Instructional Booklet **IB024020001E** Effective April 2025

Instructions for Eaton Type MPCV-NXG Network Protection Relay

MPCV-NXG Communications Relay

Powering Business Worldwide

READ AND UNDERSTAND THESE INSTRUCTIONS BEFORE ATTEMPTING ANY ASSEMBLY, OPERATION OR MAINTENANCE OF THE NETWORK PROTECTORS.

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITY

THERE ARE NO UNDERSTANDINGS, AGREEMENTS, REPRESENTATIONS OR WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OTHER THAN THOSE SPECIFICALLY SET OUT BY AN EXISTING CONTRACT BETWEEN THE PARTIES, ANY SUCH CONTRACT STATES THE ENTIRE OBLIGATION OF SELLER. THE CONTENTS OF THIS DOCUMENT SHALL NOT BECOME PART OF OR MODIFY ANY PRIOR OR EXISTING AGREEMENT, COMMITMENT OR RELATIONSHIP.

The information, recommendations, descriptions and safety notations in the document are based on Eaton's experience and judgment with respect to MPCV-NXG RELAYS.

THIS INFORMATION SHOULD NOT BE CONSIDERED TO BE ALL INCLUSIVE OR COVERING ALL CONTINGENCIES. If further information is required, the Eaton Corporation should be consulted.

NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, OR WARRANTIES ARISING FROMCOURSE OF DEALING OR USAGE OF TRADE, ARE MADE REGARDING THE INFORMATION RECOMMENDATIONS,DESCRIPTIONS AND SAFETY NOTATIONS CONTAINED HEREIN. In no event will Eaton be responsible to the use in contract, in tort (including negligence), strict liability or otherwise for any special, indirect, incidental or consequential damage or loss whatsoever including but not limited to damage to or loss of use of equipment, plant or power system, cost of capital, loss of profits or revenues, cost of replacement power, additional expenses in the use of existing power facilities, or claims against the user by its customers resulting from the use of the information, recommendations, descriptions and safety notations contained herein.

Table of Contents

Introduction

The MPCV-NXG Network Relay is designed to be a direct replacement for Westinghouse Electro-mechanical relays type CN-33, CNJ and BN. It is also a plug and play replacement for legacy MPCR and MPCV relays, ETI or Digital Grid relays. The MPCV-NXG series relays use the same voltage and current inputs as do the electromechanical equivalent. They also continually monitor voltage across an open breaker and current through a closed breaker, and perform the following functions.

A. The trip contact will operate upon balanced fault conditions if the positive sequence power flow is out of the network.
B. The close contact will operate if the ensuing positive sequence power will be into the network.
C. The trip contact will operate upon the flow of reverse magnetizing current of its associated transformer.

The MPCV-NXG series of relay will mount on standard existing 313NP, 316NP, CMD, CM22 and CM52 network protectors utilizing the present system of low voltage or high voltage relay mounting studs, without breaker wiring modification.

⚠ WARNING

THE MPCV-NXG RELAYS ARE DESIGNED TO BE USED ON NETWORK PROTECTORS WHICH HAVE BEEN WIRED FOR 216Y/125 VOLT, OR 480Y/277 VOLT UP TO 600Y/347 VOLT SERVICE USING RELAY POTENTIAL TRANSFORMERS. THIS RELAY IS DESIGNED TO OPERATE AT 125 VOLTS (LINE TO GROUND). DO NOT ATTEMPT TO APPLY THIS RELAY ON ANY OTHER SYSTEM VOLTAGE OR CONFIGURATION.

Functional Characteristics

All measurements in the relay are made as net voltages and currents, computed as the positive sequence voltage and current (represented as V1X or I1), and the negative sequence voltage and current (represented as V2X or I2). The network positive and negative voltages sequence are denoted V1N and V2N respectively. The other important voltage is the phasing voltage, which is the difference between the transformer and network voltages, whose sequence components are denoted V1P and V2P.
The V1N is defined as the reference phasor for all phase measurements, and the normal phase-to-neutral voltage (1P.U.) is defined as 125 Vac rms.

Trip Function

Figure 1 represents the current-induced trip characteristics. The positive sequence current I1 is multiplied by the cosine of the angle of its phasor related to V1N. If the resulting sign is negative, then reverse power-flow is indicated. The trip level (I1COSØ) for this can be adjusted from .05 to 5% of rated current. The cosine multiplication operation results in the straight line which is perpendicular to the phasor.

A selection to a watt-var trip curve can be made through the WEBUI which will permit 3-phase balanced trip characteristics, as well as tripping when the negative sequence voltage exceeds .06 P.U.

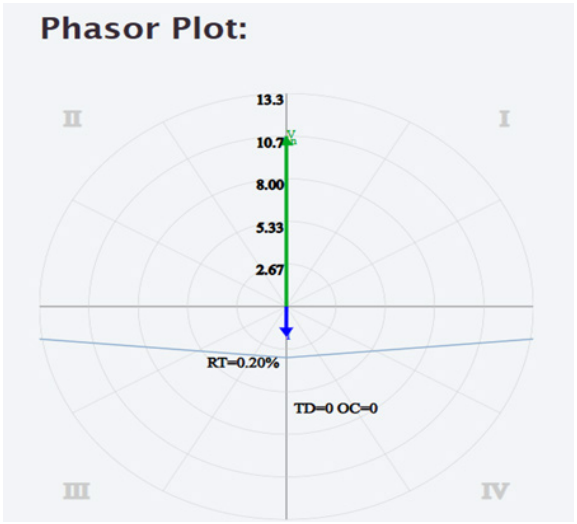


Figure 1. Reverse Trip – Sensitive Curve

Close Characteristics

Figure 2 represents the voltage regions for close, float and trip operation when the protector is open. Under extreme conditions when the protector is open, a trip is called for to prevent a dangerous manual close operation. With the protector open and the network and transformer voltages normal and balanced, positive sequence phasing voltage (V1P) is measured. If V1P is in the close region, the relay operates its close contact. If V1P is not in the close region, but is less than .06 P.U., then the float is called for, as this voltage difference is not deemed dangerous regardless of the phase relationships, and manual close of the protector would not exceed the breaker capacity. If V1P is greater than .06 P.U. and does not lie in the close region, the trip is called for to prevent manual closing. The relay also calls for trip under all rolled and crossed phase conditions, even when either the transformer side or the network side of the protector is de-energized.

