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Ethernet-DeviceNet™ BridgeWay User Manual

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Preface

Important User Information

The data and illustrations found in this document are not binding. We reserve the right to modify our products in line with our policy of product development. The information in this document is subject to change and should not be considered as a commitment by Pyramid Solutions. Pyramid Solutions assumes no responsibility for errors that may appear in this document

There are many applications of the BridgeWay module. Those responsible for the use of this device must satisfy themselves that all necessary steps have been taken to verify an application meets all performance and safety requirements including any applicable laws, regulations, codes, and standards.

The illustrations and samples in this guide are intended solely for the purpose of example. Pyramid Solutions does not assume responsibility or liability for actual use based upon the examples shown in this publication.

See the *Installation and Operation Requirements* section for important safety and installation details.

Related Documentation

Document Name	Author	Web Page
EtherNet/IP™ Specification	ODVA	www.odva.org
DeviceNet™ Specification	ODVA	www.odva.org
Modbus Application Protocol Specification	Modbus Org	www.modbus.org
Modbus Messaging on TCP/IP Implementation Guide	Modbus Org	www.modbus.org

Table 1. Related Documentation

Licenses and Trademarks

EtherNet/IP™ and DeviceNet™ are trademarks of ODVA.
Modbus is a trademark of Modbus Organization.
Microsoft and Windows are trademarks of Microsoft Corporation.

BridgeWay Module Description

Overview

The Ethernet-DeviceNet BridgeWay enables connection of Information or Control level networks with your Device level network. The BridgeWay provides full DeviceNet Master functionality with connectivity to up to 63 DeviceNet slave devices. Data from DeviceNet slave devices is mapped to I/O Table locations, making it accessible to be read or written by the Ethernet controllers. The BridgeWay operates as an EtherNet/IP Adapter (server), allowing DeviceNet slave data to be transferred to and from an EtherNet/IP Scanner (client) device using I/O or explicit messages. The module also operates as a Modbus TCP slave (server), allowing DeviceNet slave data to be accessed as Modbus registers by a Modbus TCP master (client) controller.

Examples of applications of the Ethernet-DeviceNet BridgeWay:

- A gateway to connect information or control level networks to device level networks for programming, configuration, control, or data collection. (E.g. Modbus/TCP to DeviceNet)

- BridgeWay can provide message router/bridge functionality from EtherNet/IP or Modbus TCP to DeviceNet.

Theory of Operation

The BridgeWay appears as a single device on either network using standard protocol mechanisms. No special, or extended, protocol features are required of the devices on either network to read and write the data flowing through the I/O Table; all cross-network activity is transparent to the devices on either network.

I/O Data to DeviceNet Slaves

The BridgeWay provides centralized data storage, the I/O Table, for data that is shared between DeviceNet slave devices and Ethernet networks. Data is placed into the I/O Table by one network interface, allowing the data to be read by the other network interface.

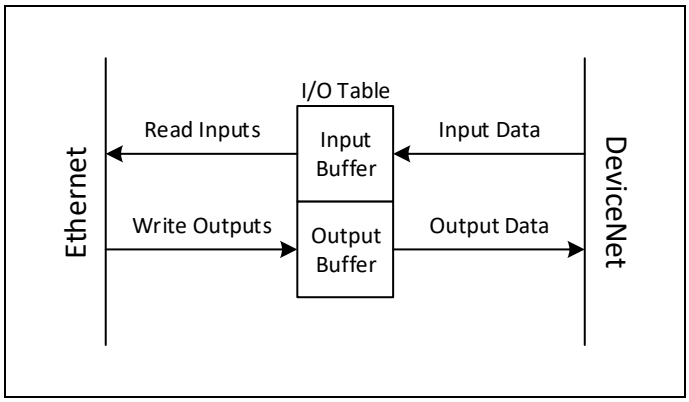


Figure 1. I/O Table Operation

Explicit Message Bridging to DeviceNet

The BridgeWay provides the message bridging from Ethernet to DeviceNet. This is done through the Message Bridge which is has a CIP object interface and a set of Modbus register addresses.

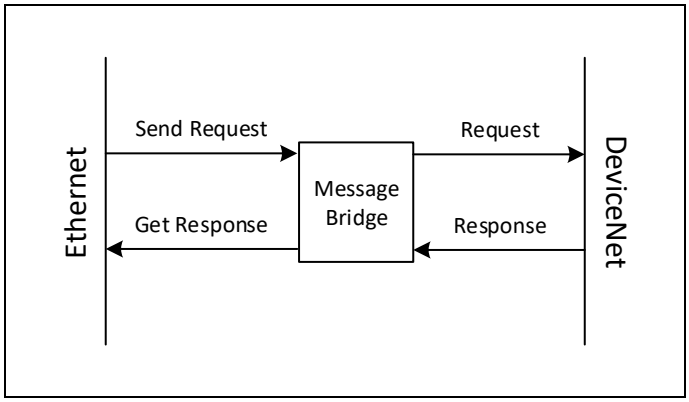


Figure 2. Message Bridging Operation

DeviceNet Features

- DeviceNet Master functionality supporting up to 63 DeviceNet slave devices.
- Support for Explicit Messaging, Bit Strobe, Poll, Change of State (COS), and Cyclic slave connections
- DeviceNet Slave functionality with configurable slave I/O size and connection support.
- Baud rates of 125, 250, and 500 Kbps.
- Configurable automatic baud rate detection option.
- Automatic Address Recovery can be configured to replace a faulted slave device with a replacement device at the same MAC ID.
- Configuration Recovery can be configured for slave devices so that a newly replaced slave can be configured to the same settings of the device it replaces. Combined with Automatic Address Recovery this feature is known as Automatic Device Recovery (ADR).
- Transfers 496 bytes DeviceNet slave input data and 492 bytes DeviceNet slave output data.
- Support for DeviceNet Quick Connect.
- Configurable input safe state mode determines the state of slave input data when a slave's I/O connection times out.
- Optional Active Node List maintains a current list of the devices on the DeviceNet network for faster bridging functionality.
- Automatic scan list generation can be used to quickly create default I/O connections to all DeviceNet slave devices on the network.

Ethernet Features

1. Supports the EtherNet/IP protocol, Adapter Class with I/O Server, Message Server, and CIP Message Routing.

2. Supports the Modbus TCP protocol with up to 4 simultaneous connections. Conforms to the Modbus TCP specification 1.0.

3. Support for either static IP address or DHCP.

4. Supports IP address conflict detection conforming to RFC 5227 and the ODVA EtherNet/IP specification.

5. Network speed may be configured to 10Mbsps, 100Mbps or auto-negotiated. Duplex may be configured to half, full or auto-negotiated.

6. EtherNet/IP and Modbus TCP may be supported simultaneously or either protocol may be disabled to meet system requirements.

7. HTTP Web server provides information on the current status and configuration of the module.

System Requirements

The following hardware and software components are needed to use the Ethernet-DeviceNet BridgeWay.

Required Hardware

1. BridgeWay module.
2. DeviceNet network and network power connection.
3. Ethernet cabling.
4. EtherNet/IP or Modbus TCP Controller or Client with access to the Ethernet network.
5. 24 VDC power connection
6. PC with USB port to execute BridgeWay Configuration Tool (BWConfig) and DeviceNet configuration tool (RSNetworx).
7. Micro USB cable to connect PC running BWConfig to the BridgeWay.

Optional Hardware

1. DIN rail to mount the BridgeWay.

Required Software

1. BridgeWay Configuration Tool software (BWConfig) to configure the BridgeWay.
2. DeviceNet configuration software such as RSNetworx for DeviceNet. **Note:** RSNetworx v7.0 or later is required to support the full 128K of ADR configuration data; earlier versions support up to 64K.
3. BWConfig requires that the PC be running Microsoft Windows 7 or higher.
4. EDS file, BW4031.eds, downloadable from the Pyramid Solutions web site.

Installation

Installation and Operation Requirements

Power, input, and output (I/O) wiring must be in accordance with Class 1, Division 2 wiring methods - article 501-4(b) of the National Electric Code, NFPA 70 and in accordance with local codes.

Field wiring terminal markings (wire type (Cu only, 14-30 AWG (0.2546-1.63mm)).

Terminal tightening torque must be between 5-7 lb-in (0.5-0.8 Nm).

For use in Class 2 circuits only.

Suitable for surrounding temperature of 70 degrees C maximum, -25 degrees C minimum.

Use 105 °C copper (Cu) wire only.

Use Copper Conductors Only.

Special conditions for safe use

Use in Overvoltage Category I Pollution Degree 2 Environment conforming to EN 60664-1.

This equipment shall be installed in an enclosure that provides a degree of protection not less than IP54 in accordance with EN 60079-15.

The enclosure must have a door or cover accessible only by the use of a tool.

The equipment must be installed with a transient suppressor on the supply that does not exceed 140% (33.6 V DC) of the nominal rated supply voltage.

	**FAIL-SAFE OR CRITICAL OPERATIONS** This product is not designed, intended, authorized, or warranted to be suitable for use or resale as control equipment in, or for other applications related to, hazardous or potentially-hazardous environments or applications requiring high-availability or fail- safe performance, such as in the operation of nuclear facilities, aircraft navigation or communications systems, air traffic control, life support, public works, weapons systems, or any other application in which the failure of a product could lead to property damage, death, personal injury, or environmental damage.

	**EXPLOSION HAZARD** Substitution of components may impair suitability for class 1, Division 2.

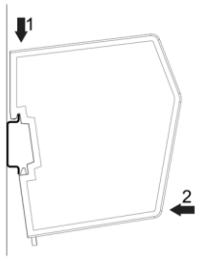
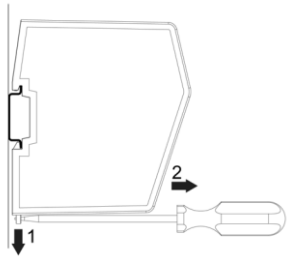
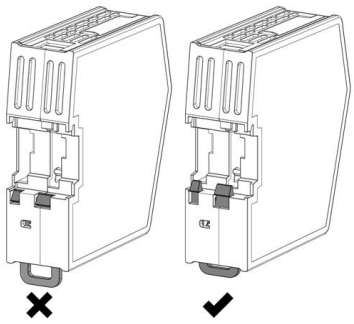
	**EXPLOSION HAZARD** When in hazardous locations turn off power before replacing or wiring modules.

	**EXPLOSION HAZARD** Do not disconnect equipment unless power has been switched off or the area is known to be nonhazardous.

Mounting

The BridgeWay can be physically mounted onto a DIN rail or, if installed in areas exposed to vibration, on a wall for more stability.

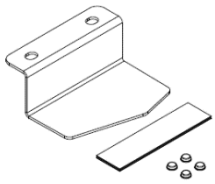
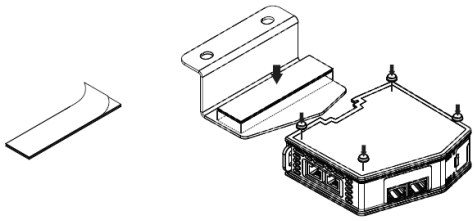
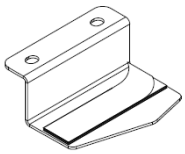
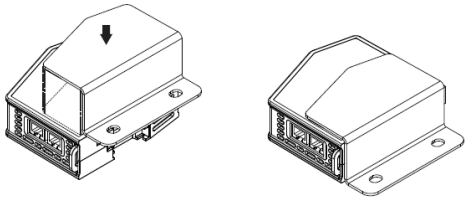
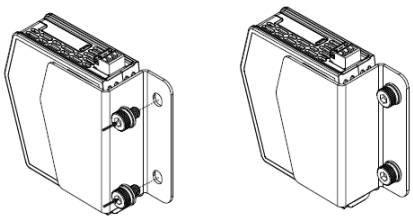
DIN Rail Mounting

	To mount the BridgeWay: Make sure the DIN rail locking tab on the back of the module is in the closed position, i.e. pushed all the way up. Hook the module on the DIN rail. (1) Push the module against the DIN rail to make it snap on. (2)
	To Unmount the BridgeWay: Use a screwdriver to pull the DIN rail locking tab on the back of the module to the open position, i.e. pulled all the way down. (1) Unhook the module from the DIN rail. (2)
	**NOTE:** Do not leave the module with the DIN rail locking tab in the open position. This may eventually wear the mechanism out so that it cannot be used efficiently. Be sure to push the locking tab back into the closed position after unmounting the module.

Wall Mounting

The wall mount option may be used if the BridgeWay is to be placed in an environment exposed to vibration. Wall mounting offers more stability than the traditional DIN rail mounting.

NOTE: The Bridgeway should be mounted in a standing-up position to ensure constant air flow.
NOTE: When the BridgeWay is wall mounted, the Ground connection must be made via the power connector.

	The wall mounting accessory package should contain: - Metal frame - Industrial Velcro - (4) plastic vibration dampers
	Remove the plastic adhesive protection from one side of the Velcro and attach the Velcro to the metal frame. Attach the four vibration dampers to the BridgeWay on the side that will face the wall.
	Remove the plastic adhesive protection from the other side of the Velcro.
	Turn the BridgeWay over so that the vibration dampers are facing down. Fasten the metal frame to the BridgeWay by pressing the frame firmly against the module to attach the Velcro to the BridgeWay.
	Attach the metal frame and the BridgeWay to the wall using screws and washers (not included).

Power and Network Connections

The locations of the connectors are shown in the figure below.

