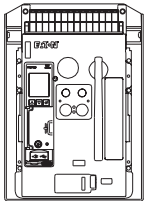
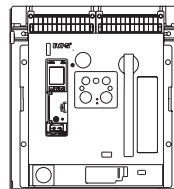


# Series NRX with PXR - instructions for modbus communications adapter module (MCAM)

## Instructions apply to:



UL1066/ANSI, UL489 series NRX NF frame  
IEC IZMX16



UL489 series NRX RF frame  
IEC IZMX40

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### WARNING

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- (1) ONLY QUALIFIED ELECTRICAL PERSONNEL SHOULD BE PERMITTED TO WORK ON THE EQUIPMENT.
- (2) ALWAYS DE-ENERGIZE PRIMARY AND SECONDARY CIRCUITS IF A CIRCUIT BREAKER CANNOT BE REMOVED TO A SAFE WORK LOCATION.
- (3) DRAWOUT CIRCUIT BREAKERS SHOULD BE LEVERED (RACKED) OUT TO THE DISCONNECT POSITION.
- (4) ALL CIRCUIT BREAKERS SHOULD BE SWITCHED TO THE OFF POSITION AND MECHANISM SPRINGS DISCHARGED.

FAILURE TO FOLLOW THESE STEPS FOR ALL PROCEDURES DESCRIBED IN THIS INSTRUCTION LEAFLET COULD RESULT IN DEATH, BODILY INJURY, OR PROPERTY DAMAGE.

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### WARNING

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THE INSTRUCTIONS CONTAINED IN THIS IL AND ON PRODUCT LABELS HAVE TO BE FOLLOWED. OBSERVE THE FIVE SAFETY RULES:

- DISCONNECTING;
- ENSURE THAT DEVICES CANNOT BE ACCIDENTALLY RESTARTED;
- VERIFY ISOLATION FROM THE SUPPLY;
- EARTHING AND SHORT-CIRCUITING; AND
- COVERING OR PROVIDING BARRIERS TO ADJACENT LIVE PARTS.

DISCONNECT THE EQUIPMENT FROM THE SUPPLY. USE ONLY AUTHORIZED SPARE PARTS IN THE REPAIR OF THE EQUIPMENT. THE SPECIFIED MAINTENANCE INTERVALS AS WELL AS THE INSTRUCTIONS FOR REPAIR AND EXCHANGE MUST BE STRICTLY ADHERED TO PREVENT INJURY TO PERSONNEL AND DAMAGE TO THE SWITCHBOARD.

# EAT•N

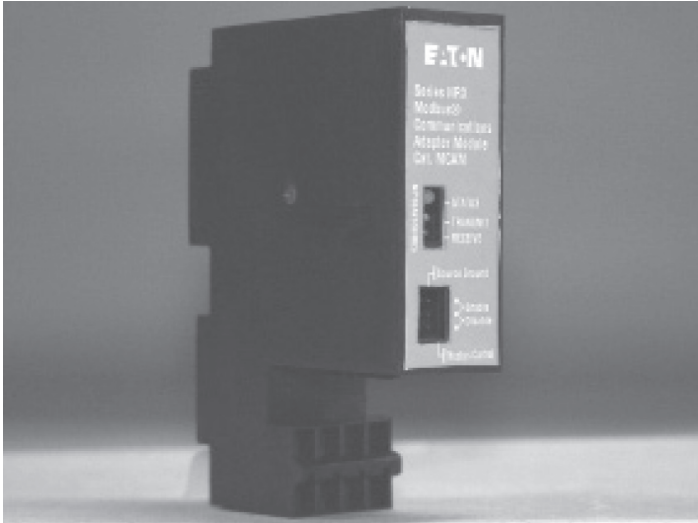
Powering Business Worldwide

## Series NRX with PXR - instructions for modbus communications adapter module (MCAM)

### Section 1: General information

The series NRX modbus communications adapter module (MCAM) (Figure 1) is an accessory that will operate as a communicating device in conjunction with a compatible series NRX trip unit/breaker in a master communications network (Figure 2).

The modbus adapter communicates to a master on a modbus network using the modbus RTU (remote terminal unit) protocol. Information is exchanged through the MCAM between the modbus master and the PXR trip unit using assigned registers.



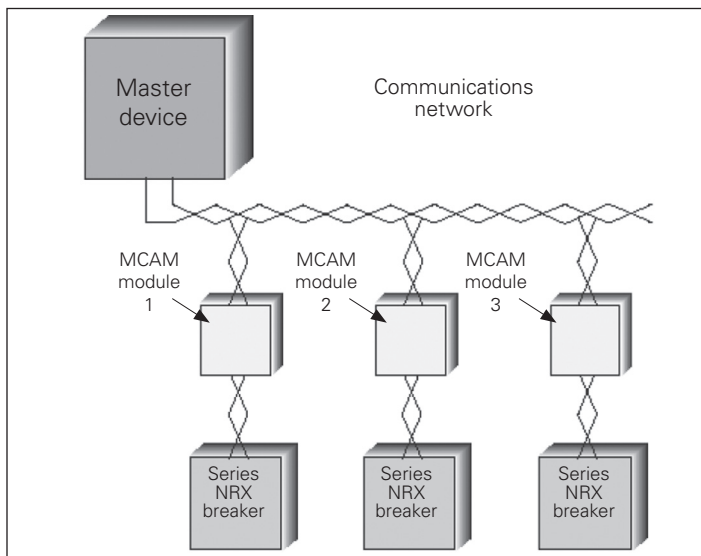
**Figure 1. Series NRX modbus communications adapter module.**

The modbus communications adapter module is a slave device and, as such, requires a master device for control command initiation. Each modbus communications adapter module provides:

- Circuit breaker open/close/reset control;
- Flashing status LED indicating module has power;
- Modbus communication enable/disable selection jumper for remote open/close control;
- DIN rail mounting (11 mm h, 28 mm w, DIN rail minimum requirement);
- Input power for module from 24 Vdc.

The modbus communications adapter module is designed to be installed, operated, and maintained by adequately trained people. These instructions do not cover all details or variations of the equipment for its storage, delivery, installation, checkout, safe operation, or maintenance.

If you have any questions or need additional information or instructions, please contact your local Eaton representative or visit [www.eaton.com](http://www.eaton.com).



**Figure 2. Modbus communications adapter modules in a modbus network.**

**Section 2: Installation of modbus communications adapter module**

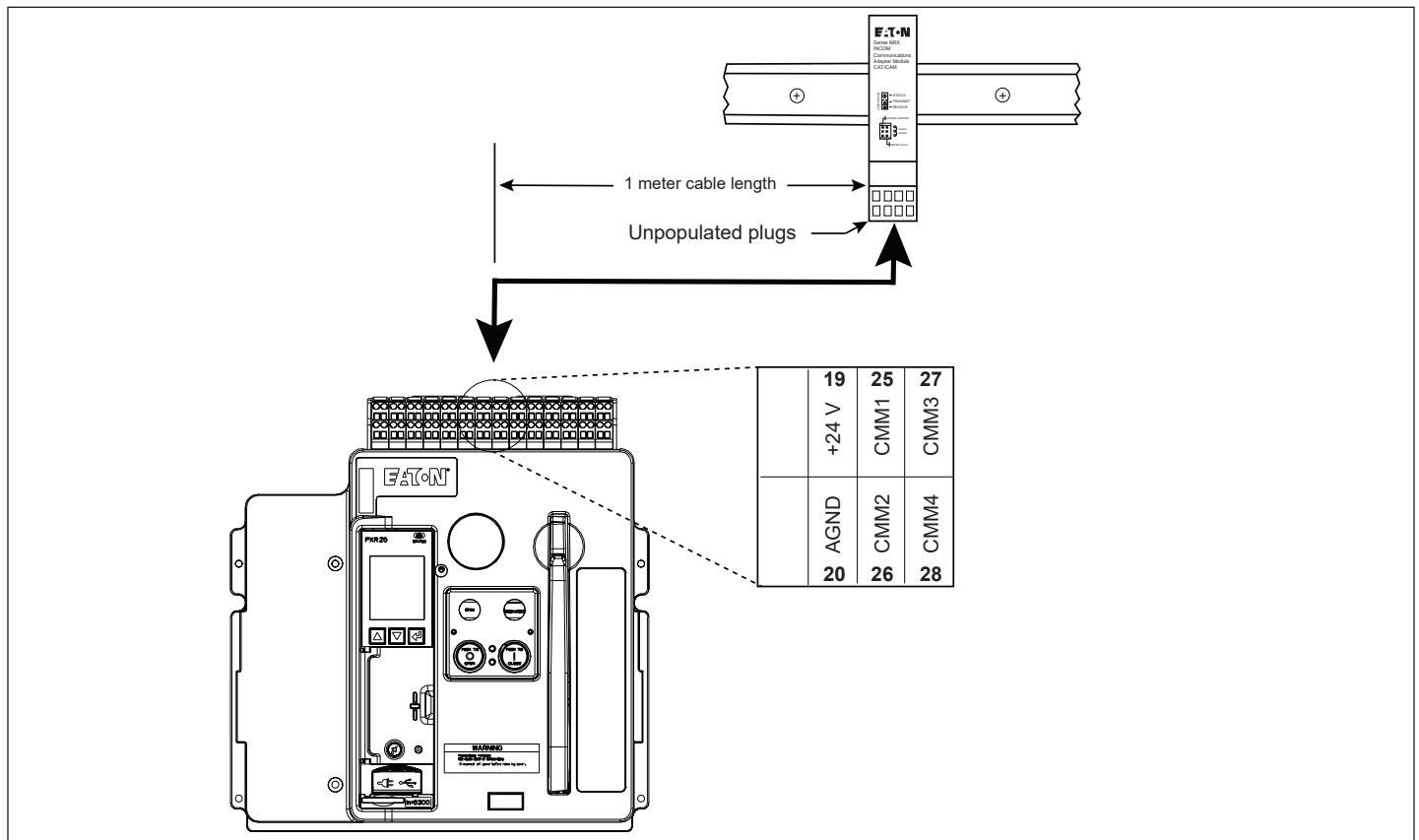
The following steps outline the installation procedure for a series NRX Modbus communications adapter module on a separate DIN rail for fixed and drawout configurations. Consult the customer support center for additional information.