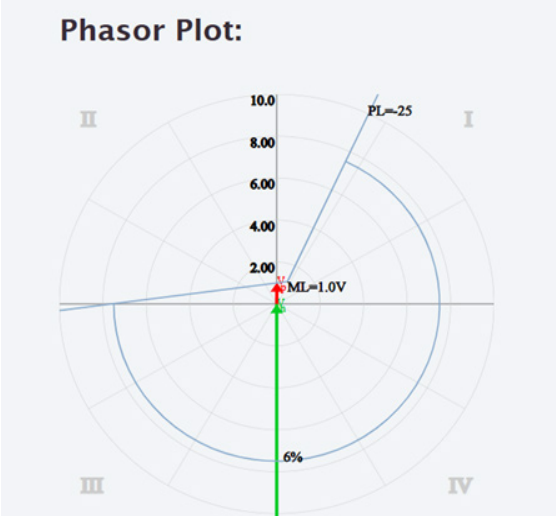


Figure 2. Straight Line Closing Curve

The close contact will operate only in the quadrant defined by the two lines, termed master and phasing. The phasing line,emanating from 0, defines a minimum phase angle of the phasing voltage ahead of the network voltage for closing, which is selectable at +5, 0, -5, -10, -15, -20 or -25 degrees. The master line sets a minimum difference between the transformer and network voltage, settable from 0.004 to 0.08 P.U. at 0 degrees (in phase). This line exhibits a slope of 7.5 degrees.

If the network side is de-energized, and the transformer side is energized, the close contact will operate, if V1N is less than .1 P.U., V2N is less than .06 P.U., and V1P exceeds .8 P.U. Note that, as stated before, if V2P exceeds .2 P.U., then the trip contact will operate, indicating crossed phases on either the transformer side or the network side. Also note, that if the phases are crossed on both the transformer and the network side, V2P could be very close to or equal to zero, but the trip contact will operate as V1N is less than 0.1 P.U. and V1P is less than .8 P.U.

The other closing curve characteristic option available is the curved line closing curve which maintains the same value of phasing volts from the -25 to +110 degree quadrants (refer to **Figure 3**).

Any close conditions must exist for 500 ms before the close contact will operate.

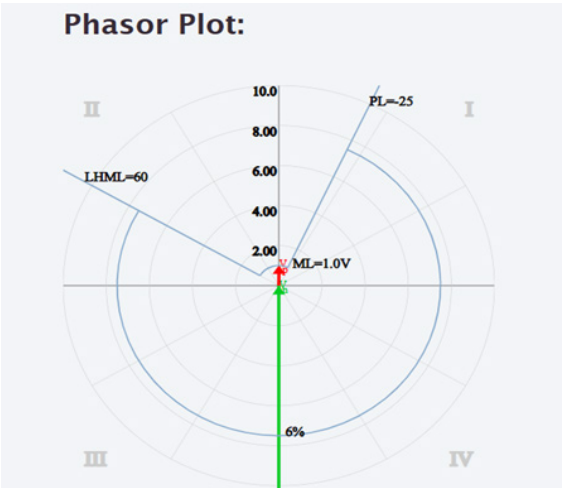


Figure 3. Curved Line Closing Curve

Access to MPCV-NXG WebUI and Navigate to Config Setpoints

Login to MPCV-NXG using the default IP Address, Username & Password.
Default Username - admin
Default Password - admin
After successful login, MPCV-NXG landing page will open. Navigate to setpoints by clicking "Config —›Setpoints."

Frequency [Hz]=60
The cycles per second can be changed by choosing the option from dropdown list. The selections are Hz=60 or Hz=50

Frequency [Hz]	60 (50,60)

System Voltage (Volts)
The system voltage selection is the line-to-line voltage from 216 volts through and including 600 volts. The selections are made by choosing the option from dropdown list.

System Voltage	216 (216,380,400,416,433,480,600)

Phase Sequence (CBA)
The relay is switchable in sequence rotation but assumes an ABC direction. If the relay is to be applied on a CBA counter-clockwise system, then the selection must be changed to CBA=ON. This can be done by selecting the checkbox.

Phase Sequence (CBA)	Enable (Enable, Disable)

Note: If the wrong sequence is selected, the relay upon power-up will give a trip indication

CT Ratio
This refers to the current transformer (CT) primary rating. For example, an 1875-ampere network protector will have 1600/5 CTs. The CT RATIO must be set to 1600. These ratings can be selected from dropdown list.

Table 1. Network Protector Rating

NWP Rating	CT Applied
800	800/5
1200	1200/5
1600	1600/5
1875	1600/5
2000	2000/5
2250	2000/5
2500	2500/5
2825	2500/5
3000	3000/5
3500	3000/5
4500	3000/5
5100	3000/5

CT Ratio	1600 (800,1200,1600,2000,3000,3500,4500,5100)

Straight Line Master Line
This is the traditional master line which has a slope of 7 to 7.5 degrees (refer to **Figure 2**). Selecting/Deselecting the checkbox will toggle the Straight Line Master Line to ON/OFF. Deselecting the straight line changes the closing characteristics to the circular master line (refer to **Figure 3**). The circular line allows the relay to close at the same ML setting and at any angle between the LH MH and PL settings. It is useful in those areas where the network load is lighter than normal. This function permits the relay to call for a close at lower loads while assuring the watt flow will be into the network.

Straight Line Master Line	Enable (Enable, Disable)

Master Line (Volts)
This is the overvoltage phasing voltage, which is the difference between the transformer and network line to ground voltages. This value represents the in-phase or 0 degree value. The Master Line value can be changed by entering the value between 0.5 to 10.

Master Line[Volts]	1 (Min:0.5, Max :10)

Phasing Line (Degrees)
This refers to the Phasing Line adjustment (refer to **Figure 2** and **3)**. The phasing line can be changed from +5 to -25 degrees by selecting from the dropdown list.

Phasing Line[Degree]	-5 (5,0,-5,-10,-15,-20,-25)

Lefthand Master Line (Degress)
The Lefthand Master Line selection will be effective only when Straight Line Master Line is disabled (Unchecked in WebUI). **Figure 3** shows the Left-Hand Master Line adjustment region from 60 to 110 degrees. This is selectable by choosing the option from the dropdown list.

Lefthand Master Line [Degree]	90(60,65,70,75,80,85,90,95,100,105,110)

Reverse Trip (%)
The Reverse Trip setting is calibrated at 180 degrees and it is entered by the user with range between 0.05 and 5. The below table tabulates the most active trip region selections. The RT setting is referred to as the sensitive trip region.Refer to **Table 9 on Page 15** for the trip Amperage as a function of CT primary from .05 to 5%.

Reverse Trip[%]	0.2 (Min:0.05, Max:5)

Time Delay (Seconds)
This represents the Time Delay setting which is divided into three separate areas.

1. TD=0 With a zero setting, there is no time delay associated with tripping. Sets relay to respond on RT setting only.
2. TD=1 to 300 seconds.This represents time delay on tripping in seconds. Sets the relay to respond on RT setting with Time Delay and respond instantaneously to OC setting.
3. TD=INF Sets the relay to nonsensitive tripping and responds instantaneously to OC setting only. It overrides the sensitive trip setting when check-box is selected.

