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

Powering Business Worldwide

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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 9: Available protection settings. Note that external control voltage is not required for protection functionality.

Line protection settings		PXR 10	PXR 20	PXR 20D and 25	Units
	Available protection styles	LI LSI	LSI LSIG, LSI with ARMS LSIG with ARMS	LSI LSIG, LSI with ARMS 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.

1.2 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:

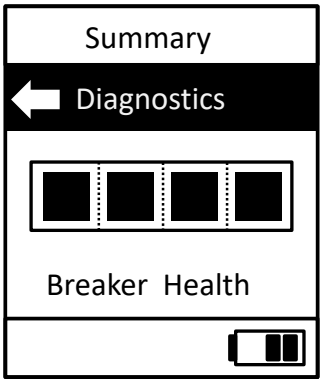
Metered value	Range of conditions (units)	PXR 10	PXR 20	PXR 20D	PXR 25
Current (I)	5 to 10 % of In (A)	5.0 %	5.0 %	1.0 %	1.0 %
	10 to 120 % of In (A)	5.0 %	2.0 %	0.5 %	0.5 %
Voltage (V)	60 to 102 (V)	not applicable			1.0 %
	102 to 690 (V)				0.5 %
	690 to 750 (V)				1.0 %
Power (kW) Energy (kWh)	5% to 10% of In (A) 102 to 690 (V) Power factor = 1				1.5 %
	10 to 120 % of In (A) 102 to 690 V Power factor = 1				1.0 %
Power (kW) Energy (kWh)	10 to 20 % of In (A) 102 to 690 (V) PF = 0.5 inductive or 0.8 capacitive				1.5 %
	20 to 120 % of In (A) 102 to 690 (V) PF = 0.5 inductive or 0.8 capacitive				1.0 %
Note:	Accuracy is expressed as % of reading, currents are RMS, voltages are line-to-line.				

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. 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™ (ARMS). 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 ARMS protection is enabled.

- "ON" – ARMS is enabled locally and cannot be disabled remotely
- "OFF/Remote" – ARMS 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.

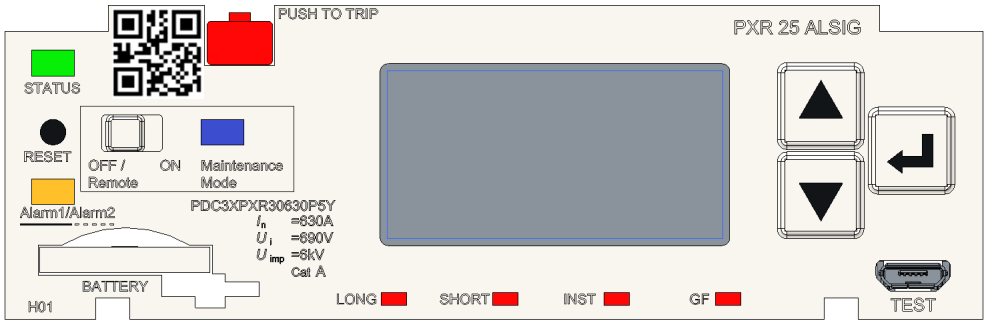
2.1.11 Catalog number and I_n rating

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

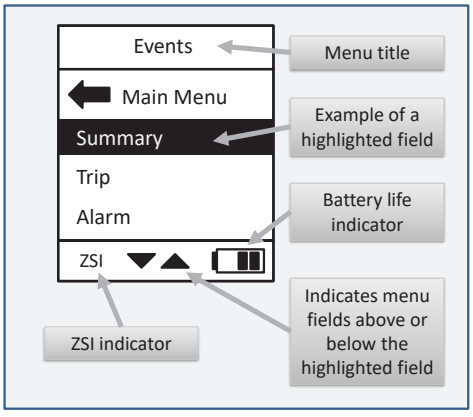
The 2D barcode (QR code) on the front of each trip unit encodes the trip unit catalog and serial number. This can be used to look-up product information that is available on-line from Eaton.

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.

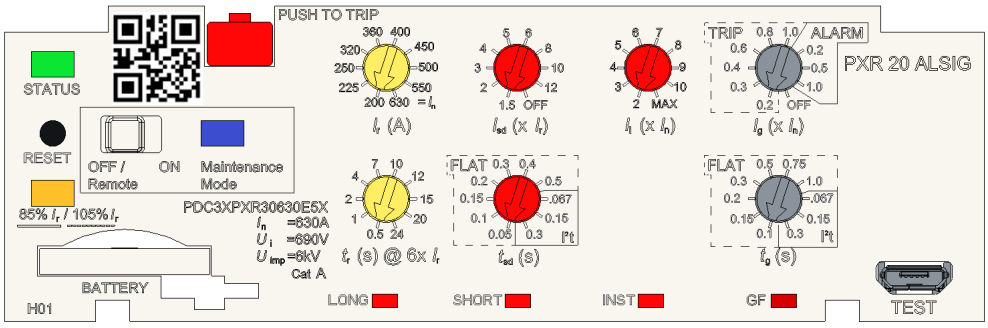
Enter button - Used to enter a menu or configuration setting or to go back to the previsions menu.

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.

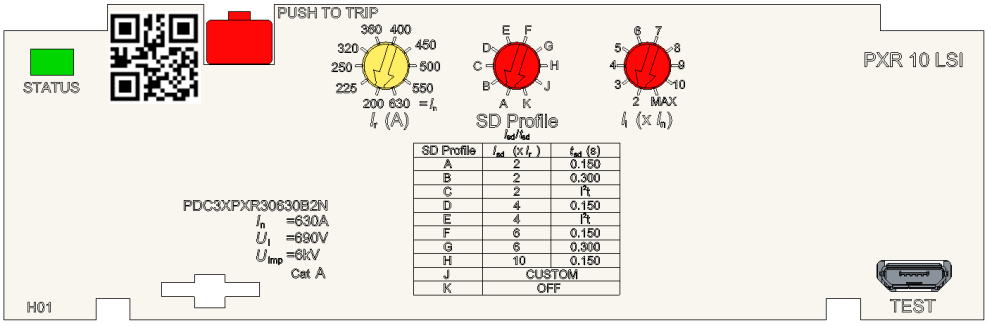
2.3 PXR 20 with rotary switches



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.

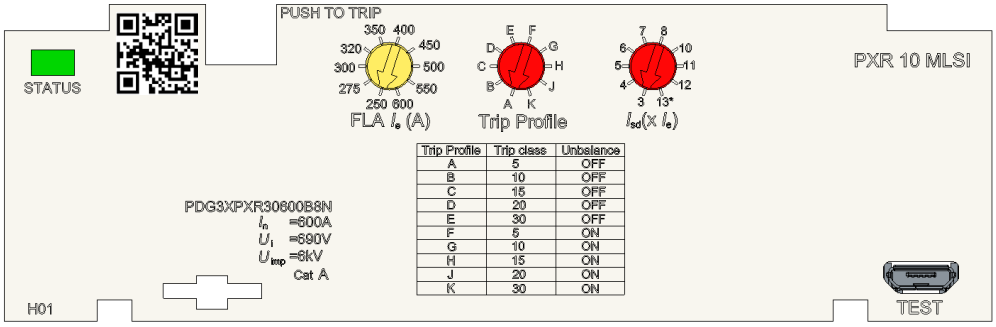
Each switch has ten positions and is set to achieve the appropriate trip-curve response. The yellow color switches set the overload configuration, red switches set the short circuit behavior and grey switches set the ground fault behavior. The "PICKUP" switches set the levels as a function of the breaker 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



Trip Profile	Trip class	Unbalance
A	5	OFF
B	10	OFF
C	15	OFF
D	20	OFF
E	30	OFF
F	5	ON
G	10	ON
H	15	ON
J	20	ON
K	30	ON

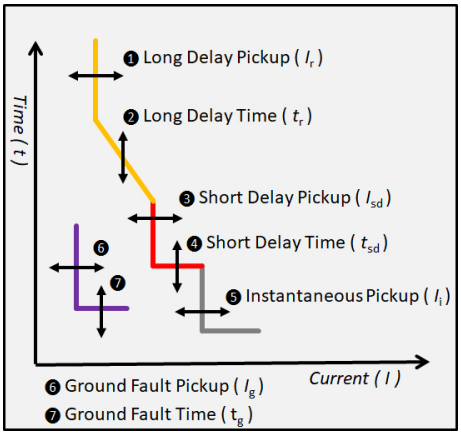
The PXR 10 motor protection trip curve configuration is simple, using the switches on the front panel. MLSI trip units have three rotary switches. The yellow color rotary switch sets the full load amps FLA I_e (A) and the red switches trip profile and Instantaneous I_{sd}(X Ie). Details regarding the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

3 Line 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.

3.1.1 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.

