

***BridgeWay***  
***PROFIBUS to DeviceNet Gateway***  
***User Manual***

Part No. AB7605

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**PYRAMID SOLUTIONS**

Publication PUB-AB7605-003

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# Preface

## ***About This Manual***

This manual discusses the use of the BridgeWay PROFIBUS to DeviceNet Gateway. It describes how to install, configure, and operate the module.

## ***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.

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DeviceNet is a trademark of the Open Device Vendor Association, Inc. (ODVA)

RSLinx and RSNetWorx are trademarks of Rockwell Software.

MS-DOS, and Windows are trademarks of Microsoft Corporation.

**Related Documentation**

| Document Name           | Author                 | Web Page         |
|-------------------------|------------------------|------------------|
| DeviceNet Specification | ODVA                   | www.odva.org     |
| PROFIBUS Specification  | PROFIBUS International | www.profibus.com |

**Table 1-1 Related Documentation****Document Revision**

| Date       | Revision | Change Description  |
|------------|----------|---|
| 10/3/02    | 001      | Initial Release   |
| 12/11/2002 | 002      | Updated specifications<br>Clarified data endian-ness<br>Corrected status codes and static bit behavior in Status section. |
| 2/18/2003  | 003      | Updated for changes in firmware releases 1.03 - 1.05  |

**Table 1-2 Document Revision Log**

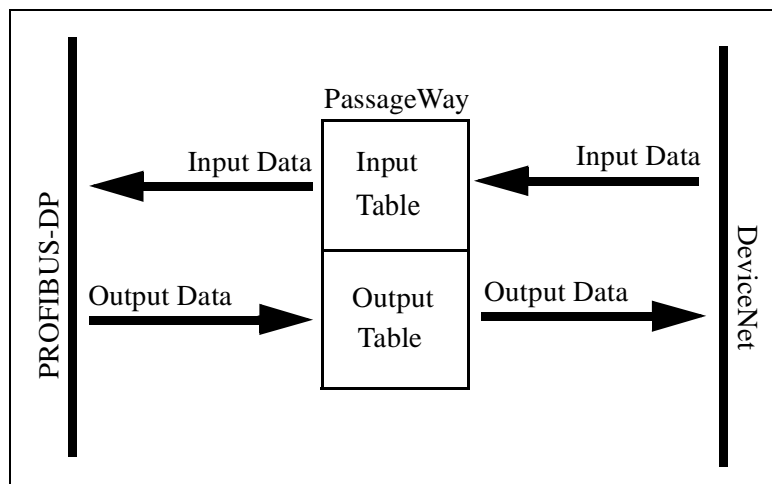
# BridgeWay Module Description

## Overview

The BridgeWay PROFIBUS to DeviceNet Gateway allows you to monitor and control data on a DeviceNet network using a PROFIBUS-DP master device. The BridgeWay acts as a DeviceNet master, collecting and distributing input and output data to modules on DeviceNet. The I/O table used by the DeviceNet master is accessible for I/O data exchange with the PROFIBUS-DP master.

## Theory of Operation

The BridgeWay provides centralized data storage, the “PassageWay™”, for data that is shared between the DeviceNet and PROFIBUS networks. Data is placed into the PassageWay by one network interface, allowing the data to be read through the other network interface.



**Figure 1-1 BridgeWay PassageWay 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 or write the data flowing through the PassageWay; all cross-network activity is transparent to the devices on either network.

### ***DeviceNet Features***

- DeviceNet Master scanner functionality supporting up to 63 DeviceNet slave devices
- Explicit Messaging and Bit Strobe, Poll, and Change of State (COS) I/O connections.
- Baud rates of 125, 250, and 500 Kbps.
- Automatic baud rate detection option may be enabled or disabled.
- 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).

### ***PROFIBUS Features***

- PROFIBUS-DP slave.
- Cyclic I/O data transmission.
- Device diagnostic transmission.
- Baud rates ranging from 9.6 Kbps to 12 Mbps.

## System Requirements

The following hardware and software components are needed to use the BridgeWay PROFIBUS to DeviceNet Gateway.

### Required Hardware

- BridgeWay module.
- DeviceNet network connection.
- PROFIBUS-DP network connection
- PROFIBUS-DP master device.
- 24 VDC power connection
- PC to execute DeviceNet Configuration Software. The DeviceNet scanner configuration is done using DeviceNet configuration software tool such as RSNetWorx for DeviceNet from Rockwell Software or HMS NetTool-DN.

### Optional Hardware

- DIN rail to mount the BridgeWay.
- A PC with a serial RS-232 port to be used for field firmware updates if required. The BridgeWay Configuration Tool (BWConfig) is used for downloading firmware updates.
- RS-232 null-modem cable (pins 2 and 3 swapped) from the PC to the BridgeWay module for field firmware updates.

### Required Software

- DeviceNet configuration software such as RSNetWorx for DeviceNet or HMS NetTool-DN to configure DeviceNet devices and the BridgeWay's DeviceNet operation.
- If RSNetWorx is to be used to configure the BridgeWay, RSLink version 2.31 or later is required.

### Optional Software

- BridgeWay Configuration Tool software (BWConfig) to perform field firmware upgrades.
- BWConfig requires that the PC be running Microsoft Windows 95, 98, NT, or 2000.



## ***Hardware Description***

All connections, whether power or fieldbus, to the BridgeWay are made on one end of the module. Phoenix connectors are provided for power and DeviceNet connections. A 9-pin D-Subminiature connector is provided for PROFIBUS connection. There is a 9-pin D-Subminiature connector for the auxiliary RS-232 port that is used for field firmware upgrades. See “Installation” Page 2-1 for details on using these connections.

Also on the end of the BridgeWay are switches that set the PROFIBUS network configuration. 2 Rotary switches are used to set the network address. A single DIP switch allows internal network termination to be enabled and disabled. See “PROFIBUS Network Configuration” Page 3-1 for details on configuring the PROFIBUS network interface.

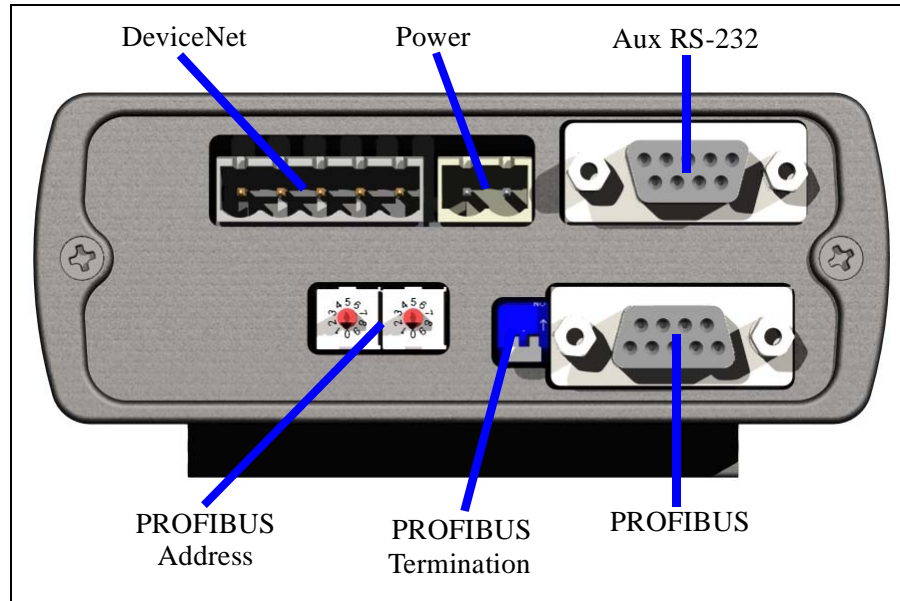
The front of the module has a set of 6 LEDs that are used for status indication. These LEDs provide visual status for the overall module, the DeviceNet interface, and the PROFIBUS interface. See “Status and Diagnostics” Page 7-1 for details on how the LEDs are used.