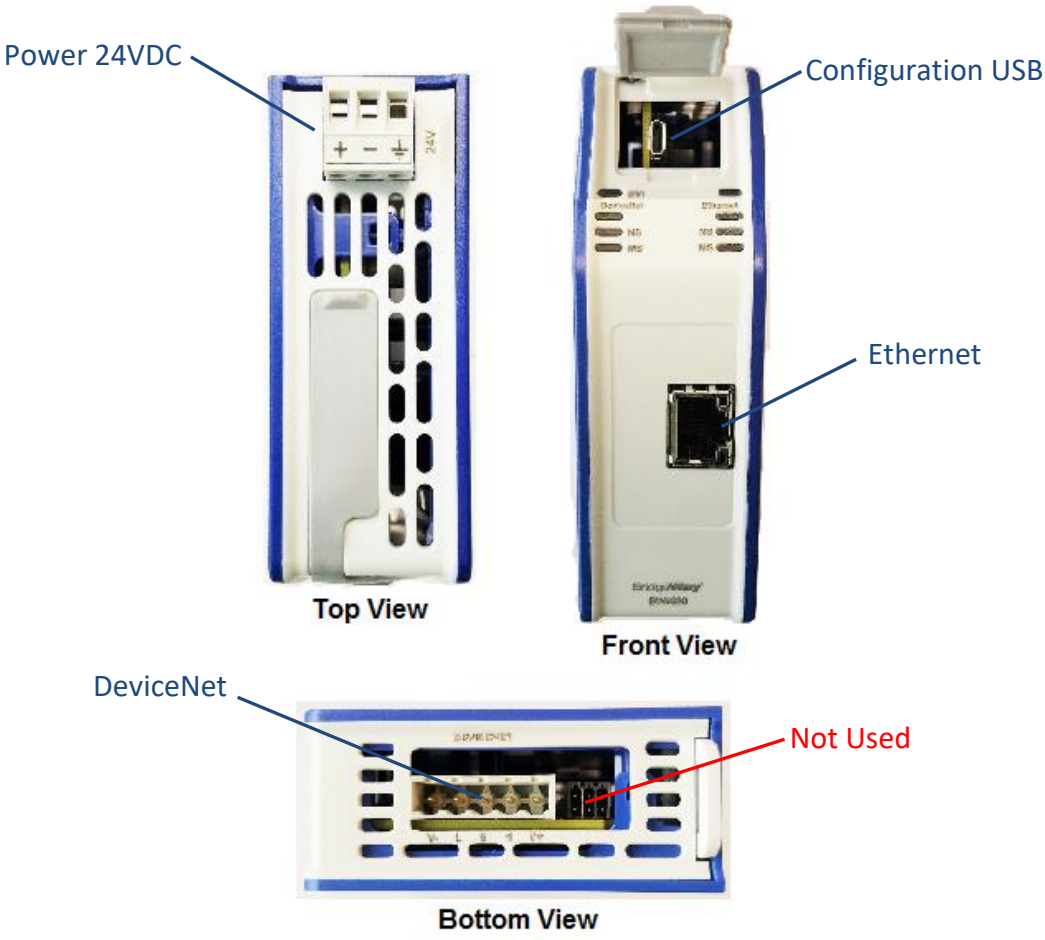


Figure 3. Connector Locations

Connecting Power

The BridgeWay requires 24 volts DC power on the 3-position terminal block connector on the top of the module.

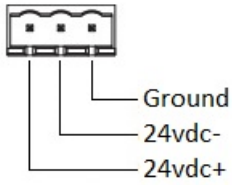


Figure 4. Power Connector

Connecting DeviceNet

DeviceNet is connected to the 5-position terminal block connector on the bottom of the module.

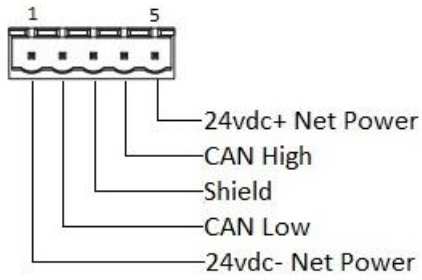


Figure 5. DeviceNet Connector

The CAN High and Low signal lines should be connected to the CAN High and Low connections respectively on all devices on the network. The signal lines should not be swapped on any device connections.

The BridgeWay module does not provide CAN network termination internally. Any termination required by the network (120 ohm) must be added during installation.

See the DeviceNet Specification for specific rules on DeviceNet network connections and termination.

Connecting to Ethernet

The Ethernet connection uses a standard RJ45 connector. The Ethernet socket is on the front of the module.

Configuration Port Connector

The Configuration Tool utilizes USB for communications with the BridgeWay. A USB cable with a Micro-B connector is required to connect to the module. The USB connector is located under the rubber flap on the front of the module; lift the flap for access to the connector.

Configuration

This chapter describes how the Ethernet-DeviceNet BridgeWay is configured. Configuration is done with a combination of the BridgeWay Configuration Tool (BWConfig) and a DeviceNet network configuration tool such as RSNetworx. This chapter will discuss the details of both of the above configurations.

The next chapter walks the reader through the steps to quickly configure the BridgeWay for a simple configuration.

Starting BridgeWay Configuration Tool (BWConfig)

The BridgeWay Configuration Tool allows you to configure the parameters associated with the Ethernet and DeviceNet network interfaces.

BWConfig is a Microsoft Windows application that communicates with a BridgeWay over a USB connection. BWConfig is compatible with Microsoft Windows 7 and later.

Installing the Tool

Install BWConfig by running *InstallBWConfig.exe* which can be downloaded from the Pyramid Solutions web site.

Connecting to the BridgeWay Module

Connect the PC running BWConfig to the BridgeWay module using a standard USB-to-Micro-USB cable between the PC USB port Micro-USB connector on the module. It does not matter which PC USB port you use, BWConfig will scan each available port and detect the connection automatically.

Starting the Tool

Launch the BridgeWay Configuration Tool from the *Pyramid Solutions → BWConfig* folder in the Windows Start Menu (Windows 7) or App list (Windows 8/10). It can also be run from the BridgeWay Configuration Tool Desktop shortcut.

When BWConfig is started, it will attempt to locate a BridgeWay module attached to the PC's USB port. If a module is detected, the Connection Status icon will show a green circle with a chain link.

If a module is not connected to the PC or is powered off when the tool is started, the Connection Status icon will show a yellow circle with a broken chain. Make sure that the module is powered and the USB cable is connected. BWConfig will automatically detect the module. If the BridgeWay is not detected, disconnect the USB cable from the PC, wait 15 seconds, then reconnect the cable. The module should be detected within a few seconds.

BWConfig User Interface

Main View

When BWConfig is run, the user is presented with the main view. The main view is divided into seven different areas, as shown in the figure below. Those areas are

1. Menu
2. View Selector
3. Billboard
4. View Area
5. Event Log Pane
6. Title Bar
7. Connection Status Icon

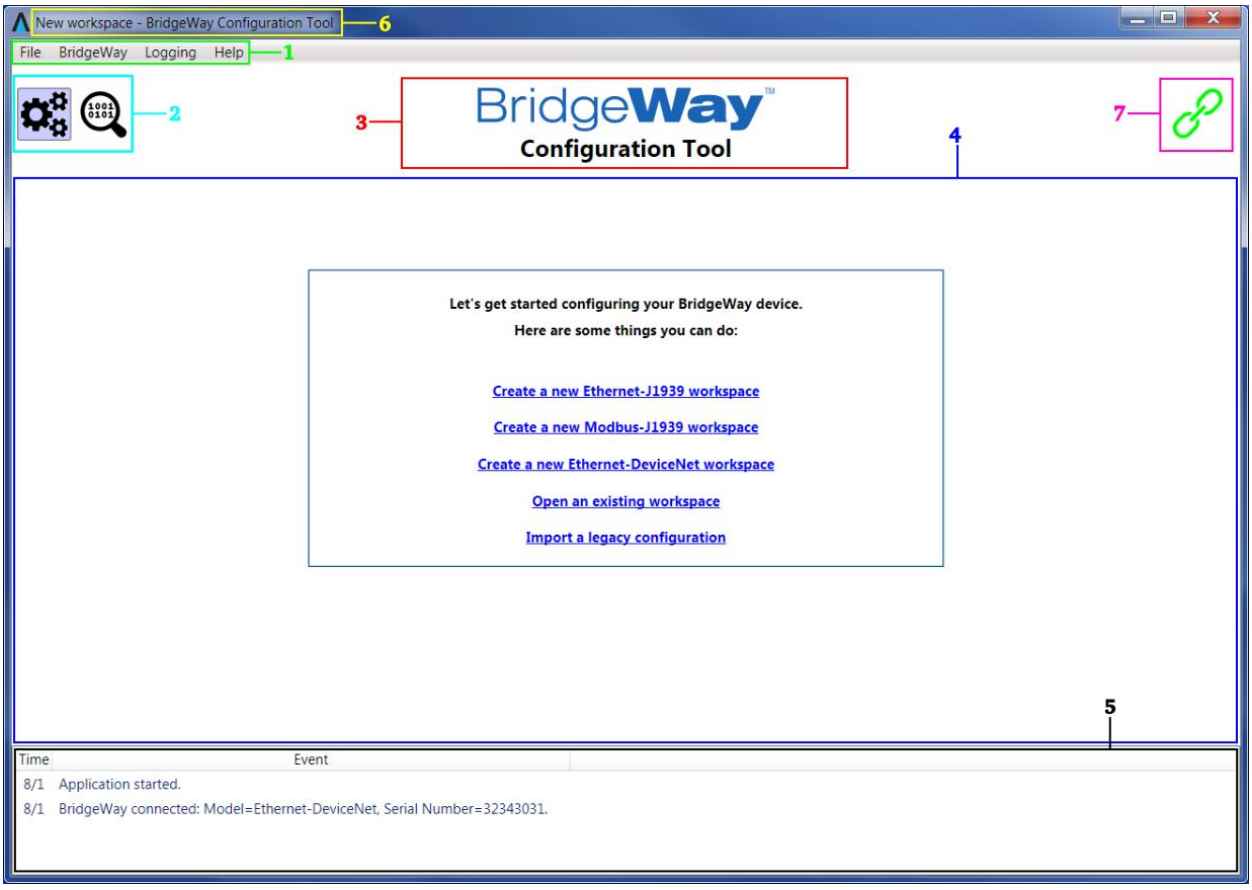


Figure 6. BWConfig Main View

Menus

File Menu

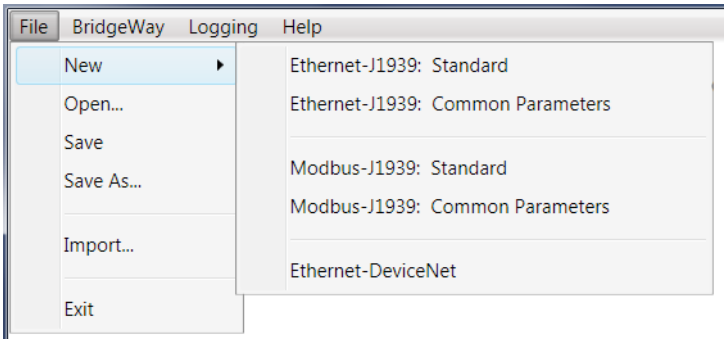


Figure 7, BWConfig File Menu

New	Creates a new workspace. The type of BridgeWay is selected in the submenu. This will create a new configuration for the specified module type with default configuration values.
Open…	Loads a previously saved workspace from a file with a .BWNXG extension. If the current workspace has unsaved changes, the user is given the option to save the changes before the new one is loaded.
Save	Saves the current workspace to a file. The current file name is shown in the title bar. If the current workspace is unnamed, a Save As runs instead.
Save As…	Asks the user for a file name, and then saves the current workspace to that file.
Import…	Creates a workspace from a legacy BridgeWay configuration file.
Exit	Exits BWConfig. If the current workspace has unsaved changes, the user is given the option of saving the changes before the tool is closed.

BridgeWay Menu

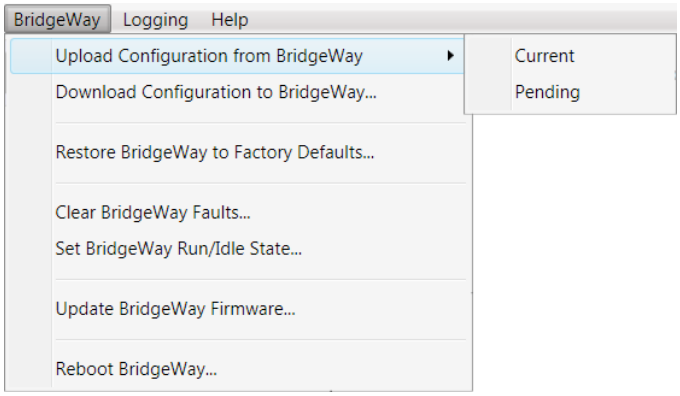


Figure 8. BWConfig BridgeWay Menu

Upload Configuration from BridgeWay → Current…	Reads the current configuration running in the connected BridgeWay and creates a new workspace using those values.
Upload Configuration from BridgeWay → Pending…	Reads the pending configuration from the connected BridgeWay and creates a new workspace using those values.
Download Configuration to BridgeWay…	Writes the current workspace settings to the pending configuration of the connected BridgeWay. The module must be rebooted in order for any changes to the pending configuration to take effect.
Restore BridgeWay to Factory Defaults…	Sets the pending configuration in the connected BridgeWay to the default settings. The module must be rebooted in order for the default settings to take effect.
Clear BridgeWay Faults…	Clears any sticky faults in the connected BridgeWay and resets protocol counters.
Set BridgeWay Run/Idle State…	Switches the connected BridgeWay between Run and Idle mode.
Update BridgeWay Firmware…	Writes new firmware to the connected BridgeWay.
Reboot BridgeWay	Reboots the connected BridgeWay.

Logging Menu

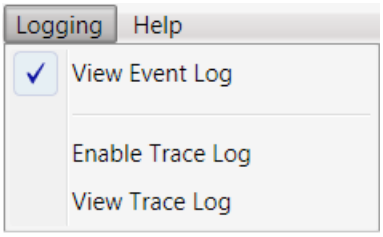


Figure 9. BWConfig Logging Menu

View Event Log	Shows/hides the Event Log Pane.
Enable Trace Log	Enables/disables diagnostic trace logging.
View Trace Log	Displays the Trace Log window.

Note: Trace logging provides information about BWConfig operations and USB communications and may be used by Pyramid Solutions Technical Support to diagnose an issue.