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: $\frac{\text{Max(Vab,Vbc,Vca)-Min(Vab,Vbc,Vca)}}{\text{Max(Vab,Vbc,Vca)}} \text{ x } 100\%$

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 x I_e).

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

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 x 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

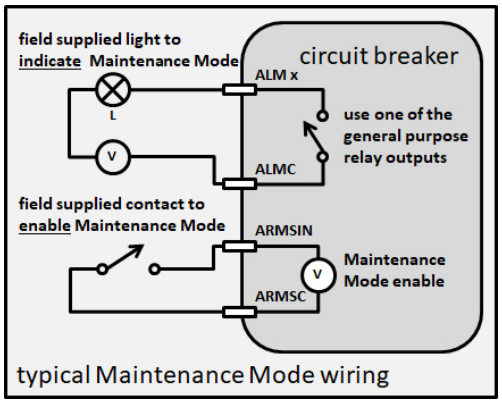
Power flowing through the breaker is continuously monitored. If the reverse real power is greater than the pickup for the specified time delay, then the protection action will be taken.

3.6 Maintenance Mode protection (ARMS)

The PXR trip units support Eaton's Arc Flash Reduction Maintenance System (ARMS), also known as Maintenance Mode. When maintenance is being performed and the ARMS is enabled, the trip unit will trip the breaker with no intentional delay whenever the configured pickup level is exceeded. The Maintenance Mode protection overlays 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.

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 ARMS 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 determined 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 auxiliary 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 configuration software using the USB port. When Maintenance Mode is enabled by communications, 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

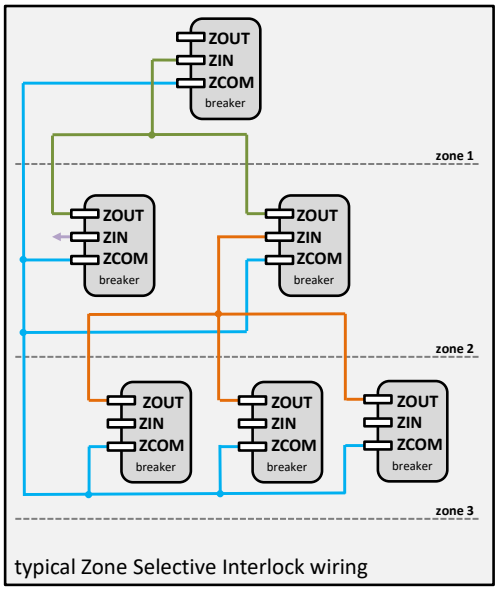
The PXR trip unit provides an override trip function that will trip the circuit breaker at the withstand rating of the circuit breaker frame. This function is factory set and reacts to the peak current level. It is always active regardless of the user's instantaneous adjustment selection. The instantaneous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

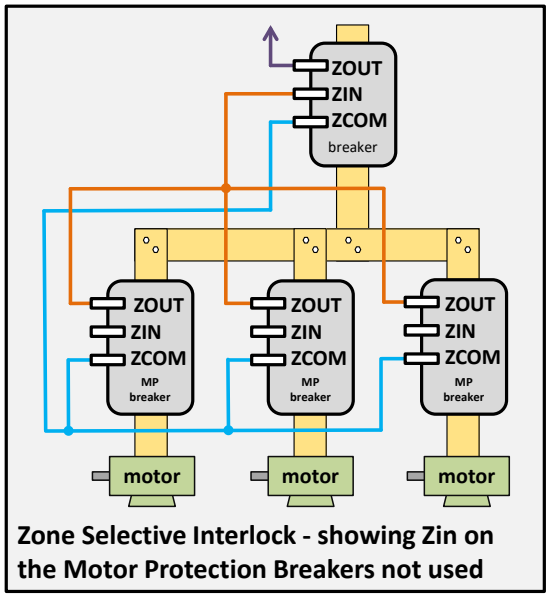
The ZSI is wired using a set of three wires labeled zone in (Zin), zone out (Zout), and zone common (Zcom). These signals are compatible will all Eaton circuit breakers which have the ZSI function. The zone out signal is sent whenever a ground fault pickup or short delay pickup is exceeded. This provides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

Feature	Short name	Color	Notes
Aux Power	AUX +24V	Orange	24 VDC 0.5 A 20 VA is required. Eaton PSG family recommended.
	AUX 0V	Orange / black	
ZSI	ZIN	Yellow / black	These connect to other ZSI enabled breakers in the system. Maximum length of 75 meters (250 feet) using AWG # 22 wire.
	ZOUT	Yellow / red	
	ZCOM	Yellow	
Neutral sensor	N1	Grey	Connect to the external neutral current sensor.
	N2	White	
Voltage sensor	NV	White/Grey	Connect to the neutral sensor module and then the neutral bus.
Configurable relays (Second Wire harness depeding on Model)	RLY1	Black /white	Normally open contacts, close when the associated alarm is active. Contacts rated to 240 VAC, 1 Amp. See Section 5.3: General purpose relay mapping
	RLY2	Black / red	
	RLY3	Black / Violet	
	RLYC	Black	
Modbus	RTU_A (D-)	Green / black	Modbus RTU, max of 99 nodes, length 1,200 meters (4,000 ft.). Recommended cable: twisted-pair foil shield w/ drain wire, 120 ohms impedance. Rated for the use (typical 75C and 300 V NEC CM, or Belden Data Tray series 3074F for 600 V NEC TC).
	RTU_B (D+)	Green / red	
	RTU_GND	Green	
Maintenance Mode	ARMSIN	Brown	External dry contact. This is a low-voltage signal, use a high quality gold contact and keep wire length under 3 meters (15 feet).
	AMSC	Brown / white	

Feature	Short name	Color	CAM pin label	CAM pin	Notes
Communication adapter (CAM) link	CMMC (GND)	Violet	0V/C/AGND	2	Connection to the selected CAM module. Refer to CAM ILs for wiring details.
	CMM1 (TX+)	Violet / red	RX+/CMM1	3	
	CMM2 (TX-)	Violet / yellow	RX-/CMM2	4	
	CMM3 (RX+)	Violet / white	TX+/CMM3	5	
	CMM4 (RX-)	Violet / green	TX-/CMM4	6	

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%, 1.0 A. The Eaton PSG family of power supplies with 24 V output are recommended. One supply can feed multiple PXR trip units if desired.

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).

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.

	Description of relay operation:	
Function name	**"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.
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.

Function name	Description of relay operation: "The relay will close when..."	"The Relay will open when..."
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 ARMS then this is programmed to be Maintenance Mode Active

Relay #1 - if there is no ARMS 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

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.

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

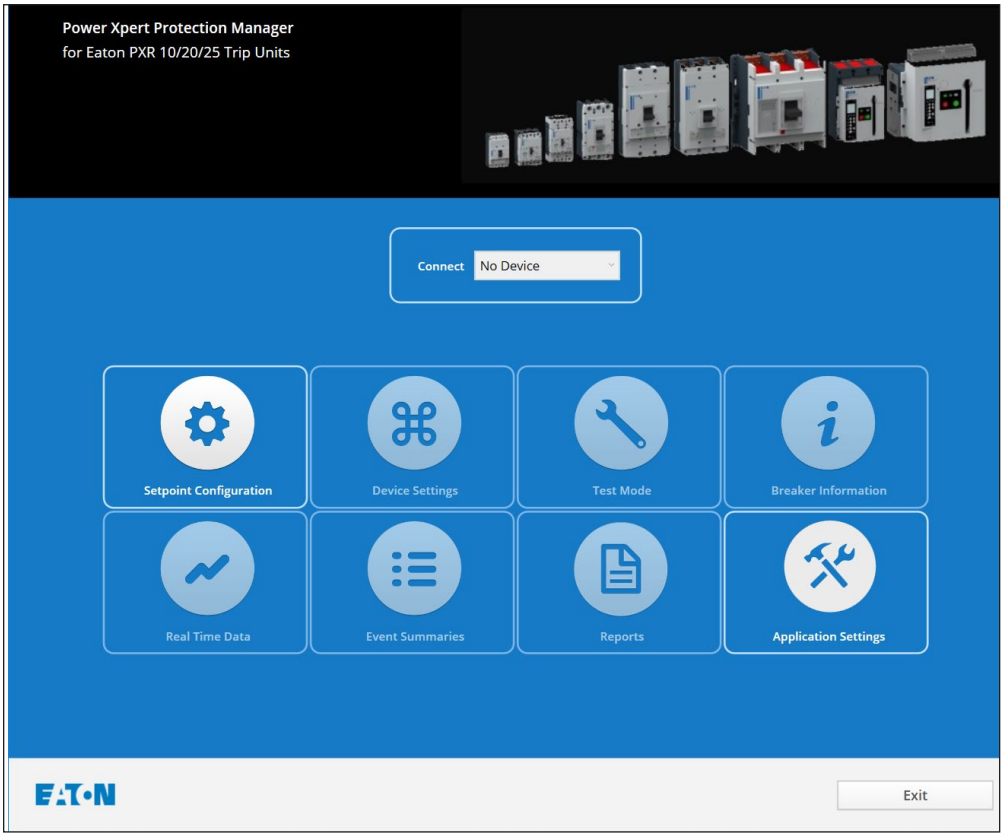
Eaton's PXPM is a Microsoft® Windows-based software that configures, controls, monitors and tests Eaton PXR trip units. The user can create, modify, and save configurations for a PXR trip unit. The software further allows user to reset trip units, adjust trip unit's date and time, capture current or 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.