The back of the module has a DIN rail mount to allow the module to be mounted on a DIN rail.

# Installation

## Power and Network Connections

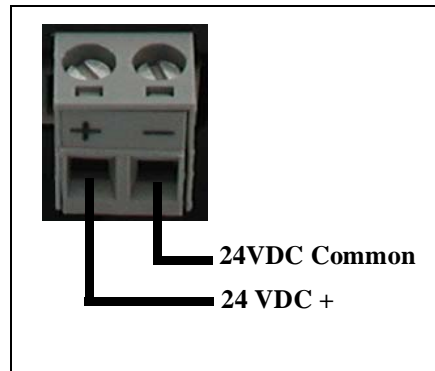
The power and network connections to the BridgeWay are made on the end of the module. Figure 2-1 indicates the location of each connector.



**Figure 2-1 BridgeWay Power and Network Connections**

## **Connecting Power**

The power connection is a 2-pin terminal block located on the end of the module. The female terminal block connector is provided with the BridgeWay. Connections to be made are illustrated in Figure 2-2.

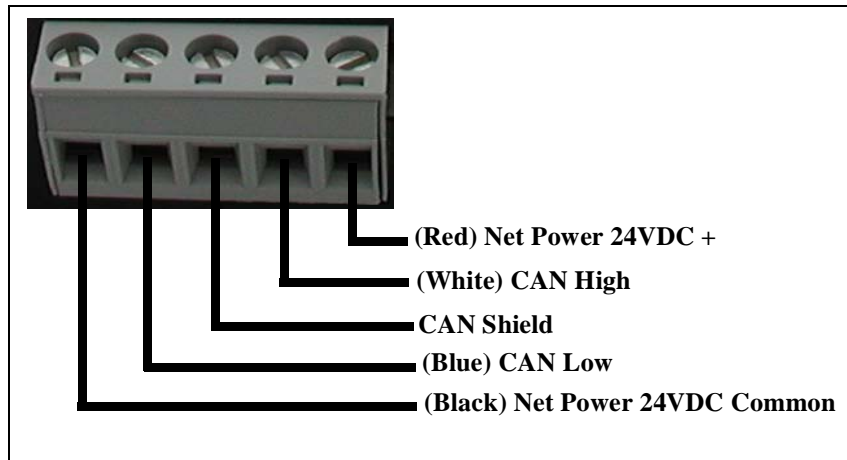


**Figure 2-2 Power Connection**

The BridgeWay requires 24 volts DC power. The module will start immediately when power is applied (There is no On/Off switch on the module).

## Connecting DeviceNet

The DeviceNet network connection is a 5-pin terminal block located next to the power connection on the end of the module. The female terminal block connector is provided with the BridgeWay. Connections to be made are illustrated in Figure 2-3.



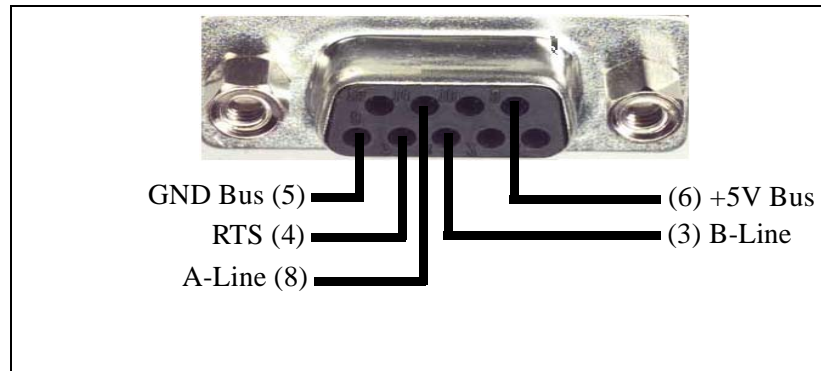
**Figure 2-3 DeviceNet Connection**

A 120 ohm termination resistor (not provided) may be required for proper network termination. See the DeviceNet Specification for specific rules on DeviceNet connections and termination.

For information on setting the DeviceNet network configuration (MAC ID, baud rate, etc.), see “DeviceNet Network Configuration” on page 3-3.

## Connecting to PROFIBUS

The PROFIBUS network connection is a 9-pin D-Subminiature connector located on the end of the module next to the PROFIBUS termination switch. Connections to be made are illustrated in Figure 2-4.



**Figure 2-4 PROFIBUS Connection**

The +5V Bus and GND Bus connections are used for bus termination. Some devices like optical transceivers (RS-485 to fiber optics) might require external power from these pins.

The RTS connection is used in some equipment to determine the direction of transmission.

In typical applications only the A-Line, B-Line and Shield connections are used.

For information on setting the PROFIBUS network configuration (address, baud rate, etc.), see “PROFIBUS Network Configuration” on page 3-1.

# Configuration

This chapter describes how the BridgeWay PROFIBUS to DeviceNet Gateway is configured. The next chapter walks the reader through the configuration of the BridgeWay using the commonly available configuration tools.

## ***PROFIBUS Network Configuration***

### **PROFIBUS Network Address**

The PROFIBUS network address is set using two rotary switches on the end of the BridgeWay. Each switch sets a digit of the address from 1 to 9, allowing for a range of network addresses from 1 to 99.

The rotary switch nearest the 9-pin D-Sub PROFIBUS network connector sets the 10's digit. The other switch sets the 1's digit

**Hint:** If you look at the end of the BridgeWay with the 9-pin D-Sub PROFIBUS network connector on your left, the node address is easier to read.

### **PROFIBUS Baud Rate**

The PROFIBUS baud rate is set during the configuration of the PROFIBUS Master. The BridgeWay has automatic baud rate detection so no configuration of the BridgeWay itself is required.

|            |          |
|------------|----------|
| 9.6 Kbps   | 1.5 Mbps |
| 19.2 Kbps  | 3 Mbps   |
| 93.75 Kbps | 6 Mbps   |
| 187.5 Kbps | 12 Mbps  |
| 500 Kbps   |          |

**Table 3-1 Supported PROFIBUS Baud Rates**

### PROFIBUS Network Termination

The end nodes on a PROFIBUS-DP network must be terminated to avoid reflections on the bus line. The BridgeWay is equipped with a termination switch to enable termination for the node if it is required.

|              |  |
|--------------|--|
| ON Position  | <p>Network termination enabled.</p> <p>If the module is the last or first module in the network, the bus termination should be set to ON, or an external connector used.</p> |
| OFF Position | <p>Network termination disabled.</p>   |

**Table 3-2 PROFIBUS Termination Switch Function**

**Note:** If an external termination connector is used, the termination switch must be in the OFF position.

### GSD File

Each device on a PROFIBUS-DP network has an associated GSD file containing all necessary information about the device. This file is used by the network configuration program during configuration of the network and PROFIBUS master.