**Table 1. Kit contents.**

Qty.	Item
1	Adapter harness – CAM module to NRX breaker secondary
1	Ferrule 2-18 AWG (Weidmuller PN 9004310000)
1	Installation instructions

This kit does not include the DIN rail for mounting the CAM module.

This kit provides an additional cable adapter for connection from the communications adapter module (CAM) to the circuit breaker when the CAM needs to be mounted remotely such as with a fixed mount circuit breaker (see Figure 3). The adapter consists of a 1 meter (3 ft.) length of cable that connects between the CAM module and the breaker secondary. The CAM module should be mounted on a length of standard grounded DIN rail.



**Figure 3. Connection of adapter cable to the NRX circuit breaker.**

The numbered flags on each wire of the cable directly correspond with the breaker secondary terminal designators. When connecting the adapter to the CAM module, ensure the unpopulated plugs are positioned on the left hand side as indicated in Figure 4. Note that the CAM module connector is keyed to fit in only one orientation.

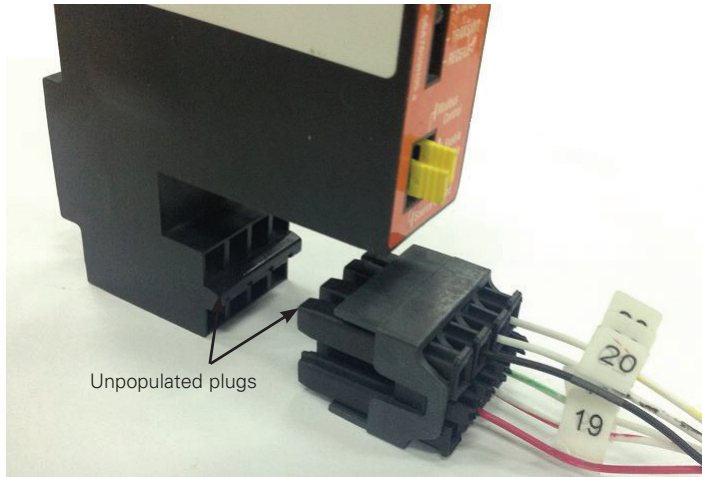


Figure 4. Connection to the CAM module.

The drain wire may be connected to the SHIELD terminal on the MCAM or the ICAM. Or it may be connected to the grounded DIN rail. If a PCAM or ECAM module is used use the 2-18 AWG Ferrule provided to connect the cable drain wire for a proper connection to the power supply ground terminal as shown in Figure 5.

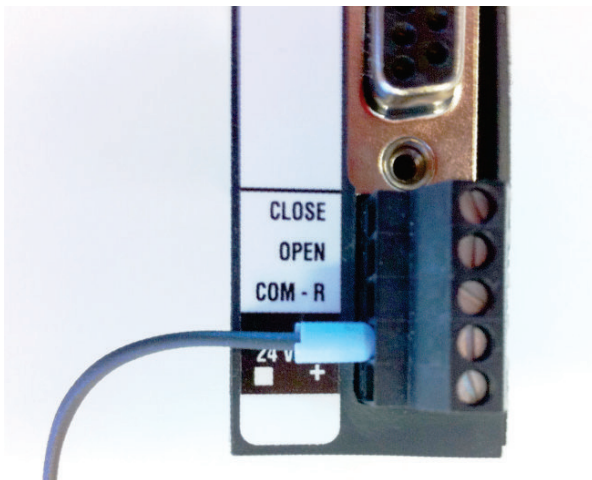


Figure 5. Connection to the CAM module.

## Series NRX with PXR - instructions for modbus communications adapter module (MCAM)

### Section 3: Basic modbus RS-485 network wiring

The following simplified rules apply to a given system consisting of a cable link between master and slave devices (see Figure 2). For more complex considerations, please refer to standard modbus RTU wiring specification rules for the RS-485 network.

1. The recommended modbus cable has twisted-pair wires (24 AWG stranded 7 x 32 conductors with PVC insulation) having an aluminum/mylar foil shield with drain wire.
2. The maximum system capacity is 4,000 ft. (1,219 m) of communications cable and 247 devices on the modbus RTU network.
3. Make sure there is twisted-pair wire that is recommended for modbus RTU network use. Use shielded twisted-pair wire to connect each slave to the modbus RTU network, daisy-chain style. **The polarity of the twisted pair is CRITICALLY important.**

**Section 4: Modbus communications adapter module connections**

**⚠ WARNING**

**ALL APPLICABLE SAFETY CODES, SAFETY STANDARDS, AND SAFETY REGULATIONS MUST BE STRICTLY ADHERED TO WHEN INSTALLING, OPERATING, OR MAINTAINING THIS EQUIPMENT. FAILURE TO COMPLY COULD RESULT IN DEATH, BODILY INJURY, OR PROPERTY DAMAGE.**

For installation specifics, refer to Figures 4 and 5 on page 4 for information, as well as pin-out Table 2 (power connector) and Table 3 (modbus connector).

**Table 2. Power connector pin-outs.**

Pin number	Input signal
1	24 Vdc+
2	24 Vdc-
3	Control signal common
4	Control open signal
5	Control close signal

•Module power uses a 5-pin input connector. Power requirement is 24 Vdc, 10 watts.

**Table 3. Modbus connector pin-outs a b.**

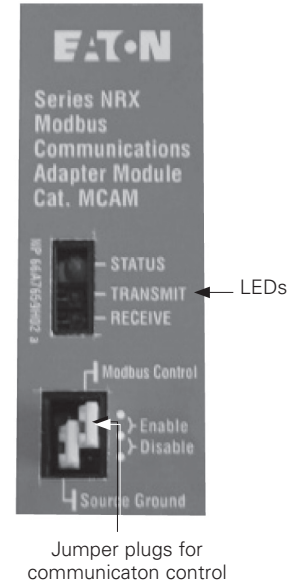
1	RS-485 network-B (non-inverting)
2	RS-485 network-A (inverting)
3	Common
4	Shield

<sup>a</sup> This 4-pin connector provides the interface to the modbus network.

<sup>b</sup> Connect shield wire to ground at master device end only. Interconnect shielding where devices are daisy-chained.

**Section 5: Jumpers and indicator LEDs**

Refer to Figure 6 to become familiar with specific jumper and LED locations on the modbus communications adapter module.



**Figure 6. Modbus communications adapter module (front view close-up).**

**Microcontroller LED (status)**

This indicator will be flashing green whenever the module is powered up and when the microprocessor is executing instructions. When the series NRX modbus communications adapter module is connected to a PXR trip unit for the first time, this LED will alternately flash red and green to signal a learning process between both units. This automatic process will take approximately 15 seconds and occurs only once during the initial startup. The LED will also flash red if the module is not connected to or unable to communicate with a PXR trip unit.

**Modbus RS-485 network Tx LED (transmit)**

This LED will be lit whenever the module is transmitting on the modbus RTU network.

