Instantaneous | | | | | |
| Dial | Ir (A) | | | | | | | SD profile | | Ii (x In) | | | | | |
| Setting | Pickup Ir (amps) | | | | | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Li = nx (In) | | | | | |
| A | 45 | 90 | 160 | 90 | 160 | 250 | 10 | 2.0 | 0.150 | 2 | 2 | 2 | 2 | 2 | 2 |
| B | 50 | 100 | 175 | 100 | 175 | 275 | 10 | 2.0 | 0.300 | 3 | 3 | 3 | 3 | 3 | 3 |
| C | 60 | 110 | 200 | 110 | 200 | 300 | 10 | 2.0 | $I^2t$ | 4 | 4 | 4 | 4 | 4 | 4 |
| D | 63 | 125 | 225 | 125 | 225 | 320 | 10 | 4.0 | 0.150 | 5 | 5 | 5 | 5 | 5 | 5 |
| E | 70 | 150 | 250 | 150 | 250 | 350 | 10 | 4.0 | $I^2t$ | 6 | 6 | 6 | 6 | 6 | 6 |
| F | 80 | 160 | 275 | 160 | 275 | 400 | 10 | 6.0 | 0.150 | 8 | 8 | 7 | 10 | 8 | 7 |
| G | 90 | 175 | 300 | 175 | 300 | 450 | 10 | 6.0 | 0.300 | 10 | 10 | 8 | 15 | 10 | 8 |
| H | 100 | 200 | 320 | 200 | 320 | 500 | 10 | 10.0 | 0.150 | 15 | 12 | 9 | 20 | 12 | 9 |
| J | 110 | 225 | 350 | 225 | 350 | 550 | 10 | 2.0-10.0 | 0.05 to 0.30 | 20 | 15 | 10 | 25 | 15 | 10 |
| K | 125 | 250 | 400 | 250 | 400 | 600 | 10 | OFF | - | 24.0 | 17.6 | 11 | 28.8 | 18 | 12.0 |
| Configurable using PXPM software | | | | | | | | | | Instantaneous override | | | | | |
| | | | | | | | | | | 3000 A | | 4400 A | | 7200 A | |

## 10.2.14  PDG3 PXR10 – Motor protection  settings (MLSI)

# 10 Available protection settings

| Frame | 125 A | 250 A | 400 A | H250 A | H400 A | H600 A | All | | 125 A | 250 A | 400 A | H250 A | H400 A | 600 A | All |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | | | Short delay | | | | | | |
| Dial | FLA Ie (A) | | | | | | Trip profile | | Isd (x Ie) | | | | | | PXPM |
| Setting | Pickup Ie (full load amps) | | | | | | Trip class at 6x (Ie) | Phase unbal. % | Pickup Isd = nx (Ie) | | | | | | Time (tsd) |
| A | 45 | 90 | 160 | 90 | 160 | 250 | 5 | No | 3 | 3 | 3 | 3 | 3 | 3 | Instantaneous 0.15s, 0.30s |
| B | 50 | 100 | 175 | 100 | 175 | 275 | 10 | | 4 | 4 | 4 | 4 | 4 | 4 | |
| C | 60 | 110 | 200 | 110 | 200 | 300 | 15 | | 5 | 5 | 5 | 5 | 5 | 5 | |
| D | 63 | 125 | 225 | 125 | 225 | 320 | 20 | | 6 | 6 | 6 | 6 | 6 | 6 | |
| E | 70 | 150 | 250 | 150 | 250 | 350 | 30 | | 7 | 7 | 7 | 7 | 7 | 7 | |
| F | 80 | 160 | 275 | 160 | 275 | 400 | 5 | Yes 5 to 35 % 1 to 200 sec | 8 | 8 | 8 | 8 | 8 | 8 | |
| G | 90 | 175 | 300 | 175 | 300 | 450 | 10 | | 10 | 10 | 10 | 10 | 10 | 10 | |
| H | 100 | 200 | 320 | 200 | 320 | 500 | 15 | | 11 | 11 | 11 | 11 | 11 | 11 | |
| J | 110 | 225 | 350 | 225 | 350 | 550 | 20 | | 12 | 12 | 12 | 12 | 12 | 12 | |
| K | 125 | 250 | 400 | 250 | 400 | 600 | 30 | | 13 | 13 | 13 | 13 | 13 | 13 | |

Configurable using PXPM software

Instantaneous override

| 3000 A | 4400 A | | 7200 A | |
|---|---|---|---|---|

Pickup (Isd) limited by Max instantaneous

## 10.2.15 PDC3 PXR10 settings (LI)

| Frame | 250 A | 400 A | H250 A | H400 A | H630 A | All | 250 A | 400 A | H250 A | H400 A | H630 A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | Instantaneous | | | | |
| Dial | Ir (A) | | | | | | Ii (x In) | | | | |
| Setting | Pickup Ir (amps) | | | | | Time (s) at 6x (Ir) | Pickup Li = nx (In) | | | | |
| A | 63 | 100 | 63 | 100 | 200 | 10 | 2 | 2 | 2 | 2 | 2 |
| B | 80 | 125 | 80 | 125 | 225 | 10 | 3 | 3 | 3 | 3 | 3 |
| C | 100 | 140 | 100 | 140 | 250 | 10 | 4 | 4 | 4 | 4 | 4 |
| D | 125 | 160 | 125 | 160 | 320 | 10 | 5 | 5 | 5 | 5 | 5 |
| E | 150 | 200 | 150 | 200 | 360 | 10 | 6 | 6 | 6 | 6 | 6 |
| F | 160 | 225 | 160 | 225 | 400 | 10 | 8 | 7 | 10 | 8 | 7 |
| G | 175 | 250 | 175 | 250 | 450 | 10 | 10 | 8 | 15 | 10 | 8 |
| H | 200 | 320 | 200 | 320 | 500 | 10 | 12 | 9 | 20 | 12 | 9 |
| J | 225 | 360 | 225 | 360 | 550 | 10 | 15 | 10 | 25 | 15 | 10 |
| K | 250 | 400 | 250 | 400 | 630 | 10 | 17.6 | 11 | 28.8 | 18 | 11.43 |

Instantaneous override

| 4400 A | | 7200 A | |
|---|---|---|---|

### 10.2.16  PDC3 PXR10 settings (LSI)

| Frame | 250 A | 400 A | H250 A | H400 A | H630 A | All | All | | 250 A | 400 A | H250 A | H400 A | H630 A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | Short delay | | Instantaneous | | | | |
| Dial | Ir (A) | | | | | | SD profile | | Ii (x In) | | | | |
| Setting | Pickup Ir (amps) | | | | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Li = nx (In) | | | | |
| A | 63 | 100 | 63 | 100 | 200 | 10 | 2.0 | 0.150 | 2 | 2 | 2 | 2 | 2 |
| B | 80 | 125 | 80 | 125 | 225 | 10 | 2.0 | 0.300 | 3 | 3 | 3 | 3 | 3 |
| C | 100 | 140 | 100 | 140 | 250 | 10 | 2.0 | I2t | 4 | 4 | 4 | 4 | 4 |
| D | 125 | 160 | 125 | 160 | 320 | 10 | 4.0 | 0.150 | 5 | 5 | 5 | 5 | 5 |
| E | 150 | 200 | 150 | 200 | 360 | 10 | 4.0 | I2t | 6 | 6 | 6 | 6 | 6 |
| F | 160 | 225 | 160 | 225 | 400 | 10 | 6.0 | 0.150 | 8 | 7 | 10 | 8 | 7 |
| G | 175 | 250 | 175 | 250 | 450 | 10 | 6.0 | 0.300 | 10 | 8 | 15 | 10 | 8 |
| H | 200 | 320 | 200 | 320 | 500 | 10 | 10.0 | 0.150 | 12 | 9 | 20 | 12 | 9 |
| J | 225 | 360 | 225 | 360 | 550 | 10 | 2.0-10.0 | 0.05 to 0.30 | 15 | 10 | 25 | 15 | 10 |
| K | 250 | 400 | 250 | 400 | 630 | 10 | OFF | - | 17.6 | 11 | 28.8 | 18 | 11.43 |
|  | Configurable using PXPM software | | | | | | | | Instantaneous override | | | | |
|  | | | | | | | | | 4400 A | | | 7200 A | |

### 10.2.17  PDC3 PXR17 – Motor protection settings (MLSI)

| Frame | 250 A | 400 A | H250 A | H400 A | All | | 250 A | 400 A | H250 A | H400 A | ALL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Overload | | | | | | Short delay | | | | |
| Dial | FLA Ie (A) | | | | Trip profile | | Isd(x Ie) | | | | PXPM |
| Setting | Pickup Ie (full load amps) | | | | Trip class at 6x (Ie) | Phase unbal. % | Pickup Isd = nx (Ie) | | | | Time (tsd) |
| A | 63 | 100 | 63 | 100 | 5 | No | 3 | 3 | 3 | 3 | Instantaneous 0.15s, 0.30s |
| B | 80 | 125 | 80 | 125 | 10 | | 4 | 4 | 4 | 4 | |
| C | 100 | 140 | 100 | 140 | 15 | | 5 | 5 | 5 | 5 | |
| D | 125 | 160 | 125 | 160 | 20 | | 6 | 6 | 6 | 6 | |
| E | 150 | 200 | 150 | 200 | 30 | | 7 | 7 | 7 | 7 | |
| F | 160 | 225 | 160 | 225 | 5 | Yes 5 to 35 % 1 to 200 sec | 8 | 8 | 8 | 8 | |
| G | 175 | 250 | 175 | 250 | 10 | | 10 | 10 | 10 | 10 | |
| H | 200 | 320 | 200 | 320 | 15 | | 11 | 11 | 11 | 11 | |
| J | 225 | 360 | 225 | 360 | 20 | | 12 | 12 | 12 | 12 | |
| K | 250 | 400 | 250 | 400 | 30 | | 13 | 13 | 13 | 13 | |
| Configurable using PXPM software | | | | | | | Instantaneous override | | | | |
|  | | | | | | | 4400 A | | 7200 A | | |
|  | | | | | | | Pickup (Isd) limited by Max Instantaneous | | | | |

### 10.2.18 PDG3 PXR20 settings

| Frame | 125 A | 250 A | 400A | H250 A | H400 A | H600 A | All | All | | 125 A | 250 A | 400A | H250 A | H400 A | H600 A | G styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | | Short delay | | Instantaneous | | | | | | Ground | |
| Dial | Ir (A) | | | | | | Tr(S) @6x Ir | Isd (x Ir) | tsd (s) | Ii (x In) | | | | | | Ig (x In) | tg (s) |
| Setting | Pickup Ir (amps) | | | | | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | | | | Pickup (Ig) Ig = nx (In) | Time (tg) tg (s) |
| A | 45 | 90 | 160 | 90 | 160 | 250 | 0.5 | 1.5 | 0.050 | 2 | 2 | 2 | 2 | 2 | 2 | 0.2 | 0.100 |
| B | 50 | 100 | 175 | 100 | 175 | 275 | 1 | 2.0 | 0.100 | 3 | 3 | 3 | 3 | 3 | 3 | 0.3 | 0.150 |
| C | 60 | 110 | 200 | 110 | 200 | 300 | 2 | 3.0 | 0.150 | 4 | 4 | 4 | 4 | 4 | 4 | 0.4 | 0.200 |
| D | 63 | 125 | 225 | 125 | 225 | 320 | 4 | 4.0 | 0.200 | 5 | 5 | 5 | 5 | 5 | 5 | 0.6 | 0.300 |
| E | 70 | 150 | 250 | 150 | 250 | 350 | 7 | 5.0 | 0.300 | 6 | 6 | 6 | 6 | 6 | 6 | 0.8 | 0.500 |
| F | 80 | 160 | 275 | 160 | 275 | 400 | 10 | 6.0 | 0.400 | 8 | 8 | 7 | 10 | 8 | 7 | 1.0 | 0.750 |
| G | 90 | 175 | 300 | 175 | 300 | 450 | 12 | 8.0 | 0.500 | 10 | 10 | 8 | 15 | 10 | 8 | 0.2 | 1.000 |
| H | 100 | 200 | 320 | 200 | 320 | 500 | 15 | 10.0 | 0.067 | 15 | 12 | 9 | 20 | 12 | 9 | 0.5 | 0.067 |
| J | 110 | 225 | 350 | 225 | 350 | 550 | 20 | 12.0 | 0.150 | 20 | 15 | 10 | 25 | 15 | 10 | 1.0 | 0.150 |
| K | 125 | 250 | 400 | 250 | 400 | 600 | 24 | OFF | 0.300 | 24.0 | 17.6 | 11 | 28.8 | 18 | 12.0 | OFF | 0.300 |
| | | | | | | | | Flat | | Instantaneous override | | | | | | Trip | Flat |
| | | | | | | | | I²t | 3000 A | 4400 A | | | 7200 A | | | Alarm | I²t |