The latest version of the GSD file for the BridgeWay can be downloaded from Pyramid Solution's web site, or received by contacting Pyramid Solutions.

## ***DeviceNet Network Configuration***

### **DeviceNet MAC ID**

The DeviceNet MAC ID is software configurable; there are no switches used to set it.

When first powered, the factory default configuration sets the MAC ID to 63. The allowable range for MAC ID is 0 - 63.

A DeviceNet node commissioning tool (e.g. RSNetWorx or NetTool-DN) is used to set the MAC ID to the desired value for the application. The value is stored in non-volatile memory and used on subsequent power ups.

### **DeviceNet Baud Rate**

The DeviceNet baud rate is software configurable; there are no switches used to set it. The baud rate can be set to one of the 3 supported rates, or the module can be configured to use automatic baud rate detection.

When first powered, the factory default configuration sets the baud rate to 125Kbps. The BridgeWay supports baud rates of 125, 250, and 500 Kbps.

If the baud rate is to be set, a DeviceNet node commissioning tool is used to set the baud rate to the desired value for the application. The value is stored in non-volatile memory and used on subsequent power ups.

If autobaud is desired, the option must be enabled. This is done through a class/instance editor in RSNetworx, or through the parameter editor in NetTool-DN. See “DeviceNet Network Configuration” on page 4-2 for details on setting this option using these tools.



**EDS File**

Each device on a DeviceNet network has an associated EDS file containing all necessary information about the device. This file is used by the network configuration tools, such as RSNetWorx or NetTool-DN, during configuration of the network.

The latest version of the EDS file for the BridgeWay can be downloaded from Pyramid Solution's web site, or received by contacting Pyramid Solutions.

***DeviceNet I/O Configuration*****I/O Mapping**

The DeviceNet I/O configuration defines the format of the Input and Output tables in the PassageWay, or the *mapping* of DeviceNet slaves' I/O data to the I/O tables. See "Theory of Operation" on page 1-1 for a discussion on the PassageWay and the use of I/O tables in the BridgeWay. As slaves are added to the BridgeWay's DeviceNet scanner configuration, the location in the I/O tables of each part of the slave's I/O data is determined and stored.

**Note:** The organization of the I/O tables is very important. This defines the format of the data that will be exposed to the PROFIBUS master. The Input and Output table formats should be planned and documented to ensure the PROFIBUS master is working with the correct data from the DeviceNet network.

**I/O Size Limitations**

The size of the I/O data that can be exchanged with the PROFIBUS master and, hence, the size of the I/O tables is restricted as explained below.

- The Input table size cannot be larger than 244 bytes.
- The Output table size cannot be larger than 244 bytes.
- The total size of the Input and Output tables combined cannot be larger than 400 bytes.
- There must be at least 1 byte of Input or Output configured. i.e. Both the Input and Output sizes cannot be 0.

It is important to remember that, although the BridgeWay is capable of handling up to 244 bytes in the Input or Output table, the limitation on the total I/O size may restrict either table to less than 244 bytes.

If an I/O configuration is saved that exceeds the size limitations, the BridgeWay status and PROFIBUS diagnostics will indicate that there is an I/O size configuration error.

**DeviceNet Configuration Tools**

The DeviceNet I/O configuration is set using a DeviceNet configuration tool. This manual is not intended to replace the user manual for the configuration tool, so will not provide details on using the tool.

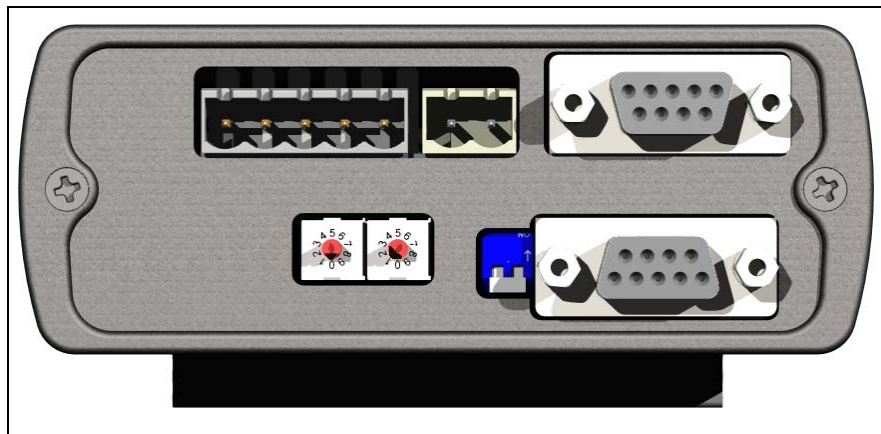
The next chapter provides an example application, and covers the use of Rockwell Software's RSNetWorx for DeviceNet and HMS' NetTool-DN.

## Step By Step Configuration

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

### ***PROFIBUS Network Configuration***

The PROFIBUS network configuration is set using the switches on the end of the BridgeWay. Since the module has automatic baud rate detection, all that needs to be set is the network address and the bus termination. See "PROFIBUS Network Configuration" on page 3-1 for complete details on the network configuration. Figure 4-1 shows the network address set at 10 and the bus termination turned off.



**Figure 4-1 Example PROFIBUS Network Configuration**

## ***DeviceNet Network Configuration***

Configuration of the DeviceNet network interface involves using a DeviceNet node commissioning tool to set the BridgeWay's MAC ID and baud rate. The following sections explain how this is done using either Rockwell Software's RSNetWorx for DeviceNet or HMS' NetTool-DN.

**Note:** The BridgeWay defaults to 125K baud out of the box. If your DeviceNet network is not running at 125K baud, the BridgeWay must be powered up on a local network with the node commissioning tool at 125K baud. Do not attempt to commission the BridgeWay on a network configured at a different baud rate.

### **Node Commissioning with RSNetWorx for DeviceNet**

#### Step 1: Connect the module to your DeviceNet network.

- Make sure a PC running RSNetWorx for DeviceNet is connected to the DeviceNet network.
- With the BridgeWay un-powered, connect the DeviceNet network cable to the DeviceNet connector of the module. (See "Connecting DeviceNet" on page 2-3)
- Power up the BridgeWay.

#### Step 2: Locate the module is on the network.

- RSNetWorx allows browsing on the network to identify devices.
- Select the *Network* menu option and pull down menu.
- Select the *Single Pass Browse* option and wait for browsing to complete. If this is the first time RSNetWorx has been used with a BridgeWay, the BridgeWay's icon should indicate "Unrecognizable Device".