Time Delay [Seconds]	0 / (Min:1, Max:300) / Infinite

⚠ WARNING

THE TD=INF WILL DISABLE THE SENSITIVE TRIP MODE AND WILL ONLY PERMIT TRIPPING OF THE NETWORK PROTECTOR AT THE SELECTED OC VALUE.

Overcurrent (%)

This represents the overcurrent instantaneous pickup point of the relay. There are two selections possible in this mode, which are:

1. OC=0 There is no instantaneous overcurrent pickup point selected. This can be the situation whenever the TD setting equals 0.
2. OC=1 to 300 % (It is entered by the user in the range between 1 and 300).

Note: If TD=INF or if TD=1 to 300 seconds, you will be directed to make an OC setting other than 0.

You can also select an OC setting other than 0 if only the sensitive trip range (RT) is being used. The sensitive trip range spans from .05% to .5%.

Overcurrent[%]	100 (Min:0, Max:300)

Watt-Var Enable

The relay can be selected to engage the watt-var trip characteristic by selecting the checkbox, changing the Watt-Var to enable/ disable. The new "Boomerang Watt-Var" trip curve is shown in **Figure 4.** Note that the new curve permits balanced 3-phase tripping under reverse magnetizing conditions, while at the same time can handle phase unbalanced conditions which can exist on overhead primary circuits. Again, the OC setting can be engaged which will add a non-sensitive trip region to the tripping characteristic.

Watt-Var Enable	Disable (Enable, Disable)

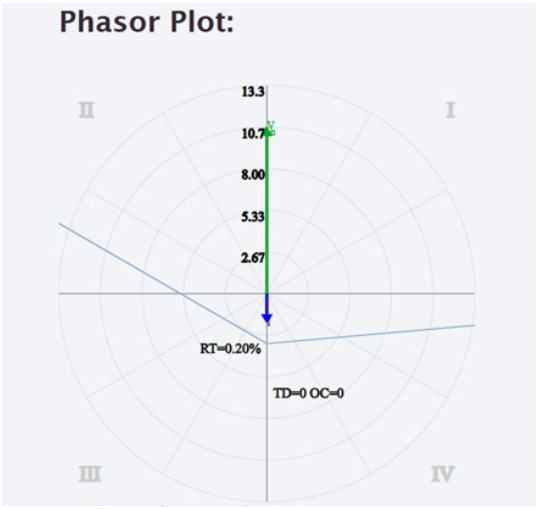


Figure 4. Boomerang Watt-Var Trip Curve

Watt-Var Tilt Angle (Degrees)

The Watt-Var Tilt Angle setting is selectable by choosing the option from the dropdown list. Available range is between 0 and 60 with increments of 5.

Watt-Var Tilt Angle [Degree]	60 (0,5,10,15,20,25,30,35,40,45,50,55,60)

System-Pumping Protection

The MPCV-NXG relay incorporates a feature whereby the operator can select to protect the network protector breaker from pumping. If the System-Pumping Protection is disabled (Unchecked), then there is no pump protection enabled.This is selectable from 3 to 20 cycles. System-Pumping Protection is ON by selecting the Checkbox. If the System-Pumping Protection is enabled (Checked) then Pump Operations (3 – 20), Pump Time (30 – 300 seconds), Pump Lockout Reset Delay (15 – 60 minutes) will be applicable. If the breaker opens and closes its contacts at the direction of the relay equal to or exceeding the Pump Operations in the specified time-frame as defined by the Pump Time, the breaker will trip and lock open.

With the System-Pumping Protection enabled, the device will enter Pump Lockout which is initiated if the Pump Operations and Pump Time are exceeded in value. The breaker will open and lock out, thereby preventing a reclosure. The Pump Lockout Reset Delay has a default value of 15 minutes but is capable of being extended up to 60 minutes. The reset time permits the closing motor to cool its field coils before calling on the motor to attempt another breaker closure, thereby extending the life of the network breaker closing motor.

Pump Enable	Enable
Pump Operations	3 (Min:3, Max:20)
Pump Time[Seconds]	30 (Min:30, Max:300)
Pump Lockout Reset Delay[Min]	15 (Min:15, Max:60)

Mechanical-Pumping Protection

Like System-Pumping, it is used to protect the network protector from pumping. If the Mechanical-Pumping Protection is disabled (Unchecked), then there is no pump protection installed. If the Relay tries to close the breaker and it is not closed within Allowed Pumping Time, then the breaker will trip. The Allowed Pumping Time has a default value of 30 seconds, but it is capable of being extended up to 5 minutes.

With the System-Pumping Protection enabled, the device will enter Pump Lockout which is initiated if the Pump Operations and Pump Time are exceeded in value. The breaker will open and lock out, thereby preventing a reclosure. The Pump Lockout Reset Delay has a default value of 15 minutes but is capable of being extended up to 60 minutes or can be set to Infinite. When Pump Lockout Reset Delay is set to Infinite and Mechanical-Pump fault occurs, the Breaker should stay in Trip state unless manual maintenance on the breaker is performed

Pump Enable	Enable
Allowed Pumping Time [Seconds]	30 (Min:30, Max:300)
Pump Lockout Reset Delay [Min]	15 (Min:15, Max:60) Infinite

When the communication system is operational, the set points must be entered.

Auxiliary Contacts

Auxiliary 2 Used must be enabled (checked) to utilize the Auxiliary 2 position contact. Either alarm (ENABLE) or only status (DISABLE) must be selected. The contact must be indicated as normally open (NO) or normally closed (NC) for the status when the alarm is not enabled. Changing the contact state then will ENABLE the alarm. Refer to **Table 5** Digital Input Harness for the Pin out configuration of the AUX ports.

Repeat as required for additional Auxiliary 3 to Auxiliary 8 inputs.

Settings

All settings can be altered through a WEBUI which can be interfaced by plugging into the unit while mounted on the network protector breaker.