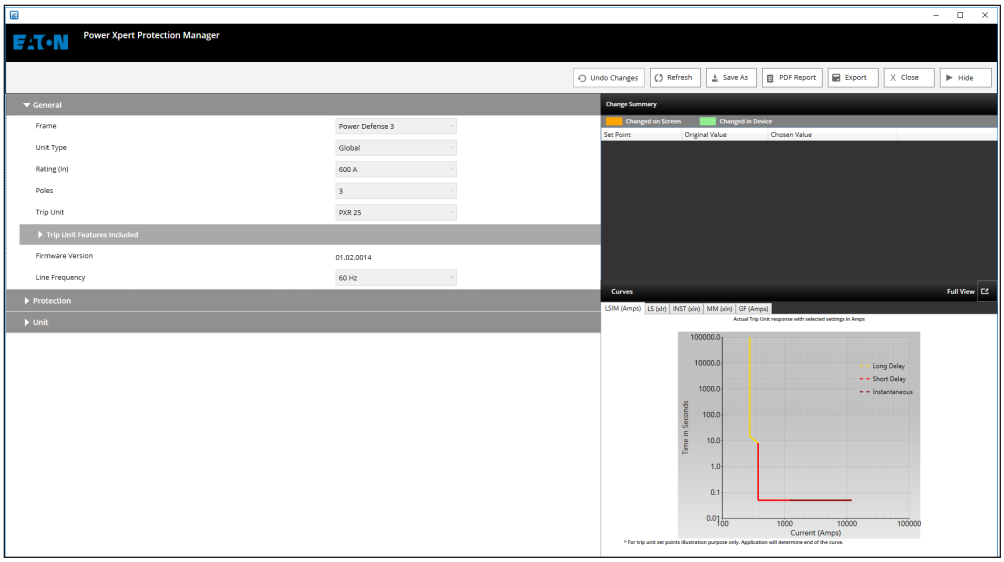
6.1 Set point configuration through PXPM

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

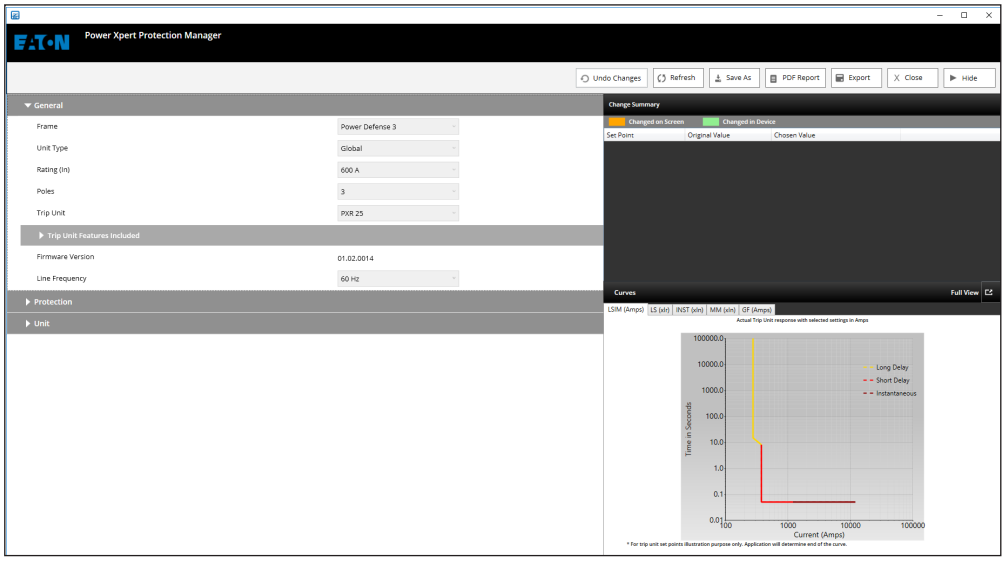


Typical actions available from the configuration screens include:

- 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.

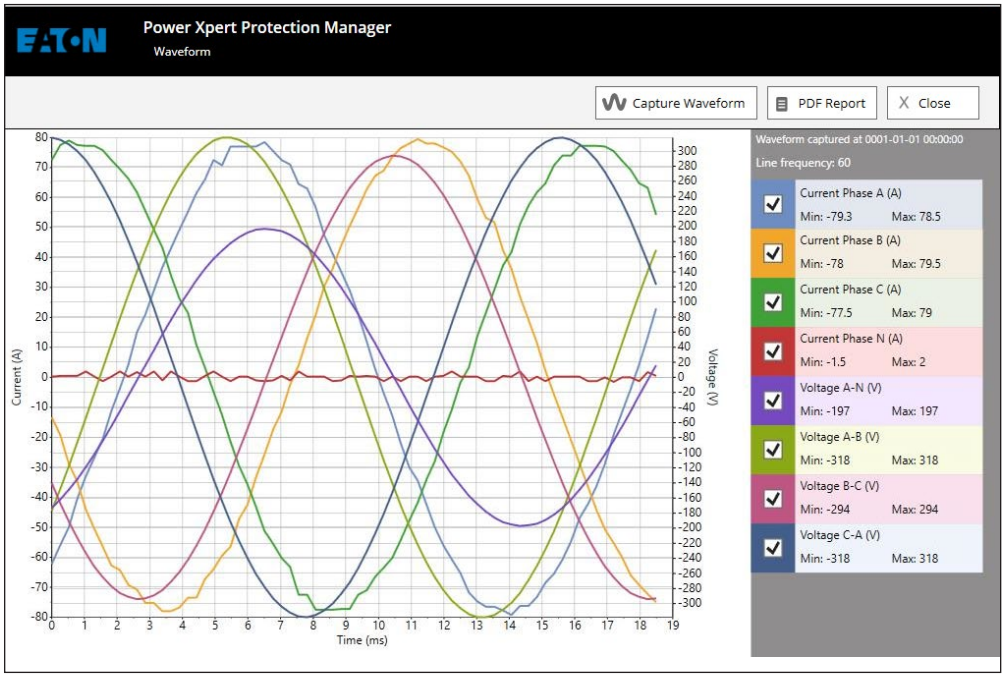


- Change summary - Displays a summary of set points that have been changed in the present session. Both original and changed values are displayed.
- Extract to PDF - Exports all set points to a portable document format (PDF) file. Modified set point parameters are highlighted in the exported PDF file.
- Undo all changes - Resets all set points to their original values.

6.2 Remote control

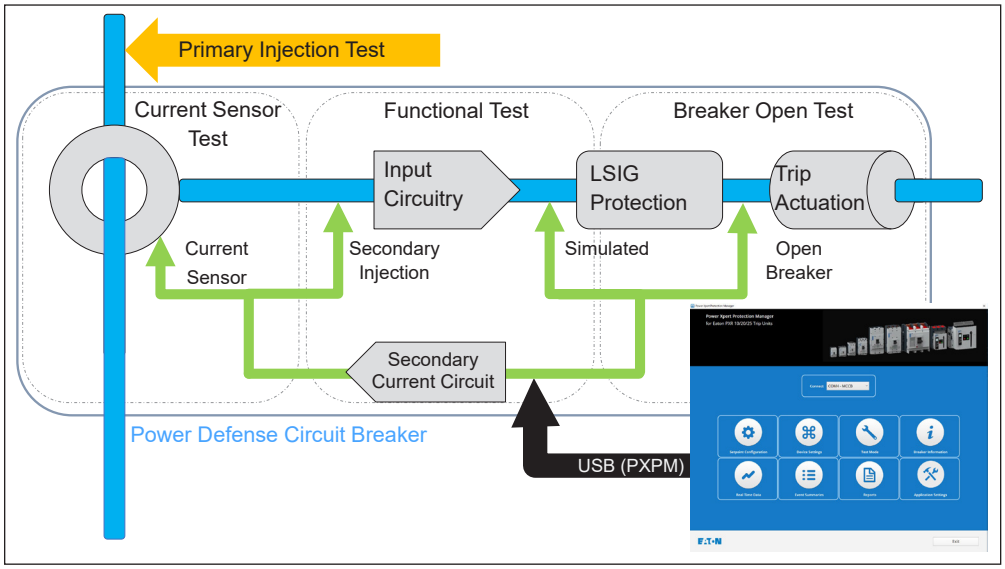
The remote control section allows users to reset trip unit, change trip unit date and time, and capture waveforms.