**Step 3: Register the BridgeWay EDS file in RSNetWorx.**

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.

- Select the *Tools* menu option and pull down menu.
- Select the *EDS Wizard* option.
- Click on *Next*.
- Select *Register an EDS File* option and click *Next*.
- Select *Register a Single File* and enter, or browse to, the location of the EDS file for BridgeWay.
- Click *Next* or *Finish* for the remaining option screens.
- Select the *Single Pass Browse* option and wait for browsing to complete. Now when an icon identifying the device as the BridgeWay module should appear.

**Step 4: Make Sure the BridgeWay is in Idle Mode**

When first powered the BridgeWay starts operation in Idle mode. The module automatically changes state between Run and Idle when a PROFIBUS master connects or disconnects. Generally, if there is not a PROFIBUS master connected to the BridgeWay, the module will be in Idle mode. If the module is not in Idle mode, it can be placed there using the following steps.

- Highlight the BridgeWay module by left clicking on its icon.
- Select the *Device* menu option and pull down menu.
- Select the *Class Instance Editor* option. A pop up Message box appears. Click on *Yes*. Another screen appears.
- There are several parts to this screen. Make sure the check box titled *Values in Decimal* is NOT checked. At the top right is an *Object Address* with 3 text boxes. Set the values in these boxes as follows:
  - *Class* set to 1.
  - *Instance* set to 1.
  - *Attribute* set to 67.
- To the left of the *Object Class* section is one titled *Service Code*. There's a text box with a pull down selection titled *Description*. Pull down the selections and select "Set Single Attribute".

- The box titled *Data Sent to the Device* is now available. At the far left of this box enter a “00”. Then click on the *Execute* button.
- A message should appear in the *Data received from device box* saying the execution was completed.
- The BridgeWay is now in Idle mode. Close the *Class Instance Editor* dialog.

**Step 5: Set the DeviceNet MAC ID and Baud Rate**

- Select the *Tools* menu option and pull down menu.
- Select the *Node Commissioning* option. Another screen appears.
- Click on *Browse* and choose the DeviceNet network.
- When the browse is completed, double click on the BridgeWay icon.
- Enter the desired MAC address and/or baud rate, then click the *Apply* button.

**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, the BridgeWay’s I/O configuration is cleared.

**Step 6: Enabling the Autobaud Option**

If it is desirable to have the BridgeWay automatically determine the network baud rate, the Autobaud option must be enabled.

- Highlight the BridgeWay module by left clicking on its icon.
- Select the *Device* menu option and pull down menu.
- Select the *Class Instance Editor* option. A pop up Message box appears. Click on *Yes*. Another screen appears.
- There are several parts to this screen. Make sure the check box titled *Values in Decimal* is NOT checked. At the top right is an *Object Address* with 3 text boxes. Set the values in these boxes as follows:
  - *Class* set to 3.
  - *Instance* set to 1.
  - *Attribute* set to 64.
- To the left of the *Object Class* section is one titled *Service Code*. There's a text box with a pull down selection titled *Description*. Pull down the selections and select "Set Single Attribute".
- The box titled *Data Sent to the Device* is now available. At the far left of this box enter a "01" to enable autobaud, or a "00" to disable it. Then click on the *Execute* button.
- A message should appear in the *Data received from device box* saying the execution was completed.

**Note:** Changes to the autobaud option configuration do not take effect until the module has been power cycled.

**Note:** If the BridgeWay is the only master on the DeviceNet network, DO NOT enable autobaud. Automatic baud detection requires there to be traffic on the network, there is typically no traffic until the master establishes connections.

## Node Commissioning with NetTool-DN

### Step 1: Connect the module to your network

- Make sure a PC running NetTool-DN (version 1.0.0.1 or later) is connected to the DeviceNet network via the NetTool-DN RS-232 interface adapter.
- With the BridgeWay un-powered, connect the DeviceNet network cable to the DeviceNet connector of the module. (See “Connecting DeviceNet” on page 2-3)
- Power up the BridgeWay.

### Step 2: Locate the module is on the network.

- Start NetTool-DN on the PC.
- NetTool-DN starts up and displays a screen prompting for a network name. Enter a name such as “BridgeWay” to refer to the network and click *Ok*. A blank screen then appears.
- Select the *Tools* menu item and pull down its menu selections. Select *Configure Drivers For...* option.
- Highlight the name of the network and click on it. A Driver Dialog box appears.
- Click on *7262 Serial RS232 DeviceNet Tool Adapter* to highlight it and click *Ok*. A screen to configure the RS-232 communications between the Adapter and the PC appears.
- Select the PC serial port being used to connect to the NetTool-DN RS-232 adapter.
- Set the DeviceNet baud rate to 125K baud. Set the MAC ID to a value that will not conflict with devices already on the network. (including the BridgeWay)
- Click *Go Online*. A confirmation message indicating that the adapter has gone online should appear. Click *Ok*.
- NetTool-DN should now display a network screen with the icons for the devices it finds on the DeviceNet network. If this is the first time that NetTool-DN has been used with a BridgeWay, the BridgeWay’s icon will indicate “No EDS file registers for this device”.



### Step 3: Register the BridgeWay EDS file with NetTool-DN

NetTool-DN 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 NetTool-DN before configuration can continue.

- From the *Tools* menu, select *Install EDS Files*.
- Enter the path, or browse to the location of the EDS file for the BridgeWay.
- Click *Open*.
- Select the *Tools* menu option, then *Update*, and click on the network name. The BridgeWay icon should be properly displayed on the network screen.

### Step 4: Make sure the BridgeWay is in Idle Mode

When first powered the BridgeWay starts operation in Idle mode. The module automatically changes state between Run and Idle when a PROFIBUS master connects or disconnects. Generally, if there is not a PROFIBUS master connected to the BridgeWay, the module will be in Idle mode. If the module is not in Idle mode, it can be placed there using the following steps.

- Highlight the BridgeWay module by right clicking with the cursor on its icon.
- Select the *Device* menu option and pull down menu, then select *Properties*.
- A screen displaying two parameters is displayed. Parameter 1 is “Mode” and parameter 2 is “Baud Rate”. To view their current settings click on *Upload*.
- Put the cursor on the text “Run” for the “Mode” parameter. Click to highlight it and then click again to get a menu. From this menu select “Idle”.
- Click *Download* to send the mode change to the BridgeWay.
- Click *Close*.

**Step 5: Set the DeviceNet MAC ID**

- Right click on the BridgeWay icon and select *Device*.
- Pull down the next menu and select *Change Node Address*.
- Select or enter the desired MAC ID and click *Ok*.

**Note:** The BridgeWay will automatically reset if a new MAC ID is entered.

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

**Step 6: Enabling the Autobaud Option**

If it is desirable to have the BridgeWay automatically determine the network baud rate, the Autobaud option must be enabled.

- Highlight the BridgeWay module by right clicking with the cursor on its icon.
- Select the *Device* menu option and pull down menu, then select *Properties*. A parameter screen is displayed.
- Click on *Upload*. The parameter values will be read from the device.
- Put the cursor "Autobaud" parameter value. Click to highlight it and then click again to get a menu. From this menu select "Enable" or "Disable" to enable or disable the autobaud option respectively.
- Click *Download* to send the mode change to the BridgeWay.
- Click *Close*.