### 10.2.19 PDC3 PXR20 settings

| Frame | 250 A | 400 A | H250 A | H400 A | H630 A | All | All | | 250 A | 400 A | H250 A | H400 A | H630 A | G styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | Short delay | | Instantaneous | | | | | Ground | |
| Dial | Ir (A) | | | | | Tr(S) @6x Ir | Isd (x Ir) | tsd (s) | Ii (x In) | | | | | Ig (x In) | tg (s) |
| Setting | Pickup Ir (amps) | | | | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | | | Pickup (Ig) Ig = nx (In) | Time (tg) tg (s) |
| A | 16 | 25 | 40 | 50 | 63 | 0.5 | 1.5 | 0.050 | 2 | 2 | 2 | 2 | 2 | 0.2 | 0.100 |
| B | 18 | 32 | 50 | 63 | 80 | 1 | 2.0 | 0.100 | 3 | 3 | 3 | 3 | 3 | 0.3 | 0.150 |
| C | 20 | 40 | 63 | 80 | 100 | 2 | 3.0 | 0.150 | 4 | 4 | 4 | 4 | 4 | 0.4 | 0.200 |
| D | 25 | 50 | 70 | 90 | 125 | 4 | 4.0 | 0.200 | 5 | 5 | 5 | 5 | 5 | 0.6 | 0.300 |
| E | 32 | 55 | 80 | 100 | 150 | 7 | 5.0 | 0.300 | 6 | 6 | 6 | 6 | 6 | 0.8 | 0.500 |
| F | 40 | 63 | 90 | 125 | 160 | 10 | 6.0 | 0.400 | 8 | 7 | 10 | 8 | 7 | 1.0 | 0.750 |
| G | 45 | 70 | 100 | 150 | 175 | 12 | 8.0 | 0.500 | 10 | 8 | 15 | 10 | 8 | 0.2 | 1.000 |
| H | 50 | 80 | 125 | 160 | 200 | 15 | 10.0 | 0.067 | 12 | 9 | 20 | 12 | 9 | 0.5 | 0.067 |
| J | 55 | 90 | 150 | 175 | 225 | 20 | 12.0 | 0.150 | 15 | 10 | 25 | 15 | 10 | 1.0 | 0.150 |
| K | 63 | 100 | 160 | 200 | 250 | 24 | OFF | 0.3 | 17.6 | 11.0 | 28.8 | 18 | 11.43 | OFF | 0.300 |
| | | | | | | | Flat | | Instantaneous override | | | | | Trip | Flat |
| | | | | | | | I²t | | 4400 A | | | 7200 A | | Alarm | I²t |

### 10.2.20  PDG3 PXR25 and 20D settings

| Frame | 125 A | 250 A | 400 A | H250 A | H400 A | H600 A | All | All | | 125 A | 250 A | 400A | H250 A | H400 A | H600 A | G styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | | Short delay | | Instantaneous | | | | | | Ground | |
| Setting | Pickup Ir (amps) | | | | | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | | | | Pickup (Ig) Ig = nx (In) | Time (tg) (s) |
| Min | 45 | 90 | 160 | 90 | 160 | 250 | 0.5 | 1.5 | 0.050 | 2 | 2 | 2 | 2 | 2 | 2 | 0.2 | 0.100 |
| Max | 125 | 250 | 400 | 250 | 400 | 600 | 24 | 12.0 | 0.500 | 24 | 17.6 | 11 | 28.8 | 18 | 12 | 1.0 | 1.000 |
| Min | | | | | | | 0.5 | | 0.067 | | | | | | | 0.2 | 0.067 |
| Max | | | | | | | 7 | | 0.300 | | | | | | | 1.0 | 0.300 |
| Step | 1 | 1 | 1 | 1 | 1 | 1 | 0.10 | 0.10 | 0.010 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.010 | 0.010 |
| Add'l opt | | | | | | | | OFF | | | | | | | | OFF | |
| | | | | | | | I²t | | Flat | Instantaneous override | | | | | | Trip | Flat |
| | | | | | | | I⁴t | | I²t | 3000 A | 4400 A | | 7200 A | | | Alarm | I²t |

### 10.2.21  PDG3 PXR25 – Motor protection settings

| Frame | 125 A | 250 A | 400 A | H250 A | H400 A | H600 A | All | All | | 125A | 250A | 400A | H250 A | H400 A | H600 A | G styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | | Short delay | | Instantaneous | | | | | | Ground | |
| Setting | FLA = pickup (Ie) | | | | | | Trip class | Pickup (Isd) | Time (tsd) | Pickup (Ii) | | | | | | Pickup (Ig) | Time (tg) |
| Min | 45 | 90 | 160 | 90 | 160 | 250 | 0.5 | 3.0 | 0.050 | 3 | 3 | 3 | 3 | 3 | 3 | 0.2 | 0.100 |
| Max | 125 | 250 | 400 | 250 | 400 | 600 | 30 | 13.0 | 0.500 | 24 | 17.6 | 11 | 28.8 | 18 | 12 | 1.0 | 1.000 |
| Min | | | | | | | | | | | | | | | | 0.2 | 0.067 |
| Max | | | | | | | | | | | | | | | | 1.0 | 0.300 |
| Step | 1 | 1 | 1 | 1 | 1 | 1 | 0.10 | 0.10 | 0.01 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.01 | 0.01 |
| Add'l opt | | | | | | | | OFF | | | | | | | | OFF | |
| | | | | | | | | Flat | | Instantaneous override | | | | | | Trip | Flat |
| | | | | | | | | | | 3000 A | 4400 A | | 7200 A | | | Alarm | |
| | | | | | | | | Pickup (Isd) limited by Max Instantaneous | | | | | | | | | |

### 10.2.22  PDC3 PXR25 and 20D settings

| Frame | 250 A | 400 A | H250 A | H400 A | H630 A | All | All | | 250 A | 400 A | H250 A | H400 A | H630 A | G styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | Short delay | | Instantaneous | | | | | Ground | |
| Setting | Pickup Ir (amps) | | | | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | | | Pickup (Ig) Ig = nx (In) | Time (tg) tg (s) |
| Min | 63 | 100 | 63 | 100 | 200 | 0.5 | 1.5 | 0.050 | 2 | 2 | 2 | 2 | 2 | 0.2 | 0.100 |
| Max | 250 | 400 | 250 | 400 | 630 | 24 | 12.0 | 0.500 | 17.6 | 11 | 28.8 | 18 | 11.43 | 1.0 | 1.000 |
| Min | | | | | | 0.5 | | 0.067 | | | | | | 0.2 | 0.067 |
| Max | | | | | | 7 | | 0.300 | | | | | | 1.0 | 0.300 |
| Step | 1 | 1 | 1 | 1 | 1 | 0.10 | 0.10 | 0.01 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.01 | 0.01 |
| Add'l opt | | | | | | | OFF | | | | | | | OFF | |
| | | | | | | I²t | Flat | | Instantaneous override | | | | | Trip | Flat |
| | | | | | | I⁴t | I²t | | 4400 A | | 7200 A | | | Alarm | I²t |

### 10.2.23 PDG4 PXR10 settings (LI)

| Frame | 800 A | All | 800 A |
|---|---|---|---|
| Profile | Long delay | | Instantaneous |
| Dial | Ir (A) | | Ii (x In) |
| Setting | Pickup Ir (amps) | Time (s) at 6x (Ir) | Pickup Ii = nx (In) |
| A | 320 | 10 | 2 |
| B | 350 | 10 | 3 |
| C | 400 | 10 | 4 |
| D | 450 | 10 | 5 |
| E | 500 | 10 | 6 |
| F | 550 | 10 | 6.5 |
| G | 600 | 10 | 7 |
| H | 630 | 10 | 7.5 |
| J | 700 | 10 | 8 |
| K | 800 | 10 | 8.5 |
| | | | Instantaneous override |
| | | | 6800 A |

### 10.2.24 PDG4 PXR10 settings (LSI)

| Frame | 800 A | All | All | | 800 A |
|---|---|---|---|---|---|
| Profile | Long delay | | Short delay | | Instantaneous |
| Dial | Ir (A) | | SD profile | | Ii (x In) |
| Setting | Pickup Ir (amps) | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) |
| A | 320 | 10 | 2.0 | 0.150 | 2 |
| B | 350 | 10 | 2.0 | 0.300 | 3 |
| C | 400 | 10 | 2.0 | I2t | 4 |
| D | 450 | 10 | 4.0 | 0.150 | 5 |
| E | 500 | 10 | 4.0 | I2t | 6 |
| F | 550 | 10 | 6.0 | 0.150 | 8 |
| G | 600 | 10 | 6.0 | 0.300 | 10 |
| H | 630 | 10 | 10.0 | 0.150 | 15 |
| J | 700 | 10 | 2.0-8.0 | 0.05 to 0.30 | 20 |
| K | 800 | 10 | OFF | - | 24.0 |
| | Configurable using PXPM software | | | | Instantaneous override |
| | | | | | 6800 A |

### 10.2.25 PDC4 PXR10 settings (LI)

| Frame | 800 A | 1000 A | All | 800 A | 1000 A |
|---|---|---|---|---|---|
| Profile | Long delay | | | Instantaneous | |
| Dial | Ir (A) | | | Ii (x In) | |
| Setting | Pickup Ir (amps) | | Time (s) at 6x (Ir) | Pickup Ii = nx (In) | |
| A | 320 | 400 | 10 | 2 | 2 |
| B | 350 | 550 | 10 | 3 | 3 |
| C | 400 | 630 | 10 | 4 | 4 |
| D | 450 | 700 | 10 | 5 | 5 |
| E | 500 | 750 | 10 | 6 | 6 |
| F | 550 | 800 | 10 | 6.5 | 6.5 |
| G | 600 | 850 | 10 | 7 | 7 |
| H | 630 | 900 | 10 | 7.5 | 7.5 |
| J | 700 | 950 | 10 | 8 | 8 |
| K | 800 | 1000 | 10 | 8.5 | 8 |
| | | | | Instantaneous override | |
| | | | | 6800 A | 8000 A |

### 10.2.26 PDC4 PXR10 settings (LSI)

| Frame | 800 A | 1000 A | All | All | | 800 A | 1000 A |
|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | Short delay | | Instantaneous | |
| Dial | Ir (A) | | | SD profile | | Ii (x In) | |
| Setting | Pickup Ir (amps) | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | |
| A | 320 | 400 | 10 | 2.0 | 0.150 | 2 | 2 |
| B | 350 | 550 | 10 | 2.0 | 0.300 | 3 | 3 |
| C | 400 | 630 | 10 | 2.0 | $I^2t$ | 4 | 4 |
| D | 450 | 700 | 10 | 4.0 | 0.150 | 5 | 5 |
| E | 500 | 750 | 10 | 4.0 | $I^2t$ | 6 | 6 |
| F | 550 | 800 | 10 | 6.0 | 0.150 | 6.5 | 6.5 |
| G | 600 | 850 | 10 | 6.0 | 0.300 | 7 | 7 |
| H | 630 | 900 | 10 | 10.0 | 0.150 | 7.5 | 7.5 |
| J | 700 | 950 | 10 | 2.0-8.0 | 0.05 to 0.30 | 8 | 8 |
| K | 800 | 1000 | 10 | OFF | - | 8.5 | 8 |
| | Configurable using PXPM software | | | | | Instantaneous override | |
| | | | | | | 6800 A | 8000 A |

### 10.2.27  PDG4 PXR20 settings

| Frame | 800 A | All | | All | | 800 A | G styles | |
|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | Short delay | | | Instantaneous | Ground | |
| Dial | Ir (A) | Tr(S)@6x Ir | Isd (x Ir) | tsd (s) | | Ii (x In) | Ig (x In) | tg (s) |
| Setting | Pickup Ir (amps) | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | | Pickup Ii = nx (In) | Pickup (Ig) Ig = nx (In) | Time (tg) tg (s) |
| A | 320 | 0.5 | 1.5 | 0.050 | | 2 | 0.2 | 0.100 |
| B | 350 | 1 | 2.0 | 0.100 | | 3 | 0.3 | 0.150 |
| C | 400 | 2 | 2.5 | 0.150 | | 4 | 0.4 | 0.200 |
| D | 450 | 4 | 3.0 | 0.200 | | 5 | 0.6 | 0.300 |
| E | 500 | 7 | 4.0 | 0.300 | | 6 | 0.8 | 0.500 |
| F | 550 | 10 | 5.0 | 0.400 | | 6.5 | 1.0 | 0.750 |
| G | 600 | 12 | 6.0 | 0.500 | | 7 | 0.2 | 1.000 |
| H | 630 | 15 | 7.0 | 0.067 | | 7.5 | 0.5 | 0.067 |
| J | 700 | 20 | 8.0 | 0.150 | | 8 | 1.0 | 0.150 |
| K | 800 | 24 | OFF | 0.300 | | 8.5 | OFF | 0.300 |
| | | | Flat | Instantaneous override | | Trip | | Flat |
| | | | I²t | 6800 A | | Alarm | | I²t |
| | | | Pickup (Isd) and (Ii) limited by Max Instantaneous | | | | | |

### 10.2.28  PDC4 PXR20 settings

| Frame | 800 A | 1000 A | All | All | | 800 A | 1000 A | G styles | |
|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | Short delay | | Instantaneous | | Ground | |
| Dial | Ir (A) | | Tr(S)@6x Ir | Isd (x Ir) | tsd (s) | Ii (x In) | | Ig (x In) | tg (s) |
| Setting | Pickup Ir (amps) | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | Pickup (Ig) Ig = nx (In) | Time (tg) tg (s) |
| A | 320 | 400 | 0.5 | 1.5 | 0.050 | 2 | 2 | 0.2 | 0.100 |
| B | 400 | 550 | 1 | 2.0 | 0.100 | 3 | 3 | 0.3 | 0.150 |
| C | 450 | 630 | 2 | 2.5 | 0.150 | 4 | 4 | 0.4 | 0.200 |
| D | 500 | 700 | 4 | 3.0 | 0.200 | 5 | 5 | 0.6 | 0.300 |
| E | 550 | 750 | 7 | 4.0 | 0.300 | 6 | 6 | 0.8 | 0.500 |
| F | 600 | 800 | 10 | 5.0 | 0.400 | 6.5 | 6.5 | 1.0 | 0.750 |
| G | 630 | 850 | 12 | 6.0 | 0.500 | 7 | 7 | 0.2 | 1.000 |
| H | 700 | 900 | 15 | 7.0 | 0.067 | 7.5 | 7.5 | 0.5 | 0.067 |
| J | 750 | 950 | 20 | 8.0 | 0.150 | 8 | 8 | 1.0 | 0.150 |
| K | 800 | 1000 | 24 | OFF | 0.3 | 8.5 | 8.0 | OFF | 0.300 |
| | | | | Flat | Instantaneous override | | | Trip | Flat |
| | | | | I²t | 6800 A | 8000 A | | Alarm | I²t |
| | | | | Pickup (Isd) and (Ii) limited by Max Instantaneous | | | | | |

