Installation Instructions for DeviceNet™ Prism Photoelectric Sensors

MODELS COVERED BY THIS MANUAL		
Catalog Number	Description	DeviceNet Product Name
Reflex		
14150ADN18	Forward viewing, cable	PRM01
14150RDN18	Right-angle viewing, cable	PRM02
14150ADN08	Forward viewing, connector	PRM03
14150RDN08	Right-angle viewing, connector	PRM04
Polarized Reflex		
14151ADN18	Forward viewing, cable	PRM05
14151RDN18	Right-angle viewing, cable	PRM06
14151ADN08	Forward viewing, connector	PRM07
14151RDN08	Right-angle viewing, connector	PRM08
Diffuse Reflective		
13150ADN18	Forward viewing, cable	PRM09
13150RDN18	Right-angle viewing, cable	PRM10
13150ADN08	Forward viewing, connector	PRM11
13150RDN08	Right-angle viewing, connector	PRM12

DESCRIPTION

General Information

- Network Media - CAN (11-bit identifier)
- Protocol - DeviceNet
- Type - Group 2 Only Slave Device using Predefined Master Slave Connection Set
- Bandwidth - 125 Kbaud only

Prism is a powerful line of miniature photoelectric sensors that deliver top-notch optical performance in a rugged package. The sensors employ CAN technology to allow them to communicate on the open DeviceNet network.

Features

- High sensing power
- Forward or right-angle viewing
- Small 18 mm diameter with flat sides for easy mounting
- Choice of cable wiring or quick-disconnect connector
- Diffuse reflective, reflex and polarized reflex sensing modes
- Gain can be configured over the DeviceNet network
- Light or dark operation is selectable over the DeviceNet network

INSTALLATION

This manual covers both forward viewing and right angle viewing models. Although the units differ in the location of the lenses, the basic fundamentals of installation, set-up, and operation are virtually identical.

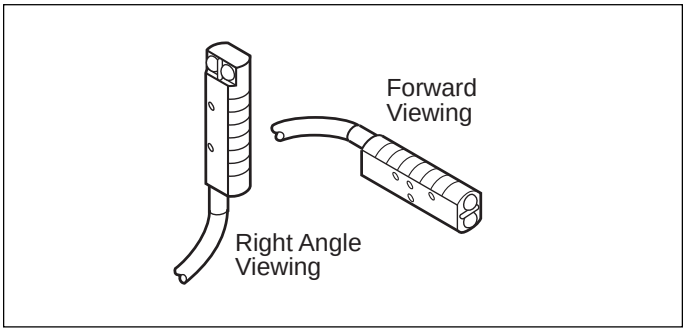


Fig. 1 Forward and right angle Prism styles

INSTALLATION (Continued)

⚠ WARNING

DO NOT INSTALL OR PERFORM MAINTENANCE ON THIS DEVICE WHILE THE CONTROLLER IS ENERGIZED. DEATH OR SEVERE PERSONAL INJURY CAN RESULT FROM CONTACT WITH ENERGIZED EQUIPMENT. VERIFY THAT NO VOLTAGE IS PRESENT BEFORE PROCEEDING WITH INSTALLATION OR MAINTENANCE. Only qualified persons, as defined in the National Electric Code, who are familiar with the installation, maintenance and operation of this device and the equipment onto which is to be installed, as well as applicable local, state and national regulations and industry standards and accepted practices regarding safety of personnel and the equipment safety should be permitted to install, maintain or operate this device. These instructions are provided only as a general guide to such qualified persons and are not all-inclusive. They do not cover every application or circumstances which may arise in the installation, maintenance or operation of this equipment. Users are advised to comply with all local, state and national regulations and industry standards and accepted practices regarding safety of personnel and the equipment safety.

⚠ WARNING

Use #4 mounting hardware only! Larger hardware will damage the sensor and may create an electrical shock hazard. Tighten the hardware just to the sensor body so that no deflection of the body occurs.

⚠ WARNING

Do not use tools to apply torque directly to sensor body. Align sensor by hand before tightening mounting hardware.

The Prism sensor features a threaded housing and includes jam nuts and washers. This allows mounting into any 0.75 inch hole, or a model 6161A-6501 “L” bracket. Use caution to avoid cross-threading the jam nuts on the sensor body. Tighten nuts to less than 4 N•m (36 in.-lbs. or 3 ft.-lbs.) torque to avoid stripping threads.