Help Menu

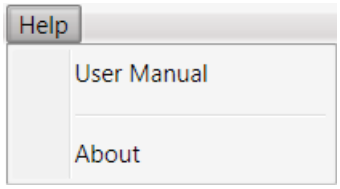


Figure 10. BWConfig Help Menu

User Manual	Displays the user manual associated with the current BridgeWay type.
About	Displays information about BWConfig.

View Selector

The view selector chooses which of the current workspace's views will be displayed in the View Area -- Configuration View or Status View.

Selecting the Gear icon will display the Configuration View.
Selecting the Bits icon will display the Status View.

View Area

The current workspace's Configuration and Status views are displayed in the View area. The View Selector chooses which view is visible.

Billboard

The Billboard area indicates the current view displayed and the BridgeWay type.

Event Log Pane

The Event Log Pane displays a list of events that have occurred since the BWConfig tool was started. These events include items such as errors, BridgeWay USB connections, loading and saving workspaces, importing configurations, etc.

The contents of the event log can be copied to the Windows clipboard to aid Technical Support in troubleshooting issues.

Title Bar

The Title Bar displays the name of the current workspace.

If a new workspace has not been saved, the Title Bar will display "New Workspace".

If the workspace has unsaved changes in the configuration data, the name will be followed by an asterisk (*).

Connection Status Icon

The connection status shows the current state of the BridgeWay USB communications.

Connected	
Disconnected	

Working with BridgeWay Configurations

Current and Pending

The BridgeWay module holds 2 sets of configuration settings, the Current configuration, and the Pending configuration.

The Current configuration is the configuration settings that the module is currently using. The Current configuration is loaded from flash memory when the BridgeWay is powered up. Changes made to the configuration in BWConfig do not affect the Current configuration.

The Pending configuration is the configuration settings that are stored flash memory on the module. The Pending configuration holds any changes that have been made in BWConfig.

Uploading and Downloading

When a configuration is Uploaded, the settings are read from the BridgeWay module into the current BWConfig workspace. Either the Current or Pending configuration may be uploaded, allowing the workspace to be loaded with settings that are currently running or stored in flash respectively.

When a configuration is Downloaded, the settings in the current BWConfig workspace are written to the BridgeWay module. A downloaded configuration is always written to the Pending configuration stored in flash. Downloaded configuration changes require a module reset to take effect.

New Configuration Workspaces

A new configuration workspace is created using the *File → New…* menu command. New workspaces are filled with factory default settings for the type of BridgeWay being configured.

Factory Default Configuration

The BridgeWay may have its configuration reset to factory default settings. This is done through the *BridgeWay → Restore BridgeWay to Factory Defaults…* menu command in BWConfig. Factory default configuration settings are written to the Pending configuration. The module must be reset for the updated configuration to take effect.

Ethernet Network Configuration

The Ethernet network configuration is viewed and updated in the Interfaces tab of the Configuration view.

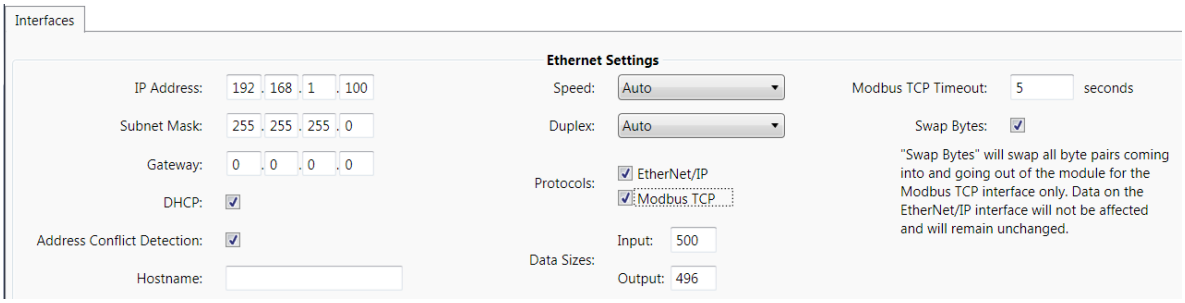


Figure 11. BWConfig Ethernet Network Configuration View

Parameter	Description	Range	Default
IP Address	The IP address the module will use. If DHCP is enabled this address is ignored.	Valid IP address	192.168.1.100
Subnet Mask	The subnet mask the module will use. If DHCP is enabled this mask is ignored.	Valid IP subnet mask	255.255.255.0
Gateway	The IP address of the network gateway. If DHCP is enabled this address is ignored. If no gateway is used on the network this may be set to 0.0.0.0.	Valid IP address or 0.0.0.0	0.0.0.0
DHCP	DHCP is enabled if checked. If checked, the module will receive its IP configuration from a DHCP server on the network. If not checked, the module will use the IP configuration set here.	Enabled Disabled	Enabled

Parameter	Description	Range	Default
Address Conflict Detection	ACD is enabled if checked. If checked, the module will check for, and defend against IP address conflicts as specified in the EtherNet/IP Specification Appendix F. If not checked, the module will send a single gratuitous ARP for an IP address claim.	Enabled Disabled	Enabled
Hostname	Ethernet IP hostname	Up to 64 characters may include letters, numbers and '-'.	Empty
Speed	Ethernet network speed. If set to 'Auto' the module will auto negotiate speed.	Auto 10Mbps 100Mbps	Auto
Duplex	Ethernet network duplex. If set to 'Auto' the module will auto negotiate duplex.	Auto Half Full	Auto
Protocols	Select the Ethernet protocols that are active. **Note:** Unless the application requires both protocols, it is recommended not to enable both to reduce the number of open Ethernet ports for security reasons.	Either or both protocols	EtherNet/IP

Parameter	Description	Range	Default
Data Sizes	The size in bytes of the I/O Table. Some EtherNet/IP devices only support smaller I/O connections. Recommended input and output sizes for some devices are listed below: ControlLogix 500/496 SLC 5/05 248/244 MicroLogix 252/248	In: 4–500 Out: 4–496	In: 500 Out: 496
Modbus Timeout	The Modbus Timeout option provides a means to detect the loss of the Modbus Scanner communications. If no Modbus requests are received within the configured timeout period, the module Run/Idle mode will be set to Idle. This parameter is only available if the Modbus protocol is enabled.	1 – 65535	5
Swap Bytes	Modbus I/O byte swapping is enabled if checked. Enabling byte swapping will cause the Modbus I/O data to be swapped on 16-bit word boundaries when transferred between Modbus and DeviceNet. This is useful since Modbus is a Big-Endian network. This parameter is only available if the Modbus protocol is enabled. **Note:** Byte swapping has no effect on EtherNet/IP I/O data.	Enabled Disabled	Enabled

Table 2. Ethernet Network Configuration Parameters

DeviceNet Network Configuration

The DeviceNet network configuration is viewed and updated in the Interfaces tab of the Configuration view below the Ethernet network settings.

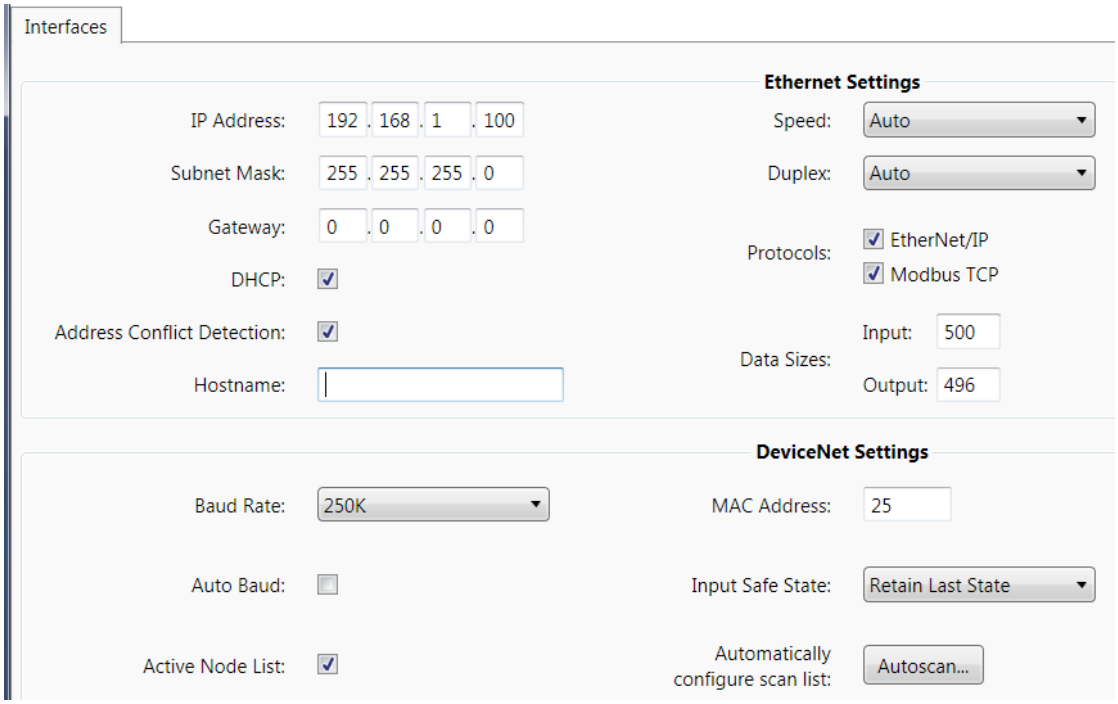


Figure 12. BWConfig DeviceNet Network Configuration View

Parameter	Description	Range	Default
Baud Rate	The CAN network baud rate to be used for DeviceNet communications.	125K 250K 500K	125K
MAC Address	The network address the BridgeWay will use on the DeviceNet network.	0 – 63	63
Auto Baud	Automatic baud rate detection is enabled when checked. **Note:** If the BridgeWay is the primary master on the DeviceNet network, do not enable automatic baud rate detection.	Enabled Disabled	Disabled

Parameter	Description	Range	Default
Active Node List	Active node list option is enabled when checked. See the *Active Node List* section for details.	Enabled Disabled	Enabled
Input Safe State	Defines the state of data in the input table associated with a DeviceNet slave when the connection times out. Setting the safe state to “Retain Last State” will cause the slave’s data to freeze at the last value received from the slave. Setting the value to “Zero Data” will cause all input data associated with the slave to be set to zero. The “Set Values to -1” setting will cause all input data to be set to 0xFF.	Retain 0 -1	Retain
Autoscan	The Autoscan button will launch the Automatic Scan List Generation dialog. See the *I/O Table Configuration Using Autoscan* section for details.		

Table 3. DeviceNet Network Configuration Parameters

Setting DeviceNet Network Configuration with Node Commissioning Tools

The DeviceNet network configuration may also be set using a DeviceNet node commissioning tool like RSNetworx. The parameters discussed above may be set through the parameter editing function of these tools. See *DeviceNet Configuration with RSNetworx* section for details on setting the DeviceNet network configuration using these tools.

I/O Table Configuration

The I/O Table configuration is used define the content and format of the input and output buffers of the I/O Table. Data that is transferred in and out of DeviceNet slave data is mapped to locations within the I/O Table.

Inputs Versus Outputs

The input buffer of the I/O Table holds data that is received from DeviceNet slaves and can be read on the Ethernet network.

The Output buffer of the I/O Table holds data that is received from the Ethernet network and is to be sent to DeviceNet slaves.

I/O Configuration Limits

The I/O configuration is limited as follows:

- The maximum Input buffer size is 500 bytes. It includes the 32-bit Status Register so actual DeviceNet slave input data size is limited to 496 bytes.
- The maximum Output buffer size is 496 bytes. It includes the 32-bit Command Register so actual DeviceNet slave output data size is limited to 492 bytes.

I/O Table Configuration using DeviceNet Configuration Tools

The layout of the I/O Table may be configured using a DeviceNet configuration tool. This approach provides the most flexibility and control over the I/O Table layout and content as compared to the Autoscan feature.

This manual is not intended to replace the user manual for the configuration tool; hence it will not provide details on using the tool.

The next chapter provides an overview of the use of Rockwell Software's RSNetWorx for DeviceNet.

I/O Table Configuration Using Autoscan

The Autoscan feature allows a the DeviceNet master scan list and I/O Table layout to be automatically generated based on the DeviceNet slaves that are active on the network. The DeviceNet Autoscan dialog is displayed when the Autoscan button is pressed in the DeviceNet Network configuration pane of BWConfig.

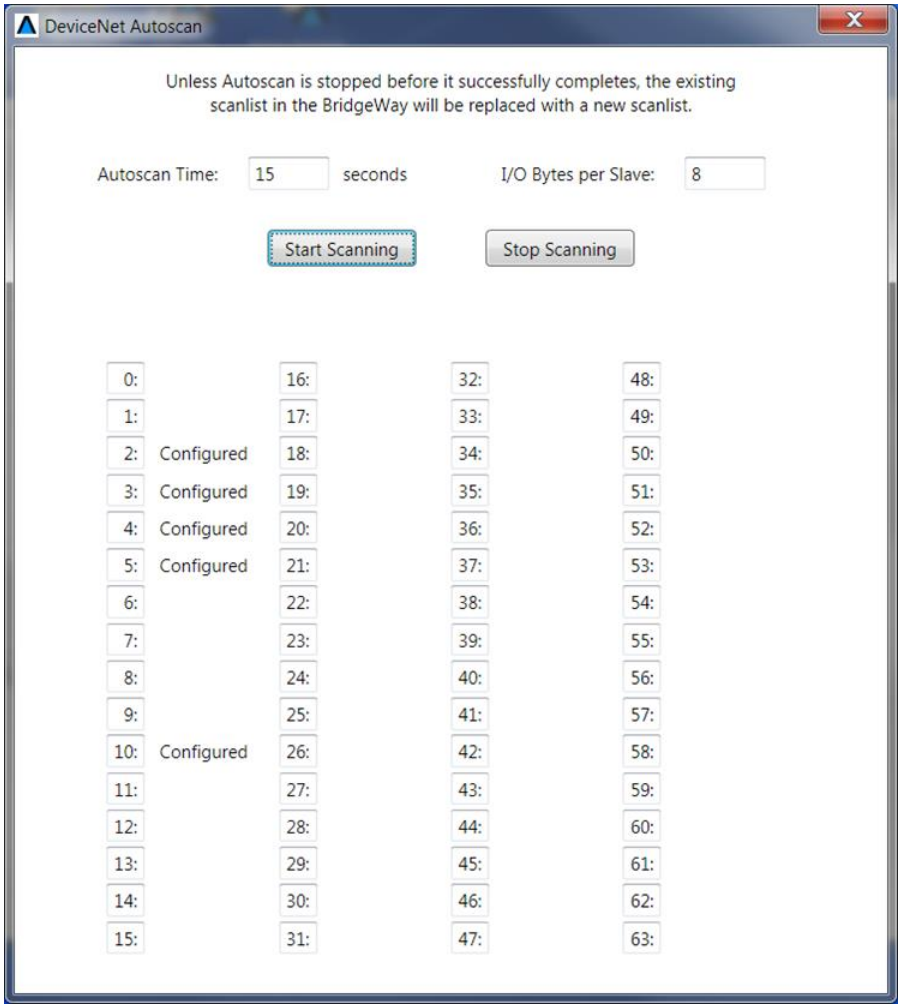


Figure 13. BWConfig DeviceNet Autoscan Dialog

Running Autoscan

Starting Autoscan:

1. Set the Autoscan Time, which is the amount of time the BridgeWay will search for DeviceNet slaves to configure.
2. Set the Bytes per Slave, which is the amount of space allocated in the Input or Output buffer for each slave.
3. Press the Start Scanning button.