**Modbus RS-485 network Rx LED (receive)**

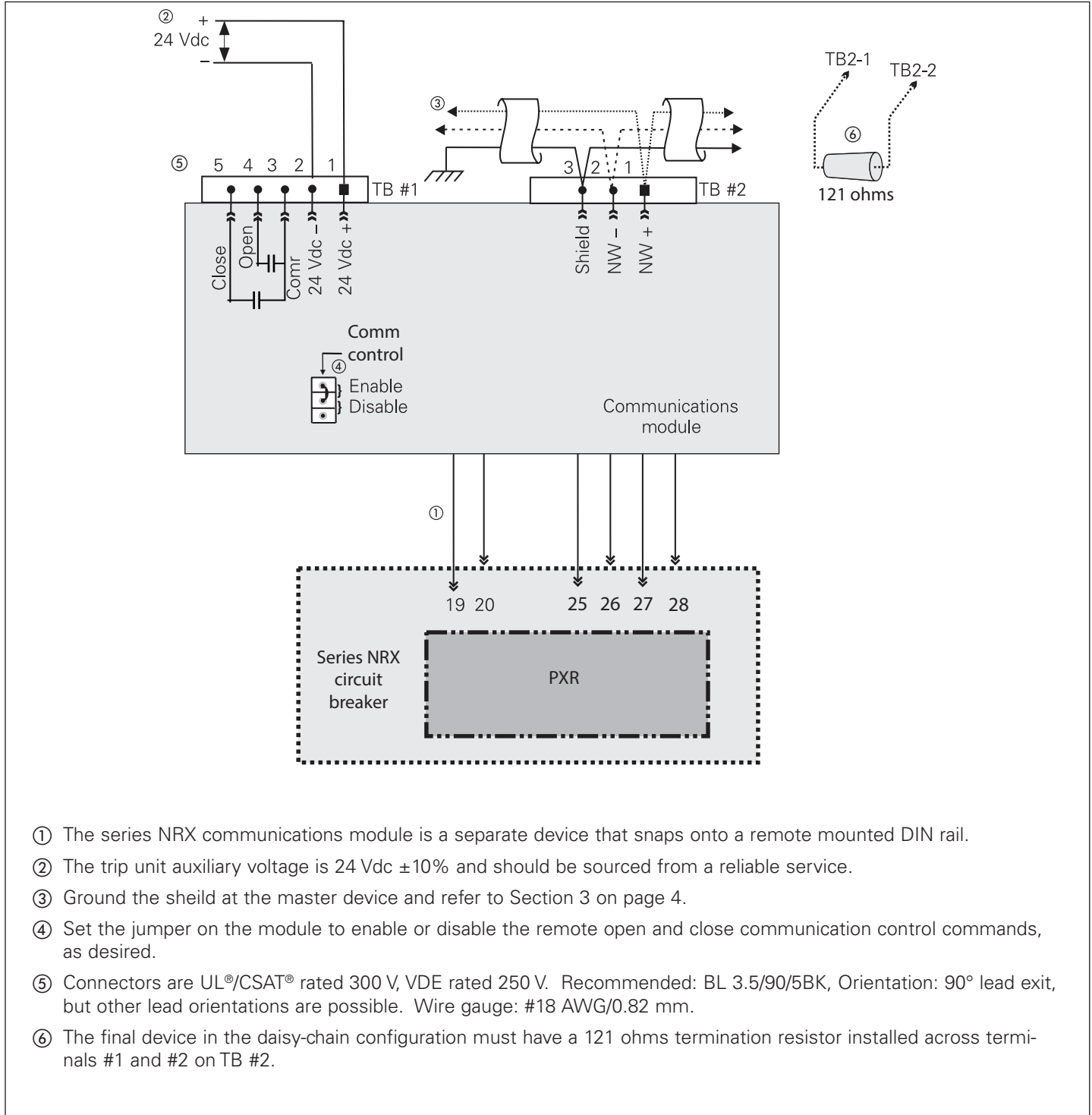
This LED will be lit whenever the module is receiving from the modbus RTU network.

**Modbus control jumper**

This jumper provides the user with a means of enabling or disabling remote communication control commands to the PXR trip unit. With jumper placed in the ENABLE position, remote Open and Close Breaker commands and Write Setpoint Registers can be acted upon. With the jumper in the DISABLE position, these commands will not be accepted.

**Source/residual ground selection jumper**

Consult PXR trip unit instructions (MN013003EN - Operating Manual for series NXR PXR 20/25 Trip Unit) for further information on ground sensing. This jumper is not applicable and does not function for PXR style trip units.



- ① The series NRX communications module is a separate device that snaps onto a remote mounted DIN rail.
- ② The trip unit auxiliary voltage is 24 Vdc ±10% and should be sourced from a reliable service.
- ③ Ground the shield at the master device and refer to Section 3 on page 4.
- ④ Set the jumper on the module to enable or disable the remote open and close communication control commands, as desired.
- ⑤ Connectors are UL®/CSAT® rated 300 V, VDE rated 250 V. Recommended: BL 3.5/90/5BK, Orientation: 90° lead exit, but other lead orientations are possible. Wire gauge: #18 AWG/0.82 mm.
- ⑥ The final device in the daisy-chain configuration must have a 121 ohms termination resistor installed across terminals #1 and #2 on TB #2.

**Figure 7. Series NRX modbus communication with PXR.**

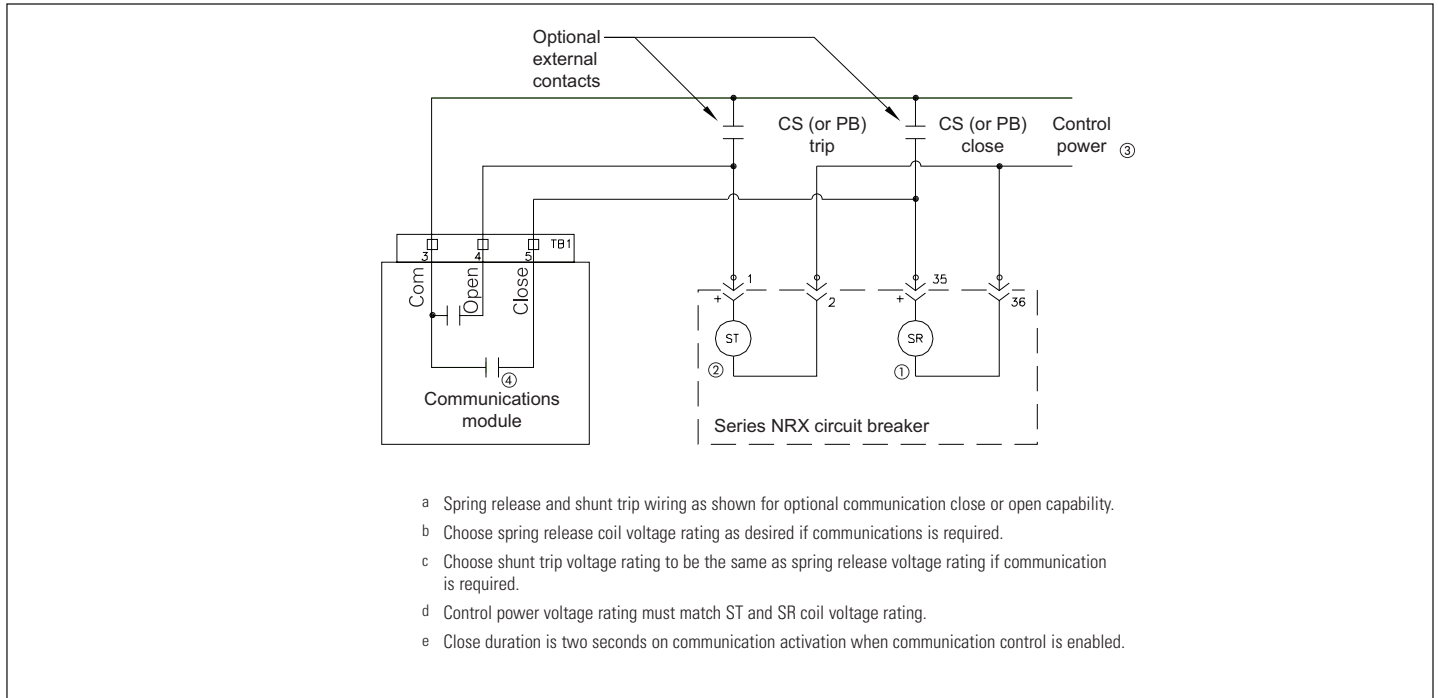


Figure 8. Communications control (SR and ST wiring).



**Section 6: Viewing/setting modbus address**

The PXR 20/25 trip unit is used as the means to display and modify the programmed modbus address setting of the MCAM module. All modules are shipped with a factory set default address of 220. The allowable address range is 001–247.

A trip unit containing a full display, such as the PXR 20/25, will provide the MCAM settings in menu form. To set or view MCAM settings on a PXR 20/25 display, the following sequence is used.

To set or view the address and the additional settings, go to the “Settings - Communication - Modbus CAM” menu on the trip unit.

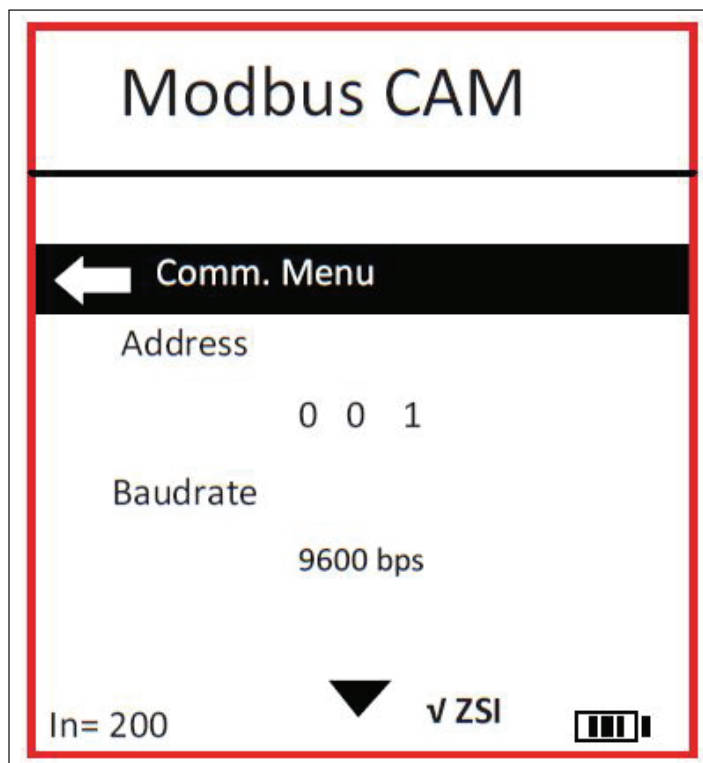


Figure 9. PXR trip unit MCAM settings.