**Note:** Changes to the autobaud option configuration do not take effect until the module has been power cycled.

**Note:** If the BridgeWay is the only master on the DeviceNet network, DO NOT enable autobaud. Automatic baud detection requires there to be traffic on the network, there is typically no traffic until the master establishes connections.

## **DeviceNet I/O Configuration**

DeviceNet I/O configuration involves using a DeviceNet configuration tool to set the BridgeWay's scan list and I/O table mapping. The following sections explain how this is done using either Rockwell Software's RSNetWorx for DeviceNet or HMS' NetTool-DN.

### **I/O Configuration Using RSNetWorx**

#### **Step 1: Set up BridgeWay module's DeviceNet scan list**

It is suggested that you disconnect the PROFIBUS master before changing the scan list. This will put the BridgeWay into Idle mode. If the BridgeWay is not in Idle mode, follow the steps described in "Step 4: Make Sure the BridgeWay is in Idle Mode" on page 4-3. Once in Idle mode the following steps should be taken to configure the scan list.

- Select the *Network* menu and *Browse Single Scan*. Wait for browsing to complete.
- Select the *Network* menu and *Upload*. Wait for the device information to be uploaded from the network.
- Double click on the BridgeWay icon to bring up the module description screen. Several tabs appear on the top of the screen.
- Click the *Scanlist* tab. The screen shows 2 columns. On the left is a list of "Available devices" that may be added to the scan list. On the right is a list of devices that are configured in the scan list.
- Check the *AutoMap on Add* check box.
- Select the devices whose I/O is to be exchanged with the PROFIBUS master from the "Available devices" column. Click the ">" button for each one to move it to the scan list.
- Select the *Input* tab. The Input mapping screen is displayed. The top portion gives a list of the devices in the scan list that the BridgeWay receives input data from. The bottom shows the location in the Input table where the data will be placed for each device. **This shows the format of the Input table of the BridgeWay. This is the format of the input data that will be sent to the PROFIBUS master. See "I/O Mapping" on page 3-4.**

- Select the *Output* tab. The Output mapping screen is displayed. The top portion gives a list of the devices in the scan list that the BridgeWay will send output data to. The bottom shows the location in the Output table where the data will be placed for each device. **This shows the format of the Output table of the BridgeWay. This is the format of the output data that will be sent to the BridgeWay from the PROFIBUS master. See “I/O Mapping” on page 3-4**
- Click the *Apply* button, and *Yes* to download the scanlist to the BridgeWay.
- The BridgeWay starts scanning as soon as it finds entries in its scanlist. However, in Idle mode, output data will not be sent to the devices.

**Note:** Automap is used in this example to 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.

#### Step 2: Put the BridgeWay in Run Mode

The BridgeWay will automatically switch to Run mode when the PROFIBUS master is connected. If it is required to switch the module to Run mode manually, this can be done using the Class Instance Editor described in “Step 4: Make Sure the BridgeWay is in Idle Mode” on page 4-3. Use the following information to set the BridgeWay to Run mode.

- *Class* set to 1.
- *Instance* set to 1.
- *Attribute* set to 67.
- *Service* set to “Set Single Attribute”
- *Data Sent to Device* set to “01”

**Note:** Once the BridgeWay is placed into Run mode, it will begin sending output data to the devices configured in its scan list.

## I/O Configuration Using NetTool-DN

### Step 1: Set up BridgeWay module's DeviceNet Scanlist

It is suggested that you disconnect the PROFIBUS master before changing the scan list. This will put the BridgeWay into Idle mode. If the BridgeWay is not in Idle mode, follow the steps described in “Step 4: Make sure the BridgeWay is in Idle Mode” on page 4-7. Once in Idle mode the following steps should be taken to configure the scan list.

- From the network display screen right click on the BridgeWay icon and select *Device*. Pull down its associated menu and select *Properties*. This displays the Parameters screen.
- Click on the *Scanner* tab. The scan list display screen appears with two columns. The left column displays a list of devices found on the network that can be added to the scanlist. The right column displays the devices that are configured in the scanlist.
- Click *Upload* to get the current settings.
- Select the devices whose I/O is to be exchanged with the PROFIBUS master from the left column. Click the “>” button for each one to move it to the scan list. A screen displaying the I/O configuration for the device will be displayed; click *Ok*.
- Click the *Input* tab. A screen is displayed for mapping the input data.
- Select the device whose input data is to be mapped and click *AutoMap*. **This sets the format of the Input table of the BridgeWay. This is the format of the input data that will be sent to the PROFIBUS master. See “I/O Mapping” on page 3-4.**
- Click the *Output* tab. A screen is displayed for mapping the output data.
- Select the device whose output data is to be mapped and click *AutoMap*. **This sets the format of the Output table of the BridgeWay. This is the format of the output data that will be sent to the BridgeWay from the PROFIBUS master. See “I/O Mapping” on page 3-4**
- Select the *Scanlist* tab, and click the *Download* button to download the scanlist to the BridgeWay.
- The BridgeWay starts scanning as soon as it finds entries in its scanlist. However, in Idle mode, output data will not be sent to the devices.

**Note:** Automap is used in this example to for simplicity. In some cases, the user may wish to organize the I/O data in other ways. See the NetTool-DN manual for complete details on how to accomplish this.

**Step 2: Put the BridgeWay in Run Mode**

The BridgeWay will automatically switch to Run mode when the PROFIBUS master is connected. If it is required to switch the module to Run mode manually, this can be done using the following steps:

- Highlight the BridgeWay module by right clicking with the cursor on its icon.
- Select the *Device* menu option and pull down menu, then select *Properties*.
- Put the cursor on the text “Idle” for the “Mode” parameter. Click to highlight it and then click again to get a menu. From this menu select “Run”.
- Click *Download* to send the mode change to the BridgeWay.
- Click *Close*.

**Note:** It is normal for an error message to be displayed about an “Object State Conflict” downloading parameter 2. This error message can be ignored.

**Note:** Once the BridgeWay is placed into Run mode, it will begin sending output data to the devices configured in its scan list.

# PROFIBUS Interface

## Network Communication

### Protocol

The BridgeWay PROFIBUS to DeviceNet Gateway acts as a PROFIBUS-DP slave node. It can be read and written to from a PROFIBUS-DP master. The BridgeWay will not initiate communication to other nodes on the PROFIBUS network; it will only respond to incoming commands.

Details of the supported protocol features are listed below.

- PROFIBUS-DP EN 50 170 (DIN 19245).
- Protocol version 1.10.
- Baud rate range 9.6 Kbps - 12 Mbps.
- Cyclic I/O data transmission.
- Device diagnostic messages supported.