Autoscan in progress:

4. Status area beneath the Start/Stop buttons will display the current status.
5. As DeviceNet slaves are found on the network, the status area next to each MAC address will display “Discovered”, then “Configuring”, then “Configured”

When Autoscan is completed the status area will be blank and each DeviceNet slave that was successfully added to the configuration will read “Configured”.

I/O Table Layout after Autoscan

Autoscan configures the I/O Table layout based on the Bytes per Slave configuration. Each slave (MAC ID’s 0-62) is allocated Bytes per Slave bytes in the Input or Output buffer, up till the end of the buffer.

Slave Data Location = BytesPerSlave x MAC_ID

For example, if Bytes per Slave is set to 8. Data for slave 0 is at offset 0, and for slave 10 is at offset 80.

Only slave entries that fit in the configured I/O Table size will be configured. If the BytesPerSlave x MAC_ID is larger than the Input or Output Sizes configured in the Ethernet network configuration, that slave will not be added to the configuration.

Note: If a slave’s I/O connection size is larger than the configured Bytes per Slave, only the first Bytes per Slave bytes of the connection data will be mapped into the I/O Table.

Note: Non-existent slaves take up space in the I/O Table. If your DeviceNet network is configured with MAC addresses that are spread out, there will be a lot of wasted space in the I/O Table.

I/O Connections Created by Autoscan

Each DeviceNet slave that is discovered during Autoscan is interrogated to determine what Predefined Connection Set connections are supported. The BridgeWay allocates a single I/O from the connections set using the following priority:

1. Change of State
2. Polled
3. Strobe
4. Cyclic

Once a connection type is found, that is what is used for the configuration regardless of what other connection types may be supported by the slave.

Quick Start

This chapter provides a step by step explanation of configuration of the Ethernet-DeviceNet BridgeWay. It is intended to be used as a beginner's guide to configuring and using the BridgeWay using RSNetWorx for DeviceNet.

Ethernet Network Configuration

See the *Ethernet Network Configuration* section for details on the configuration parameters for the Ethernet network interface that can be set in BWConfig.

DeviceNet Network Configuration

The configuration of the DeviceNet network interface involves using a tool to set at least the BridgeWay's MAC ID and baud rate. This may be done via BWConfig or through a DeviceNet commissioning tool.

Note: The BridgeWay defaults to 125K baud out of the box. If your DeviceNet network is not running at 125K baud, the BridgeWay must configured before connecting it to the network. Do not attempt to commission the BridgeWay on a live DeviceNet network configured at a different baud rate.

DeviceNet Configuration with BWConfig

See the *DeviceNet Network Configuration* section for details on the configuration parameters for the DeviceNet network interface that can be set in BWConfig.

If BWConfig is used for DeviceNet node commissioning, skip to DeviceNet I/O Configuration below.

DeviceNet Configuration with RSNetworx

This section provides a walk-through of how to set the DeviceNet network configuration parameters using RSNetworx for DeviceNet.

Note: The procedure below uses the BridgeWay Ethernet bridging which allows the PC running RSNetworx to communicate with the BridgeWay over Ethernet. The module may also be configured from DeviceNet if the PC has a DeviceNet network interface.

Step 1: Connect the PC and BridgeWay to the Ethernet network

Make sure that the BridgeWay and the PC running RSNetworx are connected to the same Ethernet network with the same subnet configuration. The BridgeWay does not need to be connected to a DeviceNet network.

Step 2: Set up RSLinx EtherNet/IP driver

If the RS Tools have not been set up to communicate on Ethernet, the following steps must be done.

1. Open RSLinx
2. Select Communications → Configure Drivers…
3. Pull down the *Available Drivers* combo box and select *EtherNet/IP Driver*
4. Press Add New…
5. Select the appropriate PC Ethernet network interface
   A new driver entry should be added to the list
6. Close RSLinx

Step 3: Register the BridgeWay EDS file

RSNetWorx requires an electronic data sheet (EDS) to recognize a device and its capabilities. An EDS file is available on the Pyramid Solutions web site. The EDS file must be registered with RSNetWorx before configuration can continue.

1. Open RSNetworx
2. Select the Tools → EDS Wizard…
3. Click on *Next*.
4. Select Register an EDS File and click Next.
5. Select *Register a Single File* and enter, or browse to, the location of the EDS file for BridgeWay.
6. Click *Next* or *Finish* for the remaining option screens.

Step 4: Connect to the BridgeWay with RSNetworx

RSNetWorx provides the ability to browse the network to locate and identify devices.

1. Select the Network → Online
2. Expand the EtherNet/IP driver that was added above
   The BridgeWay should appear in the list of connected devices
3. Expand the BridgeWay tree entry
   DeviceNet network entry should appear below the BridgeWay
4. Select the DeviceNet entry and press OK.
5. Press *OK* to the upload/download notice
   RSNetworx will upload the configuration and display the network devices.
   The BridgeWay module should appear at its configured DeviceNet MAC address.

Step 5: Set the DeviceNet MAC ID and Baud Rate with RSNetworx

1. Select the Tools → Node Commissioning
2. Click Browse
3. Expand the EtherNet/IP driver that was added above
   The BridgeWay should appear in the list of connected devices
4. Expand the BridgeWay tree entry
   DeviceNet network entry should appear below the BridgeWay
5. Select the DeviceNet entry
   The connected devices will appear in the right pane
6. Double click on the BridgeWay icon in the right pane
   The *Node Commissioning* dialog *MAC* and *Baud Rate* entries will be filled with the current BridgeWay settings
7. Enter the desired *MAC* address and/or *Baud Rate*
8. Click *Apply*

Note: The BridgeWay will automatically reset if a new MAC ID is entered. If only the baud rate is changed the BridgeWay must be power cycled before the new baud rate will take effect.

Note: When the MAC ID is changed, any BridgeWay I/O configuration is cleared.

I/O Table Configuration

I/O Table configuration involves setting the DeviceNet master scan list and I/O Table mapping. This may be done through a DeviceNet network configuration tool like RSNetworx for DeviceNet, or with the Autoscan feature.

Using Autoscan

The BridgeWay Autoscan feature will generate a scan list and I/O Table mapping based on the active nodes on the DeviceNet network. See *I/O Table Configuration Using Autoscan* for complete details of the feature.

Using RSNetworx

Note: The steps below assume that the RSLinx EtherNet/IP driver is set up and that RSNetworx is successfully connected to the BridgeWay. Follow the steps 1-4 in *DeviceNet Configuration with RSNetworx* to accomplish this.

1. Select Network → Browse Single Scan
   Wait for browsing to complete

2. Select Network → Upload
   Wait device configuration to be uploaded from the devices

3. Double click on the BridgeWay icon
   The module description dialog is displayed

4. Select the *Scanlist* tab in the dialog
   The tab displays 2 columns. The left column is a list of available devices; these are slaves that may be added to the scan list. The right column is the scan list configuration; these are slaves that are configured in the scan list.

5. Check the *AutoMap on Add* check box
   If AutoMap is enabled, RSNetworx will automatically map the slave I/O data into the I/O Table. If it is disabled the mapping of each slave's data must be done manually.

6. Select the desired slave(s) from the available devices column. Click the ">" button to move them to the scan list.

7. Select the *Input* tab in the dialog
   The Input tab is divided into 2 panes. The top pane gives a list of the slaves in the scan list. The bottom pane shows the layout of the Input buffer, indicating the location that each slave's input data will be placed. This is the format of the input data that will be sent to the Ethernet controller.

8. Select the *Output* tab in the dialog

   The Output tab is divided into 2 panes. The top pane gives a list of the slaves in the scan list. The bottom pane shows the layout of the Output buffer, indicating the location that each slave's output data will be placed. This is the format of the output data that will be received from the Ethernet controller.

9. Click *Apply*, then *Yes* to download the scan list configuration to the BridgeWay.

   The BridgeWay creates connections and starts scanning DeviceNet slaves as soon as the scan list is downloaded.

Note: Automap is used in this example for simplicity. In some cases, the user may wish to organize the I/O data in other ways; this can be done using the *Advanced* data table editor in the Input and Output tabs. See the RSNetWorx manual for complete details.

EtherNet/IP Interface

EtherNet/IP is based on the Common Industrial Protocol (CIP), which is also the application layer for DeviceNet and ControlNet, to exchange data between nodes.

Product Features

The BridgeWay supports EtherNet/IP Adapter Class functionality. Being an I/O Server it can respond to requests for I/O messages but it does not generate such requests. The BridgeWay supports Message Server functionality. This means it can act as a target for explicit messaging.

CIP Objects

CIP makes use of abstract object modeling to describe the communications interface of a product. Objects are well defined subsets of a device's functionality. They have functions that they perform called Services and data variables called Attributes. If more than one copy of an object is needed each copy is called an Instance. The BridgeWay supports the objects required by the EtherNet/IP specification.

CIP Messaging

The regular or repeated transport of a specific set of data items is known as Implicit Messaging. Both parties agree in advance and allocate resources for the connection being used to transport the data as well as the transport rate and class. The connection ID within the Implicit message defines the meaning of the data. The term Implicit Messaging can be interchanged with the term I/O Messaging.

A one-time transport of a data item where both parties do not know in advance what's being transferred is known as Explicit Messaging. Explicit messaging is used for point to point, or request/response type messaging. The protocol of the message data describes (addresses) the data to be transferred. In object modeling the address is in terms of class number, instance number, and attribute number.

Messages can be sent as Connected or Unconnected. With Connected Messaging device resources are reserved for data transfer and are dedicated and always available. Unconnected messaging provides a means for a device to send a request without establishing a connection prior to data transfer. This is accomplished through the UCMM or Unconnected Message Manager of the EtherNet/ IP protocol. With UCMM all objects are accessible.

All Explicit Messages have message data defined in a format called the Message Router Protocol Data Unit (MR_PDU). There are Requests and Responses.

The MR_PDU Request format includes a Service code, Path Size, Path, and data, if any, for the Service. The Path is an encoded series of bytes or Segments describing the location of

the data item involved in the transfer. The Logical Segment is most often used. It describes the Class, Instance, and Attribute of the data.

The BridgeWay will handle up to 8 concurrent unconnected transactions. Up to 6 class 3 (messaging) connections are supported.

I/O Messaging

The BridgeWay allows an EtherNet/IP Scanner access to the I/O Table. The data received from the DeviceNet slaves is collected in the Input buffer (IN) of the BridgeWay and becomes the EtherNet/IP Input data to the EtherNet/IP scanner. EtherNet/IP Output data from the scanner is stored in the BridgeWay's Output buffer (OUT) and transmitted to the DeviceNet slaves.

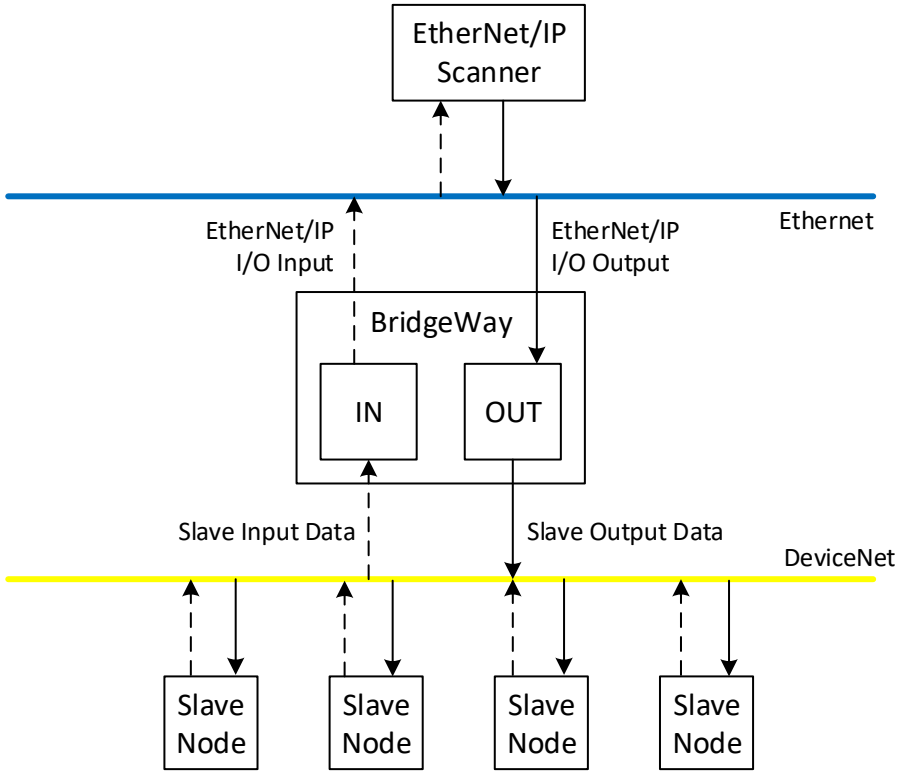


Figure 14. BridgeWay I/O Transfer with EtherNet/IP

Assembly Objects and Connections

Assembly Instances

There are 3 Assembly Object instances accessible from EtherNet/IP: input, output, and status. The input and output assemblies are linked to the Input and Output buffers. The status assembly provides status information about the BridgeWay.