Table 4. MCAM communications setting ranges.

Communication address	001-247
Baud rate	1200 4800 9600 19200
Parity	None Odd Even
Stop bit	1 bit 2 bits

**Section 7: Network communications protocol**

In order to satisfy the MCAM communications needs, please refer to the following reference material:

“Modbus Specifications”  
<http://modbus.org/tech.php>

Only the RTU communications mode is recognized by the MCAM.

The MCAM can support a maximum of 122 registers (244 data bytes) in a single modbus transaction.

To accommodate modbus masters 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 (low<sub>16</sub>/high<sub>16</sub> modbus register addresses). An example is: 4xxx/4yyyyy (XXXX+1<sub>16</sub>/YYYY+1<sub>16</sub>). Refer to Table 7.

**Function codes**

The MCAM responds to a limited number of modbus function codes. These are function codes 02, 03, 04, 06, 08, and 16 (10<sub>16</sub>). Function codes 03 and 04 are used interchangeably to obtain register data. Function code 06 can only be used to set the few single configuration registers (sections entitled “Register Access Configuration”, “Product Setpoints”, and “Product Events”).

**Input status (discrete inputs)**

Input status bits 101001 through 101032 may be available from series NRX trip unit using function code 02. The status definitions are defined in Table 6. The first 16 bits are the actual status state while the later 16 bits indicate whether the corresponding status state is valid, or supported by the series NRX trip unit.

**Data object registers**

To ensure that unique data objects (e.g. IA – phase A current) reside in identical registers independent of Eaton products, the MCAM uses a single register map of objects (see Tables 8 and 9). Data objects occupy two (2) registers except for certain energy (real and reactive) objects. These energy objects occupy four registers. Since these data objects have the capability to change in real time, a complete data object must be obtained in a single transaction to avoid data tearing of these multiple register objects. Attempting to access a partial data object will result in an exception code 84 from the MCAM. Refer to a later section entitled “Exception Codes”.

**Block of registers**

A block of registers (from the register column of Tables 8 or 9) can be established in the MCAM to remap the data object registers of an Eaton product. The block of registers list is stored in non-volatile memory.

Function code 16 (10<sub>16</sub>) is used to load the object assignments for the block of registers. The block assignments are stored beginning at register 41001/420481 (03E8<sub>16</sub>/5000<sub>16</sub>). Only the first data object register address is assigned within



# Series NRX with PXR - instructions for modbus communications adapter module (MCAM)

the block of registers. For example, although data object I<sub>A</sub> occupies registers 404611 (1202<sub>16</sub>) and 404612 (1203<sub>16</sub>), only register address (1202<sub>16</sub>) is loaded into the block of assignment registers. Verification of this block of assignment registers can be read from the MCAM by a read function code 03 or 04 from these 41001/420481 (03E8<sub>16</sub>/5000<sub>16</sub>) registers.

Data pertaining to the objects configured in the block of assignment registers is mapped into registers starting at 41201/420737 (04B0<sub>16</sub>/5100<sub>16</sub>) 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.

**Note:** An object can occupy two or four registers.

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.

## Register access configurations

Non-volatile register 42001/425345 (07D0<sub>16</sub>/6300<sub>16</sub>) is used to configure the MCAM to respond to a group of data objects, of which some objects are invalid within that group. When non-zero (factory default value), any attempt to access a group of data objects that contain an invalid object will result in an illegal data object exception code 02. Refer to a later section entitled "Exception codes."

When register 42001/425345 (07D0<sub>16</sub>/6300<sub>16</sub>) is set to zero, however, the MCAM will respond to a group of objects with data contained in the valid objects of the group along with an illegal value, if available else 0000<sub>16</sub> data contained in the invalid objects.

Non-volatile register 42003/425346 (07D1<sub>16</sub>/6301<sub>16</sub>) is used to configure 32-bit IEEE floating point word order. When non-zero (factory default), the floating point low order word is first in the Modbus register space.

When register 42002/425346 (07D1<sub>16</sub>/6301<sub>16</sub>) is set to zero, however, the floating point high order word is first in the Modbus register space.

Non-volatile register 42002/425347 (07D1<sub>16</sub>/6302<sub>16</sub>) is used to configure 32-bit fixed point and 64-bit energy word order. When non-zero (factory default), the fixed point and energy low order word is first in the modbus register space.

When register 42003/425347 (07D2<sub>16</sub>/6302<sub>16</sub>) is set to zero, however, the fixed point and energy high order word is first in the modbus register space.

Registers not containing a 32-bit or 64-bit format, such as status and product ID binary encoded objects, and MCAM control of product registers are not affected by the word order configuration registers.

Configuring any or all registers 42001/425345 through 42003/425347 (07D0<sub>16</sub>/6300<sub>16</sub> through 07D2<sub>16</sub>/6302<sub>16</sub>) is

accomplished using a write function code 06 or 16 (10<sub>16</sub>).

## Setpoint registers

A series NRX trip unit's setpoints are organized into groups. Each group can be considered a binary array of information which can be obtained through modbus register access. Register 403001 (i.e., holding register address 0BB8<sub>16</sub>) is a R/W register used to select the particular group. The high byte contains the requested group number, while the low byte must contain 255 (0FF<sub>16</sub>). Registers 403002 through 403122 contain the binary array of setpoint information for the current group. Registers 403001 through 403122 may be read by using function code 03 or 04.

To write setpoints, a complete setpoint group must be written in one modbus transaction using function code 16 (10<sub>16</sub>). Note, trip units which support write setpoint capabilities may write only Register 403001 using function code 06 or 16 (10<sub>16</sub>) to setup a requested read setpoint group. A write setpoint group will only be initiated when the modbus control jumper is in the "Enable" position (see section entitled "Modbus Control Jumper"). After completing the write setpoint group transfer, the new setpoint group values may be either saved or aborted by sending the control function "Save Setpoints Change" or "Abort Setpoints Change," respectively (see section entitled "Control of Product"). The MCAM will automatically abort the write setpoint group transfer in approximately 15 minutes if no further writes are initiated with the currently written setpoint group. The setpoint group definitions for the PXR 20 and PXR 25 are presented in Tables 10 and 11.

## Event registers

The triggering of an event in the PXR 20/25 trip unit can provide historical data object values at the instance in time the event occurs and/or oscillographic waveform samples occurring around the time of the event. The MCAM categorizes the event information into classifications, or types, to provide various depths (number of events) of each type, as shown in Table 5.

**Table 5. Event classification.**

Event type	Number stored	Event register description
Historical summary	500	Table 13
Historical date/time adjustment	500	Table 14
Historical trip	200	Table 15
Oscillographic trip	20	Table 12
Historical alarm	200	Tables 15 and 16
Oscillographic alarm	20	Table 12
Historical capture request	1	Table 15
Oscillographic capture request	1	Table 12

A single triggering can place information into multiple event classifications, or types. For example, the occurrence of a

event triggered by a circuit breaker trip function may provide a historical summary (Table 13), historical trip information (Table 15), and oscillographic trip waveforms IA, IB, IC, IN, IG Residual, VAB, VBC, and VCA (Table 12).

An Event ID is used to link the event classifications together. The Event ID is a monotonically increasing number that is incremented each time a new event occurs and rolls over at  $2^{32} - 1$ . Thus, the example above will be assigned the same Event ID. All event classifications generate a single set of information for a given Event ID.

Access to event information is based on the selection of the event type and the Event ID. Registers 408193 through 412288 (i.e., holding register addresses  $2000_{16}$  through  $2FFF_{16}$ ) are reserved for accessing event information and may be read by using function code 03 or 04. Register 408193 (i.e., holding register address  $2000_{16}$ ) is a R/W register used to select the event type. Register 408193 may be written by using function code 06 or 16 ( $10_{16}$ ).

Once the event type selection is written, the earliest and latest Event ID register pairs (408194 and 408196, respectively) are obtained to determine the range of events saved for the selected event type. The event types Event ID range will usually be non-consecutive. The request Event ID register pair 408198 can be written using function code 16 ( $10_{16}$ ) to select information for a particular event. If information exists for the requested Event ID, register pairs 408200 and 408202 then provide the Previous Event ID and Next Event ID respectively, related to the request register. If, however, no information exists for the event type request, Exception Code 87 is returned (see section entitled "Exception Codes").

The date and time associated with the event is read in registers 408204 through 408211 using the same data and time descriptions shown in the Table 19. This value corresponds to the time of occurrence of the historical event or the time of the first data point of an oscillographic waveform event.

Register 408212 provides an indication of the selected event type's data content. This is a constant value for most of the event types, with the exception of historical alarms which have two distinct formats.