Web Configuration Layout

Setpoint Configuration	Default	Range
System		
Frequency [Hz]	60	50, 60
System Voltage [Volts]	216	216, 380, 400, 416, 433, 480, 600
CT Ratio	1600	800, 1200, 1600, 2000, 3000, 3500, 4500, 5100
Phase Sequence [CBA]	Disable	Enable, Disable
Lagging Var-PF Sign Convection	Disable	Enable, Disable
Close		
Striaght Line Master Line	Enable	Enable, Disable
Master Line [Volts]	1	0.5 - 10
Phasing Line [Degree]	-5	5, 0, -5, -10, -15, -20, -25
Lefthand Master Line [Degree]	90	60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110.
Trip		
Reverse Trip [%]	0.2	0.05 - 5
Time Delay [Sec]	0	0, Infinite, 0 - 300
Overcurrent [%]	0	0 - 300
Watt-Var Enable	Disable	Enable, Disable
Watt-Var Tilt angle [Degree]	60	0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60
System Pumping Protection		
Pump Enable	Disable	Enable, Disable
Pump Operations	3	3 - 20
Pump Time [Sec]	30	30 - 300
Pump Lockout Reset Delay [Min]	15	15 - 60
Mechanical Pumping Protection		
Pump Enable	Disable	Enable, Disable
Allowing Pumping Time [Sec]	30	30 - 300
Pump Lockout Reset Delay [Min]	15	15 - 60, Infinite
Auxiliary 2 Used	Disable	Enable, Disable
Auxiliary 2 Alarm Enabled	Disable	Enable, Disable
Auxiliary 2 Normally Closed	Disable	Enable, Disable
Auxiliary 3 Used	Disable	Enable, Disable
Auxiliary 3 Normally Closed	Disable	Enable, Disable
Auxiliary 4 Used	Disable	Enable, Disable
Auxiliary 4 Alarm Enabled	Disable	Enable, Disable
Auxiliary 4 Normally Closed	Disable	Enable, Disable
Auxiliary 5 Used	Disable	Enable, Disable
Auxiliary 5 Alarm Enabled	Disable	Enable, Disable
Auxiliary 5 Normally Closed	Disable	Enable, Disable
Auxiliary 6 Used	Disable	Enable, Disable
Auxiliary 6 Alarm Enabled	Disable	Enable, Disable
Auxiliary 6 Normally Closed	Disable	Enable, Disable
Auxiliary 7 Used	Disable	Enable, Disable
Auxiliary 7 Alarm Enabled	Disable	Enable, Disable
Auxiliary 7 Normally Closed	Disable	Enable, Disable
Auxiliary 8 Used	Disable	Enable, Disable
Auxiliary 8 Alarm Enabled	Disable	Enable, Disable
Auxiliary 8 Normally Closed	Disable	Enable, Disable

Data Logs

User can navigate to “Trip Logs” tab over system page of WebUI to view and download the logs.

1. **Trip Logs** are created automatically by the MPCV-NXG upon detection of any trip condition. The MPCV-NXG can store up to 25 time-stamped most recent trip events. Trip Logs are stored in the MPCV-NXG internal memory and can be accessed over Web UI. User also has option to download these Trip Logs.
2. **Waveform Log** contains 8 cycles (6 pre and 2 post event) of data sampled 32 times per power cycle that includes the transformer and network voltages, currents and trip (reasons) flags. Waveform Logs are directly mapped with Trip Logs 1:1 i.e. 1 Waveform Log per Trip Log. Waveform Logs are also stored in the MPCV-NXG internal memory and will be accessed over Web UI. User will also have option to download these Waveform Logs.

Pin Out Configuration

When installing a relay for retrofit applications, a device wiring diagram and instructions will be provided with the necessary cable assembly.

1. Analog Input

Table 2. Analog Input Board 1-3 Harness

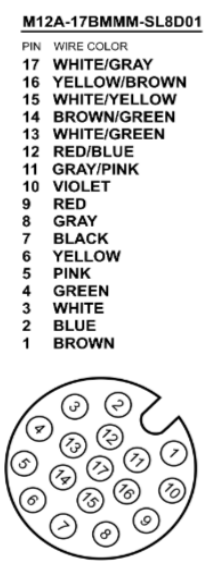
Connector on Enclosure Side	Pin#	Signals	External Harness Part	Color Code of External harness	Wire color USB side	Pin Function as per USB Connector
M12A-17PMMC-SF8B20	1	V_GAUGE_1A	M12A-17BFFM-SL8D01	Brown	Green	Data+
	2	SIG_1A		Blue	White	Data-
	3	AIN_1A		White	Red	5V DC
	4	GNDA		Green	Black	Gnd
	5	GNDPWR		Pink	Shield	Shield
	6	V_GAUGE_1B		Yellow	Green	Data+
	7	SIG_1B		Black	White	Data-
	8	AIN_1B		Grey	Red	5V DC
	9	GNDA		Red	Black	Gnd
	10	GNDPWR		Violet	Shield	Shield
	11	V_GAUGE_1C		Grey/Pink	Green	Data+
	12	SIG_1C		Red/Blue	White	Data-
	13	AIN_1C		White/Green	Red	5V DC
	14	GNDA		Brown/Green	Black	Gnd
	15	GNDPWR		White/Yellow	Shield	Shield
	16	NC				
	17	NC				

Analog Input Board 1-3 CAP for Protection

Sr.No	Description	MFGPN#	Manufacturer	Qty
1	Cap for M12A-17PMMC-SF8B20	CAP-WBDMSMA2	Amphenol LTW	1

Table 3. Analog Input Board 4-6 Harness

Connector on Enclosure side	Pin#	Signals	External Harness Part	Color Code of External harness	Wire color USB side	Pin Function as per USB Connector
M12A-17PFFC-SF8B20	1	V_GAUGE_2A	M12A-17BMMM-SL8D01	Brown	Green	Data+
	2	SIG_2A		Blue	White	Data-
	3	AIN_2A		White	Red	5V DC
	4	GNDA		Green	Black	Gnd
	5	GNDPWR		Pink	Shield	Shield
	6	V_GAUGE_2B		Yellow	Green	Data+
	7	SIG_2B		Black	White	Data-
	8	AIN_2B		Grey	Red	5V DC
	9	GNDA		Red	Black	Gnd
	10	GNDPWR		Violet	Shield	Shield
	11	V_GAUGE_2C		Grey/Pink	Green	Data+
	12	SIG_2C		Red/Blue	White	Data-
	13	AIN_2C		White/Green	Red	5V DC
	14	GNDA		Brown/Green	Black	Gnd
	15	GNDPWR		White/Yellow	Shield	Shield
	16	NC				
	17	NC				



SIG_XX - Gauge Digital Data, AIN_XX - Gauge Analog Signal, V_GAUGE_XX - Gauge Power Supply +5V, GNDA- Gauge Power Supply Ground, GNDPWR- Gauge Earth Ground

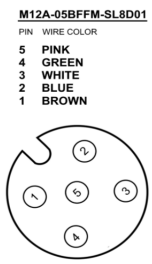
Analog Input Board 4-6 CAP for Protection

Sr.No	Description	MFGPN	Manufacturer	Qty
1	Cap for M12A-17PFFC-SF8B20	CAP-WBDFSMA2	Amphenol LTW	1