The assembly instances associated with these 3 assemblies are listed below.

Assembly Instance	Description	Size in Bytes
100	Input	500 max
101	Status	128
150	Output	496 max

Table 4. EtherNet/IP Assembly Instances

Connection Points

Class 1 connections can be established to these assemblies using the following connection points.

Conn Point	Description	Size in Bytes	Use
198	Input-Only Heartbeat	0	Output connection point for input-only connections.
199	Listen-Only Heartbeat	0	Output connection point for listen-only connections.
100	Input	4-500	Input connection point.
101	Status	128	Input connection point.
150	Output	8-500	Output connection point.

Table 5. EtherNet/IP Connection Points

The Input connection size is the Input Data Size configured in the Ethernet Network configuration.

The Output connection size is the Output Data Size configured in the Ethernet Network configuration plus 4 bytes for the Run/Idle header.

Input Assembly Format

The input assembly contains a 32-bit status register followed by the DeviceNet slave input data.

Byte Offset	Size in Bytes	Description
0	4	Status register.
4	Up to 496	DeviceNet slave input data.

Table 6. EtherNet/IP Input Assembly Format

The DeviceNet slave input data format and content is determined by the scan list and I/O mapping configuration.

The status register is a bit string with the following bit definitions.

Bit	Description
0	BridgeWay is in Run mode. (Cleared if in Idle mode.)
1	DeviceNet network interface is faulted.
2	DeviceNet network interface is disabled.
3	Communication has failed with at least 1 DeviceNet slave.
4	At least 1 DeviceNet slave has failed verification.
5	DeviceNet network interface is bus-off.
6	Duplicate MAC ID error.
7	No DeviceNet power.
8-31	Reserved

Table 7. EtherNet/IP Input Status Register Bit Definitions

Output Assembly

The output assembly contains a 32-bit command register followed by the DeviceNet slave output data.

Byte Offset	Size in Bytes	Description
0	4	Command register.
4	Up to 492	DeviceNet slave output data.

Table 8. EtherNet/IP Output Assembly Format

The DeviceNet slave output data format and content is determined by the scan list and I/O mapping configuration.

Note: EtherNet/IP I/O connections append a 32-bit Run/Idle header at the front of the output data. The actual output data transferred in the I/O connection includes this extra 4 bytes at the front of the output assembly described above. The header adds 4 bytes to the connection size but is hidden from the user in both the BridgeWay and the EtherNet/IP controller.

The Command register is a bit string with the following bit definitions.

Bit	Description
0	Local Run Mode Used in conjunction with the Run Mode bit in the Run/Idle register to determine the run mode of the BridgeWay. Both bits must be set for the BridgeWay to be in Run mode; otherwise the module will be in Idle mode.
1	Reserved
2	Disable DeviceNet network
3	Reserved
4	Reset the BridgeWay module
5-31	Reserved

Table 9. EtherNet/IP Output Command Register Bit Definitions

Status Assembly

The status assembly is a collection of status and diagnostic information for the BridgeWay DeviceNet interface. The information in the assembly is updated once a second.

Byte Offset	Size in Bytes	Data Type	Name	Description
0	4	UDINT	Scan Counter	The number of DeviceNet I/O scans that have taken place since the BridgeWay was powered up.
4	8	64-bit Bit-string	Faulted Node Table	Indicates which DeviceNet slaves are faulted. Each bit represents the status of the slave at the corresponding MAC ID.
12	8	64-bit Bit-string	Auto Verify Error Table	Indicates which DeviceNet slaves are the incorrect device type. Each bit represents the status of the slave at the corresponding MAC ID.
20	8	64-bit Bit-string	Idle Node Table	Indicates which DeviceNet slaves are in Idle mode. Each bit represents the status of the slave at the corresponding MAC ID.
28	8	64-bit Bit-string	Active Node Table	Indicates which DeviceNet nodes are configured in the BridgeWay's scan list. Each bit represents a device at the corresponding MAC ID. If the bit is set, that device is being actively scanned by the BridgeWay's DeviceNet master.

Byte Offset	Size in Bytes	Data Type	Name	Description
36	4	ASCII[4]	Status Display	Mimics a 4-character alpha-numeric display. If there are no faults, the display indicates the BridgeWay MAC ID and its Run/Idle status. If there are faults, the display will scroll through the MAC IDs of the faulted nodes and display the error code associated with each. See *DeviceNet Node Status Values* for a list of error codes.
40	1	USINT	BridgeWay MAC ID	The DeviceNet MAC ID of the BridgeWay.
41	1	USINT	Scanner Status	The current status of the DeviceNet scanner. See *DeviceNet Node Status Values* for a list of status and error codes.
42	1	USINT	Scrolling MAC ID	The scrolling address and status fields scroll through the address and status of all DeviceNet slaves that are faulted. This scrolling includes the BridgeWay scanner itself. If there are no faulted nodes, both the scrolling address and status are set to 0. The scrolling fields change once a second.
43	1	USINT	Scrolling Status	
44	20	USINT[20]	Reserved	

Byte Offset	Size in Bytes	Data Type	Name	Description
64	64	USINT[64]	Node Status Table	The current status of each DeviceNet slave node. Each array element is the status of the node at the corresponding MAC ID. The BridgeWay scanner status appears at the entry associated with the BridgeWay MAC ID. A non-zero status indicates that there is an issue with the associated node. A status of 0 indicates "OK" and is used for nodes both in and out of the scan list. See *DeviceNet Node Status Values* for a list of status codes.

Table 10. EtherNet/IP Status Assembly Format

Run/Idle Control

The Run/Idle mode of the BridgeWay determines whether the module can update output data being sent to the DeviceNet slaves. In Idle mode, the module only monitors input data from the slaves and does not send any output data updates.

Run/Idle Control with I/O Connection

Run/Idle mode is controlled by the EtherNet/IP controller through an I/O connection using 2 bits in the output data: bit 0 in the Run/Idle Header and bit 0 in the Command Register.

Both bits must be set to put the BridgeWay in Run mode. If either of the 2 bits is cleared the BridgeWay will revert to Idle mode.

Note that the Run/Idle Header bit is not directly accessible in most controllers. The Run mode bit in the Run/Idle Header is controlled by the Run/Program mode of the controller. When the controller is put into Run mode, the bit is set in the Run/Idle header.

Run/Idle Control with Explicit Messages

If I/O connections are not being used, the Run/Idle mode of the BridgeWay may be controlled though explicit writes to the Output assembly.

If bit 0 of the Command register is set when the Output assembly is written, the module will be put into Run mode. The module will remain in Run mode until an Output assembly write is made with the bit cleared.

If an I/O connection is active, explicit writes to the Output assembly are rejected, and the Run/Idle mode is controlled by the bit status in the I/O connection output data.

Interaction with Modbus TCP

If both EtherNet/IP and Modbus TCP are enabled in the EtherNet Network configuration, the BridgeWay will support messages on either protocol and will support requests simultaneously.

If an EtherNet/IP I/O connection is active, Modbus TCP requests are limited to monitor-only. Any write requests made on Modbus will be rejected while an EtherNet/IP I/O connection is active.

If all communication with the module is done via explicit messages on EtherNet/IP, all writes to the output data from either protocol will be accepted. The output data will be set to the latest write received regardless of protocol type.

I/O Data Summary

The following diagram illustrates how the various components of the Input buffer are used to create the input assembly and connection data accessible from EtherNet/IP.

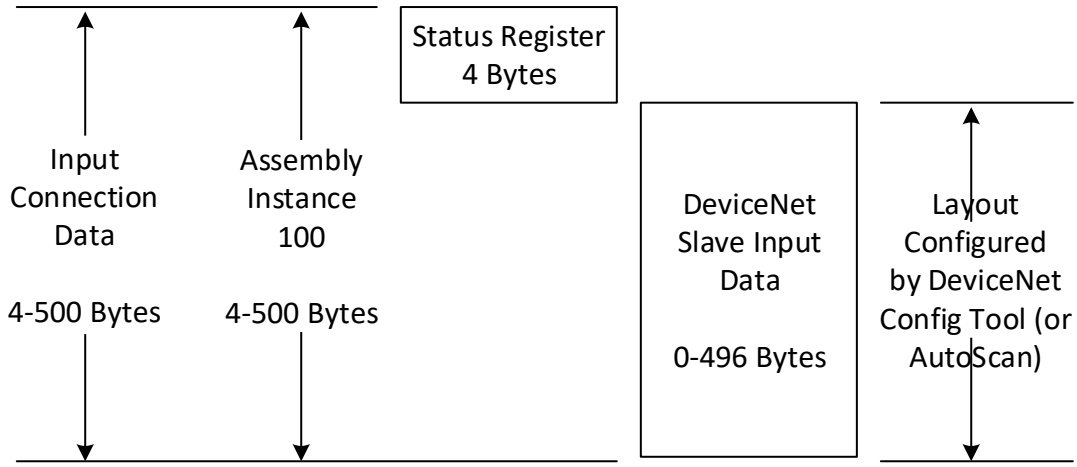


Figure 15. EtherNet/IP Input Data Summary

The following diagram illustrates how the various components of the Output buffer are used to create the output assembly and connection data accessible from EtherNet/IP.

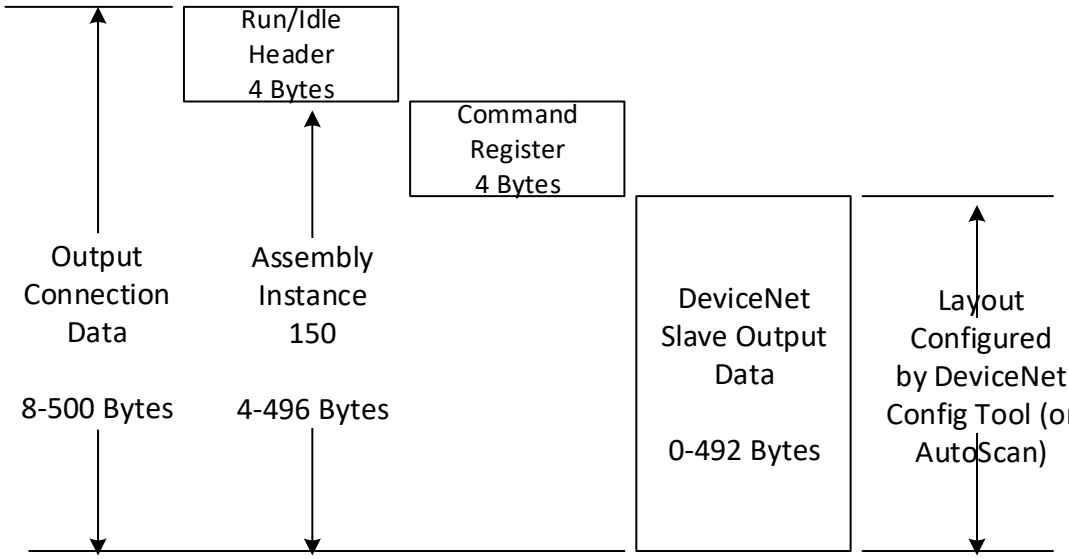


Figure 16. EtherNet/IP Output Data Summary

Using ControlLogix with the BridgeWay

When configuring I/O connections between a Rockwell Automation ControlLogix EtherNet/IP scanner and the BridgeWay, the Generic EtherNet/IP device type should be used.

The Run/Idle register is automatically inserted at the front of the output data and the application has no control over its use. The Run Mode bit in the header is set according to the Run/Program mode of the controller.

The connection output size in the RSLogix configuration must be set to the Output Data Size configured in the Ethernet Network configuration in BWConfig, which defaults to 496 bytes. (Although the Run/ Idle header adds 4 bytes to the actual connection size, it is automatically added by the controller and does not come into play in this size). The connection input size must be set to the Input Data Size configured in the Ethernet Network configuration in BWConfig, which defaults to 500 bytes.

The status assembly may also be monitored by configuring the connection in RSLogix with a "with status" Comm Format. The status size is 128 bytes.

The status output in the RsLogix connection must be set to the Input Only heartbeat connection point of 198.

The BridgeWay does not support a configuration assembly. The configuration instance in the RSLogix connection configuration may be set to any number since it will be ignored. Set the configuration size to 0.

The figure below shows a typical ControlLogix device configuration.

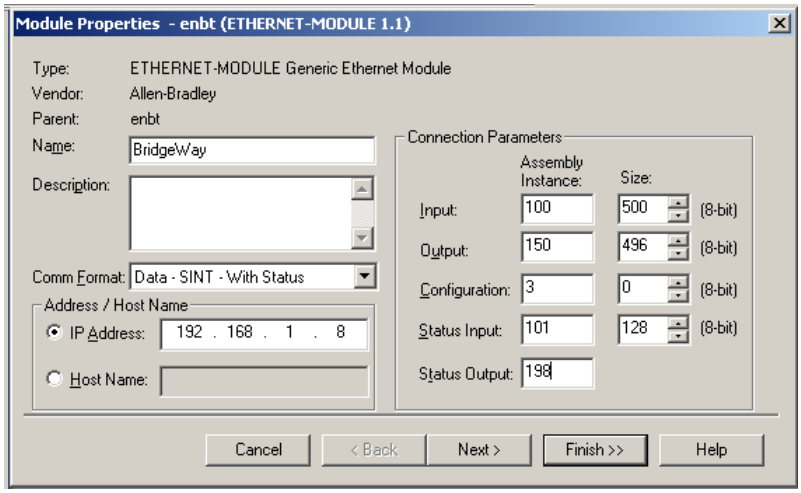


Figure 17. ControlLogix Connection Configuration

Modbus TCP Interface

The BridgeWay implementation of the Modbus TCP server is done according to the Modbus TCP specification 1.0.