A second mounting method is to use #4 hardware in the 0.125 inch diameter mounting holes in the flat sides of the sensor. This is ideal for mounting the Prism against a wall, piece of equipment, rail, mounting bracket, etc.

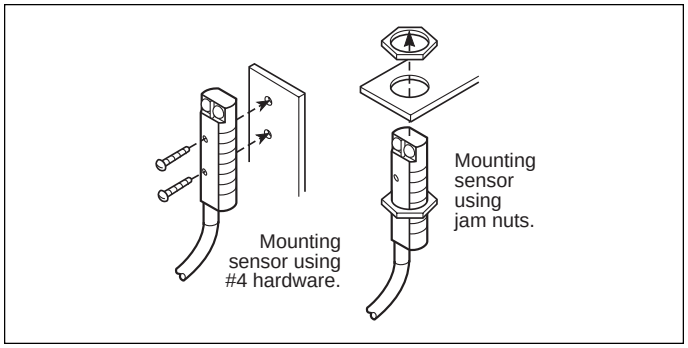


Fig. 2 Mounting methods for Prism Sensors

MOUNTING CONSIDERATIONS

Reflex sensor set-up

A *reflex sensor* has both a light source and detector in the same unit. The source sends a beam of light to a retroreflector which returns it back to the detector. A break in the light beam causes the sensor to change output state. The sensors feature visible red sources to aid in alignment of the sensor with its retroreflector.

Polarized models are used to reliably detect shiny targets that may reflect the light beam back to the sensor instead of interrupting the beam. The polarizing filter conditions the beam so that light reflected off the retroreflector is detected, but light reflected by the target is not.

⚠ ATTENTION

Retroreflective tapes can have vastly different properties than corner-cube reflectors. Polarized reflex sensors will not function with glass bead tape but will function with corner-cube tape. Also, signal strength can drop dramatically as the distance between tape and sensor is reduced. If you are using a polarized sensor, or intend to mount the tape closer than 12 inches from the sensor, we recommend that you test your particular tape prior to installation.

Position the sensor and retroreflector on opposite sides of the target. Ensure that the area of the target to be detected will block the entire beam.

Connect the sensor to the DeviceNet network and aim the unit directly at the center of the retroreflector. Move the sensor back and forth in one plane to find the extreme positions where the Output LED goes “OFF” (in light-operate mode, or “ON” in dark-operate mode). You can also look at the retroreflector with your eye as close to the sensor as possible and align the sensor until reflected light is brightest. Position the sensor midway between the two extremes. Repeat this procedure for the other plane. After alignment, tighten all mounting screws.

Stretch wrap material over a shiny surface may reflect enough light to false trigger a polarized reflex sensor. In this case, reduce the gain slightly or tilt the alignment axis of the sensor relative to the shiny surface (see the "Gain Adjustment and Operation" section on page 3 for gain adjustment).

Diffuse reflective sensor set-up

A *diffuse reflective sensor* operates by shining a beam of light out through the lens. When an object comes within the sensor's view, it reflects part of this beam of light back to the sensor causing the sensor to detect the object. The maximum range at which a given object can be detected depends on how well its surface reflects light—the less light it reflects back, the shorter the range. The ability of a surface to reflect light depends primarily upon its material of construction, color, and texture.

Select a mounting location with a clear view of the object to be detected. Avoid direct reflection from a highly reflective background (or darken the background). Mount the sensor so that it points at the most suitable part of the target object. Tighten all mounting screws.

Connect the sensor to the DeviceNet network and place a sample object in the beam. Reduce the gain setting (see the "Gain Adjustment and Operation" section on page 4) and then slowly increase the gain until the output goes ON (in light-operate mode or OFF in dark-operate mode). (The specific attribute information for setting the sensor's gain can be found in the "Presence Sensing Object" section in the appendix of this manual.) Note the gain setting and remove the sample object. Now continue increasing the gain setting to find the position where the output goes ON from the background reflection. Reset the gain midway between the two positions.

Due to normal sensor manufacturing variations, you will need to repeat this procedure if you replace the sensor with another, or place another sensor in a duplicate application (a gain setting of 200 on a 13150ADN18 sensor may not produce the exact same range as a gain setting of 200 on another 13150ADN18 sensor).