### Physical Interface

| Feature     | Specification  |
|-------------|--|
| Media       | PROFIBUS bus line type A or B specified in EN50170.              |
| Topology    | Master-Slave.  |
| Connector   | 9-pin D-Subminiature female.                                     |
| Cable       | Shielded twisted pair.   |
| Isolation   | The bus is galvanically isolated from the BridgeWay electronics. |
| Termination | Switch selectable internal bus termination.                      |

**Table 5-1 PROFIBUS Physical Interface**

## ***Device Diagnostics***

The BridgeWay sends PROFIBUS device diagnostic messages to the PROFIBUS master whenever there is a change in module status. The diagnostic data contains information about the state of the module, the DeviceNet communications, and an indication of I/O data integrity. The diagnostic data is presented in detail in “PROFIBUS Device Diagnostic Data” on page 7-4.

## ***Interaction with I/O Tables***

### **I/O Table Updates**

The PROFIBUS interface in the BridgeWay accesses the I/O tables as requests from the PROFIBUS master are processed; 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 PROFIBUS and DeviceNet interfaces. There is no synchronization between the 2 network interfaces.

When a output data is received from the PROFIBUS master, the module will copy the data to the Output table. The data is always placed at the beginning (offset 0) of the Output table. This data is available to be read by the DeviceNet interface as soon as it has been written.

When it is time to transmit input data to the PROFIBUS master, the module will retrieve the data that is currently in the Input table. Data is always read from the beginning (offset 0) of the Input table. The data will be what was placed there by the last write to the Input table by the DeviceNet interface.



**Data Endian-ness**

The BridgeWay transfers I/O data between PROFIBUS 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 tables is assumed to be stored as little endian by the DeviceNet nodes.

Care should be taken to make sure that the PROFIBUS master handles input data and transmits output data least significant byte first.

# DeviceNet Interface

## ***Network Communications***

The BridgeWay PROFIBUS to DeviceNet Gateway 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 its I/O tables with the master.

## ***Configuration***

The BridgeWay is configured using a DeviceNet configuration tool such as RSNetWorx for DeviceNet or NetTool-DN. The tool will access the module over the DeviceNet network. The BridgeWay supports a Scanner Configuration and Scan List object as the configuration interface over DeviceNet.

## ***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 to send configuration data or 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 devices are configured in the scan list are configured for bit-strobe).
- A poll command message 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 and ends after the specified time has elapsed.

The BridgeWay also supports a background polling mechanism. A foreground to background polling ratio can be specified to allow 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 contents and layout of the data in the I/O tables 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 tables.

### ***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.

## ***Run/Idle Mode***

The BridgeWay has two modes of operation, Run and Idle. In both modes the BridgeWay's DeviceNet master maintains communication 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 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 configuration can be changed.

The Run/Idle mode is automatically switched to Run when a connection is established with a PROFIBUS master. When the PROFIBUS connection is broken, the module automatically switches to Idle mode.

Alternatively, the Run/Idle mode of the BridgeWay may be set through an attribute of the Identity object. To change the Run/Idle mode, use a DeviceNet messaging tool and send the following message:

|               |                         |
|---------------|-------------------------|
| Service:      | Set_Attribute_Single    |
| Class:        | 1                       |
| Instance:     | 1                       |
| Attribute:    | 103 (67h)               |
| Request Data: | 00 for Idle, 01 for Run |

See "DeviceNet Network Configuration" on page 4-2 for explanation of setting the BridgeWay Run/Idle mode using RSNetWorx or NetTool-DN.

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

## ***Automatic Device Recovery (ADR)***

This is a feature of the DeviceNet master which allows a slave node that has dropped off the network (Fault, power loss, etc.) to be replaced with another device of the same type. There are 2 parts to ADR, Address Recovery, and Configuration Recovery.

**Note:** ADR is only available when using Rockwell Software's RSNetWorx for DeviceNet as the configuration tool.

### **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 master detects loss of a slave, it begins to monitor for a device at MAC ID 63.
2. An identical device is added to the network at MAC ID 63.
3. The master verifies that the new device at 63 is exactly the same kind as the slave that was lost.
4. The master changes the new device's MAC ID from 63 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 communication 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.

### ***Interaction with I/O Tables***

The DeviceNet interface in the BridgeWay accesses the I/O tables 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 PROFIBUS and DeviceNet interfaces. There is no synchronization between the 2 network interfaces.

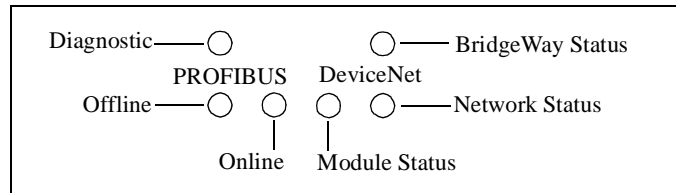
When an I/O connection with a slave requires that output data be sent to the slave, it will be read from the Output table. The data read is what was placed there by the last write to the Output table by the PROFIBUS interface.

When input data is received on a slave's I/O connection, it is copied to the Input table. This data is available to be read by the PROFIBUS interface and sent to the PROFIBUS master on the next data exchange.

# Status and Diagnostics

## BridgeWay LEDs

There is a group of LED indicators on the front of the BridgeWay that is used to announce the current status of the module and the network interfaces. The layout of the LEDs is shown in Figure 7-1.



**Figure 7-1 BridgeWay LEDs**

### BridgeWay Status LED

| State              | Summary                                       | Description   |
|--------------------|---|---|
| Off                | No Power                                      | No power to the module.   |
| Flashing Green     | Initializing                                  | Module is initializing.   |
| Solid Green        | Normal  | Module is initialized and operational.  |
| Solid Orange       | Hardware Initialization<br>or<br>Flash Update | The LED will be in this state immediately after power is applied.<br><br>This LED state also occurs when non-volatile storage is being updated. |
| Flashing Red/Green | Error   | A fault has been detected.  |

**Table 7-1 BridgeWay Status LED States**

Major unrecoverable faults are indicated by a series of green and red flashes. If the BridgeWay Status LED is flashing red and green for an extended period of time, count the number of red and green flashes and call technical support.



**DeviceNet Network Status LED**

| State          | Summary                   | Description  |
|----------------|---------------------------|--|
| Solid Green    | Online with no errors     | The BridgeWay is on the DeviceNet network and all I/O connections are running correctly.                         |
| Flashing Green | Online, no communication  | The BridgeWay is on the DeviceNet network and is not currently communicating with any devices.                   |
| Solid Red      | DeviceNet interface fault | A major fault in the DeviceNet interface has been detected. Possible causes include Bus-off or duplicate MAC ID. |
| Flashing Red   | Connection time-out       | A connection with at least 1 slave device has timed out.   |

**Table 7-2 DeviceNet Network Status LED States****DeviceNet Module Status LED**

| State          | Summary                   | Description   |
|----------------|---------------------------|---|
| Flashing Green | Standby or not configured | The DeviceNet network configuration has not been configured and is currently using default values.<br><br>This LED state is also used to indicate that the DeviceNet interface is in a standby state. This could occur during autobaud. |
| Solid Green    | Normal operation          | Normal  |
| Solid Red      | Unrecoverable major fault | A fault that requires user intervention has been detected. Correct the problem and reset the BridgeWay.   |
| Flashing Red   | Recoverable minor fault.  | A fault that can be corrected and does not require a BridgeWay reset has been detected.   |