- 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.

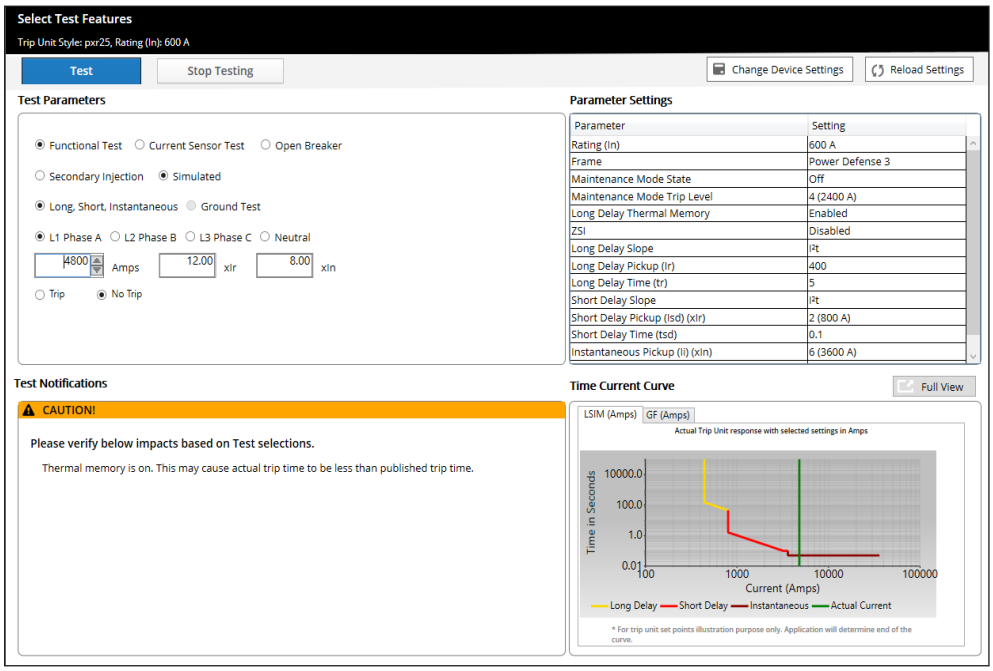
6.3.5 Primary Injection Test

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.

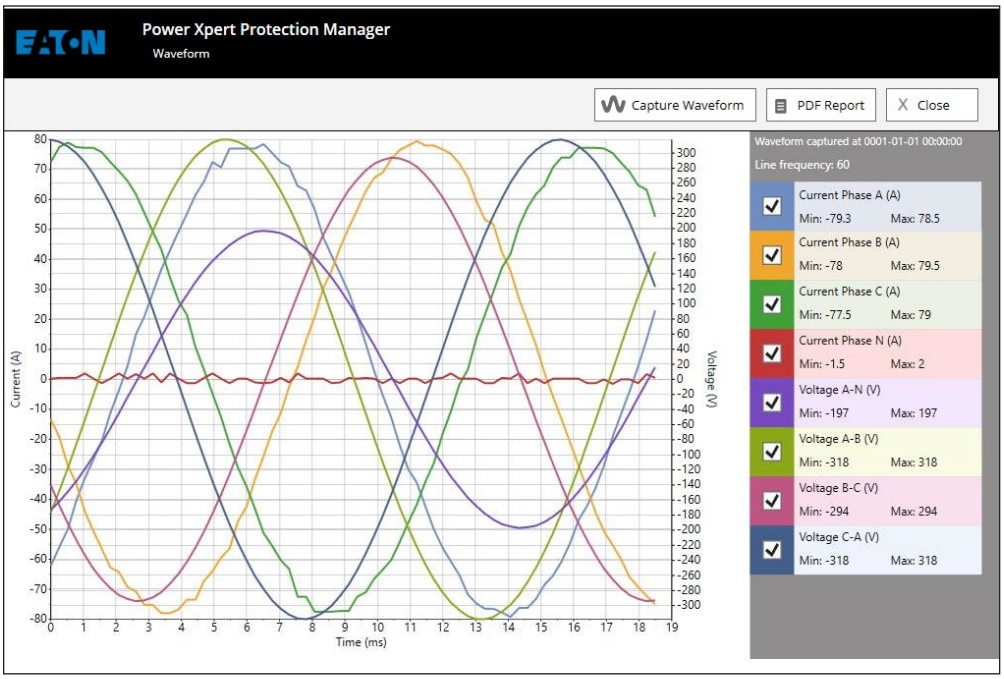
The Generate Report function will record the testing results in a PDF file. The user can input information regarding the customer and breaker's location, environment, condition, etc. as part of the report. The report includes the settings and results of all tests run during that session.



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

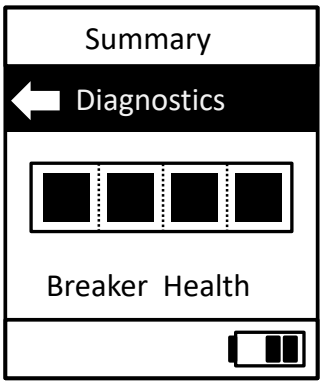
What data is captured: / What triggers a capture:	Event cause Time-stamp	Current: IA, IB, IC, IN, IG Voltages: VAB, VBC, VCA, VAN, VBN, VCN (PXR 25 only) Power and demand: watts, Vars, VA (PXR 25 only) Power factor (PXR 25 only) Line frequency Breaker operations count Trip unit internal temperature	Waveform 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	•	•	•	All trips include four cycles before trip and six cycles after the trip and can be displayed in the waveform capture.
Trip - short delay	•	•	•	
Trip - instantaneous	•	•	•	
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

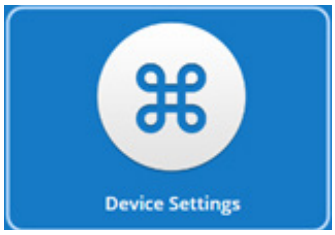
Please see available counters and data in 11.3.2 Modbus Register Map Real-time data object registers

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.

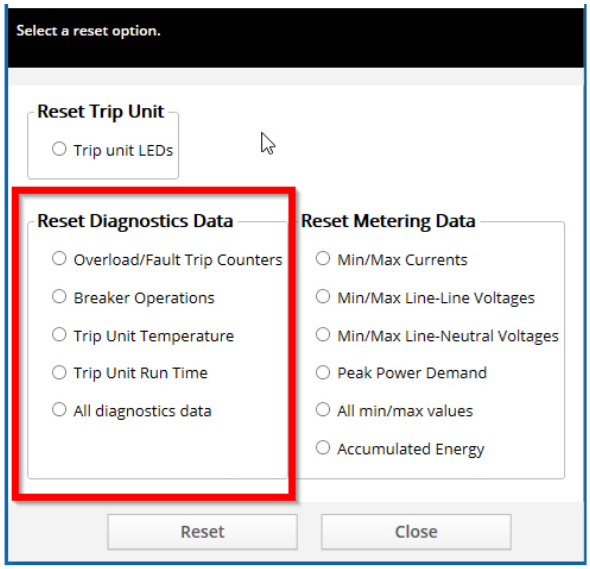
8.3.1 Power Xpert Protection Manager (PXPM)

Go to Device Settings:

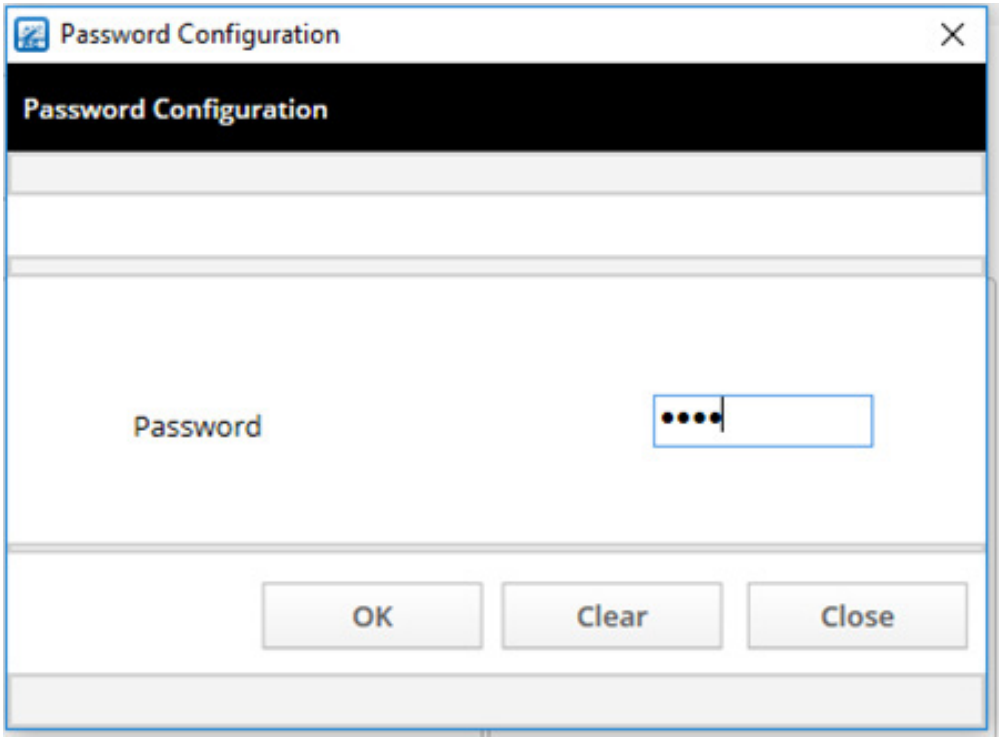


Reset Trip Unit::

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 screw-driver 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

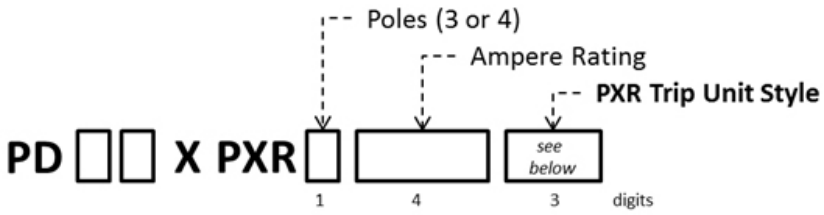
Although not typically needed, certain styles of the PXR trip unit can be changed in the field to add features. The Instruction Leaflet for each trip unit includes instructions for possible replacement and/or addition of features.

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:



10 Available protection settings

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		3	3	3	3	
B	16	35	60	80	10		4	4	4	4	
C	20	40	63	90	15	No	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		8	8	8	8	Instantaneous, 0.15s, 0.30s
G	40	70	100	150	10	Yes 5 to 35 % 1 to 200 sec	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	Instantaneous, 0.15s, 0.30s
B	18	32	50	63	80	10		4	4	4	4	4	
C	20	40	63	80	90	15	No	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		10	10	10	10	10	
H	50	80	125	160	175	15	Yes 5 to 35 % 1 to 200 sec	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
							I^2t	1100 A		2100 A		Alarm	I^2t

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
								I^2t	1100 A		2100 A			Alarm	I^2t

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	
					I^2t		Flat	Instantaneous override				Trip	Flat
					I^4t		I^2t	1100 A		2100 A		Alarm	I^2t

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		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)

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		I_{sd} (x I_e)						PXPM
Setting	Pickup Ie (full load amps)						Trip class at 6x (Ie)	Phase unbal. %	Pickup I_{sd} = nx (I_e)						Time (t_{sd})
A	45	90	160	90	160	250	5		3	3	3	3	3	3	
B	50	100	175	100	175	275	10		4	4	4	4	4	4	
C	60	110	200	110	200	300	15	No	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		8	8	8	8	8	8	Instantaneous 0.15s, 0.30s
G	90	175	300	175	300	450	10		10	10	10	10	10	10	
H	100	200	320	200	320	500	15	Yes 5 to 35 % 1 to 200 sec	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 (I_{sd}) 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 (t_{sd})
A	63	100	63	100	5		3	3	3	3	
B	80	125	80	125	10		4	4	4	4	
C	100	140	100	140	15	No	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		8	8	8	8	Instantaneous 0.15s, 0.30s
G	175	250	175	250	10	Yes	10	10	10	10	
H	200	320	200	320	15	5 to 35 %	11	11	11	11	
J	225	360	225	360	20	1 to 200 sec	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) 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	
							I^2t		Flat	Instantaneous override						Trip	Flat
							I^4t		I^2t	3000 A	4400 A		7200 A			Alarm	I^2t

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	
						I^2t		Flat	Instantaneous override					Trip	Flat
						I^4t		I^2t	4400 A		7200 A			Alarm	I^2t

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
				I^2t	6800 A	Alarm	I^2t
				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
					I^2t	6800 A	8000 A	Alarm	I^2t
					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 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	
				I^2t	I^2t	I^2t		Flat	Instantaneous override			Trip	Flat
				I^4t	I^4t	I^4t		I^2t	14400 A			Alarm	I^2t

10.2.33 PDG6 PXR20 settings

Frame	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	
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	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
								I^2t	17500 A			Alarm	I^2t
								Pickup (Isd) limited by Max Instantaneous					

Note that ground fault pickup will not exceed 1200 A.

10.2.34 PDG6 PXR25 and 20D settings

Frame	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	
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	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	
				I^2t				Flat	Instantaneous override			Trip	Flat
				I^4t				I^2t	17500 A			Alarm	I^2t
								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 01 = 19200 bit/s (factory default) 02 = 38400 bit/s 03 = 57600 bit/s
4002	FA1	Parity	00 = None 01 = Odd 02 = Even (factory default)
4003	FA2	Stop bit	00 = 1 bit (factory default) 01 = 2 bits

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 origi¬nal 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). An example is: 4xxxx/4yyyyy (XXXX+116/YYYY+116).

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".

Register number		Register address (HEX)		Objects			Trip Unit		
IEEE float	Fixed point (FP)	IEEE float	Fixed point (FP)	Descriptions	Units	Fp scale factor	PXR 20/20D	PXR 25	PXR 25MP
404609	406145	1200	1800	High byte is primary status, low byte is secondary status (see Section 11.3.8.2)			YES	YES	YES
404610	406146	1201	1801	Cause of status (see Section 11.3.8.2)			YES	YES	YES
404611	406147	1202	1802	IA	A	10	YES	YES	YES
404613	406149	1204	1804	IB	A	10	YES	YES	YES
404615	406151	1206	1806	IC	A	10	YES	YES	YES
404617	406153	1208	1808	IG	A	10	YES	YES	YES
404619	406155	120A	180A	IN	A	10	YES	YES	YES
404623	406159	120E	180E	VAB	V	10		YES	YES
404625	406161	1210	1810	VBC	V	10		YES	YES
404627	406163	1212	1812	VCA	V	10		YES	YES
404631	406167	1216	1816	VAN	V	10		YES	YES
404633	406169	1218	1818	VBN	V	10		YES	YES
404635	406171	121A	181A	VCN	V	10		YES	YES
404641	406177	1220	1820	Peak Ia demand	A	10			YES
404643	406179	1222	1822	Peak Ib demand	A	10			YES
404645	406181	1224	1824	Peak Ic demand	A	10			YES
404649	406185	1228	1828	Peak In demand	A	11			YES
404651	406187	122A	182A	Real 3 phase power	W	1		YES	YES
404653	406189	122C	182C	Reactive 3 phase power	Vars	1		YES	YES
404655	406191	122E	182E	Apparent 3 phase power	VA	1		YES	YES
404659	406195	1232	1832	Power factor		100		YES	YES
404661	406197	1234	1834	Frequency	Hz	10		YES	YES
404665	406201	1238	1838	minimum Ia demand	A	10			YES
404667	406203	123A	183A	minimum Ib demand	A	10			YES
404669	406205	123C	183C	minimum Ic demand	A	10			YES
404673	406209	1240	1840	minimum In demand	A	10			YES
404697	406233	1258	1858	Real power peak demand	W	1		YES	YES
404719	406255	126E	186E	Product ID			YES	YES	YES
404721	406257	1270	1870	Frequency	Hz	100		YES	YES
	406259		1872	Forward energy	KWh	1		YES	YES
	406261		1874	Reverse energy	KWh	1		YES	YES
	406263		1876	Total energy	KWh	1		YES	YES
	406271		187E	Apparent energy	KVAh	1		YES	YES
404765	406301	129C	189C	Temperature	C	1	YES	YES	YES
	406305		18A0	Forward energy	Wh	1		YES	YES
	406309		18A4	Reverse energy	Wh	1		YES	YES
	406313		18A8	Total energy	Wh	1		YES	YES
	406329		18B8	Apparent energy	VAh	1		YES	YES