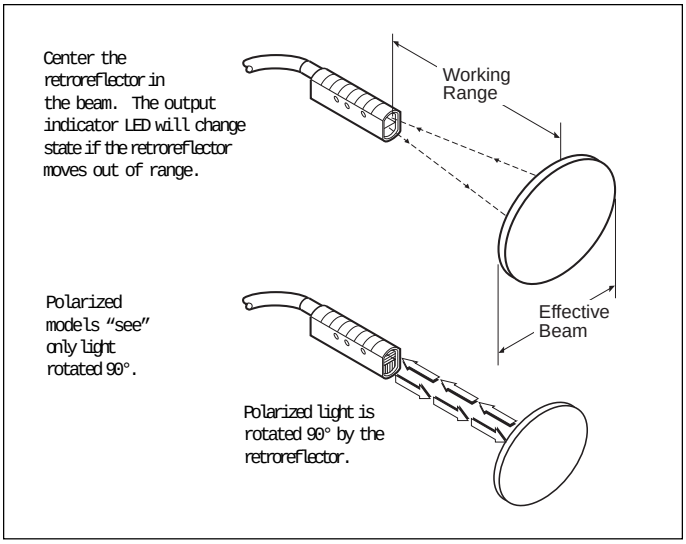


Fig. 3 Reflex sensor set-up

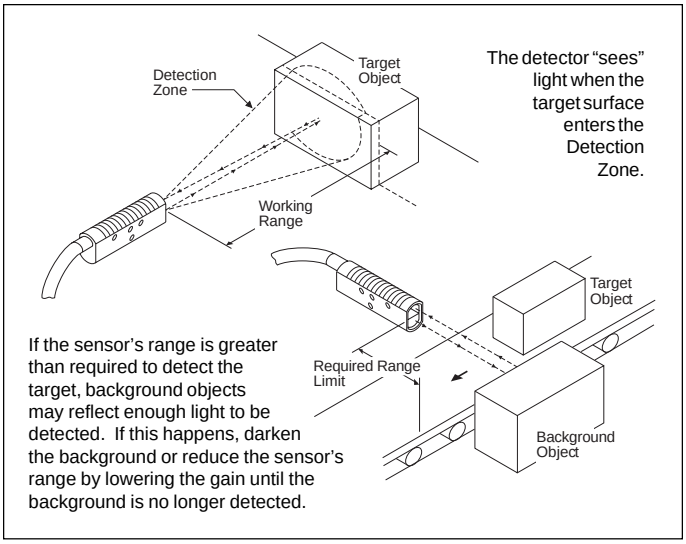
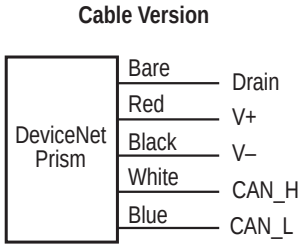
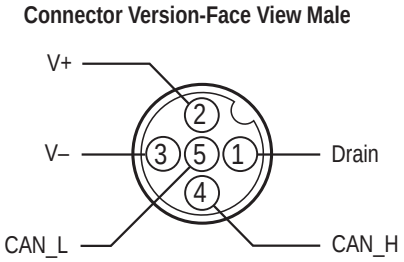


Fig 4 Diffuse Reflective sensor set-up

WIRING CONSIDERATIONS





INSTALLATION (Continued)

Gain Adjustment and Operation

To control sensing beam intensity, Prism's gain level can be set over DeviceNet (gain can also be referred to as sensitivity). The specific attribute information can be found in the "Presence Sensing Object" section in the appendix of this manual. The Gain adjustment can also be used to measure the excess gain of the sensor/ retroreflector system.

The effective dynamic range of the gain adjustment is a ratio of approximately 15:1. A gain value of about 5 or less will shut off the light source completely. The sensor will not operate at these minimum intensity levels.

It is recommended that the maximum value be applied during visual alignment, since this will produce the maximum beam intensity and will be easily visible on the retroreflector.

Recommended Gain Values for set-up and operation

For ***reflex applications***, use a gain value of 255 unless the object to be detected is translucent and fails to block the beam. If this should occur, reduce the gain value until the object is detected and note the gain value. Continue to reduce the gain until the reflector is no longer detected and note the value. Set the gain half way between the two values.

For ***diffuse reflective applications***, use a gain value of 255 unless the sensor detects the background beyond the intended target. If this should occur, reduce the gain value until the background is no longer detected and note the gain value. Continue to reduce the gain until the target can no longer be detected and note the value. Set the gain half way between the two values. Note: It is usually preferable to remove the background, paint it black or reposition the sensor rather than reduce sensor gain

Technical Note:

You can estimate the excess gain of the sensor in your application. Simply divide the gain value at "turn off" into the maximum gain value of 255. This ratio is the excess gain. For example if your "turn off" value is 10:

255/10 = 25.5, the excess gain

For more information on Excess gain, refer to pages 6-8 in "The Basics of Photoelectric Controls," document number 107027.