**Table 7-3 DeviceNet Module Status LED States**

**PROFIBUS Online LED**

| State       | Summary                     | Description   |
|-------------|-----------------------------|---|
| Off         | Offline, or no module power | The BridgeWay is either not powered, or not online on PROFIBUS. |
| Solid Green | Online                      | The BridgeWay is online on the PROFIBUS network.                |

**Table 7-4 PROFIBUS Online LED States****PROFIBUS Offline LED**

| State     | Summary                    | Description   |
|-----------|----------------------------|---|
| Off       | Online, or no module power | The BridgeWay is either not powered or is online on PROFIBUS.               |
| Solid Red | Offline                    | The BridgeWay is powered up, but is not participating in PROFIBUS activity. |

**Table 7-5 PROFIBUS Offline LED States****PROFIBUS Diagnostic LED**

| State               | Summary                  | Description  |
|---------------------|--------------------------|--|
| Off                 | Normal                   | No diagnostics are present.  |
| Flashing Red at 1Hz | Configura-<br>tion error | The input and/or output length set in module configuration does not match the value(s) set during network configuration. |
| Flashing Red at 4Hz | Hardware<br>error        | An error occurred while initializing the PROFIBUS ASIC.  |

**Table 7-6 PROFIBUS Diagnostic LED States**

## ***PROFIBUS Device Diagnostic Data***

Device diagnostic data is sent to the PROFIBUS master whenever there is a change in module status. The diagnostic data can be used by the master to determine the current status of the module, as well as a measure of I/O data integrity.

### **Diagnostic Data Format**

The diagnostic data consists of 19 bytes with the following layout.

| <b>Byte Offset</b> | <b>Description</b>               |
|--------------------|----------------------------------|
| 0                  | PROFIBUS Diagnostic Control Byte |
| 1                  | BridgeWay module status.         |
| 2                  | DeviceNet network status.        |
| 3-10               | DeviceNet active node table.     |
| 11-18              | DeviceNet faulted node table.    |

**Table 7-7 PROFIBUS Diagnostic Data Format**

### **BridgeWay Module Status**

The BridgeWay module status value is a bit-string with the following bit definitions.

| <b>Bit</b> | <b>Description</b>  |
|------------|---|
| 0          | Module in Run mode. The bit is cleared when the module is in Idle mode.   |
| 1          | A DeviceNet network error is active. See the DeviceNet network status value for the specific error.                     |
| 2          | A DeviceNet slave error is active. See the DeviceNet faulted node table to determine which slave connection is faulted. |
| 3          | PROFIBUS I/O size error. The input or output size, or both, resulting from the scan list configuration is invalid.      |
| 4-7        | Not used.   |

**Table 7-8 BridgeWay Module Status Bit Definitions**

**DeviceNet Network Status**

The DeviceNet network status value is an enumerated value. The possible status values are listed below.

| <b>Status Code</b> | <b>Description</b>   |
|--------------------|--|
| 1                  | Online with no errors.   |
| 60                 | Duplicate MAC ID test in progress.                                     |
| 70                 | Duplicate MAC ID failure.  |
| 71                 | Scanner configuration error.   |
| 72                 | Communications failed with the device.                                 |
| 73                 | Incorrect device type.   |
| 74                 | CAN receive overrun error.   |
| 75                 | CAN network failure.   |
| 76                 | Scanner is lonely; it is not receiving any network traffic.            |
| 77                 | Incorrect connection size.   |
| 78                 | No response from the device.   |
| 79                 | CAN transmit failure.  |
| 80                 | In Idle mode.  |
| 81                 | Faulted.   |
| 82                 | DeviceNet fragmentation error.   |
| 83                 | Error during slave connection initialization.                          |
| 84                 | Slave connection initialization in progress.                           |
| 85                 | Incorrect data size received on connection.                            |
| 86                 | Device went into Idle mode.  |
| 87                 | Shared master has not made connection to the device.                   |
| 88                 | Shared master has not made the right type of connection to the device. |
| 89                 | ADR keeper error.  |
| 90                 | CAN network disabled.  |
| 91                 | CAN bus-off.   |
| 92                 | No DeviceNet power.  |

**Table 7-9 Node Status Codes**

| Status Code | Description               |
|-------------|---------------------------|
| 95          | Flash update in progress. |
| 96          | CAN port is in Test mode. |
| 97          | Device halted.            |
| 98          | Firmware failure.         |
| 99          | System failure.           |

**Table 7-9 Node Status Codes (Continued)**

#### DeviceNet Active Node Table

The active node table is a 64-bit bit-string that indicates the devices which are configured as slaves to the BridgeWay on DeviceNet. Each bit in the table corresponds to a MAC ID, from 0-63. If a bit is set, the device at the corresponding MAC ID is configured as a slave to the BridgeWay.

#### DeviceNet Faulted Node Table

The faulted node table is a 64-bit bit-string that indicates the devices which are configured as slaves to the BridgeWay and have faulted. Each bit in the table corresponds to a MAC ID, from 0-63. If a bit is set in the faulted node table, connections to the device at the corresponding MAC ID are not working correctly.

#### **Static Diagnostic Control Bit**

The BridgeWay makes use of the *Static* bit in the diagnostic control byte to notify the PROFIBUS master that the I/O data integrity is in question. If the Static bit is set, it is suggested that the PROFIBUS master ignore the input data and stop updating the output data.

The Static bit is set in the diagnostic control byte if any of the following conditions are true.

- The BridgeWay is in Idle mode.
- The DeviceNet network status is *Offline*. (DeviceNet interface fault)
- The I/O sizes resulting from the current scan list configuration are invalid.

# Specifications

## *Environmental Specifications*

### **Temperature**

Operating: 0 to 70 degrees Celsius

Non-Operating: -25 to 85 degrees Celsius

## *EMC Directive Compliance*

This product is tested to meet the Council Directive 89/336/EC Electromagnetic Compatibility (EMC) by applying the following standards, in whole or in part, documented in a technical construction file:

- EN50081-2-EMC Generic Emission Standard, Part 2 - Industrial Environment
- EN50082-2-EMC Generic Immunity Standard, Part 2 - Industrial Environment

This product is intended for use in an industrial environment.