Historical event data provide a validity bit for each data object. The validity bits start at register 408213. Validity bit 0 set to 1 indicates that the first data object contains valid information, bit 1 indicates the second data object contains valid information, etc. The number of additional validity registers is thus equal to the (number of data objects - 1) / 16. The data object registers follow the last validity register. An invalid register access Exception Code 02 (see section entitled "Exception Codes") will be returned for any attempted read past the last data object register.

Oscillographic waveform data provide a delta time between points variable at register pair 408213. The data points follow time delta time variable at register 408215 up to the number of registers required to contain the all the data points. An invalid register access Exception Code 02 (see section entitled "Exception Codes") will be returned for any attempted

## Series NRX with PXR - instructions for modbus communications adapter module (MCAM)

read past the last data point register.

Unlike real-time data objects, a partial multi-register event data register may be obtained, since the data stored is stagnant information obtained when the event occurred.

Since event information is stored in non-volatile memory, a request to read event registers may return a BUSY Exception Code, 06 (see section entitled "Exception Codes") if the MCAM is in the process of placing a new event (i.e., non-volatile memory is being written).

### Control of product

Since a control error could result in unwanted actions initiated by a device, the MCAM requires a specific protocol by the Modbus master in order to perform control-related functions within the product.

A set of registers is reserved for the control protocol.

They begin at register 42901/425089 ( $0B54_{16}/6200_{16}$ ) and extend through 42903/425091 ( $0B56_{16}/6202_{16}$ ). These three registers are written with a 'slave action number' and its 1's complement using function code 16 ( $10_{16}$ ). The current "slave action numbers"; their support being product dependent, are listed in Table 17. The format of the data is shown in Figure 10. These three registers, and only these three registers, must be written in one modbus transaction.

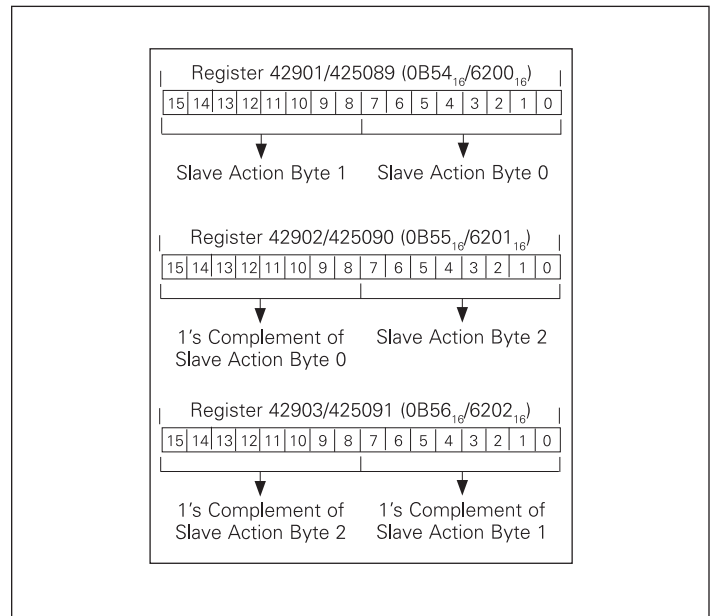


Figure 10. Control of product data format.

If the "slave action number" and its 1's complement are valid, the MCAM issues the "slave action" control command to the product. If the slave action request is successfully acknowledged by the product, the MCAM returns a normal function code 16 ( $10_{16}$ ) response to the modbus master. The modbus master may further determine if the product completed the slave action function successfully by interrogating the product, for example, by reading its status.

# Series NRX with PXR - instructions for modbus communications adapter module (MCAM)

If the product does not acknowledge the slave action request, the MCAM returns an exception code 04. If the 'slave action number' and its 1's complement are invalid, the MCAM responds to the modbus master with a data value illegal exception code 03. Refer to a later section entitled "Exception codes."

### Date and time registers

Access to date and time registers provide the opportunity for a modbus master to set up and/or read real-time clock information within an Eaton product. Eight registers, beginning at register number 402921 (i.e., holding register address  $0B68_{16}$ ), are reserved for this information, as defined in Table 18. Registers are read using function code 03 or 04 and written using function code 16 ( $10_{16}$ ).

### Energy format

Energy objects in the MCAM are supported in two-register fixed point object format and a four-register power/mantissa format. These objects do not support IEEE floating point format.

The two-register format is presented in units of kilowatt hours and is valid for products reporting energy in watt hours or kilowatt hours only. Products reporting in units greater than kilowatt hours (for example, megawatt hours) could not guarantee consistent kilowatt hour resolution up to and through their rollover values.

All products reporting energy (independent of energy units), support the energy objects occupying four registers: 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 a value corresponding to engineering units (power of 10 signed exponent). Register 3 low byte contains a mantissa multiplier value (power of 2 signed exponent).

Register 2 through Register 0 contains a 48-bit energy mantissa in units of watt hours. Net and total energy objects are signed values. All other energy objects are unsigned values.

The data format of these four registers is given in Figure 11.

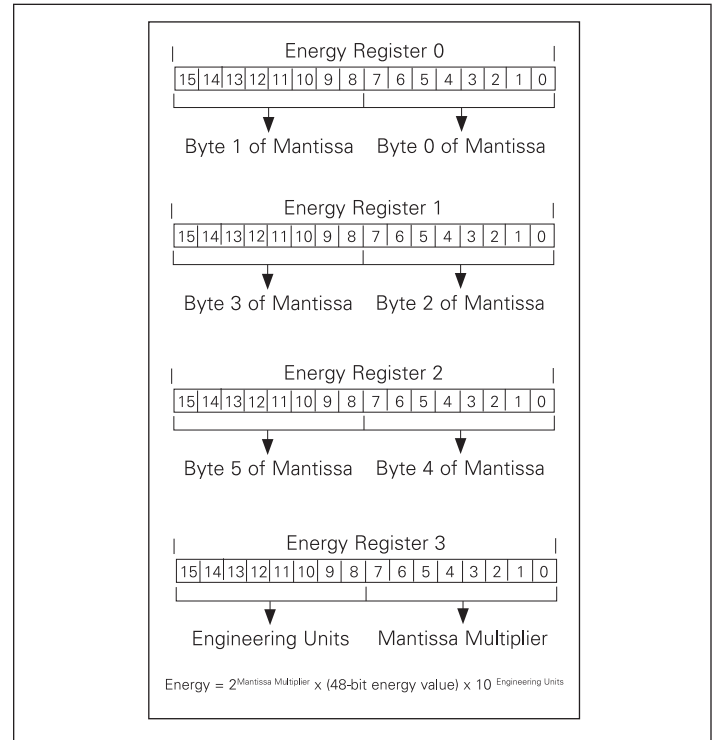


Figure 11. Four-register energy data format.

### Supported diagnostic sub-functions

It is possible to obtain diagnostics from the MCAM or an attached product using function code 08 (refer to Table 19).

### Exception codes

Under certain circumstances, the MCAM will return an exception code.

- If the function in the query is not supported by the MCAM, exception code 01 is returned in the response.
- If the data bit/register address is illegal, exception code 02 is returned in the response.
- If the data in the query is illegal, exception code 03 is returned.
- If the attached product fails (usually a time-out), exception code 04 is returned.
- In certain circumstances, an exception code 05 (ACK) is returned.
- If the MCAM cannot perform the current request at this time, a BUSY exception code 06 is returned.
- If the MCAM cannot perform the requested function, exception code 07 (NAK) is returned.
- If only a partial register is used in the query, exception code 132 ( $84_{16}$ ) is returned.
- If a requested event entry does not exist, exception code 135 ( $87_{16}$ ) is returned.

**Table 6. PXR discrete input status definitions.**

<b>Input</b>	<b>Definition</b>	<b>Input</b>	<b>Definition</b>
1001	Breaker is in the closed position	1017	Breaker is in the closed position is valid
1002	Unacknowledged trip condition	1018	Unacknowledged trip condition is valid
1003	Active or unacknowledged alarm	1019	Active or unacknowledged alarm is valid
1004	0	1020	0
1005	Maintenance mode is active	1021	Maintenance mode is active is valid
1006	Test mode is active	1022	Test mode is active is valid
1007	0	1023	0
1008	0	1024	0
1009	0	1025	0
1010	Long Delay Pickup is active	1026	Long Delay Pickup is active is valid
1011	Zone Interlock is active	1027	Zone interlock is active is valid
1012	0	1028	0
1013	"Ground" is source ground	1029	"Ground" is source ground is valid
1014	0	1030	0
1015	0	1031	0
1016	0	1032	0

**Table 7. MCAM configuration registers.**

<b>Register definition</b>	<b>R/W</b>	<b>Modbus register<sub>10</sub> number</b>		<b>Modbus register address<sub>16</sub></b>		<b>Number of registers<sub>10</sub></b>
		<b>Low</b>	<b>High</b>	<b>Low</b>	<b>High</b>	
Mapped block of registers configuration	R/W	41001	420481	03E8	5000	100
Mapped block of registers data	R	41201	420737	04B0	5100	4 * 100
Invalid object access configuration	R/W	42001	425345	07D0	6300	1
Floating Pt data word order configuration	R/W	42002	425346	07D1	6301	1
Fixed Pt data word order configuration	R/W	42003	425347	07D2	6302	1
Supervisory control query	R/W	42901	425089	0B54	6200	3
Date and time registers	R/W	42921		0B68		8

Table 8. Modbus register map in register number order.