DEVICE CONFIGURATION

Before using the Prism Sensors, you MUST configure the following:

- Verify that the network Communication rate (DeviceNet Prism operates at 125 Kbaud only)
- Set the network address

Other settings that can be configured on Prism are:

- Gain setting (the sensing power of the sensor)
- Light or dark operation

Network Address

After connecting Prism to the network, use the Netview configuration software (or other configuration software) to configure the device. Unless pre-configured, a new device will have a default address of 63 at a baud rate of 125 Kbaud when connected to the network.

⚠ CAUTION

Since all new DeviceNet devices are factory set to address 63, it is usually not a good idea to leave an address set at 63. Two nodes at the same address will cause a network fault!

Built into the Cutler-Hammer Netview configuration software is a function to locate nodes by illuminating the Module/Network Status LED. Verify that the software is communicating to the correct Prism sensor using this feature (see the chart in the next section). Once the Netview configuration software is communicating to the Prism, the address, gain setting, light/dark operation mode and all other user configurable parameters can then be programmed. (See the Netview manual for specific information on how to change attributes.) A list of configurable attributes can be found on page 5 of this manual.

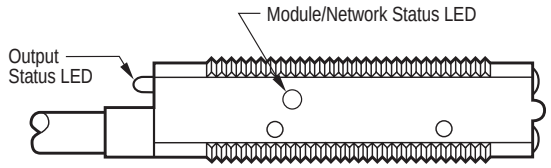
Now change the network address to the desired number. See the Cutler-Hammer DeviceNet system manual for a detailed description of choosing a network address.

Off-line Configuration

A Prism sensor may be configured off-line by connecting it directly to the configuration tool (PC with software or a hand-held type tool) and following the instructions for on-line configuration. 24 VDC must still be supplied to the Prism in order to configure it off-line.

LED DEFINITIONS AND DIAGNOSTICS

The Prism includes two LED status indicators: Output status indication and network/module status indication.



LED	Status
Output Status LED	
ON	Output attribute = 1
OFF	Output attribute = 0
For more information on this function, see Light/Dark operation in the Appendix of this manual.	
Module/Network Status LED	
OFF	Device is not on-line - Device has not completed the Dup_MAC_ID test yet - Device may not be powered
Solid Green	Device is operating in a normal condition and the device is on-line with connections in the established state - For a Group 2 Only device it means the device is allocated to a Master
Flashing Green	Device is operating in a normal condition and the device is on-line with no connections in the established state - The device has passed the Dup_MAC_ID test, is on-line, but has not established connections to other nodes - For a Group 2 Only device it means that this device is not allocated to a Master - Configuration missing, incomplete or incorrect
Flashing Red	Recoverable fault and/or one or more I/O Connections are in the Timed-Out state
Solid Red	The device has an unrecoverable fault; may need replacing Failed communication device. The device has detected an error that has rendered it incapable of communicating on the network (Duplicate MAC ID, or Bus-off).

SPECIFICATIONS

Optical Performance

All optical specifications are guaranteed to be the minimum performance under clean conditions of any product delivered from stock. Typical performance may be higher.

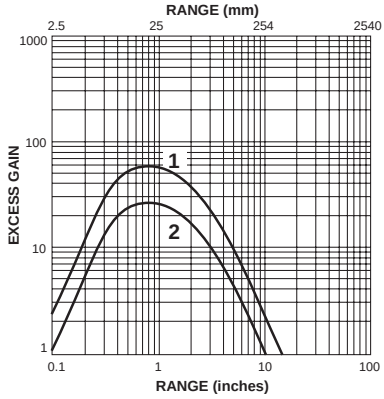
Dirt in the environment will affect optical performance by reducing the amount of light the control receives. For best results, sensors should be used at distances where excess gain is higher than 1.5 (1.5 times the amount of sensing power required to detect an object under ideal conditions). Higher excess gain will allow the sensor to overcome higher levels of contamination on the lens.

Diffuse reflective ranges and excess gain graphs are based on a 90% reflectance white card. Reflex ranges and gain graphs are based on a 3-inch diameter retroreflector.