### 10.2.29  PDG4 PXR25 and 20D settings

| Frame | 800A | All | | All | 800 A | G styles | |
|---|---|---|---|---|---|---|---|
| **Profile** | **Long delay** | | | **Short delay** | **Instantaneous** | **Ground** | |
| **Setting** | Pickup Ir (amps) | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | Pickup (Ig) Ig = nx (In) | Time (tg) tg (s) |
| Min | 320 | 0.5 | 1.5 | 0.050 | 2 | 0.2 | 0.100 |
| Max | 800 | 24 | 8.0 | 0.500 | 8.5 | 1.0 | 1.000 |
| Min | | 0.5 | | 0.067 | | 0.2 | 0.067 |
| Max | | 7 | | 0.300 | | 1.0 | 0.300 |
| Step | 10 | 0.10 | 0.10 | 0.010 | 0.10 | 0.010 | 0.010 |
| Add'l opt | | | OFF | | | OFF | |
| | | $I^2t$ | | Flat | Instantaneous override | Trip | Flat |
| | | $I^4t$ | | $I^2t$ | 6800 A | Alarm | $I^2t$ |

### 10.2.30  PDC4 PXR25 and 20D settings

| Frame | 800 A | 1000 A | All | All | 800 A | 1000 A | G styles | |
|---|---|---|---|---|---|---|---|---|
| **Profile** | **Long delay** | | | **Short delay** | **Instantaneous** | | **Ground** | |
| **Setting** | Pickup Ir (amps) | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | Pickup (Ig) Ig = nx (In) | Time (tg) tg (s) |
| Min | 320 | 400 | 0.5 | 1.5 | 0.050 | 2 | 2 | 0.2 | 0.100 |
| Max | 800 | 1000 | 24.0 | 8.0 | 0.500 | 17.6 | 11 | 1.0 | 1.000 |
| Min | | | 0.5 | | 0.067 | | | 0.2 | 0.067 |
| Max | | | 7 | | 0.300 | | | 1.0 | 0.300 |
| Step | 10 | 10 | 0.10 | 0.10 | 0.01 | 0.10 | 0.10 | 0.01 | 0.01 |
| Add'l opt | | | | OFF | | | | OFF | |
| | | | $I^2t$ | | Flat | Instantaneous override | | Trip | Flat |
| | | | $I^4t$ | | $I^2t$ | 4400 A | | Alarm | $I^2t$ |

### 10.2.31  PDG5 PXR20 settings

| Frame | 800 A | 1200 A | 1600 A IEC | 800 A | 1200 A | 1600 A IEC | All | | 800 A | 1200 A | 1600 A IEC | G styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Profile** | **Long delay** | | | | | | **Short delay** | | **Instantaneous** | | | **Ground** | |
| **Dial** | Ir (A) | | | Tr(S)@6x Ir | | | Isd (x Ir) | tsd (s) | Ii (x In) | | | Ig (x In) | tg (s) |
| **Setting** | Pickup Ir (amps) | | | Time (s) at 6x (Ir) | | | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | Pickup (Ig) Ig = nx (In)" | Time (tg) tg (s) |
| 1 | 320 | 500 | 800 | 0.5 | 0.5 | 0.5 | 1.5 | 0.050 | 2 | 2 | 2 | 0.2 | 0.100 |
| 2 | 350 | 550 | 900 | 1 | 1 | 1 | 2.0 | 0.100 | 3 | 3 | 2.5 | 0.3 | 0.150 |
| 3 | 400 | 600 | 1000 | 2 | 2 | 2 | 3.0 | 0.150 | 4 | 4 | 3 | 0.4 | 0.200 |
| 4 | 450 | 630 | 1100 | 4 | 4 | 4 | 4.0 | 0.200 | 5 | 5 | 3.5 | 0.6 | 0.300 |
| 5 | 500 | 700 | 1200 | 7 | 7 | 7 | 5.0 | 0.300 | 6 | 6 | 4 | 0.8 | 0.500 |
| 6 | 550 | 800 | 1250 | 8 | 10 | 10 | 6.0 | 0.400 | 8 | 7 | 5 | 1.0 | 0.750 |
| 7 | 600 | 900 | 1300 | 10 | 12 | 12 | 8.0 | 0.500 | 10 | 8 | 6 | 0.2 | 1.000 |
| 8 | 630 | 1000 | 1400 | 12 | 15 | 15 | 10.0 | 0.067 | 12 | 9 | 7 | 0.5 | 0.067 |
| 9 | 700 | 1100 | 1500 | 13 | 20 | 18 | 12.0 | 0.150 | 15 | 10 | 8 | 1.0 | 0.150 |
| 10 | 800 | 1200 | 1600 | 14 | 24 | 20 | OFF | 0.300 | 18.0 | 12.0 | 9 | OFF | 0.300 |
| | | | | | | | Flat | Instantaneous override | | | | Trip | Flat |
| | | | | | | | $I^2t$ | 14400 A | | | | Alarm | $I^2t$ |
| | | | | | | | Pickup (Isd) limited by Max Instantaneous | | | | | | |

### 10.2.32.1 PDG5 PXR25 and 20D settings

| Frame | 800 A | 1200 A | 1600 A IEC | 800 A | 1200 A | 1600 A IEC | All | | 800 A | 1200 A | 1600 A IEC | G styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile | Long delay | | | | | | Short delay | | Instantaneous | | | Ground | |
| Setting | Pickup Ir (amps) | | | Time (s) at 6x (Ir) | | | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | Pickup (Ig) Ig = nx (In) | Time (tg) tg (s) |
| Min | 320 | 500 | 800 | 0.5 | 0.5 | 0.5 | 1.5 | 0.050 | 2 | 2 | 2 | 0.2 | 0.100 |
| Max | 800 | 1200 | 1600 | 14.0 | 24.0 | 20.0 | 8.0 | 0.500 | 18 | 12 | 9 | 1.0 | 1.000 |
| Min | | | | 0.5 | 0.5 | 0.5 | | 0.067 | | | | 0.2 | 0.067 |
| Max | | | | 7 | 7 | 7 | | 0.300 | | | | 1.0 | 0.300 |
| Step | 10 | 10 | 10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.01 | 0.10 | | 0.10 | 0.01 | 0.01 |
| Add'l opt | | | | | | | OFF | | | | | OFF | |
| | | | | I²t | I²t | I²t | | Flat | Instantaneous override | | | Trip | Flat |
| | | | | I⁴t | I⁴t | I⁴t | | I²t | 14400 A | | | Alarm | I²t |

### 10.2.32.2

| Frame | 400 A | 400 A | All | 400 A | |
|---|---|---|---|---|---|
| Profile | Long delay | | Short delay | | Instantaneous |
| Setting | Pickup Ir (Amps) | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | Time (tsd) tsd (s) | Pickup Ii = nx (In) |
| Min | 150 | 0.5 | 1.5 | 0.050 | 2 |
| Max | 400 | 24.0 | 12.0 | 0.500 | 36 |
| Min | | 0.5 | | 0.067 | |
| Max | | 7 | | 0.300 | |
| Step | 1 | 0.10 | 0.10 | 0.01 | |
| Add'l opt | | | OFF | | |
| | | I²t | | Flat | Instantaneous override |
| | | I⁴t | | I²t | 14400A |

### 10.2.33  PDG6 PXR20 settings

| Setting | 1600 A | 2000 A | 2500 A IEC | All | 1600 A | 2000 A | 2500 A IEC | All | 1600 A | 2000 A | 2500 A IEC | G styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Long delay | | | | Short delay | | | | Instantaneous | | | Ground | |
| Profile | Ir (A) | | | Tr(S) @6x Ir | Isd (x Ir) | | | tsd (s) | Ii (x In) | | | Ig (x In) | tg (s) |
| Dial / Setting | Pickup Ir (amps) | | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | | | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | Pickup (Ig) Ig = nx(In) | Time (tg) tg (s) |
| 1 | 700 | 1000 | 1600 | 0.5 | 1.5 | 1.5 | 1.5 | 0.050 | 2 | 2 | 2 | 0.2 | 0.100 |
| 2 | 800 | 1100 | 1700 | 1 | 2.0 | 2.0 | 2.0 | 0.100 | 3 | 3 | 2.5 | 0.3 | 0.150 |
| 3 | 900 | 1200 | 1800 | 2 | 3.0 | 3.0 | 2.5 | 0.150 | 4 | 4 | 3 | 0.4 | 0.200 |
| 4 | 1000 | 1250 | 1900 | 4 | 4.0 | 4.0 | 3.0 | 0.200 | 5 | 5 | 3.5 | 0.6 | 0.300 |
| 5 | 1100 | 1400 | 2000 | 7 | 5.0 | 5.0 | 3.5 | 0.300 | 6 | 6 | 4 | 0.8 | 0.500 |
| 6 | 1200 | 1600 | 2100 | 10 | 6.0 | 6.0 | 4.0 | 0.400 | 7 | 7 | 4.5 | 1.0 | 0.750 |
| 7 | 1250 | 1700 | 2200 | 12 | 7.0 | 7.0 | 4.5 | 0.500 | 8 | 7.5 | 5 | 0.2 | 1.000 |
| 8 | 1400 | 1800 | 2300 | 15 | 8.0 | 8.0 | 5.0 | 0.067 | 9 | 8 | 6 | 0.5 | 0.067 |
| 9 | 1500 | 1900 | 2400 | 20 | 9.0 | 9.0 | 6.0 | 0.150 | 10 | 8.5 | 7 | 1.0 | 0.150 |
| 10 | 1600 | 2000 | 2500 | 24 | OFF | OFF | OFF | 0.300 | 10.94 | 8.75 | 7.00 | OFF | 0.300 |

| | | | |
|---|---|---|---|
| Flat | Instantaneous override | Trip | Flat |
| I²t | 17500 A | Alarm | I²t |
| Pickup (Isd) limited by Max Instantaneous | | | |

Note that ground fault pickup will not exceed 1200 A.

### 10.2.34  PDG6 PXR25 and 20D settings

| Setting | 1600 A | 2000 A | 2500 A IEC | All | 1600 A | 2000 A | 2500 A IEC | All | 800 A | 1200 A | 1600 A IEC | G styles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frame | Long delay | | | | Short delay | | | | Instantaneous | | | Ground | |
| Profile | Ir (A) | | | | Isd (x Ir) | | | | Ii (x In) | | | Ig (x In) | |
| | Pickup Ir (amps) | | | Time (s) at 6x (Ir) | Pickup (Isd) Isd =nx (Ir) | | | Time (tsd) tsd (s) | Pickup Ii = nx (In) | | | Pickup (Ig) Ig = nx(In) | Time (tg) tg (s) |
| Min | 700 | 1000 | 1600 | 0.5 | 1.5 | 1.5 | 1.5 | 0.050 | 2 | 2 | 2 | 0.2 | 0.100 |
| Max | 1600 | 2000 | 2500 | 24.0 | 9.0 | 9.0 | 6.0 | 0.500 | 10.94 | 8.75 | 7.00 | 1.0 | 1.000 |
| Min | | | | 0.5 | | | | 0.067 | | | | 0.2 | 0.067 |
| Max | | | | 7 | | | | 0.300 | | | | 1.0 | 0.300 |
| Step | 10 | 10 | 10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.01 | 0.10 | 0.10 | 0.10 | 0.01 | 0.01 |
| Add'l opt | | | | | OFF | OFF | OFF | | | | | OFF | |

| | | | |
|---|---|---|---|
| I²t | | | |
| I⁴t | | | |
| Flat | Instantaneous override | Trip | Flat |
| I²t | 17500 A | Alarm | I²t |
| Pickup (Isd) limited by Max Instantaneous | | | |

Note that ground fault pickup will not exceed 1200 A.

# 11 Modbus register map

A ModbusRTU communication module is integrated to the trip unit for certain styles.

## 11.1 Viewing/setting Modbus parameters

Modbus connection parameters can be viewed and set from LCD display, via PXPM and Modbus communication. To view from Modbus communication, the settings are stored beginning at register number 404000 and extending through 404003 and may be read by using function code 03 or 04, listed in the following table. These four registers can be written one by one with function code 06 to change Modbus setting. If the data written into these registers is out of range, it will result in an exception code 03.

| Register | | Modbus parameters | |
|---|---|---|---|
| DEC | HEX | Descriptions | Data range |
| 4000 | F9F | Slave ID | 001 – 246 (factory default = 2) |
| 4001 | FA0 | Baud rate | 00 = 9600 bit/s<br>01 = 19200 bit/s (factory default)<br>02 = 38400 bit/s<br>03 = 57600 bit/s |
| 4002 | FA1 | Parity | 00 = None<br>01 = Odd<br>02 = Even (factory default) |
| 4003 | FA2 | Stop bit | 00 = 1 bit (factory default)<br>01 = 2 bits |

| Color code | Wire colors PD 2, 3, 4 & 5 | Terminal PD6 only | Name |
|---|---|---|---|
| G/BK | Green/Black | D8 | RTU_D(+) |
| G/R | Green/Red | D9 | RTU_D(-) |
| G | Green | D10 | RTU_GND |



**Notes:**

1. Modbus communication cable is a twisted-pair with shield and "daisy-chained" between devices. Connect to other Modbus nodes, max. 99 nodes, max. length 1200 meters (4000ft.).
Recommended cable: twisted-pair foil shield w/drain wire, 120 ohms impedance, rated for the application (typical Belden 3105A or Belden 3074F).