2. DER & AUX PS Input

Table 4. DER & AUX PS Input

Connector on Enclosure Side	Pin#	Connector on External Side	Signals	Color Code of External Harness
M12A-05PMMS-SF8001	1	M12A-05BFFM-SL8D01	DER	Brown
	2		DER_RTN	White
	3		AUX_N	Blue (-Ve)
	4		AUX_P	Black (+Ve)
	5		NC	Gray



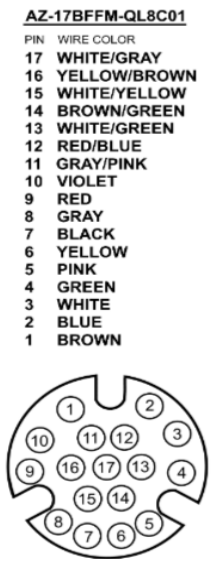
DER & AUX PS Input CAP for Protection

Sr.No	Description	MFGPN	Manufacturer	Qty
1	Cap for M12A-05PMMS-SF8001	CAP-WBDMSMA2	Amphenol LTW	1

3. Digital Input Harness

Table 5. Digital Input Harness

Connector on Enclosure Side	Signals	Pins on External Harness	Color Codes of External Harness	External Harness
AZ-17PMMS-QC8001	DIG_1	1	Brown	AZ-17BFFM-QL8C01
	DIG_2	2	Blue	
	DIG_3	3	White	
	DIG_4	4	Green	
	DIG_5	5	Pink	
	DIG_6	6	Yellow	
	DIG_7	7	Black	
	DIG_8	8	Gray	
	GND	9	Red	
	GND	10	Violet	
	GND	11	Gray/Pink	
	GND	12	Red/Blue	
	GND	13	White/Green	
	GND	14	Brown/Green	
	GND	15	White/Yellow	
	GND	16	Yellow/Brown	
	NC	17	White/Gray	



4. INCOM and RS485

Table 6. INCOM and RS485

Connector on Enclosure Side	Signals	External Harness	Pin#	Color Codes of External Harness
M12A-08PMMS-SF8001	CH_GND	M12A-08BFFM-SL8D01	1	White
	NC		2	Brown
	RS485_ISO_GND_S		3	Green
	RS485_N		4	Yellow
	RS485_P		5	Gray
	NWI_N		6	Pink
	NWI_P		7	Blue
	CH_GND		8	Red

INCOM & RS485 CAP for Protection

Sr.No	Description	MFGPN#	Manufcaturer	Qty
1	Cap for M12A-08PMMS-SF8001	CAP-WBDMSMA2	Amphenol LTW	1

5. Ethernet Connector Gland

Table 7. Ethernet Connector Gland for IP68 Protection

Sr.No	Description	MFGPN#	Manufcaturer	Qty
1	Ethernet Connector Mating Gland	3356L01010	Kinsun	1

Ethernet Connector CAP for Protection

Sr.No	Description	MFGPN#	Manufcaturer	Qty
1	Ethernet Connector CAP	CAP-WACMSMA1	Amphenol LTW	1

6. USB Connector CAP

Table 8. USB Connector CAP for IP68 Protection

Sr.No	Description	MFGPN#	Manufcaturer	Qty
1	USB Connector CAP	CAP-WACMSMA1	Amphenol LTW	1

USB External Harness for Isolated +5V DC

Sr.No	External Harness	Color Coded of External Harness#	Signals
1	UA-20BFMM-SL7A01-05	Red	+5V DC
2		Black	Com

Technical Specifications

Electrical

Input Power

The MPCV-NXG Type Relay is powered from any two phases of the three transformer voltages or the three network voltages. The Relay can also be powered by 24 or 48v auxiliary input.

Voltage Range

The relay has a 125 Vac nominal input voltage and will operate from 12 Vac to 190 Vac line to neutral, 3-phase.

Operating Frequency

The relay operates on 50 Hz or 60 Hz systems.

Power Consumption

The relay draws a power of 15 watts maximum in a balance 3-phase voltage source.

Power-Up Voltage

The relay minimum power-up voltage is 90 Vac, 3-phase.

Loss of Power

The relay shall retain all the programmable settings in a nonvolatile memory during a power loss. The memory storage has 10 years shelf life.

CT Input

The relay CT burdens are virtual short circuits, less than 2 milli-ohms, rated at 15 amperes continuous.

Phasing Voltage Input

Each of the voltage channels have nominal input impedances of 350,000 ohms.

Auxiliary Input

The relay has Eight auxiliary input channels including breaker status (Digital Input1). The input channels accept dry contacts that are internally driven with an open circuit voltage of 13 Vdc nominally, and approximately 10 mA when closed.

Indicator Lights

TRIP Indicator

Steady Green Indicator ON when normal trip is initiated, incorrect phase rotation is detected, ROBO is active, crossed-phase or rolled-phase conditions are detected.

OFF when no trip or close condition is detected.

CLOSE Indicator

Steady Red Indicator ON until phasing voltage no longer satisfies the ML, PL settings.

OFF when no close condition is detected.

FLOAT Indicator

Steady Amber Indicator ON when the relay is energized and not commanding a Trip or Close.

Trip and Close Contacts

Rating: The relay contacts are capable of 100,000 operations for 20 amperes resistive at 240 Vac and 2 hp at 240 Vac motor load.

Close Operation:

Continuously close until phasing voltage no longer satisfies the ML, PL settings. Contacts: NO

Trip Operation: Contacts: NO

1. Continuous Open/Close operation until tripping condition is removed, Phase sequence is incorrect, or Remote Open Block Open command is active.
2. Continuously ON until crossed-phase condition is cleared

ANSI/IEEE SWC Compliance

IEEE Standard Surge Withstand Capability (SWC) Test for Protective Relays and Relay Systems IEEE C37.90.1—2012.

Radio Frequency Withstand Capability

IEEE Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers IEEE C37.90.2 — 2004 (35 V/m field strength).

Harmonic Immunity

The relay shall not exhibit any spurious output when subjected to the following phasing voltage (Vph) harmonic contents with a fundamental magnitude of 6 Vac maximum.

Fundamental = 41%

3rd Harmonic = 6%

5th Harmonic = 50%

7th Harmonic = 2%

9th harmonic = 1%

With a network voltage of 125 Vac (no harmonics).

Mechanical

Construction

Enclosure: Plastic ZYTEL HTN 51G35HSL NC01, 0.177" Thick, 35% glass reinforced, heat stabilized, lubricated, hydrolysis resistant high performance polyamide resin.

Mounting Screws and Nuts: 18-8 Stainless Steel

Terminal Screws: Plated Brass

Wiring

The relay uses Teflon insulated wires with silver copper conductor rated at 200°C, 1000 volts.