	Diffuse	Reflex	Polarized Reflex
Source	Infrared, 880 nm	Visible red, 680 nm	Visible red, 680 nm
Maximum Range	8 inches	15 feet	10 feet
Optimum Range	0.1-5 inches	0.1 to 12 feet	0.1 to 8 feet
Field of View	0.6 inch dia. at 5 inches	3 inch dia. at 12 feet	3 inch dia. at 12 feet

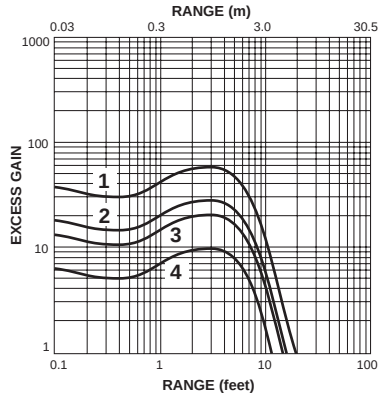
Diffuse Reflective

1. Typical
2. Minimum



Reflex and Polarized Reflex

1. Reflex typical
2. Reflex minimum
3. Polarized Reflex typical
4. Polarized Reflex minimum



SPECIFICATIONS (Continued)

Response Time
2 mS from detection event until data is available to DeviceNet

Light/Dark Operation
Configurable via DeviceNet

Operating Temperature
-25° to +55° C (-13° to +131° F);

Storage Temperature
-25° to +70° C (-13° to +158° F)

Material of Construction
Lens: Polycarbonate; Cable jacket: PVC; Body: Structural polyurethane foam (do not expose to concentrated acids, alcohols, or ketones)

Cable/Connector
6-foot cable, 4-wire with shield;
Micro Connector, 5-pin male

Vibration
30 g over 10 Hz to 2 kHz

Shock
50 g for 10 mS 1/2 sinewave pulse

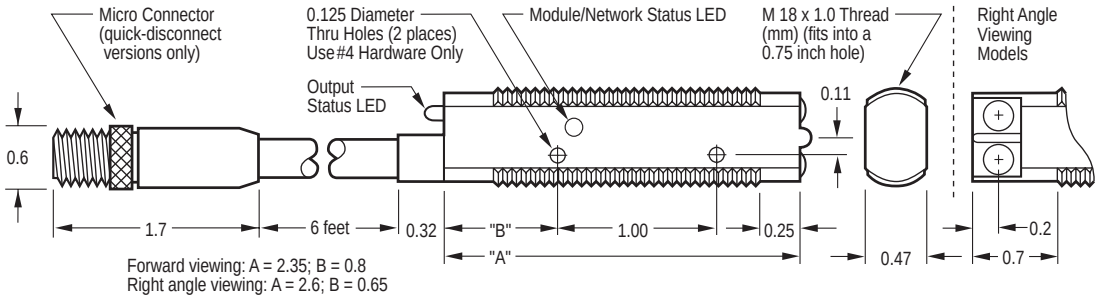
Enclosure Ratings
NEMA 1, 2, 3, 4, 4X, 6, 6P, 12, and 13 (Our products conform to NEMA tests as indicated, however, some severe washdown applications can exceed these NEMA test specifications. If you have questions about a specific application, contact the Photoelectric Applications Department at 1-800-426-9184.)

Approvals
Contact factory for the latest list of agency approvals

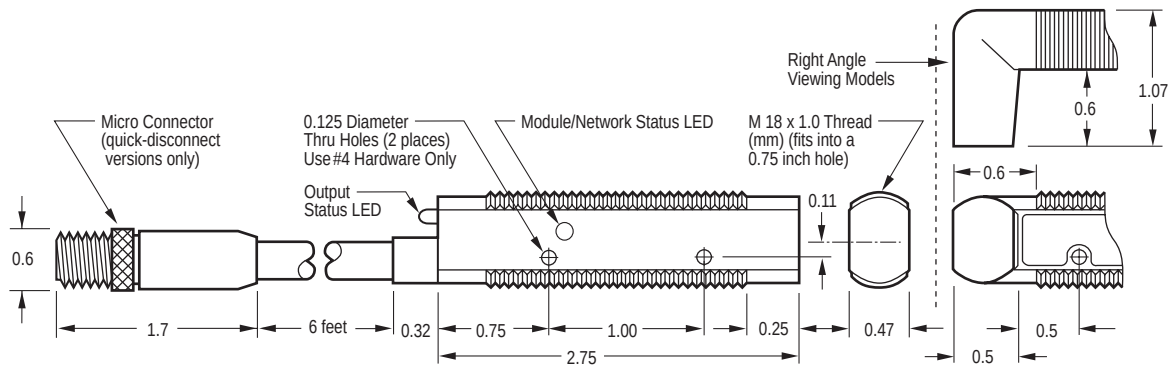
APPROXIMATE DIMENSIONS

(Shown in inches except where noted)

Diffuse Reflective



Reflex



APPENDIX: ELECTRONIC DATA SHEETS (Programming Information)

Connection Object - Class 5 (05_{HEX}), Instance 1 and 3

This device supports Explicit Messaging (Instance 1) and I/O Bit Strobe (Instance 3).