2. The first and last devices in the daisy-chain should have a 120 Ohm resistor placed between RTU_D(+) and RTU_D(-).

**Modbus RTU wiring**

## 11.2  Communication protocol

Only the Modbus RTU communication mode is recognized by the trip unit. The trip unit can support a maximum of 122 registers (244 data bytes) in a single Modbus transaction. The trip unit responds to Modbus function codes 02, 03, 04, 06, 08 and 16. Auxiliary power (24 V DC) is required for communications functionality.

To accommodate Modbus master that can only access to register 9999, some Eaton registers initially assigned above 9999 have been assigned dual access, both at the original register (to provide compatibility) and at a new register assignment below 9999. The format is given as low/high decimal number followed by low/high hexadecimal low/high. An example is: [401001/420481] [0x03E8/0x5000].

### 11.2.1 Communications protocol options

Configuring any or all registers 402001/425345 through 402003/425347(0x07D0/0x6300 through 0x07D2/0x6300) is accomplished using a write function code "06" or "16".

#### 11.2.1.1 Gap in block data

**Non-volatile register 402001/425345(0x07D0/0x6300) = 0: Block read including invalid data**

If zero when client request a block of data that includes unused registers, the trip unit will respond without errors, however the unused register may contain invalid data such as (0xFFFFFFFF16) for invalid unsigned fixed-point, (0x8000000016) may be used to represent an invalid signed fixed-point object and (0x7FF2000016) may be used to represent an invalid floating-point object.

**Non-volatile register 402001/425345(0x07D0/0x6300) <> 0: block read error with invalid data (Factory Default)**

If none-zero (factory default value), when the client requests a block read of data that includes unused register the illegal data object exception code 02 will be issued from the trip unit. No data from that block will be read.

**Note:** If the starting register number accesses an invalid object, the illegal data object exception code 02 will be issued, regardless of this configuration setting.

### *11.2.1.2 Floating-Point word order (32-bit)*

**Non-volatile register 402002/425346(0x07D1/0x6301) = 0: High word first**

If zero, when the register is set to be 0, the floating point high word is first in the Modbus register.

**Non-volatile register 402002/425346(0x07D1/0x6301) <> 0: Low word first (Factory Default)**

If none-zero (factory default value), the floating point low word is first in the Modbus register.

### *11.2.1.3 Fixed-Point word order (32-bit)*

**Non-volatile register 402003/425347(0x07D2/0x6302) = 0: High word first**

If zero, when the register is set to be 0, the fixed point high word is first in the Modbus register.

**Non-volatile register 402003/425347(0x07D2/0x6302) <> 0: Low word first (Factory Default)**

If none-zero (factory default value), the fixed point low word is first in the Modbus register.

## 11.3  Modbus register map

### 11.3.1  Input status (discrete inputs)

Input status bits 101001 through 101032 may be available using function code 02. The status definitions are defined the following table. The first 16 bits are the actual status state while the late 16 bits indicate whether the corresponding status state is valid, or supported by the trip unit.

| Register | | Input status data | Register | | Input status data validation |
|---|---|---|---|---|---|
| **DEC** | **HEX** | **Descriptions** | **DEC** | **HEX** | **Descriptions** |
| 1001 | 3E8 | Breaker is in the closed position | 1017 | 3F8 | "Breaker is in the closed position" is valid |
| 1002 | 3E9 | Un-acknowledged trip condition | 1018 | 3F9 | "Un-acknowledged trip condition" is valid |
| 1003 | 3EA | Active or un-acknowledged alarm | 1019 | 3FA | "Active or un-acknowledged alarm" is valid |
| 1005 | 3EC | Maintenance mode is active | 1021 | 3FC | "Maintenance mode is active" is valid |
| 1006 | 3ED | Test mode is active | 1022 | 3FD | "Test mode is active" is valid |
| 1010 | 3F1 | Long delay pickup is active | 1026 | 401 | "Long delay pickup is active" is valid |
| 1011 | 3F2 | Zone Interlock is active | 1027 | 402 | "Zone Interlock is active" is valid |
| 1013 | 3F4 | Ground is source ground | 1029 | 404 | "Ground is source ground" is valid |

## 11.3.2 Real-time data object registers

The data changing in real time, such as current, voltage, power, etc. are shown in the table below. Real time data can be obtained either in IEEE floating point or in fixed point format. For data shown in fixed point format, each result would be the real time data multiplied by a scale factor. The scale factors are shown as the last column in the table. Energy objects can be only obtained in fixed point format.

Each data object occupies two registers (four bytes) in length except for certain energy objects. These energy objects occupy four registers. Since these objects have the capability to change in real time, a complete data object must be obtained in a single transaction to avoid data tearing. Attempting to access a partial data object will result in an exception code 84. Refer to a later section entitled "Exception codes".

The two-register format is presented in units of kilowatt hours. The four-register format is presented in units of watt hours. The four registers encoded energy object occupies register 3 through register 0. Register 3 is the high order register and register 0 is the low order register. Register 3 high byte contains value corresponding to engineering units(power of 10 signed exponent). Register 3 low byte contains a mantissa multiplier value(power of 2 exponent). Register 2 through register 0 contains a 48-bit energy mantissa in units of watthours. The data format of four registers is shown.

**Floating point format and Note:** Format can be changed. Please see 11.3.5 Block of registers

| Modbus | Register Number (DEC) | | Register Address(HEX) | | Objects | | | | Trip Unit | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Functon Code | IEEE Float | Intiger | IEEE Float | Intiger | Descriptions | Units | Sign | Int Scale factor | PXR 20/20D | PXR 25 | PXR 25MP | Without GF |
| 3,4 | 4609 | 6145 | 1200 | 1800 | High byte is primary status, low byte is secondary status (see Section 0) | | Unsigned | | YES | YES | YES | YES |
| 3,4 | 4610 | 6146 | 1201 | 1801 | Cause of status (see Section 0) | | Unsigned | | YES | YES | YES | YES |
| 3,4 | 4611 | 6147 | 1202 | 1802 | IA | A | Signed | 10 | YES | YES | YES | YES |
| 3,4 | 4613 | 6149 | 1204 | 1804 | IB | A | Signed | 10 | YES | YES | YES | YES |
| 3,4 | 4615 | 6151 | 1206 | 1806 | IC | A | Signed | 10 | YES | YES | YES | YES |
| 3,4 | 4617 | 6153 | 1208 | 1808 | IG | A | Signed | 10 | YES | YES | YES | |
| 3,4 | 4619 | 6155 | 120A | 180A | IN | A | Signed | 10 | YES | YES | YES | YES |
| 3,4 | 4623 | 6159 | 120E | 180E | VAB | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4625 | 6161 | 1210 | 1810 | VBC | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4627 | 6163 | 1212 | 1812 | VCA | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4631 | 6167 | 1216 | 1816 | VAN | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4633 | 6169 | 1218 | 1818 | VBN | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4635 | 6171 | 121A | 181A | VCN | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4641 | 6177 | 1220 | 1820 | Peak la demand | A | Signed | 10 | | | YES | YES |
| 3,4 | 4643 | 6179 | 1222 | 1822 | Peak Ib demand | A | Signed | 10 | | | YES | YES |
| 3,4 | 4645 | 6181 | 1224 | 1824 | Peak Ic demand | A | Signed | 10 | | | YES | YES |
| 3,4 | 4649 | 6185 | 1228 | 1828 | Peak In demand | A | Signed | 11 | | | YES | YES |
| 3,4 | 4651 | 6187 | 122A | 182A | Real 3 phase power | W | Signed | 1 | | YES | YES | YES |
| 3,4 | 4653 | 6189 | 122C | 182C | Reactive 3 phase power | Vars | Signed | 1 | | YES | YES | YES |
| 3,4 | 4655 | 6191 | 122E | 182E | Apparent 3 phase power | VA | Signed | 1 | | YES | YES | YES |
| 3,4 | 4659 | 6195 | 1232 | 1832 | Power factor | | Signed | 100 | | YES | YES | YES |
| 3,4 | 4661 | 6197 | 1234 | 1834 | Frequency | Hz | Signed | 10 | | YES | YES | YES |
| 3,4 | 4665 | 6201 | 1238 | 1838 | minimum la demand | A | Signed | 10 | | | YES | YES |
| 3,4 | 4667 | 6203 | 123A | 183A | minimum Ib demand | A | Signed | 10 | | | YES | YES |
| 3,4 | 4669 | 6205 | 123C | 183C | minimum Ic demand | A | Signed | 10 | | | YES | YES |
| 3,4 | 4673 | 6209 | 1240 | 1840 | minimum In demand | A | Signed | 10 | | | YES | YES |
| 3,4 | 4697 | 6233 | 1258 | 1858 | Real power peak demand | W | Signed | 1 | | YES | YES | YES |
| 3,4 | 4719 | | 126E | | Product ID | | Unsigned | | YES | YES | YES | YES |
| 3,4 | 4721 | 6257 | 1270 | 1870 | Frequency | Hz | Unsigned | 100 | | YES | YES | YES |

| Modbus | Register Number (DEC) | | Register Address(HEX) | | Objects | | | | | Trip Unit | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Functon Code | IEEE Float | Intiger | IEEE Float | Intiger | Descriptions | Units | Sign | Int Scale factor | PXR 20/20D | PXR 25 | PXR 25MP | Without GF |
| 3,4 | | 6259 | | 1872 | Forward energy | KWh | Signed | 1 | | YES | YES | YES |
| 3,4 | | 6261 | | 1874 | Reverse energy | KWh | Signed | 1 | | YES | YES | YES |
| 3,4 | | 6263 | | 1876 | Total energy | KWh | Signed | 1 | | YES | YES | YES |
| 3,4 | | 6271 | | 187E | Apparent energy | KVAh | Signed | 1 | | YES | YES | YES |
| 3,4 | 4765 | 6301 | 129C | 189C | Temperature | C | Signed | 1 | YES | YES | YES | YES |
| 3,4 | | 6305 | | 18A0 | Forward energy | Wh | Signed | 1 | | YES | YES | YES |
| 3,4 | | 6309 | | 18A4 | Reverse energy | Wh | Signed | 1 | | YES | YES | YES |
| 3,4 | | 6313 | | 18A8 | Total energy | Wh | Signed | 1 | | YES | YES | YES |
| 3,4 | | 6329 | | 18B8 | Apparent energy | Vah | Signed | 1 | | YES | YES | YES |
| 3,4 | 4797 | 6333 | 12BC | 18BC | Reactive power peak demand | Vars | Signed | 1 | | YES | YES | YES |
| 3,4 | 4799 | 6335 | 12BE | 18BE | Apparent power peak demand | VA | Signed | 1 | | YES | YES | YES |
| 3,4 | 4835 | 6371 | 12E2 | 18E2 | Ia demand | A | Signed | 10 | | | YES | YES |
| 3,4 | 4837 | 6373 | 12E4 | 18E4 | Ib demand | A | Signed | 10 | | | YES | YES |
| 3,4 | 4839 | 6375 | 12E6 | 18E6 | Ic demand | A | Signed | 10 | | | YES | YES |
| 3,4 | 4843 | 6379 | 12EA | 18EA | In demand | A | Signed | 10 | | | YES | YES |
| 3,4 | 4845 | 6381 | 12EC | 18EC | Real power demand | W | Signed | 1 | | YES | YES | YES |
| 3,4 | 4847 | 6383 | 12EE | 18EE | Reactive power demand | Vars | Signed | 1 | | YES | YES | YES |
| 3,4 | 4849 | 6385 | 12F0 | 18F0 | Apparent power demand | VA | Signed | 1 | | YES | YES | YES |
| 3,4 | 4851 | 6387 | 12F2 | 18F2 | Minimum IA | A | Signed | 10 | YES | YES | YES | YES |
| 3,4 | 4853 | 6389 | 12F4 | 18F4 | Maximum IA | A | Signed | 10 | YES | YES | YES | YES |
| 3,4 | 4855 | 6391 | 12F6 | 18F6 | Minimum IB | A | Signed | 10 | YES | YES | YES | YES |
| 3,4 | 4857 | 6393 | 12F8 | 18F8 | Maximum IB | A | Signed | 10 | YES | YES | YES | YES |
| 3,4 | 4859 | 6395 | 12FA | 18FA | Minimum IC | A | Signed | 10 | YES | YES | YES | YES |
| 3,4 | 4861 | 6397 | 12FC | 18FC | Maximum IC | A | Signed | 10 | YES | YES | YES | YES |
| 3,4 | 4863 | 6399 | 12FE | 18FE | Minimum IG | A | Signed | 10 | YES | YES | YES | |
| 3,4 | 4865 | 6401 | 1300 | 1900 | Maximum IG | A | Signed | 10 | YES | YES | YES | |
| 3,4 | 4867 | 6403 | 1302 | 1902 | Minimum IN | A | Signed | 10 | YES | YES | YES | YES |
| 3,4 | 4869 | 6405 | 1304 | 1904 | Maximum IN | A | Signed | 10 | YES | YES | YES | YES |
| 3,4 | 4871 | 6407 | 1306 | 1906 | Minimum VAB | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4873 | 6409 | 1308 | 1908 | Maximum VAB | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4875 | 6411 | 130A | 190A | Minimum VBC | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4877 | 6413 | 130C | 190C | Maximum VBC | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4879 | 6415 | 130E | 190E | Minimum VCA | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4881 | 6417 | 1310 | 1910 | Maximum VCA | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4883 | 6419 | 1312 | 1912 | Minimum VAN | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4885 | 6421 | 1314 | 1914 | Maximum VAN | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4887 | 6423 | 1316 | 1916 | Minimum VBN | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4889 | 6425 | 1318 | 1918 | Maximum VBN | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4891 | 6427 | 131A | 191A | Minimum VCN | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4893 | 6429 | 131C | 191C | Maximum VCN | V | Signed | 10 | | YES | YES | YES |
| 3,4 | 4911 | 6447 | 132E | 192E | current phase unbalance | % | Unsigned | 100 | | | YES | YES |
| 3,4 | 4913 | 6449 | 1330 | 1930 | voltage phase unbalance | % | Unsigned | 100 | | | YES | YES |
| 3,4 | 4915 | 6451 | 1332 | 1932 | Ia% THD | % | Unsigned | 100 | | YES | YES | YES |
| 3,4 | 4917 | 6453 | 1334 | 1934 | Ib% THD | % | Unsigned | 100 | | YES | YES | YES |
| 3,4 | 4919 | 6455 | 1336 | 1936 | Ic% THD | % | Unsigned | 100 | | YES | YES | YES |
| 3,4 | 4923 | 6459 | 133A | 193A | In% THD | % | Unsigned | 100 | | YES | YES | YES |
| 3,4 | 4925 | 6461 | 133C | 193C | Vab% THD | % | Unsigned | 100 | | YES | YES | YES |
| 3,4 | 4927 | 6463 | 133E | 193E | Vbc% THD | % | Unsigned | 100 | | YES | YES | YES |
| 3,4 | 4929 | 6465 | 1340 | 1940 | Vca% THD | % | Unsigned | 100 | | YES | YES | YES |