Objects (complete list)			Modbus register number		Modbus register address			Modbus products	
Name	Numeric	Units	IEEE float	Fixed point (FP)	IEEE float (hex)	Fixed point (FP) (hex)	FP scale factor	Series PXR 20	Series PXR 25
Status cause a	Primary		404609 or 406145 hi byte		1200 or 1800 hi byte			x	x
	Secondary		404609 or 406145 lo byte		1200 or 1800 lo byte			x	x
	Cause		404610 or 406146		1201 or 1801			x	x
Current	I <sub>A</sub>	A	404611	406147	1202	1802	10	x	x
	I <sub>B</sub>	A	404613	406149	1204	1804	10	x	x
	I <sub>C</sub>	A	404615	406151	1206	1806	10	x	x
	I <sub>G</sub> <sup>C</sup>	A	404617	406153	1208	1808	10	x	x
	I <sub>N</sub>	A	404619	406155	120A	180A	10	x	x
L-L voltage	V <sub>AB</sub>	V	404623	406159	120E	180E	10		x
	V <sub>BC</sub>	V	404625	406161	1210	1810	10		x
	V <sub>CA</sub>	V	404627	406163	1212	1812	10		x
L-N voltage	V <sub>AN</sub>	V	404631	406167	1216	1816	10		x
	V <sub>BN</sub>	V	404633	406169	1218	1818	10		x
	V <sub>CN</sub>	V	404635	406171	121A	181A	10		x
Power	Real 3-phase (power)	W	404651	406187	122A	182A	1		x
	Reactive 3-phase (power)	VAR	404653	406189	122C	182C	1		x
	Apparent 3-phase (power)	VA	404655	406191	122E	182E	1		x
Power factor	Apparent	pf	404659	406195	1232	1832	100		x
Frequency	Freq	Hz	404661	406197	1234	1834	10	x	x
Power	Peak demand	W	404697	406233	1258	1858	1		x
	Real 3-phase (power)	W	404715	406251	126A	186A	1		x
Power factor	pf b	pf	404717	406253	126C	186C	100		x
Product ID	Prod ID		404719 or 406255		126E or 186E			x	x
Frequency	Freq	Hz	404721	406257	1270	1870	100	x	x
(K) Energy	Forward	KWh	N/A	406259	N/A	1872	1		x
	Reverse	KWh	N/A	406261	N/A	1874	1		x
	Total b	KWh	N/A	406263	N/A	1876	1		x
	Apparent	KVAh	N/A	406271	N/A	187E	1		x
Temperature	Device temperature	Celsius	404763	406299	129A	189A	1	x	x
	Max device temperature	Celsius	404765	406301	129C	189C	1	x	x
Energy (four reg. objects)	Forward	Wh	N/A	406305	N/A	18A0	1		x
	Reverse	Wh	N/A	406309	N/A	18A4	1		x
	Total b	Wh	N/A	406313	N/A	18A8	1		x
	Apparent	VAh	N/A	406329	N/A	18B8	1		x
Peak power	Peak demand reactive	vars	404797	406333	12BC	18Bc	1		x
	Peak demand apparent	VA	404799	406335	12BE	18BE	1		x
Demand power	Real power demand	W	404845	406381	12EC	18EC	1		x
	Reactive power demand	vars	404847	406383	12EE	18EE	1		x
	Apparent power demand	VA	404849	406385	12F0	18F0	1		x

**Table 8. Modbus register map in register number order (continued).**

Objects (complete list)			Modbus register number		Modbus register address			Modbus products	
Name	Numeric	Units	IEEE float	Fixed point (FP)	IEEE float (hex)	Fixed point (FP) (hex)	FP scale factor	Series PXR 20	Series PXR 25
Min/max currents	Minimum 1 <sub>A</sub>	A	404851	406387	12F2	18F2	10	x	x
	Maximum 1 <sub>A</sub>	A	404853	406389	12F4	18F4	10	x	x
	Minimum 1 <sub>B</sub>	A	404855	406391	12F6	18F6	10	x	x
	Maximum 1 <sub>B</sub>	A	404857	406393	12F8	18F8	10	x	x
	Minimum 1 <sub>C</sub>	A	404859	406395	12FA	18FA	10	x	x
	Maximum 1 <sub>C</sub>	A	404861	406397	12FC	18FC	10	x	x
	Minimum 1 <sub>G</sub> <sup>c</sup>	A	404863	406399	12FE	18FE	10	x	x
	Maximum 1 <sub>G</sub> <sup>c</sup>	A	404865	406401	1300	1900	10	x	x
	Minimum 1 <sub>N</sub>	A	404867	406403	1302	1902	10	x	x
	Maximum 1 <sub>N</sub>	A	404869	406405	1304	1904	10	x	x
Min/max L-L voltage	Minimum V <sub>AB</sub>	V	404871	406407	1306	1906	10		x
	Maximum V <sub>AB</sub>	V	404873	406409	1308	1908	10		x
	Minimum V <sub>BC</sub>	V	404875	406411	130A	190A	10		x
	Maximum V <sub>BC</sub>	V	404877	406413	130C	190C	10		x
	Minimum V <sub>CA</sub>	V	404879	406415	130E	190E	10		x
	Maximum V <sub>CA</sub>	V	404881	406417	1310	1910	10		x
Min/max L-N voltage	Minimum V <sub>AN</sub>	V	404883	406419	1312	1912	10		x
	Maximum V <sub>AN</sub>	V	404885	406421	1314	1914	10		x
	Minimum V <sub>BN</sub>	V	404887	406423	1316	1916	10		x
	Maximum V <sub>BN</sub>	V	404889	406425	1318	1918	10		x
	Minimum V <sub>CN</sub>	V	404891	406427	131A	191A	10		x
	Maximum V <sub>CN</sub>	V	404893	406429	131C	191C	10		x
Counters	INST/SDT		N/A	406495	135E	195E	1		x
	LDT/GFT		N/A	406497	1360	1960	1		x
	Operations count		N/A	406499	1362	1962	1		x

**Note:** Objects are two registers in length unless specified otherwise.

<sup>a</sup> The primary and secondary codes are mapped to the high and low bytes, respectively, of registers 404609 (1200<sub>16</sub>) and 406145 (1800<sub>16</sub>). The primary status codes are shown in Table 20. The secondary status codes are shown in Table 21. The cause-of-status codes are mapped to registers 404610 (1201<sub>16</sub>) and 406146 (1801<sub>16</sub>). The cause-of-status codes are shown in Table 22. The primary/secondary and cause-of-status must be read as a single two register object.

<sup>b</sup> These numeric entries have specific definitions dependent on the particular Eaton product.

<sup>c</sup> Only applies for ground fault trip units.



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**Table 9. Modbus register map in functional number order.**

Objects (complete list)			Modbus register number		Modbus register address			Modbus products	
Name	Numeric	Units	IEEE float	Fixed point (FP)	IEEE float (hex)	Fixed point (FP) (hex)	FP scale factor	Series PXR 20	Series PXR 25
Product ID	Prod ID		404719 or 406255		126E or 186E			x	x
Status cause a	Primary		404609 or 406145 hi byte		1200 or 1800 hi byte			x	x
	Secondary		404609 or 406145 lo byte		1200 or 1800 lo byte			x	x
	Cause		404610 or 406146		1201 or 1801			x	x
Current	I <sub>A</sub>	A	404611	406147	1202	1802	10	x	x
	I <sub>B</sub>	A	404613	406149	1204	1804	10	x	x
	I <sub>C</sub>	A	404615	406151	1206	1806	10	x	x
	I <sub>G</sub>	A	404617	406153	1208	1808	10	x	x
	I <sub>N</sub>	A	404619	406155	120A	180A	10	x	x
	Minimum <sub>IA</sub>	A	404851	406387	12F2	18F2	10		x
	Maximum <sub>IA</sub>	A	404853	406389	12F4	18F4	10		x
	Minimum <sub>IB</sub>	A	404855	406391	12F6	18F6	10		x
	Maximum <sub>IB</sub>	A	404857	406393	12F8	18F8	10		x
	Minimum <sub>IC</sub>	A	404859	406395	12FA	18FA	10		x
	Maximum <sub>IC</sub>	A	404861	406397	12FC	18FC	10		x
	Minimum <sub>IG</sub> <sup>C</sup>	A	404863	406399	12FE	18FE	10		x
	Maximum <sub>IG</sub> <sup>C</sup>	A	404865	406401	1300	1900	10		x
	Minimum <sub>IN</sub>	A	404867	406403	1302	1902	10		x
	Maximum <sub>IN</sub>	A	404869	406405	1304	1904	10		x
L-L voltage	V <sub>AB</sub>	V	404623	406159	120E	180E	10		x
	V <sub>BC</sub>	V	404625	406161	1210	1810	10		x
	V <sub>CA</sub>	V	404627	406163	1212	1812	10		x
	Minimum V <sub>AB</sub>	V	404871	406407	1306	1906	10		x
	Maximum V <sub>AB</sub>	V	404873	406409	1308	1908	10		x
	Minimum V <sub>BC</sub>	V	404875	406411	130A	190A	10		x
	Maximum V <sub>BC</sub>	V	404877	406413	130C	190C	10		x
	Minimum V <sub>CA</sub>	V	404879	406415	130E	190E	10		x
Maximum V <sub>CA</sub>	V	404881	406417	1310	1910	10		x	
L-L Voltage	Minimum V <sub>AN</sub>	V	404883	406419	1312	1912	10		x
	Maximum V <sub>AN</sub>	V	404885	406421	1314	1914	10		x
	Minimum V <sub>BN</sub>	V	404887	406423	1316	1916	10		x
	Maximum V <sub>BN</sub>	V	404889	406425	1318	1918	10		x
	Minimum V <sub>CN</sub>	V	404891	406427	131A	191A	10		x
	Maximum V <sub>CN</sub>	V	404893	406429	131C	191C	10		x
L-N voltage	V <sub>AN</sub>	V	404631	406167	1216	1816	10		x
	V <sub>BN</sub>	V	404633	406169	1218	1818	10		x
	V <sub>CN</sub>	V	404635	406171	121A	181A	10		x
Frequency	Freq	Hz	404661	406197	1234	1834	10		x
	Freq	Hz	404721	406257	1270	1870	100		x