Device Network Object - Class 3 (03_{HEX}), Instance 1

Attribute	Attribute ID	Get/Set
MAC ID (0-63)	1	Get/Set
Baud Rate (fixed at 125K)	2	Get

Use Device Network Object to program MAC ID.

Presence Sensing Object - Class 14 ($0E_{HEX}$), Instance 1

Attribute	Attribute ID	Get/Set
Output (0 or 1)	1	Get
Operate Mode (0=Light Operate, 1=Dark operate)	8	Get/Set
Gain/Sensitivity (0-255)	9	Get/Set

Use Presence Sensing Object to read Output Status (see below). It is also used to set Operate Mode or Gain.

Output Status

Sensing Mode	Operate Mode	Output Value Output=1	Output=0
Diffuse Reflective	Light Operate	Light Detected (Object Detected)	No Light Detected (No object)
	Dark Operate	No Light Detected (No object)	Light Detected (Object Detected)
Reflex	Light Operate	Light Detected (No object)	No Light Detected (Object Detected)
	Dark Operate	No Light Detected (Object Detected)	Light Detected (No object)

As shown in the table above, changing the Operate Mode inverts the Output Values. Diffuse reflective sensors are typically set to Light Operate Mode and Reflex sensors are typically set to Dark Operate Mode.

Assembly Object Data - Class 4 (04_{HEX}), Instance 1

Attribute	Attribute ID	Get/Set
Data	3	Get

Use Assembly Object Data to read diagnostic and Output Status. This data is the same as returned using Bit Strobe Connection. Note: Reading Identity Object Status (Class 1 (01_{HEX}), Attribute 5) clears the diagnostic bit.

Assembly Object Data/Bit Strobe Connection Data

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	0	X	X
----------Not Used----------						--See Below--	

Diagnostic Bit (Bit 1)	Output Bit (Bit 0)	Byte Value
0 (No fault)	0 (Off)	00 (00_{HEX})
0 (No fault)	1 (On)	01 (01_{HEX})
1 (Fault)	0 (Off)	02 (02_{HEX})
1 (Fault)	1 (On)	03 (03_{HEX})

Identity Object - Class 1 (01_{HEX}), Instance 1

Attribute	Attribute ID	Get/Set
Vendor - 68 00 (44 00_{HEX})	1	Get
Device Type - 06 00 (06 00_{HEX})	2	Get
Product Code - 60 00 (3C 00_{HEX})	3	Get
Product Name - see table below	7	Get

Note: A number of other attributes are supported. The above attributes are included to show the unique values associated with this product.

(Appendix continued on next page.)

APPENDIX: ELECTRONIC DATA SHEETS (Continued)

Product Name

Catalog Number	String Length (BYTE 1)	String (BYTES 2-6) Decimal	Hexadecimal	ASCII
14150ADN18	05	80 82 77 48 49	50 52 40 30 31	PRM01
14150RDN18	05	80 82 77 48 50	50 52 40 30 32	PRM02
14150ADN08	05	80 82 77 48 51	50 52 40 30 33	PRM03
14150RDN08	05	80 82 77 48 52	50 52 40 30 34	PRM04
14151ADN18	05	80 82 77 48 53	50 52 40 30 35	PRM05
14151RDN18	05	80 82 77 48 54	50 52 40 30 36	PRM06
14151ADN08	05	80 82 77 48 55	50 52 40 30 37	PRM07
14151RDN08	05	80 82 77 48 56	50 52 40 30 38	PRM08
13150ADN18	05	80 82 77 48 57	50 52 40 30 39	PRM09
13150RDN18	05	80 82 77 49 48	50 52 40 31 30	PRM10
13150ADN08	05	80 82 77 49 49	50 52 40 31 31	PRM11
13150RDN08	05	80 82 77 49 50	50 52 40 31 32	PRM12

Still Need Help?
Contact the Cutler-Hammer DeviceNet Products
Application Engineering Department

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