The module can handle 4 simultaneous connections.

Supported Modbus Commands

The following Modbus TCP commands are supported by the BridgeWay.

Function Code	Function Name
1	Read Coils
2	Read Input Discrete
3	Read Holding Registers
4	Read Input Registers
5	Force Single Coil
6	Write Single Register
15	Force Multiple Coils
16	Write Multiple Registers
22	Mask Write Registers

Table 11. Supported Modbus Commands

Supported Modbus Exception Codes

An exception code is returned in the Modbus response when the BridgeWay is unable to service the Modbus request that was received. The following exception codes are used by the BridgeWay.

Exception Code	Name	Description
01	Illegal Function	The BridgeWay does not support the function code requested
02	Illegal Data address	The register address received in the request is outside the allowed I/O Table range
03	Illegal Data Value	The data in the request is invalid

Table 12. Supported Modbus Exception Codes

Modbus TCP Register Addressing

The BridgeWay Input and Output buffers in the I/O Table and the status assembly are mapped to ranges of Modbus register addresses.

Modbus Register 101

There are 4 types of Modbus registers:

Coils	Output bits. Coils are used to address the output buffer in the I/O Table at the bit level.
Input Status Bits	Input bits. Input Status bits are used to address the input buffer in the I/O Table or the status assembly at the bit level.
Input Registers	Input words. Input Registers are used to address the input buffer in the I/O Table or the status assembly at the 16-bit word level.
Holding Registers	Output words. Holding Registers are used to address the output buffer in the I/O Table at the 16-bit word level.

Register addresses are 1's offset. The first location in the I/O area is addressed as register 1.

Bit registers are mapped most significant bit first. Hence register 1 corresponds to bit 15 of the first 16-bit word.

Depending on the application, controller or configuration software, Modbus register addresses are depicted in several different ways to specify the type of register.

- The type of register is specified with the register number.
- The Modicon Convention uses a prefix on the number to specify the type of register, followed by a 4 digit register number.
- The Extended Modicon Convention uses a 5 digit register number after the prefix to allow for a larger register range.

	Modicon Addresses	Extended Modicon Addresses
Coils	00001 – 09999	000001 – 065535
Input Status Bits	10001 – 19999	100001 – 165535
Input Registers	30001 – 39999	300001 – 365535
Holding Registers	40001 – 49999	400001 – 465535

Table 13. Modbus Register Addressing Schemes

Input Addressing

Starting Input Register: 1 (30001 or 300001 also 40001 or 400001)
Register Count: up to 250

Starting Input Status Bit: 1 (10001 or 100001 also 000001)
Bit Count: up to 4000

Note: Input data may also be read using Holding Register or Coil functions in the same register range.

The full range is dependent on the Input Data Size configured in the Ethernet Network configuration.

Input Register	Input Status Bit Address									
	15	**14**	**13**	**12**	**11**	**10**	**9**	**...**	**1**	**0**
1	1	2	3	4	5	6	7	...	15	16
2	17	18	19	20	21	22	23	...	31	32
.....										
250	3985	3986	3987	3988	3989	3990	3991	...	3999	4000

Table 14. Modbus Addressing for Input Buffer

Output Addressing

Starting Holding Register: 1027 (41027 or 401027)
Register Count: up to 248

Starting Coil: 16417 (016417)
Coil Count: up to 3968

The full range is dependent on the Output Data Size configured in the Ethernet Network configuration.

Note: The Legacy BridgeWay Modbus TCP interface started the Output Register addresses at 1025, but included the equivalent of the EtherNet/IP Run/Idle Header. Current BridgeWay's do not support the extra Run/Idle Header in the Modbus output data. Holding Registers 1025 and 1026 (41025 and 41026) are supported to maintain backward compatibility, but serve no functional purpose.

Holding Register	Coil Bit Address									
	15	14	13	12	11	10	9	...	1	0
1027	16417	16418	16419	16420	16421	16422	16423	...	16431	16432
1028	16433	16434	16435	16436	16437	16438	16439	...	16447	16448
...										
1274	20369	20370	20371	20372	20373	20374	20375	...	20383	20384

Table 15. Modbus Addressing for Output Buffer

Status Addressing

Starting Input Register: 2051 (32051 or 302051 also 42051 or 402051)
Register Count: 64

Starting Input Status Bit: 32801 (132801 also 032801)
Bit Count: 1024

Note: Status data may also be read using Holding Register or Coil functions in the same register range.

Input Register	Input Status Bit Address									
	15	**14**	**13**	**12**	**11**	**10**	**9**	**...**	**1**	**0**
2051	32801	32802	32803	32804	32805	32806	32807	...	32815	32816
2052	32817	32818	32819	32820	32821	32822	32823	...	32831	32832
...										
2114	33809	33810	33811	33812	33813	33814	33815	...	33823	33824

Table 16. Modbus Addressing for Status Data

Modbus Addressing Examples

Word Addressing Examples

- Input buffer word 0 — Input Register 1, 30001, or 300001
Holding Register 1, 40001, or 400001
- Input buffer word 10 — Input Register 11, 30011, 300011
Holding Register 11, 40011, 400011
- Output buffer word 0 — Holding Register 1027, 41027, or 401027
- Output buffer word 100 — Holding Register 1127, 41127, or 401127

Bit Addressing Examples

- Input buffer bit 0 — Input Status bit 16, 10016, or 100016
- Input buffer bit 15 — Input Status bit 1, 10001, or 100001
- Output buffer bit 0 — Coil 16432 or 016432
- Output Table bit 15 — Coil 16417 or 016417

Register Data Content

Input Data

The input data contains a 32-bit status register followed by the DeviceNet slave input data.

Modbus Input Register	Register Count	Description
1	2	Status register
3	Up to 248	DeviceNet slave input data

Table 17. Modbus TCP Input Data Format

The DeviceNet slave input data format and content is determined by the scan list and I/O mapping configuration.

The status register is a bit string with the following bit definitions.

Bit	Description
0	BridgeWay is in Run mode. (Cleared if in Idle mode.)
1	DeviceNet network interface is faulted.
2	DeviceNet network interface is disabled.
3	Communication has failed with at least 1 DeviceNet slave.
4	At least 1 DeviceNet slave has failed verification.
5	DeviceNet network interface is bus-off.
6	Duplicate MAC ID error.
7	No DeviceNet power.
8-31	Reserved

Table 18. Modbus TCP Input Status Register Bit Definitions

Output Data

The output data contains a 32-bit command register followed by the DeviceNet slave output data.

Modbus Holding Register	Register Count	Description
1025	2	Legacy Run/Idle Register **Note:** Writes to these registers are ignored
1027	2	Command register
1029	Up to 246	DeviceNet slave output data

Table 19. Modbus TCP Output Data Format

The DeviceNet slave output data format and content is determined by the scan list and I/O mapping configuration.

The Command register is a bit string with the following bit definitions.

Bit	Description
0	Local Run Mode Used in conjunction with the Run Mode bit in the Run/Idle register to determine the run mode of the BridgeWay. Both bits must be set for the BridgeWay to be in Run mode; otherwise the module will be in Idle mode.
1	Reserved
2	Disable DeviceNet network
3	Reserved
4	Reset the BridgeWay module
5-31	Reserved

Table 20. Modbus TCP Output Command Register Bit Definitions

Status Data

The status data is a collection of status and diagnostic information for the BridgeWay DeviceNet interface. The information in the assembly is updated once a second.

Modbus Input Register	Register Count	Name	Description
2051	2	Scan Counter	The number of DeviceNet I/O scans that have taken place since the BridgeWay was powered up.
2053	4	Faulted Node Table	Indicates which DeviceNet slaves are faulted. This is a 64-bit bit string with each bit representing the status of the slave at the corresponding MAC ID.
2057	4	Auto Verify Error Table	Indicates which DeviceNet slaves are the incorrect device type. This is a 64-bit bit string with each bit representing the status of the slave at the corresponding MAC ID.
2061	4	Idle Node Table	Indicates which DeviceNet slaves are in Idle mode. This is a 64-bit bit string with each bit representing the status of the slave at the corresponding MAC ID.
2065	4	Active Node Table	Indicates which DeviceNet nodes are configured in the BridgeWay's scan list. This is a 64-bit bit string with each bit representing a device at the corresponding MAC ID. If the bit is set, that device is being actively scanned by the BridgeWay's DeviceNet master.

2069	2	Status Display	Mimics a 4-character alpha-numeric display. If there are no faults, the display indicates the BridgeWay MAC ID and its Run/Idle status. If there are faults, the display will scroll through the MAC IDs of the faulted nodes and display the error code associated with each. See *DeviceNet Node Status Values* for a list of error codes.
2071	1	BridgeWay MAC ID	The DeviceNet MAC ID and current status of the BridgeWay DeviceNet scanner. See *DeviceNet Node Status Values* for a list of status and error codes.
		Scanner Status	
2072	1	Scrolling MAC ID	The scrolling address and status fields scroll through the address and status of all DeviceNet slaves that are faulted. This scrolling includes the BridgeWay scanner itself. If there are no faulted nodes, both the scrolling address and status are set to 0. The scrolling fields change once a second.
		Scrolling Status	
2073	10	Reserved	

2083	32	Node Status Table	The current status of each DeviceNet slave node. This is a byte array with each array element being the status of the node at the corresponding MAC ID. The BridgeWay scanner status appears at the entry associated with the BridgeWay MAC ID. A non-zero status indicates that there is an issue with the associated node. A status of 0 indicates “OK” and is used for nodes both in and out of the scan list. See *DeviceNet Node Status Values* for a list of status codes.

Table 21. Modbus TCP Status Data Format

Run/Idle Control

The Run/Idle mode of the BridgeWay determines whether the module can update output data being sent to the DeviceNet slaves. In Idle mode, the module only monitors input data from the slaves and does not send any output data updates.

If bit 0 of the Command register (Holding register 1027) is set, the module will be put into Run mode. The module will remain in Run mode if there is an active Modbus TCP connection and Holding register 1027 is not written with bit 0 cleared.

If the Modbus TCP connection is closed, the module will immediately change to Idle mode.

If no Modbus requests are received within the configured Modbus TCP Timeout period, the module will change to Idle mode.

Interaction with EtherNet/IP

See the *Interaction with Modbus TCP* section for details.

I/O Data Summary

The following diagram illustrates how the various components of the Input buffer are used to create the input data accessible from Modbus TCP.

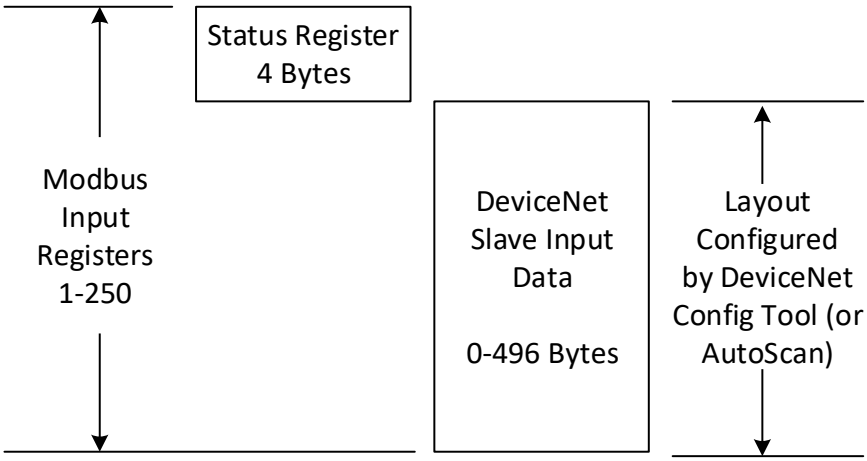


Figure 18. Modbus TCP Input Data Summary

The following diagram illustrates how the various components of the Output buffer are used to create the output data accessible from Modbus TCP.

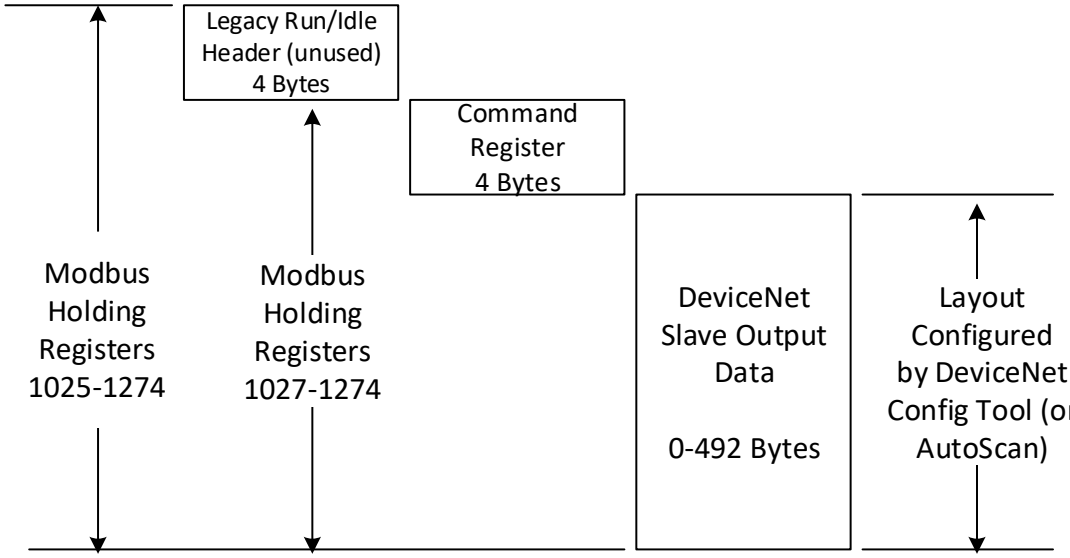


Figure 19. Modbus TCP Output Data Summary

I/O Data Endian Format

The BridgeWay transfers I/O data between Modbus TCP and DeviceNet without regard to data content or format. Due to this, the user is responsible for making sure that the devices on either network understand the format of the data.