# 11 Modbus register map

| Modbus | Register Number (DEC) | | Register Address(HEX) | | Objects | | | | | Trip Unit | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Functon Code | IEEE Float | Intiger | IEEE Float | Intiger | Descriptions | Units | Sign | Int Scale factor | | PXR 20/20D | PXR 25 | PXR 25MP | Without GF |
| 3,4 | 4931 | 6467 | 1342 | 1942 | Van% THD | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 4933 | 6469 | 1344 | 1944 | Vbn% THD | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 4935 | 6471 | 1346 | 1946 | Vcn% THD | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 4959 | 6495 | 135E | 195E | INST/SDT/HIGH_INST count | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4961 | 6497 | 1360 | 1960 | LFT/GFT count | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4963 | 6499 | 1362 | 1962 | Operations count | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4965 | 6501 | 1364 | 1964 | Short Delay Trip count | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4967 | 6503 | 1366 | 1966 | Inst Delay Trip count | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4969 | 6505 | 1368 | 1968 | High Current Delay Trip count | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4971 | 6507 | 136A | 196A | Long Delay Trip count | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4973 | 6509 | 136C | 196C | Ground Fault Trip count | | Unsigned | 1 | | YES | YES | YES | |
| 3,4 | 4975 | 6511 | 136E | 196E | Total Trip count | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4977 | 6513 | 1370 | 1970 | Test Trip count | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4979 | 6515 | 1372 | 1972 | Open by Comm count | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4981 | 6517 | 1374 | 1974 | Manual Open count | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4983 | 6519 | 1376 | 1976 | Time of Last Operation (Year) | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4985 | 6521 | 1378 | 1978 | Time of Last Operation (Month) | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4987 | 6523 | 137A | 197A | Time of Last Operation (Day) | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4989 | 6525 | 137C | 197C | Time of Last Operation (Hour) | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4991 | 6527 | 137E | 197E | Time of Last Operation (Minute) | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4993 | 6529 | 1380 | 1980 | Time of Last Operation (second) | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4995 | 6531 | 1382 | 1982 | Max Device Temperature | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4997 | 6533 | 1384 | 1984 | Time of Max Device Temp (Year) | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 4999 | 6535 | 1386 | 1986 | Time of Max Device Temp (Month) | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 5001 | 6537 | 1388 | 1988 | Time of Max Device Temp (Day) | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 5003 | 6539 | 138A | 198A | Time of Max Device Temp (Hour) | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 5005 | 6541 | 138C | 198C | Time of Max Device Temp (Minute) | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 5007 | 6543 | 138E | 198E | Time of Max Device Temp (Second) | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 5009 | 6545 | 1390 | 1990 | Running Time: Minute | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 5011 | 6547 | 1392 | 1992 | Running Time: Hour | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 5013 | 6549 | 1394 | 1994 | Running Time: Day | | Unsigned | 1 | | YES | YES | YES | YES |
| 3,4 | 5015 | 6551 | 1396 | 1996 | Health Status: Percent | | Unsigned | 10000-x /10000 | | YES | YES | YES | YES |
| 3,4 | 5025 | 6561 | 13A0 | 19A0 | harmonics are for: | | | 1 | | | YES | YES | YES |
| 3,4 | | | | | 0 - Ia | | | | | | | | YES |
| 3,4 | | | | | 1 - Ib | | | | | | | | YES |
| 3,4 | | | | | 2 - Ic | | | | | | | | YES |
| 3,4 | | | | | 4 - In | | Unsigned | | | | | | YES |
| 3,4 | | | | | 5 - Vab | | | | | | | | YES |
| 3,4 | | | | | 6 - Vbc | | | | | | | | YES |
| 3,4 | | | | | 7 - Vca | | | | | | | | YES |
| 3,4 | | | | | 8 - Van | | | | | | | | YES |
| 3,4 | | | | | 9 - Vbn | | | | | | | | YES |
| 3,4 | | | | | 10 - Vcn | | | | | | | | YES |
| 3,4 | 5027 | 6563 | 13A2 | 19A2 | Item harmonics[0] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5029 | 6565 | 13A4 | 19A4 | Item harmonics[1] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5031 | 6567 | 13A6 | 19A6 | Item harmonics[2] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5033 | 6569 | 13A8 | 19A8 | Item harmonics[3] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5035 | 6571 | 13AA | 19AA | Item harmonics[4] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5037 | 6573 | 13AC | 19AC | Item harmonics[5] | % | Unsigned | 100 | | | YES | YES | YES |

| Modbus | Register Number (DEC) | | Register Address(HEX) | | Objects | | | | | Trip Unit | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Functon Code | IEEE Float | Intiger | IEEE Float | Intiger | Descriptions | Units | Sign | Int Scale factor | | PXR 20/20D | PXR 25 | PXR 25MP | Without GF |
| 3,4 | 5039 | 6575 | 13AE | 19AE | Item harmonics[6] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5041 | 6577 | 13B0 | 19B0 | Item harmonics[7] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5043 | 6579 | 13B2 | 19B2 | Item harmonics[8] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5045 | 6581 | 13B4 | 19B4 | Item harmonics[9] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5047 | 6583 | 13B6 | 19B6 | Item harmonics[10] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5049 | 6585 | 13B8 | 19B8 | Item harmonics[11] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5051 | 6587 | 13BA | 19BA | Item harmonics[12] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5053 | 6589 | 13BC | 19BC | Item harmonics[13] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5055 | 6591 | 13BE | 19BE | Item harmonics[14] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5057 | 6593 | 13C0 | 19C0 | Item harmonics[15] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5059 | 6595 | 13C2 | 19C2 | Item harmonics[16] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5061 | 6597 | 13C4 | 19C4 | Item harmonics[17] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5063 | 6599 | 13C6 | 19C6 | Item harmonics[18] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5065 | 6601 | 13C8 | 19C8 | Item harmonics[19] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5067 | 6603 | 13CA | 19CA | Item harmonics[20] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5069 | 6605 | 13CC | 19CC | Item harmonics[21] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5071 | 6607 | 13CE | 19CE | Item harmonics[22] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5073 | 6609 | 13D0 | 19D0 | Item harmonics[23] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5075 | 6611 | 13D2 | 19D2 | Item harmonics[24] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5077 | 6613 | 13D4 | 19D4 | Item harmonics[25] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5079 | 6615 | 13D6 | 19D6 | Item harmonics[26] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5081 | 6617 | 13D8 | 19D8 | Item harmonics[27] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5083 | 6619 | 13DA | 19DA | Item harmonics[28] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5085 | 6621 | 13DC | 19DC | Item harmonics[29] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5087 | 6623 | 13DE | 19DE | Item harmonics[30] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5089 | 6625 | 13E0 | 19E0 | Item harmonics[31] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5091 | 6627 | 13E2 | 19E2 | Item harmonics[32] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5093 | 6629 | 13E4 | 19E4 | Item harmonics[33] | % | Unsigned | 100 | | | YES | YES | YES |
| 3,4 | 5095 | 6631 | 13E6 | 19E6 | Item harmonics[34] | % | Unsigned | 100 | | | YES | YES | YES |

Note: V1.3.8 or higher for harmonics on PXR25 non Motor Protection (5025-5095)

### 11.3.3  Set points registers

The trip unit's set points are organized into groups. Each group can be considered as a binary array of information which can be obtained through Modbus register access. Register 403001 is an R/W register used to select the particular group (Default selected group 0). The high byte contains the requested group number, while the low byte must contain 255(0FF16). The set points register can be read using function code 03 or 04. Register 3001 can be written using function code 06 or 16. For trip units which support write set points capabilities, the set points group 0/1/2 should be written one by one using function code 06, the set points group four should be written the whole group using function code 16. Before reading or writing the set points, register 3001 should be written to choose corresponding group. Before writing any set points, you must input correct password, and write the set points within ten seconds after password checks ok.

# 11 Modbus register map

## Set points group 0: system group

| Modbus Functon code | Register number DEC | Register number HEX | Bit field | Mask field | Set point name | R/W | Format | Value definition | Unit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 3000 | BB7 | 15-0 | 0xFFFF | Password | W | Encoded | Default "0-0-0-0" | | |
| 3,4,6,16 | 3001 | BB8 | 15-0 | 0xFFFF | Group 0 = System | R/W | | 0x00FF (hex) 255 (dec) | | |
| 3,4 | 3002 | BB9 | 12-0 | 0x0FFF | Rating information | R | Encoded | PD2 UL: 60, 100, 150, 225<br>PD2 IEC: 63, 100, 160, 200, 225<br>PD2 MP 60, 100, 150, 200<br>PD3 125,250,400<br>PD3H 125, 250, 400, 600<br>PD4 UL 800<br>PD4 IEC 800, 1000<br>PD5 UL 800, 1200<br>PD5 IEC 1600<br>PD6 1600, 2000, 2500 | A | |
| 3,4 | 3003 | BBA | 4-0 | 0x001A | Breaker frame | R | Encoded | 00 --> NRX NF<br>01 --> NRX RF<br>11 --> NZM2<br>12 --> NZM3<br>13 --> NZM4<br>21 --> PD2<br>22 --> PD3<br>23 --> PD3H<br>24 --> PD4<br>25 --> PD5<br>26 --> PD6 | | |
| 3,4 | 3004 | BBB | 13-0 | 0x1FFF | Style 1 | R | "Encoded" | b0 --> LdSel : with long delay protection<br>b1 --> SdSel : with short delay protection<br>b2 --> InstSel : with Inst protection<br>b3 --> GfSel : with ground fault protection<br>b4 --> ARMSel : with maintenance mode<br>b5 --> OvrideSel : with override protection<br>b6 --> RCDSel : with ground fault RCD<br>b7 --> MotorSel : with motor protection<br>b8 --> NeuSenorSel : with neutral sensor<br>b9 --> ThermalSel : with thermal memory<br>b12 --> VoltSel : with voltage sampling feature<br>b13 --> ExtADCSel : with external AD7779 | | |
| 3,4 | 3005 | BBC | 13-0 | 0x1FFF | Style 2 | R | Encoded | b0 --> ModbusSel : with integrated Modbus<br>b1 --> CAMSel : with CAM port<br>b2 --> InstSel : with Inst protection<br>b3 --> RelaySel : with relay<br>b4 --> ZSISel : with ZSI<br>b12 --> NZM_ACB_Sel<br>b13 --> IECSel : IEC = 1, UL = 0 | | |
| 3,4 | 3006 | BBD | 8 | 0x0100 | Maintenance mode: Current state | R | Encoded | b8 --> 0 = Off 1 = On | | Only available with units that have ARMS |
| 3,4,6 | | | 1 | 0x0001 | Maintenance mode: activated by remote control | R/W | Encoded | b1 --> 0 = Off 1 = On | | Only available with units that have ARMS |
| 3,4,6 | | | 15-0 | 0x0101 | Maintenance Mode: full word (DEC/HEX) | R/W | Encoded | (0/0) = Off<br>(256/0x0100) = On Local<br>(257/0x0101) = On Remote | | Only available with units that have ARMS |
| 3,4,6 | 3007 | BBE | 2-0 | 0x0007 | Arms level | R/W | Encoded | 1 = 2.5 * In<br>2 = 4 * In<br>3 = 6 * In<br>4 = 8 * In<br>5 = 10 * In | A | Only available with units that have ARMS |
| 3,4 | 3008 | BBF | 1-0 | | Frequency | R | Unsigned | Range: 50, 60 , 400 | Hz | |
| 3,4,6 | 3009 | BC0 | 0 | 0x0001 | Rev feed | R/W | Encoded | 0 = Forward 1 = Reverse | | PXR25 only |
| 3,4,6 | 3010 | BC1 | 0 | 0x0001 | Sign convention | R/W | Encoded | sign convention :<br>0 = IEC, 1 = IEEE, 2 = IEEEalt | | PXR25 only |
| 3,4,6 | 3011 | BC2 | 1-0 | 0x0003 | Power window | R/W | Encoded | Power demand window :<br>0 = fixed, 1 = sliding | | PXR25 only |