Weight

5.5 lbs. (2.5 kg)

Overall Dimension

9.860 x 7.060 x 5.000 inches (250.44 x 179.324 x 127 mm)

Environmental

Operating Temperature

The relay shall operate satisfactorily in ambient temperature range of -25°C to +80°C.

Testing

Electrical: The relay shall be tested for critical parameters over the temperature range of -40°C to +85°C for 5.6 hours.

Submergibility: Waterproof up to 15 feet.

Burn-in

Each relay is burned-in for 5.6-hour period including 3 hours at 85°C, 45 minutes at -40°C and ramp time is 2 hours.

Settings

All settings can be edited through a MPCV-NXG WebUI. The trip and close operations along with remote communications are inhibited and the Trip light is ON while editing.

System Voltage (Metered)

216, 380, 400, 416, 433, 480, 600 volts.

Operating Frequency

50 Hz, 60 Hz

Phase Rotation

ABC, CBA

CT Ratio

800, 1200, 1600, 2000, 3000, 3500, 4500, 5100

Close Characteristic Line

Straight Line Master Line (Enable), Circular (Straight Line Master Line is Disable).

Master Line:

0.5 V to 10 V.

Phasing Line

+5°, 0°, -5°, -10°, -15°, -20° -25°.

Left Hand Master Line

60°, 65°, 70°, 75°, 80°, 85°, 90°, 95°, 100°, 105°, 110°

Dead Network

Network voltage must be equal or less than 7 volts.

Trip Current

Sensitive, RT: 0.05 to 5% (2.5 to 250 mA).

Insensitive (Overcurrent, OC): 0 to 300% (0 to 15 amperes).

A minimum of 1% OC when time delay is set other than zero.

Time Delay

TD: 0 sensitive mode, no instantaneous overcurrent pickup.

TD: 1 to 300 seconds, instantaneous overcurrent pickup is enabled.

TD: Infinite disables the sensitive setting, set the time delay to infinite and only permit tripping on insensitive OC value.

Watt-Var

Enable: Check, Uncheck.

Angle: 0°, 5°, 10°, 15°, 20°, 25°, 30°, 35°, 40°, 45°, 50°, 55°, 60°.

System Pump Protection Enable: On, Off

Pump Operations: 3 to 20.

Pump Time: 30 to 300 seconds.

Pump Lockout Reset Delay: 15 to 60 minutes.

Mechanical Pump Protection Enable: On, Off

Pump Time: 30 to 300 seconds.

Pump Lockout Reset Delay: 15 to 60 minutes , Infinite.

Auxiliary Input

Auxiliary Used: Enable, Disable.

Auxiliary Alarm: Enable, Disable.

Auxiliary Contacts: Enable, Disable.

Tolerances

The relay shall operate within the tolerance shown while operating over the normal temperature range of -25°C to +80°C and the normal network voltage range of 12 to 190 Vac.

Sensitive Trip: ±5% of setting or ± 0.5 mA, whichever is greater.

Instantaneous Trip: ±5% of setting or ±0.1 A, whichever is greater.

Insensitive Trip: ±5% of setting or ±0.1 A, whichever is greater.

Time Delay: ±1% of setting.

Phasing Voltage: ±5% of setting or ± 0.2 volts, whichever is greater.

Phasing Angle: ±1 degree of setting.

Phase Compensation Angle: ±2 degree of setting.

Trip and Close Angle: ±1 degree of setting.

Operation

Automatic Trip

The trip contacts shall close within 5 cycles of reverse current detection. The magnitude and direction of the current must exist for at least 2 cycles to initiate trip operation.

Sensitive — The relay shall permit a trip when the reverse current is in the trip region and magnitude is equal or greater than the sensitive current setting.

Insensitive — The relay is set to insensitive mode when TD is set to INF.

Time Delay — The delay starts when reverse current is in the trip region and has a magnitude equal or greater than the sensitive current setting. The delay stops when the current is less than the sensitive current setting. The relay also initiates an instantaneous trip when the reverse current is equal or greater than the overcurrent setting.

Watt-Var — The relay rotates the trip region by 60° and initiates a trip when the instantaneous reverse current is equal or greater than the overcurrent setting.

Manual (Remote) Trip

Initiated via MPCV-NXG WebUI by a ROBO (Remote Open Block Open) ON command. The relay shall not permit any trip or close operation while the command is active. The ROBO OFF command will allow the relay to assume normal automatic mode.

Automatic Close

The relay shall permit a closure when the phasing voltage is in the close region and the magnitude is equal or greater than the phasing voltage setting, ML. The close contacts shall close within 5 cycles of phasing voltage detection. The magnitude and direction of the voltage must exist for at least 30 cycles to initiate close operation.

Characteristic Line

Straight Line (Standard) — Used on typical loaded system.

Circular — Used on lightly loaded system.

Pump Protection

This feature shall protect the network protector from excessive close-trip (pumping) operation within a given time. When the protector number of operations is equal or greater than the breaker cycles within the pump time setting, the relay shall initiate a trip and lock open to inhibit a close operation until the reset time expires.

Manual (Remote) Close

Initiated via MPCV-NXG WebUI by a PRC (Protective Remote Close) command. The relay will relax the close criteria by effectively setting the ML to near zero volts and expand the phasing line(s) to the setpoint boundary for up to 10 seconds or until closure is initiated. Upon expiration of the 10-second PRC window or closure initiation, the original ML and PL programmed settings are restored. The Anti-Pump Protection must be off to complete the PRC operation.

Dead Network

The relay shall initiate an instantaneous closure when the network voltage is equal or less than the Dead Network setting.

Communication

Medium 1

INCOM with 1500 volt isolation via 3-pin connector and a twisted pair cable.

Protocol

INCOM — a Master/Slave two-way communication system. The master device like VaultGard or NPServe can covert these INCOM signals into DNP.

Modulation: Carrier Based, FSK

Frequency: 115.2 KHz logical “one”, 92.16 KHz logical “zero”.

Message: 33 bits.

Start Bit: 2 bits.

Control Bit: 1 bit.

Data: 24 bits.

BHC Check: 5 bits code.

Medium 2

DNP3 via RJ-45 connecter and a Ethernet cable.

DNP3 via 3-pin connector and a twisted pair cable.

Protocol

DNP3 – Supports Server communication and Slave communication system. The Master or Client (PC that has an Ethernet or RS-485 communication port) connected to Server or Slave running in MPCV-NXG relay.

Ethernet (TCP or UDP): IP & Port address

Serial: Baud Rate, Parity, Data & Stop bits.

SCADA (DNP Slave)-MPCV-NXG Relay has the ability to interface to a DNP Monitoring or SCADA system via the RS-485 DNP Slave port or the Ethernet connection. The SCADA page is where MPCV Relay is configured to talk to a DNP master. Virtual Devices are specified to access the device data stored in MPCV Relay. Each DNP virtual device must have a DNP Profile. DNP profiles can be uploaded for other virtual device configurations that may be developed in the future.

