USER MANUAL

Revision: 0

Based on P-Series PLC on a Chip

HEC-Gateway

Covered Models:

HEC-GW-X-X
HEC-GW-C-W
HEC-GW-C-X
HEC-GW-X-W

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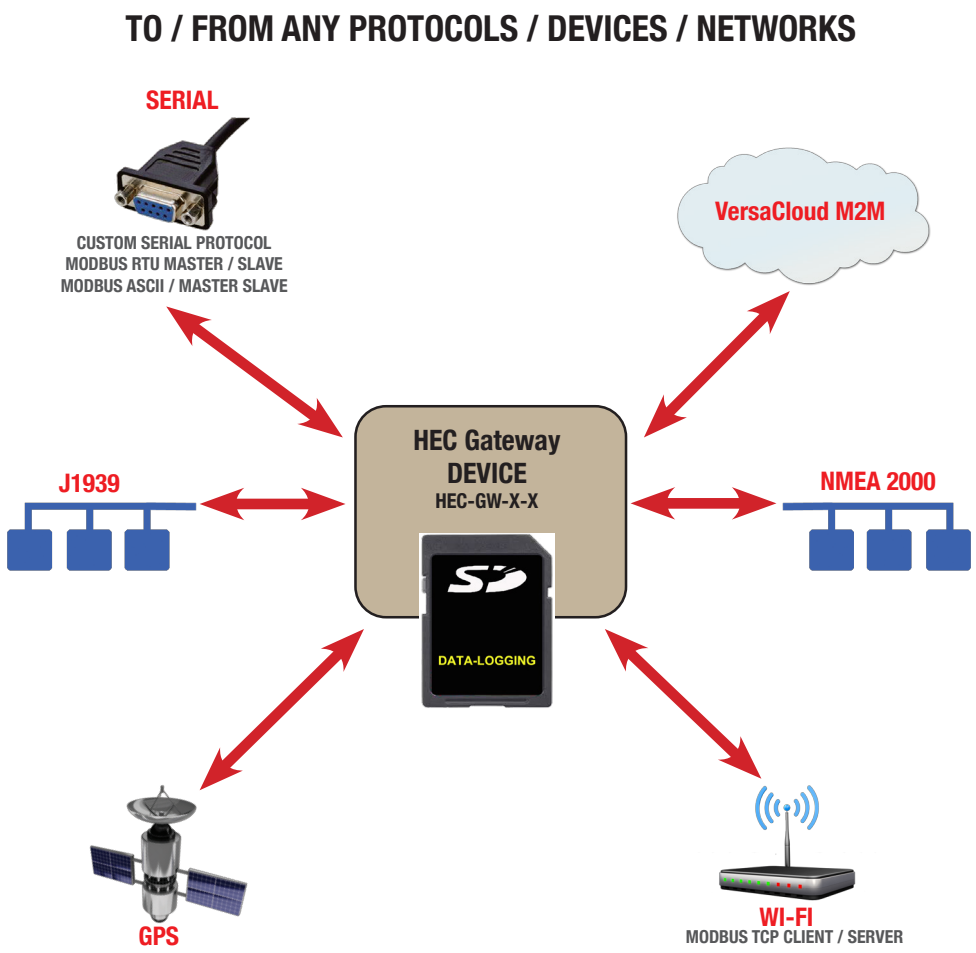
Getting Started

The HEC-Gateway is a ladder diagram, function block and structured text programmable device that can act as an intermediate communication device between multiple sources alone (communication buses) or between multiple sources (communication buses) and the VERSACLOUD M2M Cloud. The HEC-Gateway can communicate to/from other devices using WI-FI (Modbus TCP), Serial RS232 (Modbus Master/Slave or custom driver with Structured Text) and CAN devices (SAE J1939 / NMEA 2000 / OptiCAN) to/from the cloud (VERSACLOUD M2M cloud) using WI-FI and cellular data.

This communication provides the ability to monitor, control and collect data from one to multiple devices and have access and control from any smart device such as computer, smartphone or tablet.