Register number		Register address (HEX)		Objects			Trip Unit		
IEEE float	Fixed point (FP)	IEEE float	Fixed point (FP)	Descriptions	Units	Fp scale factor	PXR 20/20D	PXR 25	PXR 25MP
404797	406333	12BC	18BC	Reactive power peak demand	Vars	1		YES	YES
404799	406335	12BE	18BE	Apparent power peak demand	VA	1		YES	YES
404835	406371	12E2	18E2	Ia demand	A	10			YES
404837	406373	12E4	18E4	Ib demand	A	10			YES
404839	406375	12E6	18E6	Ic demand	A	10			YES
404843	406379	12EA	18EA	In demand	A	10			YES
404845	406381	12EC	18EC	Real power demand	W	1		YES	YES
404847	406383	12EE	18EE	Reactive power demand	Vars	1		YES	YES
404849	406385	12F0	18F0	Apparent power demand	VA	1		YES	YES
404851	406387	12F2	18F2	Minimum IA	A	10	YES	YES	YES
404853	406389	12F4	18F4	Maximum IA	A	10	YES	YES	YES
404855	406391	12F6	18F6	Minimum IB	A	10	YES	YES	YES
404857	406393	12F8	18F8	Maximum IB	A	10	YES	YES	YES
404859	406395	12FA	18FA	Minimum IC	A	10	YES	YES	YES
404861	406397	12FC	18FC	Maximum IC	A	10	YES	YES	YES
404863	406399	12FE	18FE	Minimum IG	A	10	YES	YES	YES
404865	406401	1300	1900	Maximum IG	A	10	YES	YES	YES
404867	406403	1302	1902	Minimum IN	A	10	YES	YES	YES
404869	406405	1304	1904	Maximum IN	A	10	YES	YES	YES
404871	406407	1306	1906	Minimum VAB	V	10		YES	YES
404873	406409	1308	1908	Maximum VAB	V	10		YES	YES
404875	406411	130A	190A	Minimum VBC	V	10		YES	YES
404877	406413	130C	190C	Maximum VBC	V	10		YES	YES
404879	406415	130E	190E	Minimum VCA	V	10		YES	YES
404881	406417	1310	1910	Maximum VCA	V	10		YES	YES
404883	406419	1312	1912	Minimum VAN	V	10		YES	YES
404885	406421	1314	1914	Maximum VAN	V	10		YES	YES
404887	406423	1316	1916	Minimum VBN	V	10		YES	YES
404889	406425	1318	1918	Maximum VBN	V	10		YES	YES
404891	406427	131A	191A	Minimum VCN	V	10		YES	YES
404893	406429	131C	191C	Maximum VCN	V	10		YES	YES
404911	406447	132E	192E	current phase unbalance	%	100			YES
404913	406449	1330	1930	voltage phase unbalance	%	100			YES
404915	406451	1332	1932	Ia% THD	%	100			YES
404917	406453	1334	1934	Ib% THD	%	100			YES
404919	406455	1336	1936	Ic% THD	%	100			YES
404923	406459	133A	193A	In% THD	%	100			YES
404925	406461	133C	193C	Vab% THD	%	100			YES
404927	406463	133E	193E	Vbc% THD	%	100			YES
404929	406465	1340	1940	Vca% THD	%	100			YES
404931	406467	1342	1942	Van% THD	%	100			YES
404933	406469	1344	1944	Vbn% THD	%	100			YES
404935	406471	1346	1946	Vcn% THD	%	100			YES
404959	406495	135E	195E	INST/SDT/HIGH_INST count		1	YES	YES	YES
404961	406497	1360	1960	LDT/GFT count		1	YES	YES	YES
404963	406499	1362	1962	Operations count		1	YES	YES	YES
404965	406501	1364	1964	Short delay trip count		1	YES	YES	YES
404967	406503	1366	1966	Inst delay trip count		1	YES	YES	YES
404969	406505	1368	1968	High current delay trip count		1	YES	YES	YES

Register number		Register address (HEX)		Objects			Trip Unit		
IEEE float	Fixed point (FP)	IEEE float	Fixed point (FP)	Descriptions	Units	Fp scale factor	PXR 20/20D	PXR 25	PXR 25MP
404971	406507	136A	196A	Long delay trip count		1	YES	YES	YES
404973	406509	136C	196C	Ground fault trip count		1	YES	YES	YES
404975	406511	136E	196E	Total trip count		1	YES	YES	YES
404977	406513	1370	1970	Test trip count		1	YES	YES	YES
404979	406515	1372	1972	Open by comm count		1	YES	YES	YES
404981	406517	1374	1974	Manual open count		1	YES	YES	YES
404983	406519	1376	1976	Time of last operation (year)		1	YES	YES	YES
404985	406521	1378	1978	Time of last operation (month)		1	YES	YES	YES
404987	406523	137A	197A	Time of last operation (day)		1	YES	YES	YES
404989	406525	137C	197C	Time of last operation (hour)		1	YES	YES	YES
404991	406527	137E	197E	Time of last operation (minute)		1	YES	YES	YES
404993	406529	1380	1980	Time of last operation (second)		1	YES	YES	YES
404995	406531	1382	1982	Max device temperature		1	YES	YES	YES
404997	406533	1384	1984	Time of max device temp (year)		1	YES	YES	YES
404999	406535	1386	1986	Time of max device temp (month)		1	YES	YES	YES
405001	406537	1388	1988	Time of max device temp (day)		1	YES	YES	YES
405003	406539	138A	198A	Time of max device temp (hour)		1	YES	YES	YES
405005	406541	138C	198C	Time of max device temp (minute)		1	YES	YES	YES
405007	406543	138E	198E	Time of max device temp (second)		1	YES	YES	YES
405009	406545	1390	1990	Running time: minute		1	YES	YES	YES
405011	406547	1392	1992	Running time: hour		1	YES	YES	YES
405013	406549	1394	1994	Running time: day		1	YES	YES	YES
405015	406551	1396	1996	Health points (0-10000)		100-(Health point/100)	YES	YES	YES
405025	406561	13A0	19A0	harmonics are for: 0 - Ia 1 - Ib 2 - Ic 4 - In 5 - Vab 6 - Vbc 7 - Vca 8 - Van 9 - Vbn 10 - Vcn		1			YES
405027	406563	13A2	19A2	Item harmonics[0]	%	100			YES
405029	406565	13A4	19A4	Item harmonics[1]	%	100			YES
405031	406567	13A6	19A6	Item harmonics[2]	%	100			YES
405033	406569	13A8	19A8	Item harmonics[3]	%	100			YES
405035	406571	13AA	19AA	Item harmonics[4]	%	100			YES
405037	406573	13AC	19AC	Item harmonics[5]	%	100			YES
405039	406575	13AE	19AE	Item harmonics[6]	%	100			YES
405041	406577	13B0	19B0	Item harmonics[7]	%	100			YES
405043	406579	13B2	19B2	Item harmonics[8]	%	100			YES
405045	406581	13B4	19B4	Item harmonics[9]	%	100			YES
405047	406583	13B6	19B6	Item harmonics[10]	%	100			YES
405049	406585	13B8	19B8	Item harmonics[11]	%	100			YES
405051	406587	13BA	19BA	Item harmonics[12]	%	100			YES
405053	406589	13BC	19BC	Item harmonics[13]	%	100			YES
405055	406591	13BE	19BE	Item harmonics[14]	%	100			YES
405057	406593	13C0	19C0	Item harmonics[15]	%	100			YES
405059	406595	13C2	19C2	Item harmonics[16]	%	100			YES
405061	406597	13C4	19C4	Item harmonics[17]	%	100			YES

Register number		Register address (HEX)		Objects			Trip Unit		
IEEE float	Fixed point (FP)	IEEE float	Fixed point (FP)	Descriptions	Units	Fp scale factor	PXR 20/20D	PXR 25	PXR 25MP
405063	406599	13C6	19C6	Item harmonics[18]	%	100			YES
405065	406601	13C8	19C8	Item harmonics[19]	%	100			YES
405067	406603	13CA	19CA	Item harmonics[20]	%	100			YES
405069	406605	13CC	19CC	Item harmonics[21]	%	100			YES
405071	406607	13CE	19CE	Item harmonics[22]	%	100			YES
405073	406609	13D0	19D0	Item harmonics[23]	%	100			YES
405075	406611	13D2	19D2	Item harmonics[24]	%	100			YES
405077	406613	13D4	19D4	Item harmonics[25]	%	100			YES
405079	406615	13D6	19D6	Item harmonics[26]	%	100			YES
405081	406617	13D8	19D8	Item harmonics[27]	%	100			YES
405083	406619	13DA	19DA	Item harmonics[28]	%	100			YES
405085	406621	13DC	19DC	Item harmonics[29]	%	100			YES
405087	406623	13DE	19DE	Item harmonics[30]	%	100			YES
405089	406625	13E0	19E0	Item harmonics[31]	%	100			YES
405091	406627	13E2	19E2	Item harmonics[32]	%	100			YES
405093	406629	13E4	19E4	Item harmonics[33]	%	100			YES
405095	406631	13E6	19E6	Item harmonics[34]	%	100			YES

The two-register format is presented in units of kilowatt 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 3 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

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 403001 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 403001 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.