Communication System

Eaton has developed an Integrated Monitoring Protection and Control Communications, known as IMPACC specifically for power distribution and industrial applications. It centers on the Industrial communication (INCOM) chip, which employs frequency shift key (FSK) technology and has the following benefits:

1. Devices are easily "daisy chained" with inexpensive shielded twisted pair cable.
2. Noise immunity and signal integrity verification to ensure reliable data transfer.
3. Up to 1,000 devices are supported on Main Network.
4. Up to 99 devices are supported in Subnetwork.
5. Up to 1,000 devices may be monitored and controlled from a single location.
6. Distances of up to 10,000 feet (3,048 m) are supported without repeaters.
7. Polarity is not an issue when connecting wiring to devices.
8. Wiring may be installed close to power wiring in accordance with NEC (or CSA) and local safety codes.
9. Wiring may be installed in control and communication cable trays and conduit in accordance with NEC (or CSA) and local safety codes.

Since the MPCV Relay is an IMPACC compatible device, communication is provided for the relay to remotely monitor and control network protectors so valuable information can be obtained for load flow analysis, reliability improvement, maintaining highest level of protection, early detection of potential service interruption through instantaneous alarm notification, and safe maintenance operation while optimizing the cost and benefits of electric services.

Safety

The relay shall not permit any closure in automatic mode when:

1. Line-to-Ground fault is detected in any of the transformer or network terminals.
2. Line-to-Line fault is detected between the transformer terminals or network terminals.
3. Crossed-phase is detected in the transformer terminals or in the network terminals.
4. Incorrect phase sequence is detected.
5. Rolled phase is detected.
6. Any one phase is dead in the transformer or network terminals.

Table 9. Trip Amperage as a Function of Percent of CT Primary, from .05 to 5%

Percent of CT Primary	Network Protector Rating					
	800	1200	1600/ 1875	2000/ 2250	2500/ 2825	3000/ 3500
.05	0.4	0.60	0.80	1.00	1.25	1.50
.07	0.56	0.84	1.12	1.40	1.75	2.10
.1	0.8	1.20	1.60	2.00	2.50	3.00
.2	1.6	2.40	3.20	4.00	5.00	6.00
.3	2.4	3.60	4.80	6.00	7.50	9.00
.4	3.2	4.80	6.40	8.00	10.00	12.00
.5	4.0	6.00	8.00	10.00	12.50	15.00
	<— Trip Amperage —>					

Note: This table represents only that regions from .05 to 0.5% of the CT primary. The relay can be adjusted up to the 5% level if desired. The ampere values listed are based upon the standard rating of current transformers being applied to the appropriate rating of the network protector**.**

Installation Rules

In order to deliver a comprehensive and powerful energy management solution for use in electrical distribution environments while ensuring affordability, flexibility, simplicity and noise immunity the following rules will allow the user to achieve the above advantages. These rules are expected to be followed as a starting point before troubleshooting is performed on a system.

1. Cable Selection

The approved cable types are:

- Eaton supplied wire Harness.
- IMPACABLE — a 600 volt rated custom designed for IMPACC Style No. 2A95705G01.

2. Cable Intermixing

Any of the above approved cables may be intermixed without compromising communication performance.

3. INCOM System Topology, Size and Capacity

Topology

- Bus or single star.
- Maximum number of long line from star: 5.
- No line termination for tap.
- Required EOLTR (100 ohms) at the end of long line.
- Maximum cable length between ends of longest lines: 10,000 feet (3,048 m)

Attenuation:

- Total system attenuation capacity: 25 dB.
- Attenuation per device: 0.01 dB.
- Attenuation of approved cables:

Cable Type	Attenuation Per 1,000 ft (304.8m)
IMPACABLE Belden 9463	1.6 dB 2.0 dB

- Attenuation at Star:

No. of Long Lines	Attenuation
3	3.5 dB
4	6.0 dB
5	8.0 dB

Definition

STAR — single point with a number of long lines emanating from it.
LONG LINE — greater than 200-foot (61 m) wire run.

4. Cable Splicing

The prime goal is to create a secure electrical connection while minimizing exposure to electrical transients.

- Ferrules are used to dress cable ends in order to avoid problems associated with frayed and loose wires.
- Use the device built-in two pole terminal blocks when splicing.
- All devices, EOLTR, Simple Taps and Complex Taps should be placed in parallel across the cable.

5. Cable Shielding

- Cable shielding and outer jacket should not be stripped longer than 1-1/2 inches (38.1 mm).
- Use the three pole terminal blocks at tap points to ensure a continuous metallic shield ground path.
- Mechanically crimp sleeves on to the two-shield path drain wires.
- The cable shield ground path for a Main Network and Subnetwork must not be joined together. Each should have a separate connection to earth ground reference.

6. Cable Grounding

- The shield ground path of a Main Network (and each subnetwork) should be broken up into two separate isolated segments in such a way that a single, solid earth ground is available within 3,000 feet (914.4 m) of any point along the Main Network (or subnetwork).
- Do not tie together drain wires of neighboring segments to achieve isolation.
- Insulate unused drain wire to prevent accidental grounding.
- Connect the shield ground path's drain wire to a #14 AWG or larger multi-stranded wire that has an impedance path of 1 ohm or less to a known earth ground. Note that a new ground path will be required when the shield ground travel through many connections and considerable distances before reaching earth ground.

7. Cable Termination

The Main Runs of the Main INCOM network and each Subnetwork require a pair of EOLTR, rated 100 ohms, carbon or metal film resistors. Do not use wirewound resistors.

- The resistors should be placed in parallel across the splicing junction servicing the Complex Tap rather than at the far end within the Complex Tap.
- Tap off from the Main Runs do not require EOLTR.

8. Device Address

To avoid the possibility of devices in a Main Network having the same address as those in Subnetworks, set the Main Network device addresses to start at 100 or higher excluding 901 to 908.

WebUI Reason Descriptions on MPCV-NXG Relay Status

Table 10 provides descriptions of all of the possible Status and Reason states as reported by the MPCV-NXG Relay via WebUI. Note that the status is a function of the Auxiliary 1 input contact to the MPCV-NXG in combination with any Trip or Close control from the MPCV-NXG and time. The first column shows network protector status based on the Auxiliary 1 input contact, where "C" denotes the network protector is sensed to be CLOSED (physical Auxiliary 1 contact is open). Similarly, an "O" indicates an OPEN protector (Auxiliary 1 contact is closed).