This HEC-Gateway User Manual is intended to provide the basics and information for accessing the HEC-Gateway hardware specific features. As the HEC-Gateway programs using EZ LADDER Toolkit as the programming platform (ladder diagram function block and Structured Text), the HEC-Gateway User Manual should be used in conjunction with the P-Series EZ LADDER Toolkit Manual. The P-Series EZ LADDER Toolkit Manual provides greater information and support documentation for some hardware features as well as comprehensive information on using and implementing software features and functions.

This section explains how to read this manual and understand the symbols and information that it contains.

To begin using your HEC-Gateway Device, you will need to follow these steps:

- Install EZ LADDER Toolkit if not already installed (ordered separately, contact Divelbiss).
- Configure the HEC-Gateway in the EZ LADDER Toolkit Project Settings.
- Using purchased or self-made cables, connect the Input Power and Programming Port.
- Write a ladder diagram program.
- Install the HEC-Gateway's Kernel if this is a new unit from the factory.
- Download and run the program on the HEC-Gateway

Additional items that will need to be completed based on your specific applications needs:

- Configure on-board jumpers for Serial Ports and CAN Ports configurations.
- Bootloader Configurations for SD Card and Wi-Fi

Refer to the appropriate sections of this manual for details on the above items.

WARNING!!

The HEC-GATEWAY must not be used in applications which could be hazardous to personnel in the event of failure of this device. Precautions must be taken by the user to provide mechanical and/or electrical safeguards external to this device. This device is NOT APPROVED for domestic or human medical use.

How to Use this Manual

In this manual, the following conventions are used to distinguish elements of text:

BOLD	Denotes labeling, commands, and literal portions of syntax that must appear exactly as shown.
Italic	Used for variables and placeholders that represent the type of text to be entered by the user.
SMALL CAPS	Used to show key sequences or actual buttons, such as OK, where the user clicks the OK button.

In addition, the following symbols appear periodically in the left margin to call the readers attention to specific details in the text:

Warns the reader of a potential danger or hazard associated with certain actions.

Appears when the text contains a tip that is especially useful.

Indicates the text contains information to which the reader should pay particularly close attention.

All Specifications and Information Subject to Change without Notice

The HEC-Gateway Overview

The HEC-Gateway is a powerful and versatile interface / gateway device based on the new P-Series PLC on a Chip™.

The HEC-Gateway boasts the following capabilities:

- 9 to 32VDC Operation
- -40°C to 80°C Operating Temperature Range
- Wi-Fi Communications via Modbus TCP, VersaCloud M2M or as Programming Port (Model Dependent)
- Micro SD Card for Kernel and Program updates and Data Logging using Structured Text.
- 1 CAN Port, NMEA compliant. Supports SAE J1939, NMEA 2000 and Divelbiss OptiCAN
- 2 General Purpose Serial Ports - RS232. Support Custom drivers and Modbus Master / Slave.
- 2 External Analog Inputs, configurable for 0-5VDC, 0-10VDC or 0-20mADC.
- 1 Internal Analog Input for monitoring the on-board battery voltage.
- 1 Internal Analog Input for monitoring the input power.
- 1 Sourcing Digital Output (2 Amps)
- 1 Digital Input / High Speed Counter Input (configurable NPN/PNP) with Software controlled debounce.
- 1 Programmable LEDs
- Power Monitor LED and Status/Watchdog LED
- Real Time Clock
- Retentive Memory and EEPROM Storage
- Sealed Deutsch removable plug.
- Cellular Modem Data using VersaCloud M2M (Model dependent)
- GPS Locations using external HEC-P5-GPS
- 512K Battery Backed S-RAM

Some of the features listed above are based on the HEC-Gateway model purchased. To gain the use of some features, other features may become unusable. Refer to the individual feature sections in this manual for details.

HEC-Gateway Models

The following models are available for the HEC-Gateway device.

Ordering Information:

Model	Description
HEC-GW-X-X	HEC-Gateway Base Model with Cellular[2] Data Modem
HEC-GW-C-X	HEC-Gateway Base Model with Cellular[2] Data Modem
HEC-GW-X-W	HEC-Gateway Base Model with Wi-Fi Connectivity
HEC-GW-C-W	HEC-Gateway Base Model with Cellular[2] Data Modem and Wi-Fi Connectivity

1: Cellular data provided by VersaCloud by Divelbiss
2: VersaCloud features require VersaCloud M2M Package with Cloud Portal. Additional charges apply to connected devices.