DeviceNet is a little-endian protocol; values are transmitted least significant byte first. Hence, all data in the I/O Table is assumed, by the DeviceNet nodes, to be stored as little endian.

Modbus TCP is a big-endian protocol; values are transmitted most significant byte first.

The Swap I/O Bytes option in the Ethernet Network configuration will swap the bytes of each 16-bit word in the Input, Output, and Status data. This will aid in the transformation between the big and little-endian networks. However, care must be taken to assure that DeviceNet slave data is mapped to 16-bit word boundaries for this feature to be fully effective.

DeviceNet Interface

Network Communication

The Ethernet – DeviceNet BridgeWay acts as a DeviceNet Master or a slave. The BridgeWay, as a master, can exchange I/O data with up to 63 nodes. The module can also act as a slave to another DeviceNet Master, exchanging the contents of the I/O Tables with the second master.

Automatic Baud Rate Detection

Depending on its configuration, the BridgeWay can set its DeviceNet baud rate automatically. If the autobaud option is enabled, the module will detect the current network baud rate and set its baud rate accordingly before joining the network. If the option is disabled, the module will join the network with the configured baud rate.

Slave Device Communication

The BridgeWay continuously attempts to establish connections with devices configured in the scan list (list of configured slaves). Once connections are established, the module performs all necessary steps to configure the required I/O messaging.

The BridgeWay provides explicit message proxy services for all group 2 only slaves. Once any Group 2 only devices are configured, the BridgeWay sends “keep alive” messages to the devices in addition to the I/O messages. This function prevents the explicit message connections between the BridgeWay and the slave from timing out. This eliminates the need to re-establish an explicit connection should the BridgeWay need serve as a proxy.

Scan Cycles

The BridgeWay employs a scan cycle for producing poll and strobe I/O messages. A scan cycle consists of the following:

- A bit-strobe output message (if any devices in the scan list are configured for bit-strobe).
- Poll command messages for each device configured for polled I/O.
- A configurable delay before the next scan cycle.

The configurable delay is the Inter-Scan Delay (ISD). The ISD is a Scanner Configuration Object attribute. The delay begins when the last poll command message is transmitted.

The BridgeWay also supports a background polling mechanism. A foreground to background polling ratio can be specified to allow slower polling of devices at certain scan cycle intervals.

I/O Message Types

The BridgeWay supports all I/O messaging types specified by the DeviceNet protocol. These include strobe, poll, COS, COS Unacknowledged, Cyclic, and Cyclic Unacknowledged I/O messages. I/O messaging and I/O parameters are configured using the DeviceNet configuration tool.

I/O Mapping

The content and layout of the data in the I/O Table is defined during configuration of the scan list. The input and output data of each slave is configured, or mapped, to specific locations in the Input and Output buffers.

Input Data Safe State

The BridgeWay provides the option of configuring how the data in the Input buffer will be set when a DeviceNet slave connection faults. The safe state behavior may be configured as one of the following:

- Maintain Last State
- Zero Data
- Set Values to -1

If the option is set to Maintain Last State, the input data associated with a DeviceNet slave will be frozen to the last value received from the slave prior to the connection fault.

If the option is set to Zero Data, the input data associated with the slave will be set to 0 when the connection is faulted.

If the option is set to -1, the input data associated with the slave will be set to 0xFF when the connection is faulted.

Only the input data associated with a particular slave's I/O mapping configuration will be affected, all other non-faulted slaves' data will continue to update normally. Note that this is a global setting and all slave connections will be treated in the same manner.

Proxy for Group 2 Only Devices

The BridgeWay provides the capabilities necessary for being a Group 2 Only Client as defined for the Predefined Master/Slave Connection Set. Group 3 explicit messages destined for a group 2 only device that is configured as a slave to the BridgeWay will be intercepted and relayed to the slave.

Quick Connect Feature

The BridgeWay supports DeviceNet Quick Connect. Quick Connect is a special, shortened connection establishment procedure. Quick Connect can be used in applications where the normal delay between when a slave comes online and the scanner establishes a connection cannot be tolerated. Quick Connect is enabled on a per-slave basis using the RSNetworx *Tools → Quick Connect* menu.

Active Node List

The BridgeWay monitors the DeviceNet network and tracks the online/offline state of all nodes on the network. The current state of each node is kept in the Active Node List which can be accessed at DeviceNet object instance attribute 13.

The message bridging utilizes the Active Node List to determine whether a target node is online. If the target node is not online, the bridging functions will immediately return an error response.

Note: The Active Node List feature will create some additional traffic on the DeviceNet network as the BridgeWay queries the network to monitor device online status. If the network cannot tolerate the additional traffic it is recommended that the Active Node List option be disabled.

The Active Node List monitoring can be disabled in the BWConfig DeviceNet network configuration.

Run/Idle Mode

The BridgeWay has two modes of operation, Run and Idle. In both modes, the BridgeWay's DeviceNet master maintains connections with slave devices in its scan list.

In Run mode, the BridgeWay sends output data to the slaves and receives input data. Since it is actively sending output data affecting slave device operation, the BridgeWay rejects attempts to alter its scan list configuration and disrupt communications; it must first be put in Idle mode.

In Idle mode, the BridgeWay still receives input data from the slaves but it does not send output data. In Idle mode, the BridgeWay scan list configuration can be changed.

The Run/Idle mode of the BridgeWay is controlled through the command register at the front of the output data from the Ethernet controller.

The module automatically reverts to Idle mode when the Ethernet I/O messaging stops. If the Ethernet protocol is EtherNet/IP, this is handled when the I/O connection closes. If the protocol is Modbus/TCP, this is handled when no requests are received within the configured timeout period.

Note: When the BridgeWay is reset or powered up, it begins operation in Idle mode.

Automatic Device Recovery (ADR)

ADR is a feature of the DeviceNet master which allows a slave node to be configured when the I/O connection is established. This not only guarantees device configuration, but provides a means to replace a faulty device with a new one without any additional device commissioning.

There are 2 parts to ADR, Address Recovery, and Configuration Recovery.

Address Recovery

Address Recovery is responsible for automatically setting a new device's address to that of a slave that has lost communications. The steps followed by ADR are:

1. When the BridgeWay detects the loss of a DeviceNet slave, it begins to monitor for a new device at MAC ID 63.
2. An identical device is added to the network at MAC ID 63 (default out of box configuration for a DeviceNet device).
3. The BridgeWay verifies that the new device at 63 is exactly the same kind as the slave that was lost by querying the Identity attributes.
4. The BridgeWay changes the new device's MAC ID to that of the lost slave.

Configuration Recovery

Configuration Recovery is responsible for setting the configuration of a slave device to the configuration that is stored in the BridgeWay. The slave's configuration is stored in the BridgeWay's non-volatile memory. Whenever the BridgeWay establishes a connection with the slave device, the configuration is downloaded to the slave.

Configuration recovery serves 2 purposes.

1. If a new device is added to the network to replace a faulted slave, after Address Recovery is completed, Configuration Recovery will configure the new device.
2. Configuration Recovery guarantees that the slave devices will always run the same configuration.

The BridgeWay module will hold up to 130,560 bytes (approximately 128K) of configuration recovery data.

Note: RSNetworx v7.0 or later is required to support the full 128K bytes of ADR configuration recovery data; earlier versions support up to 64K bytes of data.

Interaction with I/O Table

The DeviceNet interface in the BridgeWay accesses the I/O Table as slave I/O connections are processed by the DeviceNet master; there is no buffering or timed updates of the I/O within the module. Safeguards are in place to ensure data integrity by prohibiting simultaneous access by the Ethernet and DeviceNet interfaces. There is no synchronization between the 2 network interfaces.

When an I/O connection with a slave requires output data be sent to the slave, data will be read from the Output buffer. The data read is what was placed there by the last write to the Output buffer by the Ethernet interface.

Transmission of data on Change of State (COS) connections is triggered when new output data is written by the Ethernet interface in the region mapped by the COS connection.

When input data is received on a slave's I/O connection, it is copied to the Input buffer. This data is available to be read by the Ethernet interface immediately after it has been written.

Ethernet to DeviceNet Message Bridging

Message bridging provides the ability to send a CIP request on DeviceNet the Ethernet network. The message can originate from either an EtherNet/IP or Modbus TCP request.

EtherNet/IP Message Bridging

The CIP protocol provides bridging capabilities to allow messages to be routed from a device on EtherNet/IP to a device on DeviceNet. The BridgeWay allows a device on EtherNet/IP to send an Explicit Message to a device on DeviceNet and receive the associated response. This allows the device on EtherNet/IP to directly access the objects and attributes of any DeviceNet device to configure or access data.

To send an Explicit Message to a DeviceNet device, the Unconnected Send services of the Connection Manager Object are used. The MAC ID of the destination DeviceNet node along with a network port address must be used in the Unconnected Send service. Refer to Volume 1, Chapter 10 of the EtherNet/IP specification for further information on CIP Bridging.

The BridgeWay supports multi-hop bridged paths. If a routing path routes the message through the local DeviceNet network to another network, via another bridge, the BridgeWay will correctly route the message to the next bridge using an Unconnected Send service over DeviceNet.

Note: The BridgeWay does not support message routing from DeviceNet to EtherNet/IP.

Bridged Message CIP Request Address

CIP messages that are to be sent to a DeviceNet node must be sent to Port 3. The CIP request path must use the following format:

<BridgeWay_IP>,3,<DeviceNet_MAC>

Where

<BridgeWay_IP>	The IP address of the BridgeWay
<DeviceNet_MAC>	Destination DeviceNet address

Modbus TCP Message Bridging

CIP bridging from Modbus TCP may be done by writing to a set of Holding registers (starting at 42201) and reading the result from a set of Input registers (starting at 32325).

Note: The result may also be read at Holding registers starting at 42325.

Note: The Modbus register addresses below are 1-offset. Some Modbus controllers specify registers 0-offset; in that case, the register or bit addresses would be subtracted by 1.

Bridged Message Request Registers

The bridged message fields are specified in the following Holding registers.

Holding Register	Register Count	Description
2201	1	Request Counter This register is incremented by 1 to trigger the transmission of the bridged request. As long as the Request Counter is not incremented, the message request registers below can be changed without affecting the message transmission. Once the Request Counter is incremented, the message request registers should not be altered until the Result Counter (Input Register 2325) matches the Request Counter.
2202	1	DeviceNet MAC address
2203	1	CIP Service
2204	1	CIP Class
2205	1	CIP Instance
2206	1	CIP Attribute
2207	1	Request data length in bytes
2208	Up to 116	Request data

Table 22. Modbus TCP Bridged Message Request Registers

Bridged Message Response Registers

The status/extended status and response data for the bridged request can be read in the following Input registers.

Input Register	Register Count	Description
2325	1	Result Counter This register is incremented by 1 to indicate that a bridged transmission has completed.
2326	1	CIP response status
2327	1	CIP response extended status
2328	1	Response data length in bytes
2329	Up to 120	Response data

Table 23. Modbus TCP Bridged Message Response Registers

Status and Diagnostics

BridgeWay LEDs

There is a group of LED indicators on the front of the BridgeWay that is used to indicate the status of the module and the network interfaces. The layout of the LEDs is shown below.

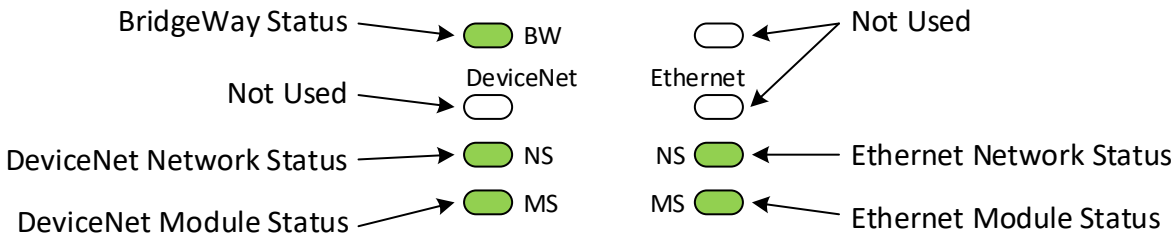


Figure 20. BridgeWay LEDs

BridgeWay Status LED

LED State	Summary	Description
Flashing Green	Idle	Module is in Idle mode.
Solid Green	Run	Module is in Run mode.
Solid Amber	Bootloader / Initialization	The LED will be in this state immediately after power is applied. If the bootloader is running all LEDs will be Amber.

Table 24. BridgeWay Status LED States

DeviceNet Network Status LED

LED State	Summary	Description
Flashing Green	Online, No Communication	The DeviceNet network interface is online but there are no active communications.
Solid Green	Online and Communicating	The DeviceNet network interface is online and actively communicating with at least one device.
Solid Red	Interface Fault	The DeviceNet network interface is bus-off or a duplicate MAC ID has been detected.
Flashing Red	Connection Timeout	Communications with at least one DeviceNet slave has timed out.
Solid Amber	Bootloader	If the bootloader is running all LEDs will be Amber.

Table 25. DeviceNet Network Status LED States

DeviceNet Module Status LED

LED State	Summary	Description
Flashing Green	Initializing	The DeviceNet network interface is initializing or is has not been configured and is using default values.
Solid Green	Configured	The DeviceNet network interface has been successfully configured and is operating normally.
Solid Red	Initialization Error	An error was detected in the configuration and the DeviceNet network interface initialization could not complete.
Solid Amber	Bootloader	If the bootloader is running all LEDs will be Amber.

Table 26. DeviceNet Module Status LED States

Ethernet Network Status LED

LED State	Summary	Description
Solid Green	Connected	There is at least one connection from an Ethernet Controller.
Flashing Green	Network OK	There are no active connections.
Solid Red	Address conflict	The module's IP address is already in use by another module.
Flashing Red	Connection Timeout	One or more of the I/O connections has timed out.
Solid Amber	Bootloader	If the bootloader is running all LEDs will be Amber.