## *Electrical Specifications*

### **DC Power**

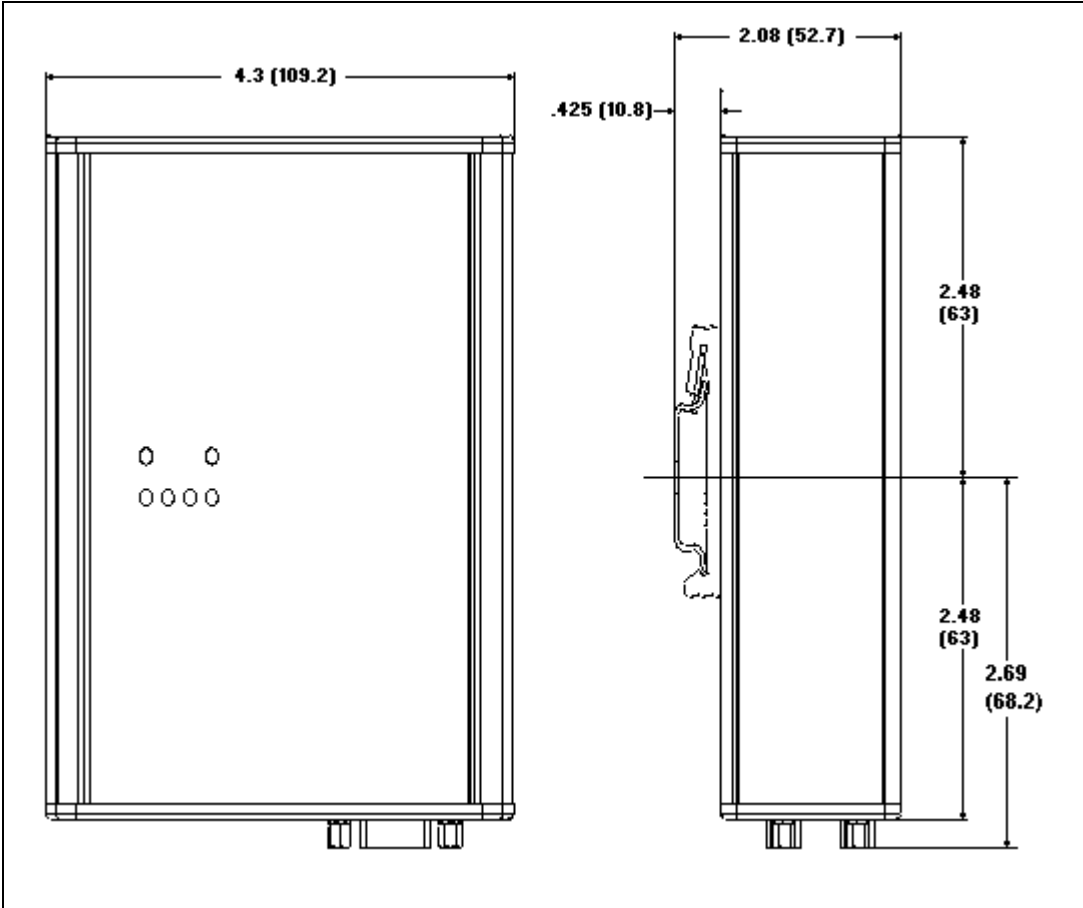
Operating voltage: 7-32 VDC.

Current Requirements: 105-110 mA at 24 VDC.

**Mechanical Specifications**

**Mechanical Rating**  
IP20/NEMA 1

**Dimensions**



**Figure 8-1 BridgeWay PROFIBUS to DeviceNet Gateway Mechanical Dimensions**

### ***I/O Data Sizes***

- Maximum 244 bytes Input table size.
- Maximum 244 bytes Output table size.
- Combined Input and Output table size must not be more than 400 bytes.
- There must be at least 1 byte of Input or Output data configured.



# Connectors

## Power

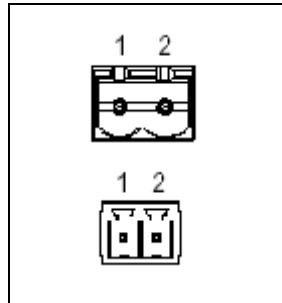
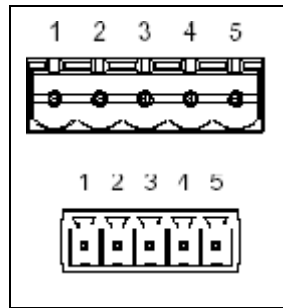


Figure 9-1 Power Connector

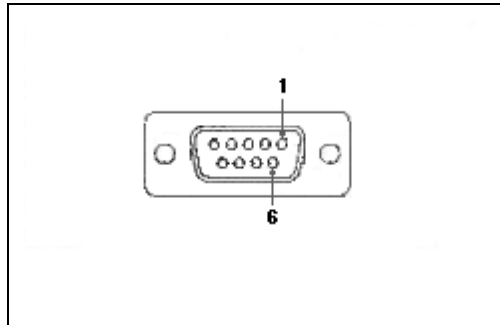
| Pin | Connection    |
|-----|---------------|
| 1   | 24 VDC +      |
| 2   | 24 VDC Common |

Table 9-1 Power Connector Pin Definitions

**DeviceNet****Figure 9-2 DeviceNet Connector**

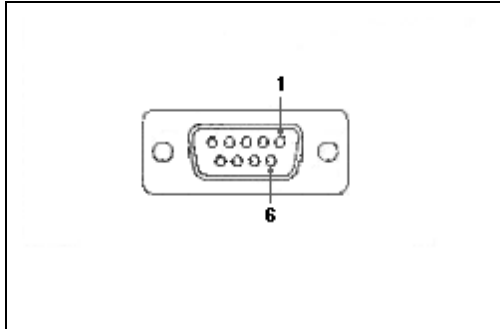
| Pin | Connection    |
|-----|---------------|
| 1   | 24 VDC Common |
| 2   | CAN Low       |
| 3   | Shield        |
| 4   | CAN High      |
| 5   | 24 VDC        |

**Table 9-2 DeviceNet Connector Pin Definitions**

**PROFIBUS****Figure 9-3 PROFIBUS Connector**

| Pin | Connection |
|-----|------------|
| 1   | Not used   |
| 2   | Not used   |
| 3   | B-Line     |
| 4   | RTS        |
| 5   | GND Bus    |
| 6   | +5 V Bus   |
| 7   | Not used   |
| 8   | A-Line     |
| 9   | Not used   |

**Table 9-3 PROFIBUS Connector Pin Definitions**

**Auxiliary RS-232****Figure 9-4 Auxiliary RS-232 Connector**

| Pin | Connection    |
|-----|---------------|
| 1   | Not used      |
| 2   | Receive Data  |
| 3   | Transmit Data |
| 4   | Not used      |
| 5   | Not used      |
| 6   | Not used      |
| 7   | Not used      |
| 8   | Not used      |
| 9   | Not used      |

**Table 9-4 Auxiliary RS-232 Pin Definitions**

## Warranty

Pyramid Solutions warrants all new products to be free of defects in material and workmanship when applied in the manner for which they were intended and according to Pyramid Solutions' published information on proper installation. The Warranty period is one year from the date of shipment.

Pyramid Solutions will repair or replace, at its option, all products returned to it freight prepaid, which prove upon examination to be within the Warranty definitions and time period.

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# Support

## ***Technical Product Assistance***

If you need to contact Pyramid Solutions for technical assistance, ask for BridgeWay technical support at:

**1-248-524-3890.**

You can obtain technical assistance by email at:

**ProductSupport@pyramid-solutions.com.**

You can also obtain technical assistance and download documentation and firmware updates online at:

**[http://www.pyramid-solutions.com/Expertise\\_DataCom\\_Support.htm](http://www.pyramid-solutions.com/Expertise_DataCom_Support.htm).**

## ***Contact Information***

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