Configuring the HEC-Gateway Target in EZ LADDER Toolkit

Before you can program and use the HEC-Gateway Device, it must be configured as a target within the EZ LADDER Toolkit. For help with installing or using EZ LADDER, please refer to the P-Series EZ LADDER User's Manual.

The HEC-Gateway programs using the P-Series EZ LADDER Toolkit. It is not compatible with M-Series EZ LADDER Toolkit.

1. In P-Series EZ LADDER Toolkit, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the ***Project Settings*** Window. Select **HEC-Gateway** as the target from the choices. Refer to Figure 1-1. Verify the correct computer COM Port for communication to the HEC-Gateway target is selected.

2. Click the **PROPERTIES** button to the right side of the window. The ***HEC-Gateway Properties*** Window will open.

3. Using the Drop-down Part Number select box, select the model of the HEC-Gateway from the choices. Refer to Figure 1-2. With the model selected, the Devices pane will update with the currently selected features for the HEC-Gateway. The **ADD DEVICE** button is used to install and configure additional features such as Modbus or J1939 that are not automatically loaded and configured. For this example, we will not add additional features at this time. These features may be installed and configured by re-visiting this window.

4. Click **OK**. This will close the HEC-Gateway Properties window and save the model selected.

5. Click **OK**. This will close the Project Settings Window, saving the target and installed features for this ladder diagram project.

Note: Any features not shown when clicking **ADD DEVICE** are already installed when the target is selected or are not available.