**Table 9. Modbus register map in functional number order (continued).**

Objects (complete list)			Modbus register number		Modbus register address			Modbus products	
Name	Numeric	Units	IEEE float	Fixed point (FP)	IEEE float (hex)	Fixed point (FP) (hex)	FP scale factor	Series PXR 20	Series PXR 25
Power	Real 3-phase	W	404715	406251	126A	186A	1		x
	Peak demand	W	404697	406233	1258	1858	1		x
	Real 3-phase (power)	W	404651	406187	122A	182A	1		x
	Reactive 3-phase	VAR	404653	406189	122C	182C	1		x
	Apparent 3-phase	VA	404655	406191	122E	182E	1		x
	Real power demand	W	404845	406381	12EC	18EC	1		x
	Reactive power demand	vars	404847	406383	12EE	18EE	1		x
	Apparent power demand	VA	404849	406385	12FO	18FO	1		x
	Peak demand reactive	vars	404797	406333	12BC	18BC	1		x
	Peak demand apparent	VA	404799	406335	12BE	18BE	1		x
Power factor	pf <sup>b</sup>	pf	404717	406253	126C	186C	100		x
	Apparent	pf	404659	406195	1232	1832	100		x
(K) Energy	Forward	KWh	N/A	406259	N/A	1872	1		x
	Reverse	KWh	N/A	406261	N/A	1874	1		x
	Total <sup>b</sup>	KWh	N/A	406263	N/A	1876	1		x
	Apparent	KVAh	N/A	406271	N/A	187E	1		x
Energy (four reg. objects)	Forward	Wh	N/A	406305	N/A	18A0	1		x
	Reverse	Wh	N/A	406309	N/A	18A4	1		x
	Total <sup>b</sup>	Wh	N/A	406313	N/A	18A8	1		x
	Apparent	VAh	N/A	406329	N/A	18B8	1		x
Temperature	Max device temperature	C	404765	406301	129C	189C	1		x
Counters	INST/SDT fault count		N/A	406495	135E	195E	1		x
	LDT/GFT event count		N/A	406497	1360	1960	1		x
	Operations count		N/A	406499	1362	1962	1		x

**Note:** Objects are two registers in length unless specified otherwise.

- a The primary and secondary codes are mapped to the high and low bytes, respectively, of registers 404609 (1200<sub>16</sub>) and 406145 (1800<sub>16</sub>). The primary status codes are shown in Table 20. The secondary status codes are shown in Table 21. The cause-of-status codes are mapped to registers 404610 (1201<sub>16</sub>) and 406146 (1801<sub>16</sub>). The cause-of-status codes are shown in Table 22. The primary/secondary and cause-of-status must be read as a single two register object.
- b These numeric entries have specific definitions dependent on the particular Eaton product.
- c Only applies for ground fault trip units.

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**Table 10. PXR group 00 setpoint.**

Register number	Bit field	Mask field	Setpoint name	R/W	Format	Value definition	Units
403001	15-0	0xFFFF	Group 0 = system	R/W		0x00FF	
403002	12-0	0x1FFF	Rating Information	R		NRX NF: 200, 250, 300, 400, 500, 600, 630, 800, 1000, 1200, 1250, 1600. NRX RF: 800, 1000, 1200, 1250, 1600, 2000, 2500, 3000, 3200, 4000.	A
403003	2-0	0x0007	Breaker frame	R	Encoded	0 = NRX NF 1 = NRX RF	
403004	3-0	0x000F	Style	R	Encoded	0 = PXR20V000L00C 1 = PXR20V000L00M 2 = PXR20V000L00G 3 = PXR20V000L00G 4 = PXR20V000L00G 5 = PXR20V000L00G 6 = PXR25V000L00M 7 = PXR25V000L00G 8 = PXR25V000L00G 9 = PXR25V000L00G 10 = PXR20V000L00M 11 = PXR20V000L00A	
403005 (1)	8	0x0100	Maintenance mode: State	R	Encoded	0 = Off 1 = On	
	0	0x0001	Maintenance mode: Local control	R/W	Encoded	0 = Off 1 = On	
403006 (1)	2-0	0x0007	ARMS level	R/W	Encoded	1 = 2.5 x In 2 = 4.0 x In 3 = 6.0 x In 4 = 8.0 x In 5 = 10.0 x In	
403007			Frequency	R	Unsigned	Range: 50, 60, 400	Hz
403008	0	0x0001	Rev. Feed	R/W	Encoded	0 = Forward 1 = Reverse	
403009	0	0x0001	Language	R/W	Encoded	0 = English 1 = Chinese	

1. Only for maintenance mode style trip units.

Table 11. PXR group 01: protection.

Register number	Bit field	Mask field	Setpoint name	Read only	Format	Value definition	Units
403001	15-0	0xFFFF	Group 1 = protection			0x01FF	
403002	12-0	0x1FFF	Rating information	R	Encoded	NRX NF: 200, 250, 300, 400, 500, 600, 630, 800, 1000, 1200, 1250, 1600. NRX RF: 800, 1000, 1200, 1250, 1600, 2000, 2500, 3000, 3200, 4000.	A
403003	2-0	0x0007	Breaker frame	R	Encoded	0 = NRX NF      1 = NRX RF	
403004	3-0	0x000F	Style	R	Encoded	0 = PXR20V000L00C 1 = PXR20V000L00M 2 = PXR20V000L00G 3 = PXR20V000L00M 4 = PXR20V000L00G 5 = PXR20V000L00M 6 = PXR25V000L00M 7 = PXR25V000L00M 8 = PXR25V000L00M 9 = PXR25V000L00M 10 = PXR20V000L00M 11 = PXR20V000L00C	
403005	0	0x0001	Therm. memory		Encoded	0 = Disable      1 = Enable	
403006	0	0x0001	ZSI		Encoded	0 = Disable      1 = Enable	
403007	0-1	0x0003	Curve slope		Encoded	0 = I0.5T    1 = IT    2 = I2T    3 = I4T	
403008			LD Pickup (I <sub>r</sub> )	R	Encoded	40 = 0.4    50 = 0.5    60 = 0.6    70 = 0.7 75 = 0.75    80 = 0.8    90 = 0.9    95 = 0.95 98 = 0.98    100 = 1.0	In
403009			LD time (tr)	R	Encoded	5 = 0.5    10 = 1    20 = 2    40 = 4 70 = 7    100 = 10    120 = 12    150 = 16 200 = 20    240 = 24	Sec
403010			High load alarm	R	Unsigned	85	%
403011	0	0x0001	SD slope	R	Encoded	0 = flat    1 = 12T	
403012			SD pickup (I <sub>sd</sub> )	R	Encoded	15 = 1.5    20 = 2.0    25 = 2.5    30 = 3.0 40 = 4.0    50 = 5.0    60 = 6.0    70 = 7.0 80 = 8.0    100 = 10.0	In
403013			SD time (tsd)	R	Encoded	5 = 50    10 = 100    20 = 200    30 = 300 40 = 400    50 = 500	ms
403014			Inst. pickup (I <sub>i</sub> )	R	Encoded	0 = Off    20 = 2    40 = 4    50 = 5 60 = 6    70 = 7    80 = 8    100 = 10 120 = 12    150 = 15	In
403015 (1)	0	0x0001	Ground sensing		Encoded	0 = Residual      1 = Source/zero	
403016 (1)			Ground feature	R	Encoded	0 = Trip    1 = Alarm    2 = Off	
403017 (1)	0	0x0001	Ground slope	R	Encoded	0 = Flat    1 = I2T	
403018 (1)			Ground pickup (I <sub>g</sub> )	R	Encoded	0 = Off    20 = 0.2    40 = 0.4 60 = 0.6    80 = 0.8    100 = 1.0	In
403019 (1)			Ground time (tg)	R	Encoded	10 = 0.1    20 = 0.2    30 = 0.3 40 = 0.4    50 = 0.5	Sec
403020			Neutral protection ratio		Encoded	0    60    100	%

1. Only for ground fault style trip units.

Table 12. Oscillographic waveform event.