Table 27. Ethernet Network Status LED States

Note: When both EtherNet/IP and Modbus TCP are enabled in the Ethernet Network configuration, the Network Status LED will only show Connected and Timeout status for EtherNet/IP connections.

Ethernet Module Status LED

LED State	Summary	Description
Flashing Green	Initializing	The Ethernet network interface is initializing and not configured.
Solid Green	Configured	The Ethernet network interface has been successfully configured.
Flashing Red	Configuration	There is an error in the configuration.
Solid Red	Initialization Error	An error was detected in the configuration and the Ethernet network interface initialization could not complete.
Solid Amber	Bootloader	If the bootloader is running all LEDs will be Amber.

Table 28. Ethernet Module Status LED States

Ethernet Network LEDs

The Ethernet Network LEDs are located on the RJ-45 connector.

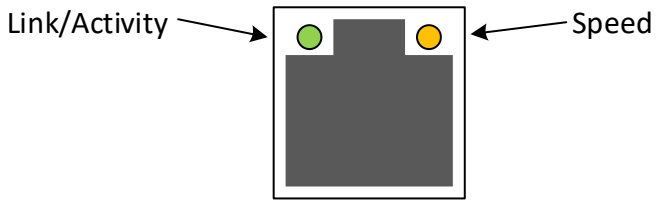


Figure 21. Ethernet Network LEDs

Ethernet Link/Activity LED

The Link/Activity LED is green if the link is up and flashes green as Ethernet packets are received or transmitted. The LED is off if there is no link.

Ethernet Speed LED

The Speed LED is Amber if the link speed is 100Mbps. The LED is off if the speed is 10Mbps.

BWConfig Status View

Status Tab

The Status tab on the BWConfig Status view contains general status information for the BridgeWay and the network interfaces.

The following subsections describe the status and state values that may be displayed for some of the Status tab fields.

BridgeWay Error

State	Description
No Error	The module has successfully initialized and is running.
Configuration Error	An error in the configuration was detected.
Initialization Error	An error occurred during startup and initialization.

Table 29. BridgeWay Error Values

Ethernet Interface State

State	Description
Initializing	The Ethernet interface is initializing.
Configuration Error	There is an error in the configuration and the Ethernet interface is not able to be initialized.
Initialization Error	There is an error in the system or Ethernet network that caused the Ethernet interface initialization to fail.
Address Error	An IP address conflict was detected.
Offline	The Ethernet interface is configured and initialized, but no Ethernet link is detected.
Online	The Ethernet interface is online and participating in network activity.

Table 30. Ethernet Interface States

Ethernet Status

State	Description
No IP Assigned	No IP address has been assigned. This typically the state while waiting for a DHCP address assignment. The IP Address State will display “Waiting for DHCP”.
Not Connected	The module is online, but no Ethernet controller has made any I/O connection.
Connected	1 or more I/O connections are active.
Connection Timeout	1 or more I/O connections have timed out.
IP Address Conflict	An IP address conflict was detected.

Table 31. Ethernet Status Values

DeviceNet Interface State

State	Description
Initializing	The DeviceNet interface is initializing.
Configuration Error	There is an error in the configuration and the DeviceNet interface is not able to be initialized.
Initialization Error	There is an error in the system or DeviceNet network that caused the DeviceNet interface initialization to fail.
Address Error	A duplication MAC ID was detected.
Offline	The DeviceNet interface is configured and initialized, but is unable to communicate on the CAN network.
Online	The interface is online and participating in DeviceNet network activity.

Table 32. DeviceNet Interface States

DeviceNet Status

Status	Description
Configured	The DeviceNet network interface is configured and initialized and is attempting to go online for the first time.
Online	The DeviceNet network interface is online and participating in network activity.
Autobaud in Progress	The interface is performing automatic baud rate detection prior to coming online.
Duplicate MAC Check in Progress	The interface is checking for duplicate MAC IDs on the network prior to coming online.
Duplicate MAC Error	A duplicate MAC ID was detected on the network. The module will remain offline.
Network Disabled	The DeviceNet network interface is disabled.
No Network Power	No CAN network power is present for the DeviceNet network.
Bus-Off	The DeviceNet network interface has been knocked offline due to CAN network errors.
Autoscan in Progress	The DeviceNet master is scanning the network and automatically generating a scan list configuration.

Table 33. DeviceNet Status Values

Diagnostic Counters Tab

The Diagnostic Counters tab on the BWConfig Status view displays counters and status information that are specific to each of the network interfaces.

Slave Status Tab

The Slave Status tab on the BWConfig Status view displays the status of the configured I/O connections with the DeviceNet slaves. The display shows the status next to the MAC ID of the slave. Unconfigured slaves will have a blank status. Configured slaves' status will be one of the node status values shown in the *DeviceNet Node Status Values* section.

BridgeWay Web Pages

The web pages on the BridgeWay are accessible using any web browser by entering the IP address of the BridgeWay as the URL.

Web Status Tabs

The web page contains 3 status tabs, for BridgeWay, Ethernet and DeviceNet, each displaying status and state information for the associated module or network interface. The information displayed on the web page status tabs mirror that displayed on the BWConfig Status view described above.

Web I/O Table Tabs

The web page contains an Input Table and Output Table tab. These tabs display the current data in the Input and Output buffers of the BridgeWay.

The displayed word size, starting offset and byte count can be set at the top of the tab, as well as the display radix, allowing the data display to be configured to meet the user's needs.

Status Data

The status data contains status and diagnostic information for the DeviceNet network interface. The status data is accessible through the EtherNet/IP Status Assembly (see *Status Assembly*) or the Modbus Status Data registers (see *Status Data*). See the referenced sections for complete details.

DeviceNet Node Status Values

Node status values are used in many places in DeviceNet network interface status data to indicate the status of the BridgeWay and the slave devices. The table below describes the possible status values.

Status Value	Description
0	Ok. Note that this value will be used for nodes both in and out of the scan list to indicate that there is no issue with the node.
60	Duplicate MAC ID test in progress. This status is only used for the BridgeWay MAC ID.
70	Duplicate MAC ID failure. Another node on the DeviceNet network has the same MAC ID. This status is only used for the BridgeWay MAC ID.
72	Device communications failed. The I/O connection with the slave has timed out.
73	Incorrect device type. Device verification has failed with a slave when attempting to start I/O connections. The level of verification is determined by the scan list entry. The following identity information may be checked during verification depending on the configuration: Vendor ID Revision Device Type Product Code
75	CAN network quiet. No CAN packets have been received from the network for more than 10 seconds. This status is only used for the BridgeWay MAC ID.

Status Value	Description
76	No messages for BridgeWay. No CAN packets specifically for the BridgeWay DeviceNet interface have been received in more than 10 seconds. This status is only used for the BridgeWay MAC ID.
77	Incorrect connection size. The connection size configured in the scan list entry for the slave does not match the actual required connection size specified by the slave.
78	No device response. A connection could not be established with the slave because it did not respond.
79	CAN DUP-MAC transmit failure. The DeviceNet interface was unable to transmit the duplicate MAC detection message on the CAN network. This status is only used for the BridgeWay MAC ID.
80	In Idle mode. The device is in Idle mode. This status is only used for the BridgeWay MAC ID.
81	Faulted. The DeviceNet network interface is faulted, and all DeviceNet network activity is disabled. This status is only used for the BridgeWay MAC ID.

Status Value	Description
83	Error during slave connection initialization. An error occurred while creating the I/O connections to the slave (beyond the identity mismatch or I/O size errors). This error is triggered by error responses from the slave during the connection establishment sequence.
84	Slave connection initialization in progress. The I/O connection establishment sequence to this slave is in progress.
85	Incorrect data size received on connection. The amount of data received with the last connected message does not match the connection size.
86	Device went into Idle mode. The slave is in Idle mode as indicated by the slave sending idle packets on the input connection. Idle packets are of zero length and are used to keep the connection open, yet not move any data when the device is in Idle mode.
87	Shared master error. The slave scan list entry is configured for input sharing and the primary master has not made a connection to the device.
88	Shared master choice error. The slave scan list entry is configured for input sharing and the primary master has not made the right type of connections to the device.
89	ADR error. An error occurred during auto device replacement or configuration recovery. This is triggered when the slave returns an error response during an auto device replacement or configuration recovery message sequence.

Status Value	Description
90	Network disabled. The DeviceNet network interface has been disabled. This status is only used for the BridgeWay MAC ID.
91	CAN bus-off. Indicates that the DeviceNet CAN controller is in the Bus-Off state. This status is only used for the BridgeWay MAC ID.
92	No DeviceNet power. Indicates that there is no network power detected on the DeviceNet network. This status is only used for the BridgeWay MAC ID.

Table 34. DeviceNet Node Status Values

Specifications

General

Weight	184g
Dimensions (L x W x H)	110 x 35 x 101 mm 4.33 x 1.38 x 3.98 inches
Protection class	IP20, NEMA rating 1
Mounting	DIN rail (35 x 7.5/15) or Wall Mount

Certifications

UL	UL 61010-1 UL 61010-2-201
Hazardous Locations	ANSI/ISA 12.12.01
ATEX	EN 60079-0 EN 60079-15
CE	EN 61000-6-2 EN 61000-6-4

Electrical

Power	7 – 40 VDC
Current consumption	300mA at 24 VDC

Environmental

Operating temp (Ta)	IEC 60068-2-1 IEC 60068-2-2	-25 to 70 °C
Storage temp	IEC 60068-2-1 IEC 60068-2-2	-40 to 85 °C
Relative Humidity	IEC 60068-2-30	5-95 % non condensing
Installation altitude	Up to 2000 m	

Emission and Immunity

Electrostatic discharge	EN 61000-4-2	+/- 4 kV Contact, +/- 8kV Air
Electromagnetic RF fields	EN 61000-4-3	10 V/m 80 MHz - 1 GHz 3 V/m 1.4 GHz – 2 GHz 1 V/m 2 GHz – 2.7 GHz
Fast Transients	EN 61000-4-4	+/- 2kV AC, +/- 1 kV IO
Surge protection	EN 61000-4-5	+/- 1 kV Diff, +/- 2kV Comm
RF conducted interference	EN 61000-4-6	10 V/rms
Emissions (Radiated)	EN 55011	30 MHz - 100 MHz, Class A
Emissions (Conducted)	EN55011	150 kHz - 39 MHz, Class A

Certifications

Atex Certification

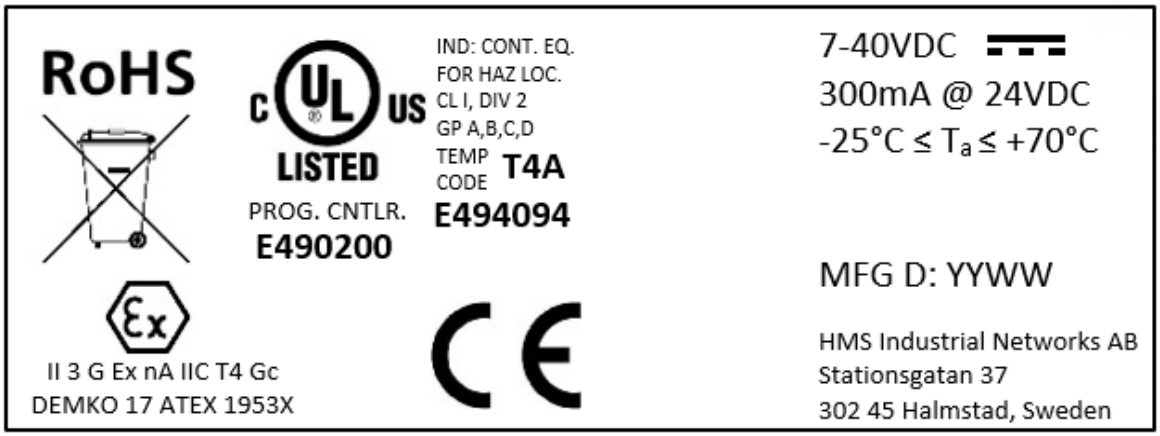
e II 3 G Ex nA IIC T4 Gc

II 3 G

Demko 17 ATEX 1953X

Side Label

Example of side label



I/O Table Configuration Sizes and Limits

Input

4 – 500 bytes

Output

4 – 496 bytes

Status

128 bytes

DeviceNet ADR Configuration Storage

130,560 bytes

Connectors

Power

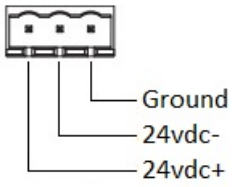


Figure 22. Power Connector

Use Phoenix connector part number MSTB 2,5/3-ST-5,08

DeviceNet

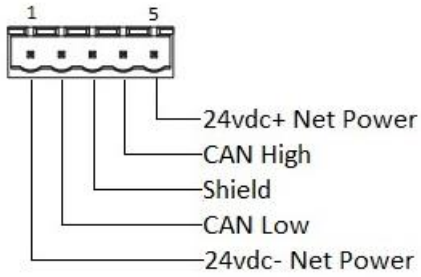


Figure 23. DeviceNet Connector

Use Phoenix connector part number MSTB 2,5/5-ST-5,08

Ethernet

The BridgeWay uses a standard Ethernet RJ-45 connector.

USB

The BridgeWay uses a standard USB Micro-B connector.

Support

Technical Product Assistance

If you require BridgeWay product technical support by phone:

- Call 248-549-1200
- Dial 0 for the Operator
- Ask for BridgeWay Support

If you require support by email:

- Email: productsupport@pyramidsolutions.com
- Subject: “BW4030 Support Request”
- Provide a detailed explanation of your question or issue in the email text.

You can also obtain BW4030 files and information online at the following URL:
http://pyramidsolutions.com/support/network-connectivity-support/

Contact Information

Pyramid Solutions, Inc.
302000 Telegraph Road
Suite 440
Bingham Farms, Michigan 48025

Phone: 1-248-549-1200
Toll free: 1-888-PYRASOL
Fax: 1-248-549-1400
Website: www.pyramidsolutions.com