| Modbus Functon code | Register number DEC | Register number HEX | Bit field | Mask field | Set point name | R/W | Format | Value definition | Unit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 3,4,6 | 3012 | BC3 | 5-0 | 0X003C | Power interval | R/W | Encoded | Power demand interval: [5…60] min | Min | PXR25 only |
| 3,4,6 | 3013 | BC4 | 4-0 | 0x0017 | Language | R/W | Encoded | set language on local LCD display<br>0x01 --> English<br>0x02 --> German<br>0x03 --> French<br>0x04 --> Spanish<br>0x05 --> Italian<br>0x06 --> Chinese<br>0x07 --> Russian<br>0x08 --> Dutch<br>0x09 --> Danish<br>0x10 --> Greek<br>0x11 --> Portuguese<br>0x12 --> Swedish<br>0x13 --> Finnish<br>0x14 --> Czech<br>0x15 --> Estonian<br>0x16 --> Hungarian<br>0x17 --> Lithuanian<br>0x18 --> Latvian<br>0x19 --> Polish<br>0x20 --> Slovenian<br>0x21 --> Slovak<br>0x22 --> Bulgarian<br>0x23 --> Romanian | | |
| 3,4,6 | 3014 | BC5 | 1-0 | 0x0003 | LCD Rotation | R/W | Encoded | Setting LCD display direction<br>0 <--> horizontal<br>1 <--> vertical - left<br>2 <--> vertical - right | | |
| 3,4,6 | 3015 | BC6 | | | Relay Config 1 | R/W | Unsigned | 0x01 --> Trip Overload<br>0x02 --> Trip Neutral Current<br>0x03 --> Trip Shout Circuit<br>0x04 --> Trip Shout Delay<br>0x05 --> Trip Instantaneous<br>0x06 --> Trip Ground Fault<br>0x07 --> Trip Main Mode<br>0x08 --> Trip All Trips<br>0x20 --> Other Aux Contact<br>0x21 --> Other Bell Contact<br>0x22 --> Other Arms Active<br>0x23 --> Other ZSI Active<br>0x24 --> Other ZSI Input<br>0x25 --> Other ZSI Output<br>0x26 --> Other Comm Open Breaker Pulse<br>0x27 --> Other Comm Close Breaker Pulse<br>0x27 --> Other Comm Output<br>0x40 --> Alarm High Load 1<br>0x41 --> Alarm High Load 2<br>0x42 --> Alarm High Temp.<br>0x43 --> Alarm Ground Fault<br>0x44 --> Alarm Thermal Mem<br>0x45 --> Alarm Watchdog<br>0x46 --> Alarm Low Battery<br>0x47 --> Alarm HW Fault<br>0x49 --> Alarm Breaker Health<br>0x4A --> Alarm Comms Fault<br>0x4B --> Alarm All Faults | | |
| 3,4,6 | 3016 | BC7 | | | Relay Config 2 | R/W | Unsigned | | | |
| | 3017 | BC8 | 0 | | Relay_config3 | R/W | Encoded | | | |
| | 3018 | BC9 | 0 | 0x0001 | Pole Location Phase A(1) | R/W | Encoded | Pole Location Phase A<br>0 = Left<br>1 = Right | | |
| | 3019 | BCA | | | Reserved | R | | | | |
| | 3020 | BCB | | | Reserved | R | | | | |
| | 3021 | BCC | | | Reserved | R | | | | |

## Set points group 1: protection group

| Modbus Function code | Register DEC | Register HEX | Bit field | Mask field | Set point name | R/W | Format | Value definition | Unit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 3000 | BB7 | 15-0 | 0xFFFF | Password | W | Encoded | Default "0-0-0-0" | | |
| 3,4,6,16 | 3001 | BB8 | 15-0 | 0xFFFF | Group 1 = protection Group | R/W | | (Hex) 0x01FF (Dec) 511 | | |
| 3,4 | 3002 | BB9 | 36861 | 0x0FFF | Rating information | R | Encoded | PD2 UL: 60, 100, 150, 225<br>PD2 IEC: 63, 100, 160, 200, 225<br>PD2 MP 60, 100, 150, 200<br>PD3 125,250,400<br>PD3H 125, 250, 400, 600<br>PD4 UL 800<br>PD4 IEC 800, 1000<br>PD5 UL 800, 1200<br>PD5 IEC 1600<br>PD6 1600, 2000, 2500 | A | |
| 3,4 | 3003 | BBA | 2-0 | 0x001A | Breaker frame | R | Encoded | 00 --> NRX NF<br>01 --> NRX RF<br>11 --> NZM2<br>12 --> NZM3<br>13 --> NZM4<br>21 --> PD2<br>22 --> PD3<br>23 --> PD3H<br>24 --> PD4<br>25 --> PD5<br>26 --> PD6 | | |
| 3,4 | 3004 | BBB | | 0x1FFF | Style 1 | R | Encoded<br>0 = false<br>1 = true | b0 --> LdSel : with long delay protection<br>b1 --> SdSel : with short delay protection<br>b2 --> InstSel : with Inst protection<br>b3 --> GfSel : with ground fault protection<br>b4 --> ARMSel : with maintenance mode<br>b5 --> OvrideSel : with override protection<br>b6 --> RCDSel : with ground fault RCD<br>b7 --> MotorSel : with motor protection<br>b8 --> NeuSenorSel : with neutral sensor<br>b9 --> ThermalSel : with thermal memory<br>b12 --> VoltSel : with voltage sampling feature<br>b13 --> ExtADCSel : with external AD7779 | | |
| 3,4 | 3005 | BBC | 13-0 | 0x1FFF | Style 2 | R | Encoded | b0 --> ModbusSel : with integrated Modbus<br>b1 --> CAMSel : with CAM port<br>b2 --> InstSel : with Inst protection<br>b3 --> RelaySel : with relay<br>b4 --> ZSISel : with ZSI<br>b12 --> NZM_ACB_Sel<br>b13 --> IECSel : IEC = 1, UL = 0 | | |
| 3,4,6 | 3006 | BBD | 0 | 0x0001 | LD thermal memory | R/W | Encoded | thermal memory enable/disable<br>LD Thermal Memory (powered and unpowered operation. Used only in I2t and I4t)<br>trip unit :<br>0 <--> off<br>1 <--> cooling | | |
| 3,4,6 | 3007 | BBE | 0 | 0x0001 | ZSI | R/W | Encoded | ZSI, zone interlock<br>*when enable, for trip unit with G, ZSI is implemented for short delay and ground fault.<br>*when enable, for trip unit without G, ZSI is implemented for short delay.<br>trip unit side :<br>0 <--> disable<br>1 <--> enable | | |
| 3,4,6 | 3008 | BBF | 1-0 | 0x0003 | LD Slop | R/W | Encoded | long delay slope:<br>0 = I0.5T 1 = IT<br>2 = I2T 3 = I4T | | |
| 3,4,6 | 3009 | BC0 | | | LD pick up (Ir) | R/W | Unsigned | long delay pick up:<br>detail see the ""PXR MCCB amp rating labels""<br>Ir = xxx ( A ) | A | |
| 3,4,6 | 3010 | BC1 | | | LD time (tr) | R/W | Unsigned | long delay time:<br>detail see the ""PXR MCCB amp rating labels""<br>Tr = xxx /10 ( s ) | Sec | |

| Modbus Function code | Register DEC | HEX | Bit field | Mask field | Set point name | R/W | Format | Value definition | Unit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 3,4,6 | 3011 | BC2 | | | Alarm High Load 1 | R/W | Unsigned | Alarm 1 / High Load 1 [50...120*] step 1 50% Ir...120% Ir (Must be less than Alarm High Load 2) * 130 for Motor protection styles | % | |
| 3,4,6 | 3012 | BC3 | 0 | 0x0001 | SD slp | R/W | Encoded | Short delay slope: 0 = flat 1 = I2T [5…60] min | | |
| 3,4,6 | 3013 | BC4 | | | SD pick up (Isd) | R/W | Unsigned | Short delay pick up: detail see the ""PXR MCCB amp rating labels"" Isd = xxx /10 ( xIr ) | *Ir | |
| 3,4,6 | 3014 | BC5 | | | SD time (tsd) | R/W | Unsigned | Short delay time: detail see the ""PXR MCCB amp rating labels"" Tsd = xxx / 1000 ( s ) | ms | |
| 3,4,6 | 3015 | BC6 | | | Instantaneous pick up(Ii) | R/W | Unsigned | Instantaneous pick up: detail see the ""PXR MCCB amp rating labels"" Ii = xxx /10 ( xIn ) | *In | |
| 3,4 | 3016 | BC7 | 0 | 0x0001 | Ground sensing type | R | Encoded | Ground sensing type setting: MCCB only support residual mode 0 = residual 1 = source/zero sequence | | Only on units with ground fault |
| 3,4,6 | 3017 | BC8 | 0-1 | 0x0003 | Local ground fault type | R/W | Encoded | Ground fault style - trip/alarm/OFF 0 = Trip 1 = Alarm 2 = OFF | | Only on units with ground fault |
| 3,4,6 | 3018 | BC9 | 0 | 0x0001 | Ground fault slope | R/W | Encoded | Ground fault slope: 0 = Flat 1 = I2T | | Only on units with ground fault |
| 3,4,6 | 3019 | BCA | | | Ground pick up(Ig) | R/W | Unsigned | Ground fault pick up: detail see the ""PXR MCCB Amp Rating Labels"" Ig = xxx / 100 ( x In ) | *In | Only on units with ground fault |
| 3,4,6 | 3020 | BCB | | | Ground time(tg) | R/W | Unsigned | Ground fault time: detail see the ""PXR MCCB amp rating labels"" Tg = xxx / 1000 ( s ) | Sec | Only on units with ground fault |
| 3,4,6 | 3021 | BCC | | | Ground fault thermal memory | R/W | Encoded | Thermal memory enable/disable LD thermal memory (powered and unpowered operation. Used only in I2t and I4t) 0 = off 1 = cooling | | Only on units with ground fault |
| 3,4,6 | 3022 | BCD | | | Neutral protection ratio | R/W | Unsigned | Neutral protection ratio: 0 <--> 0% 60 <--> 60% 100 <--> 100% | % | |
| 3,4,6 | 3023 | BCE | | | Alarm High Load 1 | R/W | Unsigned | Alarm 2 / High Load 2 [50...120*] step 1 50% Ir...120% Ir (Must be greater than Alarm High Load 1) * 130 for Motor protection styles | | |
| 3,4,6 | 3024 | BCF | | | Ground Fautl Pre Alarm | R/W | Unsigned | Ground Fault trip pre alarm pick up: [50…100] step 5 | | Only on units with ground fault |
| 3,4 | 3025 | BD0 | | | Reserved | R | Unsigned | | | |

## Set points group 2: ModbusRTU group

| Modbus Function code | Register DEC | HEX | Bit field | Mask field | Set points name | R/W | Format | Value definition | Unit |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 3000 | BB7 | 15-0 | 0xFFFF | Password | W | Encoded | Default "0-0-0-0" | |
| 3,4,6,16 | 3001 | BB8 | 15-0 | 0xFFFF | Group 2 = On-board Modbus | R/W | | (Hex) 0x02FF (Dec) 767 | |
| 3,4,6 | 3002 | BB9 | 7-0 | 0x00F6 | Modbus RTU - Communication Address | R/W | Encoded | 001 - 247 | |
| 3,4,6 | 3003 | BBA | 2-0 | 0x0004 | Modbus RTU - baudrate | R/W | Encoded | 00 = 9600 bit/s<br>01 = 19200 bit/s<br>02 = 38400 bit/s<br>03 = 57600 bit/s<br>04 = 115200 bit/s | |
| 3,4,6 | 3004 | BBB | 1-0 | 0x0002 | Modbus RTU - Parity | R/W | Encoded | 00 = none<br>01 = odd<br>02 = even | |
| 3,4,6 | 3005 | BBC | 0 | 0x0001 | Modbus RTU - Stop bit | R/W | Encoded | 00 = 1 bit<br>01 = 2 bits | |

## Set points group 3: CAM settings group

| Modbus Function code | Register DEC | HEX | Bit field | Mask field | Set points name | R/W | Format | Value definition | Unit |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 3000 | BB7 | 15-0 | 0xFFFF | Password | W | Encoded | Default "0-0-0-0" | |
| 3,4,6,16 | 3001 | BB8 | 15-0 | 0xFFFF | Group 3 = Protection group | R/W | Encoded | (Hex) 0x01FF (Dec) 1023 | |
| 3,4 | 3002 | BB9 | | | CAM connection status | R | Encoded | 0 = No external CAM<br>1 = External Modbus<br>2 = INCOM CAM<br>3 = Ethernet CAM<br>4 = Profibus CAM | |
| 3,4 | 3003 | BBA | | | CAM communication address | R | Encoded | 001-246 | |
| 3,4 | 3004 | BBB | | | CAM baud rate | R | Encoded | 0 = 1200bps<br>1 = 4800bps<br>2 = 9600bps<br>3 = 19200bps | |
| 3,4 | 3005 | BBC | | | CAM parity | R | Encoded | 0 = None<br>1 = Odd<br>2 = Even | |
| 3,4,6 | 3006 | BBD | | | CAM stopbit | R | Encoded | 0 = 1bit<br>1 = 2bits | |
| 3,4,6 | 3007 | BBE | | | INCOM CAM baud rate | R | Encoded | 1 <--> 9600bps see IL01301033e<br>P8 for series NRX INCOM communication adapter module, baud rate is fixed at 9600 baud and represented by a value of 01 | |
| 3,4,6 | 3008 | BBF | | | Ethernet CAM DHCP enable | R | Encoded | 0 <--> false<br>1 <--> true | |
| 3,4,6 | 3009 | BC0 | | | Ethernet CAM IP addr. MSB | R | Encoded | 0-255 | |
| 3,4,6 | 3010 | BC1 | | | Ethernet CAM IP addr. LSB | R | Encoded | 0-255 | |
| 3,4,6 | 3011 | BC2 | | | Ethernet CAM IP addr. MSB | R | Encoded | 0-255 | |
| 3,4,6 | 3012 | BC3 | | | Ethernet CAM IP addr. LSB | R | Encoded | 0-255 | |
| 3,4,6 | 3013 | BC4 | | | | R | Encoded | Short delay pick up:<br>detail see the PXR MCCB amp rating labels Isd = xxx /10 ( xlr ) | |
| 3,4,6 | 3014 | BC5 | | | | R | Encoded | Short delay time:<br>detail see the PXR MCCB amp rating labels Tsd = xxx / 1000 ( s ) | |
| 3,4,6 | 3015 | BC6 | | | | R | Encoded | Instantaneous pick up:<br>detail see the PXR MCCB amp rating labels Ii = xxx /10 ( xln ) | |
| 3,4 | 3016 | BC7 | | | | R | Encoded | Ground sensing type setting: MCCB only support residual mode<br>0 = residual<br>1 = source/zero sequence | |

| Modbus Function code | Register DEC | Register HEX | Bit field | Mask field | Set points name | R/W | Format | Value definition | Unit |
|---|---|---|---|---|---|---|---|---|---|
| 3,4,6 | 3017 | BC8 | | | | R | Encoded | Ground fault style - trip/alarm/OFF<br>0 = Trip<br>1 = Alarm<br>2 = OFF | |
| 3,4,6 | 3018 | BC9 | | | | R | Encoded | Ground fault slope:<br>0 = Flat<br>1 = I2T | |