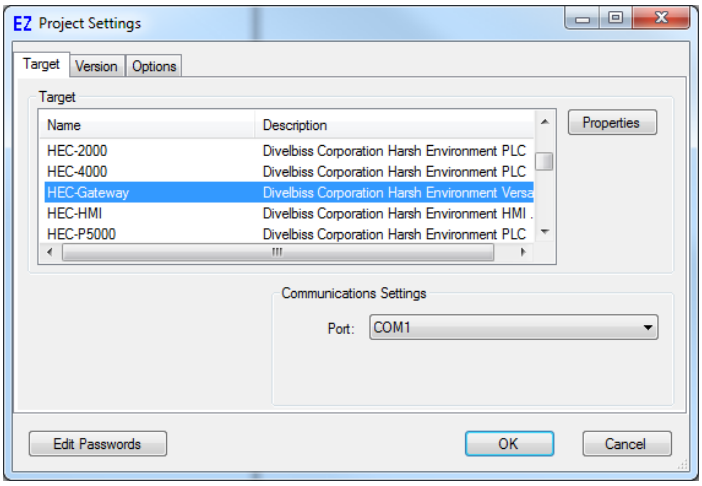


Figure 1-1 - Project Settings Window

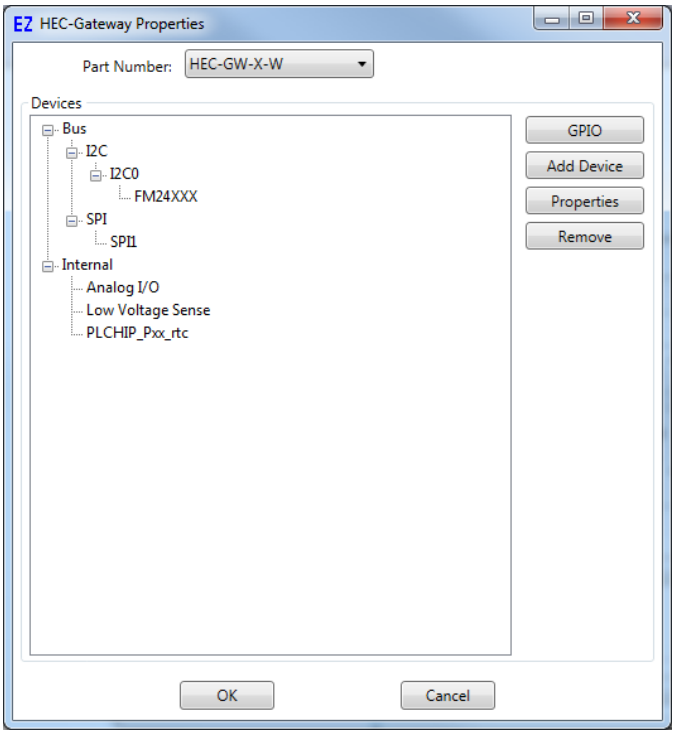


Figure 1-2 - HEC-Gateway Properties Window

6. Save your P-Series EZ LADDER Toolkit project by using the **SAVE** or **SAVE AS** from the File Menu at the top of P-Series EZ LADDER Toolkit.

Loading the HEC-Gateway Kernel

THE HEC-Gateway WILL NOT FUNCTION UNLESS THIS STEP (KERNEL LOADING) IS COMPLETED.

The kernel is the firmware for the device and to provide greater flexibility and reliability, HEC-Gateway device shipments are factory shipped **without** a kernel installed. If this is a new unit from the factory, it will be necessary to load the kernel before a ladder program can be downloaded. If the kernel is already loaded, this step is not required. To upgrade a kernel, see the P-Series EZ LADDER Toolkit Manual.

To install the HEC-Gateway's kernel:

1. Verify the target has been configured (see *Configuring the HEC-Gateway Target in EZ LADDER Toolkit*).

2. Connect the Programming cable(s) from the computer to the HEC-Gateway device. See *Programming Port* in the *VersaGateway Features* section. An HEC-910 Programming port Breakout cable is recommended.

3. Create a small one-rung program with a normally open (direct contact) and an output tied together. You may also open a pre-existing program for the HEC-Gateway Device. EZ LADDER Toolkit includes a sub-directory (...EZ LADDER\P-Series Example Programs\)which has starter programs for each target to load the kernel. Choose ***GetStarted_HEC-GW-X-X.dld***. (where X-X-X is the model of VersaGateway device).

4. Click the 

(Compile) button

5. Click the 

(Monitor) button to change from the 'Edit' to 'Monitor' Mode.

6. Click the 
(Connect) button to connect to the target. A dialog will appear automatically when no kernel is loaded. If this dialog does not appear, click **PROJECT** then **BOOTLOADER**.

7. Click the **BROWSE** button and select the target's kernel (by part number) located by default at C:\Program Files\EZ Ladder\Kernel\. Refer to Figure 1-3.

The following are kernel names and descriptions:

File Name	Description	To be Used on (Part number)
HEC-Gateway.dat	Kernel for HEC-Gateway	All HEC-Gateway Devices

8. Click the **OPEN** button to finish the kernel selection. Make sure the correct kernel is chosen.

9. Click the **UPDATE TARGET** button to install the kernel. Refer to Figure 1-4.

10. A dialog box will appear to show the status of the kernel installation. This could take a couple of minutes to install.

11. When the dialog windows close, the installation is complete. The HEC-Gateway Device is ready to use and may be connected to and programs may be downloaded.