Set points group 0: system group

Register		Bit field	Mask field	Set point name	R/W	Format	Value definition	Unit
DEC	HEX							
403000	BB7	15-0		Password	W		"0-0-0-0" (factory default)	
403001	BB8	15-0	0xFFFF	Group 0 = system	R/W		0x00FF (hex) 255 (dec)	
403002	BB9	12-0	0x1FFF	Rating information	R	Encoded	PD2 PD3A: 125, 250, 400. PD3B: 400, 600, 630. PD4: 800, 1000. PD5: PD6:	A
403003	BBA	2-0	0x0007	Breaker frame	R	Encoded	00 --> NRX NF 01 --> NRX RF 11 --> NZM2 12 --> NZM3 13 --> NZM4 21 --> PD2 22 --> PD3 23 --> PD3H 24 --> PD4 25 --> PD5 26 --> PD6	
403004	BBB			Style1	R	Encoded 0 = false 1 = true	b0 --> LdSel : with long delay protection b1 --> SdSel : with short delay protection b2 --> InstSel : with Inst protection b3 --> GfSel : with ground fault protection b4 --> ARMSel : with maintenance mode b5 --> OvrideSel : with override protection b6 --> RCDSel : with ground fault RCD b7 --> MotorSel : with motor protection b8 --> NeuSenorSel : with neutral sensor b9 --> ThermalSel : with thermal memory b12 --> VoltSel : with voltage sampling feature b13 --> ExtADCSel : with external AD7779	
403005	BBC	3-0	0x000F	Style2	R	Encoded 0 = false 1 = true	b0 --> ModbusSel : with integrated Modbus b1 --> CAMSel : with CAM RS422 port b2 --> IOModuleSel : with IO module port b3 --> RelaySel : with relay b4 --> ZSISel : with ZSI b12 --> NZM_ACB_Sel b13 --> IECSel : IEC = 1, UL = 0	
403006	BBD	8	0x0100	Maintenance mode: state	R	Encoded	0 = Off 1 = On	
		BBE	0x0001	Maintenance mode: remote control	R/W	Encoded	0 = Off 1 = On	
403007	BBE	2-0	0x0007	Arms level	R/W	Encoded	1 = 2.5 * In 2 = 4 * In 3 = 6 * In 4 = 8 * In 5 = 10 * In	A
403008	BCF			Frequency	R	Unsigned	Range: 50, 60 , 400	Hz
403009	BC0	0	0x0001	Rev feed	R/W	Encoded	0 = Forward 1 = Reverse	
403010	BC1	0	0x0001	Sign convention	R/W	Encoded	sign convention : 0 = IEC, 1 = IEEE, 2 = IEEEalt	
403011	BC2			Power window	R/W	Encoded	Power demand window : 0 = fixed, 1 = sliding	
403012	BC3			Power interval	R/W	Encoded	Power demand interval: [5…60] min	min

Register		Bit field	Mask field	Set point name	R/W	Format	Value definition	Unit
DEC	HEX							
403013	BC4			Language	R/W	Encoded	set language on local LCD display 0x01 --> English 0x02 --> German 0x03 --> French 0x04 --> Spanish 0x05 --> Italian 0x06 --> Chinese 0x07 --> Russian 0x08 --> Dutch 0x09 --> Danish 0x10 --> Greek 0x11 --> Portuguese 0x12 --> Swedish 0x13 --> Finnish 0x14 --> Czech 0x15 --> Estonian 0x16 --> Hungarian 0x17 --> Lithuanian 0x18 --> Latvian 0x19 --> Polish 0x20 --> Slovenian 0x21 --> Slovak 0x22 --> Bulgarian 0x23 --> Romanian 0x24 --> Croatian	
403014	BC5			LCD_rotation	R/W	Encoded	Setting LCD display direction 0 <--> horizontal 1 <--> vertical - left 2 <--> vertical - right	
403015	BC6			Relay_config1	R/W	Encoded	Relay 1/2/3 function configuration	
403016	BC7			Relay_config2	R/W	Encoded	OFF_RELAY = 0x0000	
403017	BC8			Relay_config3	R/W	Encoded	TRIP_OVERLOAD_RELAY = 0x0001 TRIP_NEUTRAL_RELAY = 0x0002 TRIP_SHORTCIRCUIT_RELAY = 0x0003 TRIP_SHORTDELAY_RELAY = 0x0004 TRIP_INST_RELAY = 0x0005 TRIP_GROUND_RELAY = 0x0006 TRIP_MM_RELAY = 0x0007 TRIP_ALL_RELAY = 0x0008 ALARM_HL_ALARM_RELAY = 0x0010 ALARM_HL_LOAD_RELAY = 0x0011 ALARM_HIGHTEMP_RELAY = 0x0012 ALARM_GROUND_RELAY = 0x0013 ALARM_THERMAL_RELAY = 0x0014 ALARM_WATCHDOG_RELAY = 0x0015 ALARM_LOW_BAT_RELAY = 0x0016 ALARM_INTERNAL_FAULT_RELAY = 0x0017 ALARM_STP_ERROR_RELAY = 0x0018 ALARM_BRK_HEALTH_RELAY = 0x0019 ALARM_COMM_FAULT_RELAY = 0x001A ALARM_ALL_RELAY = 0x001B AUX_RELAY = 0x0020 BELL_RELAY = 0x0021 MM_ACTIVE_RELAY = 0x0022 ZSI_ACTIVE_RELAY = 0x0023 ZSI_INPUT_RELAY = 0x0024 ZSI_OUTPUT_RELAT = 0x0025 COMM_OPEN_BREAKER_ PULSE_ RELAY = 0x0026 COMM_CLOSE_BREAKER_PULSE_RELAY = 0x0027 OUTPUT_RELAY = 0x0028	
403018	BC9			Pole location - phase a(1)	R/W	Encoded	Pole location - phase A(1) 0 - left 1 - right	
403019	BCA			Reserved				
403020	BCB			Reserved				
403021	BCC			Reserved				

Set points group 1: protection group

Register		Bit field	Mask field	Set point name	R/W	Format	Value definition	Unit
DEC	HEX							
403000	BB7	15-0		Password	W		Default "0-0-0-0"	
403001	BB8	15-0	0xFFFF	Group 0 = system	R/W		(Hex) 0x01FF (Dec) 511	
403002	BB9	12-0	0x1FFF	Rating information	R	Encoded	PD2: PD3A: 125, 250, 400. PD3B: 400, 600, 630. PD4: 800, 1000. PD5: PD6:	A
403003	BBA	2-0	0x0007	Break frame	R	Encoded	00 --> NRX NF 01 --> NRX RF 11 --> NZM2 12 --> NZM3 13 --> NZM4 21 --> PD2 22 --> PD3 23 --> PD3H 24 --> PD4 25 --> PD5 26 --> PD6	
403004	BBB			Style1	R	Encoded 0 = false 1 = true	b0 --> LdSel : with long delay protection b1 --> SdSel : with short delay protection b2 --> InstSel : with Inst protection b3 --> GfSel : with ground fault protection b4 --> ARMSel : with maintenance mode b5 --> OvrideSel : with override protection b6 --> RCDSel : with ground fault RCD b7 --> MotorSel : with motor protection b8 --> NeuSenorSel : with neutral sensor b9 --> ThermalSel : with thermal memory b12 --> VoltSel : with voltage sampling feature b13 --> ExtADCSel : with external AD7779	
403005	BBC	3-0	0x000F	Style2	R	Encoded 0 = false 1 = true	b0 --> ModbusSel : with integrated Modbus b1 --> CAMSel : with CAM RS422 port b2 --> IOModuleSel : with IO module port b3 --> RelaySel : with relay b4 --> ZSISel : with ZSI b12 --> NZM_ACB_Sel b13 --> ECSel : IEC = 1, UL = 0	
403006	BBD	0	0x0001	LD thermal memory	R/W	Encoded	thermal memory enable/disable LD Thermal Memory (powered and unpowered operation. Used only in I^2t and I^4t) trip unit : 0 <--> off 1 <--> cooling	
403007	BBE	0	0x0001	ZSI	R/W	Encoded	ZSI, zone interlock *when enable, for trip unit with G, ZSI is implemented for short delay and ground fault. *when enable, for trip unit without G, ZSI is implemented for short delay. trip unit side : 0 <--> disable 1 <--> enable	
403008	BBF	0-1	0x0003	LD_slp	R/W	Encoded	long delay slope: 0 = $I^{0.5}T$ 1 = IT 2 = I^2T 3 = I^4T	
403009	BC0			LD pick up (Ir)	R/W	Unsigned	long delay pick up: detail see the "PXR MCCB amp rating labels" Ir = xxx (A)	A
403010	BC1			LD time (tr)	R/W	Unsigned	long delay time: detail see the "PXR MCCB amp rating labels" Tr = xxx /10 (s)	Sec