**Setpoints group 5 motor protection configuration**

| Register number DEC | HEX | Bit field | Mask field | Set points name | R/W | Format | Value definition |
|---|---|---|---|---|---|---|---|
| 403000 | BB7 | | | Password | W | Encoded | Default "0000" |
| 403001 | BB8 | | | Group5 - motor protection | R/W | Encoded | (HEX) 0x05FF (DEC) 1535 |
| 403002 | BB9 | 1-0 | | over voltage action | R/W | Encoded | 0 = Trip,<br>1 = Alarm,<br>2 = OFF |
| 403003 | BBA | | | over voltage pickup | R/W | Unsigned | xxx ( V ), from 180 to 720, 1 V step |
| 403004 | BBB | | | over voltage time | R/W | Unsigned | Time is from 1s to 300s,  1s step |
| 403005 | BBC | 1-0 | | under voltage action | R/W | Encoded | 0 = Trip,<br>1 = Alarm,<br>2 = OFF |
| 403006 | BBD | | | under voltage pickup | R/W | Unsigned | xxx ( V ), from 60 to 670, 1 V step |
| 403007 | BBE | | | under voltage time | R/W | Unsigned | Time is from 1s to 300s, 1s step |
| 403008 | BBF | 1-0 | | voltage unbalance action | R/W | Encoded | 0 = Trip,<br>1 = Alarm,<br>2 = OFF |
| 403009 | BC0 | | | voltage unbalance pickup | R/W | Unsigned | xxx ( % ),<br>from 5% to 25% max phase voltage, 1% step |
| 403010 | BC1 | | | voltage unbalance time | R/W | Unsigned | Time is from 1s to 300s, 1s step |
| 403011 | BC2 | 1-0 | | current unbalance action | R/W | Encoded | 0 = Trip,<br>1 = Alarm,<br>2 = OFF |
| 403012 | BC3 | | | current unbalance pickup | R/W | Unsigned | xxx ( % ), from 5% to 25% max phase current, 1% step. |
| 403013 | BC4 | | | current unbalance time | R/W | Unsigned | Time is from 1s to 300s, 1s step |
| 403014 | BC5 | 1-0 | | reverse power action | R/W | Encoded | 0 = Trip,<br>1 = Alarm,<br>2 = OFF |
| 403015 | BC6 | | | reverse power pickup | R/W | Unsigned | xxx ( Kw ), from 1 to 65500Kw, 1Kw step |
| 403016 | BC7 | | | reverse power time | R/W | Unsigned | Time is from 1s to 300s, 1s step |
| 403017 | BC8 | 0 | | phase rotation sensing | R/W | Encoded | 0 = ABC,<br>1 = CBA |
| 403018 | BC9 | 1-0 | | phase rotation action | R/W | Encoded | 0 = Trip,<br>1 = Alarm,<br>2 = OFF |
| 403019 | BCA | 1-0 | | phase loss action | R/W | Encoded | 0 = Trip,<br>1 = Alarm,<br>2 = OFF |
| 403020 | BCB | | | phase loss time | R/W | Unsigned | Time is from 1s to 240s, 1s step |

### 11.3.4  Event registers

The triggering of an event in trip unit can provide historical data object values at the instance in time the event occurs occurring around the time of the event. Trip unit categorizes the event information into classifications to provide various numbers of each type.  Modbus communication can only have the access to obtain historical summary, trip and alarm event data, as shown:

| Event type | Number stored |
|---|---|
| Historical summary | 200 |
| Historical trip | 10 |
| Historical alarm | 10 |

### Event classification

A single triggering can place information into multiple event types. For example, the occurrence of an event triggered by a circuit breaker trip may provide both historical summary and historical trip information.

Access to event information is based on the selection of event type and event ID. Register 408193 is a R/W register used to select the event type, using function code 06 or 16 to write. The event information may be read by using function code 03 or 04.

When written event type selection in register 408193, the earliest and latest event ID can be obtained respectively in register 408194 and 408196 to determine the range of events saved for the selected event type. Register 408198 is a R/W register used to select the request event ID and is written with function code 16. If request event exists in trip unit, register 408200 and 408202 provide the Previous event ID and Next event ID. If the requested event doesn't exist in trip unit, exception code 0 x 87 is returned.

The date and time when request event happened is read in registers 408204 through 408211 using the same date and time description as shown in 11.3.7 Date and time. This value corresponds to the time of occurrence of the historical event.

Register 408212 provides an indication of the selected event type's data content. This is a constant value for the three event types Modbus port supports.

Event data also provide a validity bit for each data object, starting from register 408213. Bit 0 setting to be 1 indicates that the first data is valid for current trip unit style, bit 1 for the second data object, bit 2 for the third data object and so on. The number of validity bit registers is calculated as (number of data objects - 1)/16.

The following registers are the data objects. Request out of the range of the registers address would result in exception code 02.

### Historical summary

| Register | Format | R/W | Historical summary event |
|---|---|---|---|
| 408193 | Encoded | R/W | Event type: summary = $8EFF_{16}$ |
| 408194 | Unsigned32 | R | Earliest event ID |
| 408196 | Unsigned32 | R | Latest event ID |
| 408198 | Unsigned32 | R/W | Requested event ID |
| 408200 | Unsigned32 | R | Previous event ID |
| 408202 | Unsigned32 | R | Next event ID |
| 408204 | Date/time | R | Date/time |
| 408212 | Encoded | R | Format of data= $0000_{16}$, $0001_{16}$, $0004_{16}$, $0005_{16}$, $0006_{16}$ |
| 408213 | B0 | R | Object validity bit |
| 408214 | Encoded | R | Event Cause:<br>00 = Power up – time OK<br>01 = Set points download<br>02 = Time adjusted<br>03 = Trip<br>04 = Alarm<br>05 = Enter test mode<br>06 = Exit test mode<br>08 = Power up – no time<br>09 = Test completed<br>10 = Maintenance mode active<br>11 = Maintenance mode inactive<br>12 = Opened by Communications<br>13 = Closed by communications |

*Historical trip event*

| Register | Format | R/W | Descriptions | Units |
|---|---|---|---|---|
| 408193 | Encoded | R/W | Event type: trip = 80FF16/alarm = 81FF16 | |
| 408194 | Unsigned32 | R | Earliest event ID | |
| 408196 | Unsigned32 | R | Latest event ID | |
| 408198 | Unsigned32 | R/W | Requested event ID | |
| 408200 | Unsigned32 | R | Previous event ID | |
| 408202 | Unsigned32 | R | Next event ID | |
| 408204 | Date/time | R | Date/time | |
| 408212 | Encoded | R | Format of data: trip = $0004_{16}$, major alarm = $0005_{16}$ | |
| 408213 | B15-b00 | R | Object validity bits | |
| 408214 | B31-b16 | R | Object validity bits | |
| 408215 | Encoded | R | Status cause (primary, secondary, cause) | |
| 408217 | Unsigned32 | R | IA | A |
| 408219 | Unsigned32 | R | IB | A |
| 408221 | Unsigned32 | R | IC | A |
| 408223 | Unsigned32 | R | IN | A |
| 408225 | Unsigned32 | R | IG source | A |
| 408227 | Unsigned32 | R | IG residual | A |
| 408229 | Unsigned16 | R | VAB | V |
| 408230 | Unsigned16 | R | VBC | V |
| 408231 | Unsigned16 | R | VCA | V |
| 408232 | Unsigned16 | R | VAN | V |
| 408233 | Unsigned16 | R | VBN | V |
| 408234 | Unsigned16 | R | VCN | V |
| 408235 | Signed32 | R | Real 3 phase power | W |
| 408237 | Signed32 | R | Reactive 3 phase power | VAR |
| 408239 | Unsigned32 | R | Apparent 3 phase power | VA |
| 408241 | Signed32 | R | Real 3 phase power demand | W |
| 408243 | Signed32 | R | Reactive 3 phase power demand | VAR |
| 408245 | Unsigned32 | R | Apparent 3 phase power demand | VA |
| 408247 | Singed16 | R | Device temperature | 1/10 °C |
| 408248 | Unsigned16 | R | Frequency | 1/10 Hz |
| 408249 | Singed16 | R | Apparent power factor | 1/100 pf |
| 408250 | Unsigned16 | R | Operations count | |
| 408251 | B31-b00 | R | Binary status with validity bits | |

*Historical alarm*

| Register | Format | R/W | Historical summary event |
|---|---|---|---|
| 408193 | Encoded | R/W | Event type: summary = $81FF_{16}$ |
| 408194 | Unsigned32 | R | Earliest event ID |
| 408196 | Unsigned32 | R | Latest event ID |
| 408198 | Unsigned32 | R/W | Requested event ID |
| 408200 | Unsigned32 | R | Previous event ID |
| 408202 | Unsigned32 | R | Next event ID |
| 408204 | Date/time | R | Date/time |
| 408212 | Encoded | R | Format of data: minor alarm = $0006_{16}$ |
| 408213 | B0 | R | Object validity bit |
| 408214 | Encoded | R | Status cause(primary, secondary, cause) |

**Note:** address 408225 and 408227 are both ground current. According to the set point 'Ground Sensing' setting in set points group 1: protection group, the actual ground current would be displayed in related register and value in the other register would be zero. For example, if the 'Ground Sensing' setting is 0, representing the ground current sensing type is residual ground current. IG residual in address 408227 would be the actual value and IG source in address 408225 would be zero.

### 11.3.5  Block of registers

A block of registers can be established in trip unit to remap the data object registers of an Eaton product. The block map of registers is stored in non-volatile memory.

Function code 16 is used to load the object assignments for the block of registers. The block assignments are stored beginning at 401001/420481 (0x03E8/0x5000). Only the first data object register address is assigned within the block of registers. For example, although data object IA occupies register 0x1202 and 0x1203, only register 0x1202 is loaded into the block of assignment registers. Verification of this block of assignment registers can be read from trip unit with a function code 03 or 04 from these 401001/420481 (0x03E8/0x5000) registers.

Data pertaining to the objects configured in the block of assignment registers is mapped into registers starting at 401201/420737 (0x 04B0/0x5100) and continuing in successive order for each object assigned. The number of objects and their placement order in this data block of registers is dependent on the configuration of the block of assignment registers. The total number of data block of registers is limited to 100.

The data can be obtained from the data block of registers by a read function code 03 or 04. The address of the starting object must be aligned with a starting address of an object within the data block of registers. The number of registers to obtain must align with an ending address of an object within the data block of registers.

***Configuration registers***

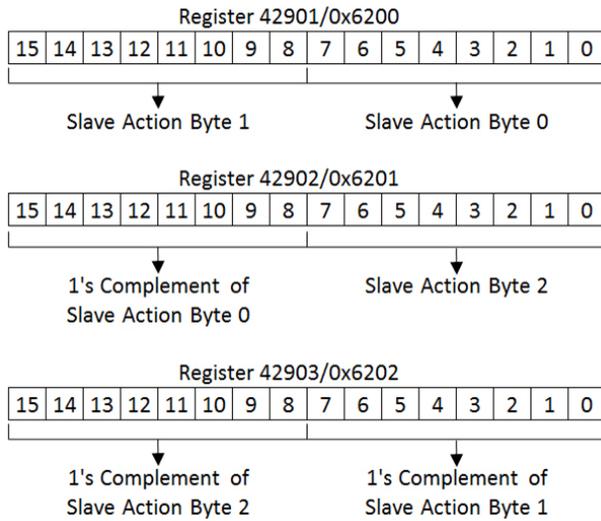| Register definition | R/W | Modbus register number | | Modbus register address | | Number |
|---|---|---|---|---|---|---|
| | | Low | High | Low | High | |
| Mapped block of registers configuration | R/W | 401001 | 420481 | 0x03E8 | 0x5000 | 100 |
| Mapped block of registers data | R | 401201 | 420737 | 0x04B0 | 0x5100 | 100* 2 |
| Invalid object access configuration | R/W | 402001 | 425345 | 0x07D0 | 0x6300 | 1 |
| Floating point data word order configuration | R/W | 402002 | 425346 | 0x07D1 | 0x6301 | 1 |
| Fixed point data word order configuration | R/W | 402003 | 425347 | 0x07D2 | 0x6302 | 1 |
| Remote control | R/W | 402901 | 425089 | 0x0B54 | 0x6200 | 3 |
| Date and time register | R/W | 402921 | | 0x0B68 | | 8 |

Non-volatile Register 402001/425345(0x07D0/0x6300) is used to configure trip unit to respond to a group of data objects. See 11.2.1 Communications protocol options.

To accommodate Modbus master that can only access to register 9999, some Eaton registers initially assigned above 9999 have been assigned dual access, both at the original register(to provide compatibility) and at a new register assignment below 9999. The format is given as low/high register numbers followed by (low16/high16 Modbus register addresses).

### 11.3.6  Remote control

A set of registers is reserved for trip unit remote control, starting from 42901/425089 through 42903/425091. These three registers should be written together with a "slave action number" and its first complement using function code 16. The "slave action number" and its function are listed in remote control data formats, their support being product dependent.