The first column shows network protector status based on the Auxiliary 1 input contact, where "C" denotes the network protector is sensed to be CLOSED (physical Auxiliary 1 contact is open). Similarly, an "O" indicates an OPEN protector (Auxiliary 1 contact is closed).It indicates that all the following TRIP descriptions imply that the network protector has been sensed to be OPEN, prior to which a protective TRIP control was issued to the protector by the MPCV-NXG. The associated WebUI Reason String attempts to detail what power system condition caused the MPCV-NXG to command a trip. The descriptions provided for the Trip states are also applicable for Time-Stamped Trip Events.

Note: Alarm Status has higher priority than Trip, Open or Close in **Table 10** below.

Table 10.WebUI Reason Descriptions on MPCV-NXG Relay Status

NWP Status	Relay Status	Reason	Description
C	Closed	Normal	Sensed in the CLOSED position, Normal
O	Open	Remote Open Blocked Open	Sensed in the OPEN position, and MPCV-NXG was Remotely commanded to be Open/ Blocked Open (ROBO)
O	Trip	Reversed Phase	Typically indicative of a reversed phase condition on the network side. An improper CBA rotation set point will also generate this reason. Bus voltages and the bus connections to the MPCV-NXG should also be verified.
O	Trip	Rolled Phase	Typically indicative of a rolled phased power system condition. Bus voltages and the bus connections to the MPCV-NXG should also be verified.
O	Trip	Reversed or Rolled Phase	Indicative of a reversed phase condition on the transformer, or a rolled phase on the transformer, or a rolled phase on the network. Bus voltages and the bus connections to the MPCV-NXG should also be verified
O	Trip	Sensitive Trip	Reverse current exceeded RT set point for at least 2 power cycles (instantaneous), Watt Trip characteristic (WV=OFF), TD=0.
O	Trip	Time Delayed Sensitive Trip	Reverse current exceeded RT set point for the duration of the non-zero TD setting, Watt Trip characteristic (WV=OFF).
O	Trip	De-energized Network & Feeder	The magnitudes of the positive sequence network voltage AND the positive sequence phasing voltage indicates a de-energized network and feeder system condition. Bus voltages and the bus connections to the MPCV-NXG should be verified.
O	Trip	Var Trip	Reverse current exceeded RT set point for at least 2 power cycles (instantaneous), Watt-Var Trip characteristic (WV=ON), TD=0, and the reverse current phasor fell in the var region (60 degree portion) of the overall Watt-Var Trip curve..
O	Trip	Breaker Pumping	Pump Protection is enabled, and the protector has cycled the programmed number of cycles within the pump time setting. The MPCV-NXG will continue to command a TRIP to protector, until expiration of the Pump lockout reset delay or a Remote command to clear the pumping fault
O	Trip	Mechanical Breaker Pumping	Mechanical Pump Protection is enabled, and the protector operation exceeded the allowed pumping time setting. The MPCV-NXG will continue to command a TRIP to protector, until expiration of the Pump lockout reset delay or a Remote command to clear the pumping fault
O	Trip	Overcurrent Trip	Reverse current exceeded OC set point for at least 2 power cycles, Watt Trip characteristic (WV=OFF). Overcurrent OC is strictly an "instantaneous" setting.
O	Trip	Watt Trip	Reverse current exceeded RT set point for at least 2 power cycles (instantaneous), Watt-Var Trip characteristic (WV=ON), TD=0, and the reverse current phasor fell in the Watt region (-5 deg portion) of the overall Watt-Var Trip curve.
O	Trip	Time Delayed Watt/Var Trip	Reverse current exceeded RT set point for the duration of the non-zero TD setting, Watt-Var Trip characteristic (WV=ON).
O	Trip	Overcurrent Watt/Var Trip	Reverse current exceeded OC set point for at least 2 power cycles, Watt-Var Trip characteristic (WV=ON). Overcurrent OC is strictly an "instantaneous" setting.
O	Trip	Set Point Checksum Failure	MPCV-NXG has detected a checksum problem with the programmed set points in non-volatile memory. Protector will trip and relay should be replaced.
O	Trip	RAM	MPCV-NXG has detected a RAM memory problem on power-up. Protector will trip and relay should be replaced.
(C)	Alarm	Failed to Open	MPCV-NXG has tried to TRIP the protector, but did NOT sense that the Aux B input contact closed within 10 seconds. May be a problem in the protector trip circuit or wiring of the Aux B contact.
(O)	Alarm	Failed to Close	MPCV-NXG has tried to CLOSE the protector, but did NOT sense that the Aux B input contact opened within 10 seconds. May be a problem in the protector close circuitry or wiring of the Aux B contact

NA	Alarm	Auxiliary 2 Alarm	Auxiliary Channel 2 has been activated, has been set to alarm on activation, and the channel is currently in the active state.
NA	Alarm	Auxiliary 3 Alarm	Auxiliary Channel 3, as Aux 2 above.
NA	Alarm	Auxiliary 4 Alarm	Auxiliary Channel 4, as Aux 2 above.
NA	Alarm	Auxiliary 5 Alarm	Auxiliary Channel 5, as Aux 2 above.
NA	Alarm	Auxiliary 6 Alarm	Auxiliary Channel 6, as Aux 2 above.
NA	Alarm	Auxiliary 7 Alarm	Auxiliary Channel 7, as Aux 2 above.
NA	Alarm	Auxiliary 8 Alarm	Auxiliary Channel 8, as Aux 2 above.

This instruction booklet is published solely for information purposes and should not be considered all-inclusive. If further information is required, you should consult an authorized Eaton sales representative.
The sale of the product shown in this literature is subject to the terms and conditions outlined in appropriate Eaton selling policies or other contractual agreement between the parties. This literature is not intended to and does not enlarge or add to any such contract. The sole source governing the rights and remedies of any purchaser of this equipment is the contract between the purchaser and Eaton.

NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, OR WARRANTIES ARISING FROM COURSE OF DEALING OR USAGE OF TRADE, ARE MADE REGARDING THE INFORMATION, RECOMMENDATIONS, AND DESCRIPTIONS CONTAINED HEREIN. In no event will Eaton be responsible to the purchaser or user in contract, in tort (including negligence), strict liability or otherwise for any special, indirect, incidental or consequential
damage or loss whatsoever, including but not limited to damage or loss of use of equipment, plant or power system, cost of capital, loss of power, additional expenses in the use of existing power facilities, or claims against the purchaser or user by its customers resulting from the use of the information, recommendations and description contained herein.

Eaton Corporation
Electrical Group
1000 Cherrington Parkway
Moon Township, PA 15108
United States
877-ETN-CARE (877-386-2273)
Eaton.com

Printed in USA
IPublication No. IB02402001E / TBG000504
April 2025

Powering Business Worldwide

PowerChain Management®