Register		Bit field	Mask field	Set point name	R/W	Format	Value definition	Unit
DEC	HEX							
403011	BC2			High load alarm (Alarm1)	R/W	Unsigned	High Load Alarm [50...120*] step 1 50% Ir...120% Ir (Must be greater than High Load Warning) * 130 for Motor protection styles	%
403012	BC3	0	0x0001	SD slp	R/W	Encoded	Short delay slope: 0 = flat 1 = I^2T	
403013	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
403014	BC5			SD time (tsd)	R/W	Unsigned	long delay time: detail see the "PXR MCCB amp rating labels" Tsd = xxx / 1000 (s)	ms
403015	BC6			Instantaneous pick up(Ii)	R/W	Unsigned	Instantaneous pick up: detail see the "PXR MCCB amp rating labels" Ii = xxx /10 (xIn)	*In
403016	BC7	0	0x0001	Ground sensing type	R	Encoded	Ground sensing type setting: MCCB only support residual mode 0 = residual 1 = source/zero sequence	
403017	BC8	0-1	0x0003	Local ground fault type	R/W	Encoded	Ground fault style - trip/alarm/OFF 0 = Trip 1 = Alarm 2 = OFF	
403018	BC9	0	0x0001	Ground fault slope	R/W	Encoded	Ground fault slope: 0 = Flat 1 = I^2T	
403019	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
403020	BCB			Ground time(tg)	R/W	Unsigned	Ground fault time: detail see the "PXR MCCB amp rating labels" Tg = xxx / 1000 (s)	Sec
403021	BCC			Ground fault thermal memory	R/W		Thermal memory enable/disable LD thermal memory (powered and unpowered operation. Used only in I^2t and I^4t) 0 = off 1 = cooling	
403022	BCD			Neutral protection ratio	R/W	Unsigned	Neutral protection ratio: 0 <--> 0% 60 <--> 60% 100 <--> 100%	%
403023	BCE			High load warning Alarm1	R/W		High Load Alarm [50...120*] step 1 50% Ir...120% Ir (Must be less than High Load Alarm) * 130 for Motor protection styles	
403024	BCF			GF_pre_alarm	R/W		Ground Fault trip pre alarm pick up: *100 [50…100] step 5	
403025	BD0			reserved (TBD)				

Set points group 2: ModbusRTU group

Register		Bit field	Mask field	Set points name	R/W	Format	Value definition	Units
DEC	HEX							
403000	BB7	15-0	0xFFFF	Password	W	Encoded	Default "0-0-0-0"	
403001	BB8	15-0	0xFFFF	Group 2 = on-board Modbus	R/W	Encoded	(Hex) 0x02FF (Dec) 767	
403002	BB9	15-0		Integrated Modbus -- communication address	R/W	Encoded	001 - 246	
403003	BBA	15-0		Integrated Modbus -- baudrate	R/W	Encoded	00 = 9600 bit/s 01 = 19200 bit/s 02 = 38400 bit/s 03 = 57600 bit/s	
403003	BBA	15-0		Integrated Modbus -- parity	R/W	Encoded	00 = none 01 = odd 02 = even	
403003	BBA	15-0		Integrated Modbus -- stop bit	R/W	Encoded	00 = 1 bit 01 = 2 bits	

Set points group 3: CAM settings group

Register		Bit field	Mask field	Set points name	R/W	Format	Value definition
DEC	HEX						
403000	BB7	15-0	0xFFFF		W	Encoded	Default "0-0-0-0"
403001	BB8	15-0	0xFFFF		R/W	Encoded	(Hex) 0x03FF (Dec) 1023
403002	BB9	15-0		CAM connection status	R	Encoded	0 = No external CAM 1 = External Modbus 2 = INCOM CAM 3 = Ethernet CAM 4 = Profibus CAM
403003	BBA	15-0		CAM communication address	R	Encoded	001~246 <--> 001~246
403004	BBB	15-0		CAM baud rate	R	Encoded	0 = 1200bps 1 = 4800bps 2 = 9600bps 3 = 19200bos
403005	BBC	15-0		CAM parity	R	Encoded	0 = None 1 = Odd 2 = Even
403006	BBD			CAM stopbit	R		0 = 1bit 1 = 2bits
403007	BBE			INCOM CAM address	R		0001~4094 <--> 0001~4094
403008	BBF			INCOM CAM baud rate	R		1 <--> 9600bps see IL01301033e P8 "for series NRX INCOM communication adapter module, baud rate is fixed at 9600 baud and represented by a value of 01"
403009	BC0			Ethernet CAM DHCP enable	R		0 <--> false 1 <--> true
403010	BC1			Ethernet CAM IP addr. MSB	R		0~255 <--> 0~255
403011	BC2			Ethernet CAM IP addr. LSB	R		0~255 <--> 0~255
403012	BC3			Ethernet CAM IP addr. MSB	R		0~255 <--> 0~255
403013	BC4			Ethernet CAM IP addr. LSB	R		0~255 <--> 0~255
403014	BC5			Ethernet CAM subnet mask	R		16~32 <--> 16~32
403015	BC6			Ethernet CAM default gateway	R		0~255 <--> 0~255
403016	BC7			Ethernet CAM default gateway	R		0~255 <--> 0~255
403017	BC8			Ethernet CAM reset pin	R		0~255 <--> 0~255
403018	BC9			Profibus CAM address	R		1~125 <--> 1~125

Setpoints group 5 motor protection configuration

Register number		Bit field	Mask field	Set points name	R/W	Format	Value definition
DEC	HEX						
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, 1 = Alarm, 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, 1 = Alarm, 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, 1 = Alarm, 2 = OFF
403009	BC0			voltage unbalance pickup	R/W	Unsigned	xxx (%), 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, 1 = Alarm, 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, 1 = Alarm, 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, 1 = CBA
403018	BC9	1-0		phase rotation action	R/W	Encoded	0 = Trip, 1 = Alarm, 2 = OFF
403019	BCA	1-0		phase loss action	R/W	Encoded	0 = Trip, 1 = Alarm, 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 0. 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 = 8EFF16
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: 00 = Power up – time OK 01 = Set points download 02 = Time adjusted 03 = Trip 04 = Alarm 05 = Enter test mode 06 = Exit test mode 08 = Power up – no time 09 = Test completed 10 = Maintenance mode active 11 = Maintenance mode inactive 12 = Opened by Communications 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

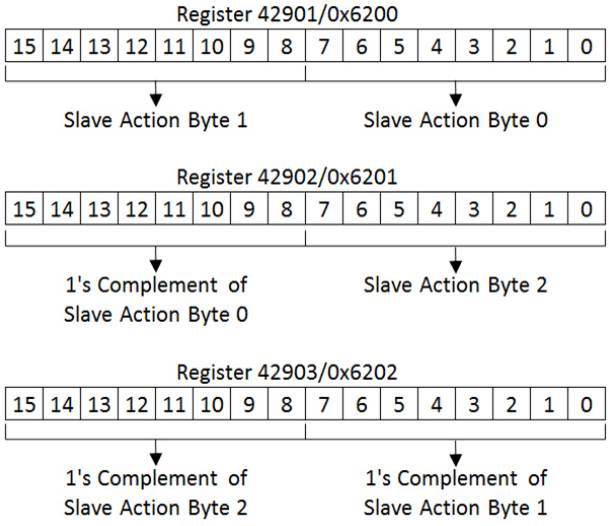
Non-volatile Register 402001/425345(0x07D0/0x6300) is used to configure trip unit to respond to a group of data objects. See 11.2.1 Communications protocol options.

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.



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 information is listed in 0. 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 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) EATON PXR20D (for pxr20d) 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	ppppppvvvvdddddd Use division code (dddddd) of 32 (0x20) Use product code (pppppp) of 2 for PXR MCCB 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.

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