If the "slave action number" and its first complement command is valid, trip unit will execute the action. Once the command is successfully acknowledged by trip unit, it returns a normal function code 16 response to Modbus master. Since it may take some time for trip unit to take action, Modbus master may further determine if the product completed the slave action function successfully after the normal response by interrogating the trip unit, for example, by reading its status. If the "slave action number" and its first complement command is invalid, trip unit returns exception code 03.

Register 42901/0x6200

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Slave Action Byte 1     Slave Action Byte 0

Register 42902/0x6201

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

1's Complement of Slave Action Byte 0     Slave Action Byte 2

Register 42903/0x6202

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

1's Complement of Slave Action Byte 2     1's Complement of Slave Action Byte 1

### *Remote Control Date Format*

| Control group | Definition | Password | Decimal byte | | | | | | Decimal word | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 42903 | | 42902 | | 42901 | | 42903 | 42902 | 42901 |
| | | | Byte 5 | Byte 4 | Byte 3 | Byte 2 | Byte 1 | Byte 0 | Word 3 | Word 2 | Word 1 |
| Reset | Reset trip | No | 255 | 255 | 253 | 0 | 0 | 2 | 65535 | 64768 | 2 |
| | Reset min/max currents | Yes | 255 | 254 | 242 | 0 | 1 | 13 | 65534 | 61952 | 269 |
| | Reset min/max line-to-neutral voltages | Yes | 255 | 254 | 240 | 0 | 1 | 15 | 65534 | 61440 | 271 |
| | Reset min/max line-to-line voltages | Yes | 255 | 254 | 241 | 0 | 1 | 14 | 65534 | 61696 | 270 |
| | Reset peak demand watts | Yes | 255 | 255 | 251 | 0 | 0 | 4 | 65535 | 64256 | 4 |
| | Reset all min/max values | Yes | 255 | 254 | 251 | 0 | 1 | 4 | 65534 | 64256 | 260 |
| | Reset energy | Yes | 255 | 255 | 247 | 0 | 0 | 8 | 65535 | 63232 | 8 |
| | Reset trip count | Yes | 255 | 250 | 254 | 0 | 5 | 1 | 65530 | 65024 | 1281 |
| | Reset operations count | Yes | 255 | 254 | 253 | 0 | 1 | 2 | 65534 | 64768 | 258 |
| | Reset temperature | Yes | 255 | 250 | 253 | 0 | 5 | 2 | 65530 | 64768 | 1282 |
| | Reset runtime | Yes | 255 | 254 | 252 | 0 | 1 | 3 | 65534 | 64512 | 259 |
| | Reset all diagnostics information | Yes | 255 | 250 | 252 | 0 | 5 | 3 | 65530 | 64512 | 1283 |
| | Reset powered up indication | No | 255 | 255 | 252 | 0 | 0 | 3 | 65535 | 64512 | 3 |
| | Open breaker | Yes | 254 | 255 | 255 | 1 | 0 | 0 | 65279 | 65281 | 0 |
| Maintenance Mode | Enable maintenance mode | No | 254 | 255 | 247 | 1 | 0 | 8 | 65279 | 63233 | 8 |
| | Disable maintenance mode | No | 254 | 255 | 246 | 1 | 0 | 9 | 65279 | 62977 | 9 |
| Relay Output | Activate relay output 1 | No | 251 | 254 | 254 | 4 | 1 | 1 | 64510 | 65028 | 257 |
| | De-activate relay output 1 | No | 251 | 253 | 254 | 4 | 2 | 1 | 64509 | 65028 | 513 |
| | Activate relay output 2 | No | 251 | 254 | 253 | 4 | 1 | 2 | 64510 | 64772 | 258 |
| | De-activate relay output 2 | No | 251 | 253 | 253 | 4 | 2 | 2 | 64509 | 64772 | 514 |
| | Activate relay output 3 | No | 251 | 254 | 252 | 4 | 1 | 3 | 64510 | 64516 | 259 |
| | De-activate relay output 3 | No | 251 | 253 | 252 | 4 | 2 | 3 | 64509 | 64516 | 515 |

*Remote Control Date Format (continued)*

| Control Group | Definition | Password | Hex byte | | | | | | Hex word | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0x6202 | | 0x6201 | | 0x6200 | | 0x6202 | 0x6201 | 0x6200 |
| | | | Byte 5 | Byte 4 | Byte 3 | Byte 2 | Byte 1 | Byte 0 | Word 3 | Word 2 | Word 1 |
| Reset | Reset trip | No | FF | FF | FD | 00 | 00 | 02 | FFFF | FD00 | 0002 |
| | Reset min/max currents | Yes | FF | FE | F2 | 00 | 01 | 0D | FFFE | F200 | 010D |
| | Reset min/max line-to-neutral voltages | Yes | FF | FE | F0 | 00 | 01 | 0F | FFFE | F000 | 010F |
| | Reset min/max line-to-line voltages | Yes | FF | FE | F1 | 00 | 01 | 0E | FFFE | F100 | 010E |
| | Reset peak demand watts | Yes | FF | FF | FB | 00 | 00 | 04 | FFFF | FB00 | 0004 |
| | Reset all min/max values | Yes | FF | FE | FB | 00 | 01 | 04 | FFFE | FB00 | 0104 |
| | Reset energy | Yes | FF | FF | F7 | 00 | 00 | 08 | FFFF | F700 | 0008 |
| | Reset trip count | Yes | FF | FA | FE | 00 | 05 | 01 | FFFA | FE00 | 0501 |
| | Reset operations count | Yes | FF | FE | FD | 00 | 01 | 02 | FFFE | FD00 | 0102 |
| | Reset temperature | Yes | FF | FA | FD | 00 | 05 | 02 | FFFA | FD00 | 0502 |
| | Reset runtime | Yes | FF | FE | FC | 00 | 01 | 03 | FFFE | FC00 | 0103 |
| | Reset all diagnostics information | Yes | FF | FA | FC | 00 | 05 | 03 | FFFA | FC00 | 0503 |
| | Reset powered up indication | No | FF | FF | FC | 00 | 00 | 03 | FFFF | FC00 | 0003 |
| | Open breaker | Yes | FE | FF | FF | 01 | 00 | 00 | FEFF | FF01 | 0000 |
| Maintenance Mode | Enable maintenance mode | No | FE | FF | F7 | 01 | 00 | 08 | FEFF | F701 | 0008 |
| Relay Output | Disable maintenance mode | No | FE | FF | F6 | 01 | 00 | 09 | FEFF | F601 | 0009 |
| | Activate relay output 1 | No | FB | FE | FE | 04 | 01 | 01 | FBFE | FE04 | 0101 |
| | De-activate relay output 1 | No | FB | FD | FE | 04 | 02 | 01 | FBFD | FE04 | 0201 |
| | Activate relay output 2 | No | FB | FE | FD | 04 | 01 | 02 | FBFE | FD04 | 0102 |
| | De-activate relay output 2 | No | FB | FD | FD | 04 | 02 | 02 | FBFD | FD04 | 0202 |
| | Activate relay output 3 | No | FB | FE | FC | 04 | 01 | 03 | FBFE | FC04 | 0103 |
| | De-activate relay output 3 | No | FB | FD | FC | 04 | 02 | 03 | FBFD | FC04 | 0203 |

## 11.3.7  Date and time

Trip unit supports Modbus master read real-time clock information.  Eight registers, starting from register number 402921 are reserved for this information, as defined in 0.  Detailed below.  User could set system time through function code 16.

| Definition | Modbus register number | Modbus register address | Data range |
|---|---|---|---|
| Month | 402921 | 0x0B68 | 1-12 |
| Day | 402922 | 0x0B69 | 1-31 |
| Year | 402923 | 0x0B6A | 2000-2099 |
| Day of week | 402924 | 0x0B6B | 1=Sunday…7=Saturday |
| Hour | 402925 | 0x0B6C | 0-23 |
| Minute | 402926 | 0x0B6D | 0-59 |
| Second | 402927 | 0x0B6E | 0-59 |
| 1/100th second | 402928 | 0x0B6F | |

### 11.3.8 Internal diagnostics

#### 11.3.8.1 Modbus function 8ode 8 diagnostics

Trip unit support internal Modbus diagnostics to monitor internal Modbus port communication with function code 08. For different sub-function codes, diagnostics information is listed below.

| Sub-function code | Data | Action |
|---|---|---|
| 0 | | Echo query |
| 1 | 0000 remain the counters<br>00FF reset all counters | Restart communication |
| 4 | 0000 | Force listen |
| 10 | 0000 | Clear counters |
| 11 | 0000 | Modbus UART bus message count |
| 12 | 0000 | Modbus UART CRC error count |
| 13 | 0000 | Exception count |
| 14 | 0000 | Slave message count |
| 15 | 0000 | Slave no response count |
| 16 | 0000 | Slave NAK count |
| 17 | 0000 | Slave busy count |
| 18 | 0000 | Modbus UART over run error count |
| 20 | 0000 | Clear Modbus UART counters |
| 23 | 0000 | Modbus UART framing error count |
| 24 | 0000 | Modbus UART noise error count |
| 25 | 0000 | Modbus UART parity error count |
| 26 | 0000 | MCU1 firmware version |
| 27 | 0000 | MCU1 firmware reversion |
| 28 | 0000 | MCU1 firmware build |
| 29 | 0000 | MCU2 firmware version |
| 30 | 0000 | MCU2 firmware reversion |
| 31 | 0000 | MCU2 firmware build |
| 32 | 0000 | USB version |
| 33 | 0000 | USB reversion |
| 34 | 0000 | Reset block of registers |

#### 11.3.8.2 Real-time data diagnostics

**Primary status**

| Definition | Code |
|---|---|
| Open | 0x01 |
| Closed | 0x02 |
| Tripped | 0x03 |
| Alarmed | 0x04 |
| Picked-up | 0x0D |

**Secondary status**

| Definition | Code |
|---|---|
| Not applicable | 0x01 |
| Test mode | 0x03 |
| Powered-up since last trip/alarm reset | 0x07 |
| Alarm | 0x08 |

***Cause of status***

| Definition | Code | Definition | Code |
|---|---|---|---|
| Unknown | 0x0000 | Fixed hardware instantaneous | 0x004C |
| Normal | 0x0001 | Set points error | 0x004D |
| Instantaneous | 0x0003 | Over temperature | 0x004E |
| Aux-power under power | 0x000E | Long delay neutral over current | 0x0050 |
| Current un-balance | 0x0011 | Ground fault | 0x0054 |
| Operations count | 0x001F | Earth fault | 0x0055 |
| Control via communication | 0x0021 | Calibration | 0x0071 |
| Coil supervision | 0x0025 | Real time clock | 0x0088 |
| Battery low voltage alarm | 0x0029 | MM mode | 0x0099 |
| Diagnostics warning #2 (configuration reading failure) | 0x002B | Breaker mechanism fault | 0x009A |
| Long delay | 0x003D | Digital bypass | 0x07FC |
| Short delay | 0x003E | NV memory failure | 0x07FD |
| Phase currents near pickup, high load alarm | 0x0049 | Watchdog fault | 0x07FE |
| Making current release | 0x004B | Motor alarm or trip | 0x07FF |

## 11.3.9 Board information data (fixed data section)

Trip unit information, include device name, model name, catalog #, style # , serial # date code, firmware version1/ 2, USB version and product ID, the following registers are the data objects.

**Fixed data section**

| Register number | Modbus address | Description | Format | Range | Registers | Comments |
|---|---|---|---|---|---|---|
| 404497 | 0x1190 | Device name | ASCII | 16 char | 8 | EATON PXR25  (for pxr25) <br> EATON PXR20D (for pxr20d) <br> EATON PXR20  (for pxr20) |
| 404505 | 0x1198 | Model name | ASCII | 16 char | 8 | PXR 20/25 MCCB |
| 404513 | 0x11A0 | Catalog # | ASCII | 32 char | 16 | Vista catalog # (max 20 characters) |
| 404529 | 0x11B0 | Style # | ASCII | 32 char | 16 | Vista style # (max 20 characters) |
| 404545 | 0x11C0 | Serial # | ASCII | 32 char | 16 | |
| 404561 | 0x11D0 | Date code | ASCII | 12 char | 6 | yyyy.mm.dd |
| 404567 | 0x11D6 | Firmware version 1 | ASCII | 16 char | 8 | Example version of 01.02.0033 |
| 404575 | 0x11DE | Firmware version 2 | ASCII | 16 char | 8 | Example version of 01.02.0033 |
| 404583 | 0x11E6 | USB version | ASCII | 16 char | 8 | Example version of 01.02.0033 |
| 404591 | 0x11EE | Reserved | | | 16 | |
| | … | Reserved | | | | Refer to |
| 404606 | 0x11FD | Reserved | | | | |
| 404607 | 0x11FE | Product ID | Bit map | 32-bit | 2 | pppppvvvvdddddd <br> Use division code (dddddd) of 32 (0x20) <br> Use product code (ppppp) of 2 for PXR MCCB <br> Start with comm version (vvvv) of 0 |
| | | | | | 112 | Block size |

### 11.3.10  Exception codes

When there's error in request or response, trip unit would respond an exception code.

- If the function code in the query is not supported by trip unit, exception code 01 is returned in the response, also used for the unsupported sub-function code in Modbus diagnostics.

- If the requested data register/ bit address is illegal, exception code 02 is returned.

- If the data in the query is illegal, exception code 03 is returned.

- If trip unit doesn't support the query function, exception code 04 is returned.

- In certain circumstances, exception code 05(ACK) is returned.

- If trip unit can't perform the current request at this time, a BUSY exception code 06 is returned.

- If trip unit can't perform the requested action, a NAK exception code 07 is returned.

- If only a partial register is used in the query, exception code 132 is returned.

- If the requested event entry doesn't exist, exception code 135 is returned.