Register			Oscillographic event	Data format	Number of points	Units	PXR 20	PXR 25
408193	Encoded	R/W	Event type: 00xx16					
			0000 <sub>16</sub> = IA captured waveform	IEEE float	64	A	X	X
			0001 <sub>16</sub> = IB captured waveform	IEEE float	64	A	X	X
			0002 <sub>16</sub> = IC captured waveform	IEEE float	64	A	X	X
			0003 <sub>16</sub> = IN captured waveform	IEEE float	64	A	X	X
			0004 <sub>16</sub> = VAN captured waveform	IEEE float	64	V		X
			0005 <sub>16</sub> = VBN captured waveform	IEEE float	64	V		X
			0006 <sub>16</sub> = VCN captured waveform	IEEE float	64	V		X
			0007 <sub>16</sub> = VAB captured waveform	IEEE float	64	V		X
			0008 <sub>16</sub> = VBC captured waveform	IEEE float	64	V		X
			0009 <sub>16</sub> = VCA captured waveform	IEEE float	64	V		X
			000A <sub>16</sub> = IA trip waveform	IEEE float	384	A	X	X
			000B <sub>16</sub> = IB trip waveform	IEEE float	384	A	X	X
			000C <sub>16</sub> = IC trip waveform	IEEE float	384	A	X	X
			000D <sub>16</sub> = IN trip waveform	IEEE float	384	A	X	X
			000E <sub>16</sub> = IG source trip waveform (1)	IEEE float	384	A	X	X
			000F <sub>16</sub> = IG residual trip waveform (1)	IEEE float	384	A	X	X
			0010 <sub>16</sub> = VAB trip waveform	IEEE float	384	A	X	X
			0011 <sub>16</sub> = VBC trip waveform	IEEE float	384	V		X
			0012 <sub>16</sub> = VCA trip waveform	IEEE float	384	V		X
			0013 <sub>16</sub> = IA alarm waveform	IEEE float	64	V		X
			0014 <sub>16</sub> = IB alarm waveform	IEEE float	64	A	X	X
			0015 <sub>16</sub> = IC alarm waveform	IEEE float	64	A	X	X
			0016 <sub>16</sub> = IN alarm waveform	IEEE float	64	A	X	X
			0017 <sub>16</sub> = IG source alarm waveform (1)	IEEE float	64	A	X	X
			0018 <sub>16</sub> = IG residual alarm waveform (1)	IEEE float	64	A	X	X
			0019 <sub>16</sub> = VAB alarm waveform	IEEE float	64	V		X
			001A <sub>16</sub> = VBC alarm waveform	IEEE float	64	V		X
			001B <sub>16</sub> = VCA alarm waveform	IEEE float	64	V		X
408194	Unsigned 32	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 date (== event type)					
408213	IEEE float	R	Delta time between points			Sec.		
408215	Data format (xx)	R	Data points					

1. Only for ground fault style trip units.

**Table 13. Historical summary event.**

Register		Historical summary event	
408193	Encoded	R/W	Event type = 8EFF <sub>16</sub>
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 <sub>16</sub> ' 0001 <sub>16</sub> ' 0004 <sub>16</sub> ' 0005 <sub>16</sub> ' 0006 <sub>16</sub> '
408213	b0	R	Object validity bit
408214	Encoded	R	Event cause: 00 = Power up – time OK 01 = Setpoints 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

**Table 14. Historical time adjustment event.**

Register		Historical summary event	
408193	Encoded	R/W	Event type = 85FF <sub>16</sub>
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 = 0001 <sub>16</sub>
408213	b0	R	Object validity bit
408214	Date/time	R	New date/time

**Table 15. Historical trip/major alarm event.**

Register	Format	R/W	Descriptions	Units
408193	Encoded	R/W	Event type: trip = 80FF <sub>16</sub> , alarm = 81FF <sub>16</sub>	
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 = 0x0004, major alarm = 0x0005	
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	Apparant 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	Signed16	R	Device temperature	1/10°C
408248	Unsigned32	R	Frequency	1/10 Hz
408249	Signed16	R	Apparent power factor	1/100 pf
408250	Unsigned16	R	Operations count	
408251	B31-b00	R	Binary status with validity bits	

**Table 16. Historical minor alarm event.**

Register	Format	R/W	Historical trip and major alarm event	Units
408193	Encoded	R/W	Event type: alarm = 81FF <sub>16</sub>	
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 <sub>16</sub>	
408213	b0	R	Object validity bit	
408214	Encoded	R	Status cause (primary, secondary, cause)	

**Table 17. Control 'slave action number' definitions.**

Control group	Definition	Byte 2	Byte 1	Byte 0	PXR 20	PXR 25
Reset	Reset trip	0	0	2		X
	Reset powered up indication	0	0	3	X	X
	Reset (peak) demand-watts	0	0	4	X	X
	Reset all min./max. values	0	1	4	X	X
	Reset min./max. currents	0	1	13	X	X
	Reset min/max line-to-line voltages	0	1	14 (0E <sub>16</sub> )		X
	Reset min/max line-to-neutral voltages	0	1	15 (0F <sub>16</sub> )		X
Circuit breaker open-close	Open request	1	0	0	X	X
	Close request	1	0	1	X	X
	Enable maintenance mode (1)	1	0	8	X	X
	Disable maintenance mode (1)	1	0	9	X	X
System control	Capture waveform	3	0	1	X	X
	Save setpoints change	3	0	7	X	X
	Abort setpoints change	3	0	10 (0A <sub>16</sub> )		X

1. Only for maintenance mode style trip units.

**Table 18. Date and time register definitions.**

Definition	Register number (decimal)	Register address (hexadecimal)	Data range (decimal)
Month	402921	0B68	1–12
Day	402922	0B69	1–31
Year	402923	0B6A	
Day of week	402924	0B6B	1 = Sunday...7 = Saturday
Hour	402925	0B6C	0–23
Minute	402926	0B6D	0–59
Second	402927	0B6E	0–59
1/100th second	402928	0B6F	0–99

**Table 19. Diagnostic sub-function numbers.**

Sub-function No. (decimal)	Name
0	Echo query
1	Restart communications
4	Force listen
10	Clear MCAM/slave product counters
11	Modbus UART bus message count
12	Modbus UART communication error count
13	MCAM exception error count
14	MCAM message count
15	MCAM no response count
16	MCAM NAK count
17	MCAM busy count
18	Modbus UART over run error count
20	Clear modbus UART counters
21	Slave product checksum error count
22	Slave product over run count
23	Modbus UART framing error count
24	Modbus UART noise error count
25	Modbus UART parity error count
26	MCAM firmware version & rev
27	MCAM firmware month & day
28	MCAM firmware year
29	Reset MCAM block of registers



**Table 20. Primary Status codes.**

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

**Table 21. Secondary Status codes.**

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

**Table 22. Primary and secondary cause of status.**

Definition	Code	Definition	Code
Unknown	0x0000	Bad/missing rating plug	0x0040
Normal	0x0001	Reverse power	0x0041
Instantaneous	0x0003	Reverse sequency	0x0044
Over-voltage	0x000B	Phase current loss	0x0045
Under-voltage	0x000C	Phase currents near pickup, high load alarm	0x0049
Auxiliary power under power	0x000E	Making current release	0x004B
Over-frequency	0x000F	Fixed hardware instantaneous	0x004C
Under-frequency	0x0010	Setpoints error	0x004D
Current unbalance	0x0011	Over-temperature	0x004E
Voltage unbalance	0x0012	Long delay neutral over current	0x0050
Apparent power actor	0x0013	Ground fault	0x0054
Power demand	0x001A	Earth fault	0x0055
VA demand	0x001B	Calibration	0x0071
THD	0x001E	Real time clock	0x0088
Operations count	0x001F	MM mode	0x0099
Control via communication	0x0021	Breaker mechanism fault	0x009A
Coil supervision	0x0025	RAM error	0x07FC
Diagnostics warning	0x0027	Non-volatile memory error	0x07FD
Long delay	0x003D	Watchdog fault	0x07FE
Short delay	0x003E	ROM error	0x07FF

## Section 8: Troubleshooting

The following are the most common issues experienced with the installation of a series NRX modbus communications adapter module. If you have additional questions or need further information and/or instructions, please contact your local Eaton representative or visit [www.eaton.com](http://www.eaton.com).

### **Observation 1 - Status LED not flashing.**

**Action** - Verify proper input power to the module connectors.

### **Observation 2 - Status LED flashing red.**

**Action** - Verify the connection between module and PXR trip unit.

### **Observation 3 - Status LED flashing green, but module does not change state in response to master command requests.**

**Action** - Verify the correct module address.

**Action** - Verify the communication cable is connected correctly from the master to the module.

Series NRX with PXR - instructions for  
modbus communications adapter  
module (MCAM)

Instruction Leaflet IL0131091EN

Effective September 2018

**Notes:**

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