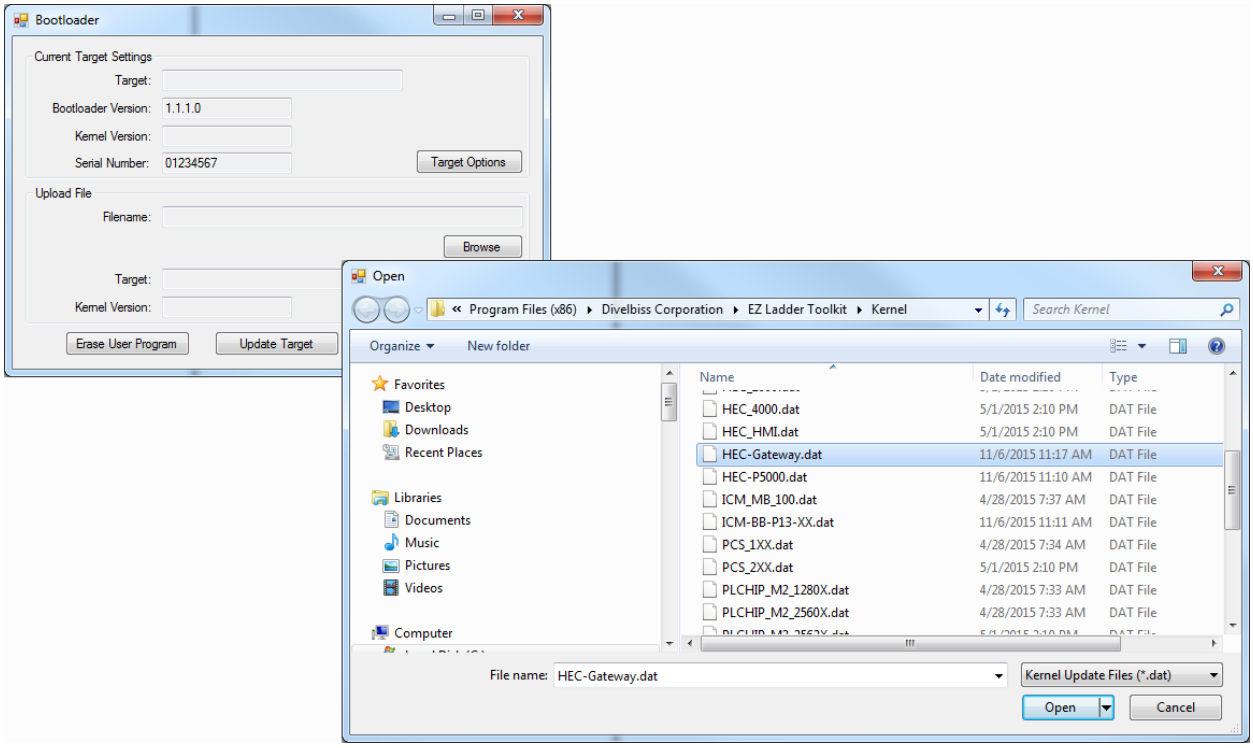


Figure 1-3 - Browse to Kernel

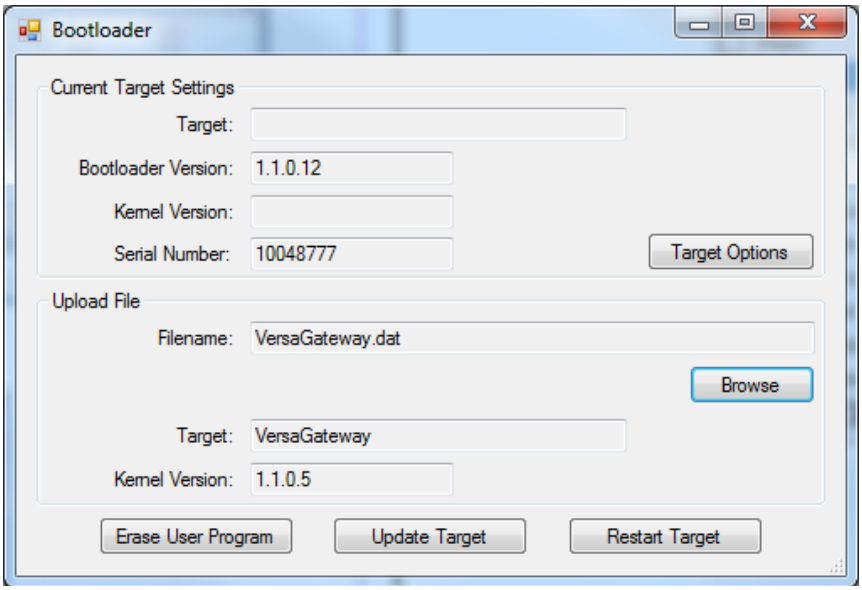


Figure 1-4 - Bootloader - Update Target

Getting to Know the HEC-Gateway Device

The HEC-Gateway device is designed to provide powerful programmable features in an easy to mount and sealed package. The HECGateway device's features are accessed via a sealed Deutsch connector and an M-12 connector. Configuration items such as jumpers and switches are internal and require dis-assembly of the HEC-Gateway for configuration.

Figure 1-5 illustrates the HEC-Gateway device and it's external features.

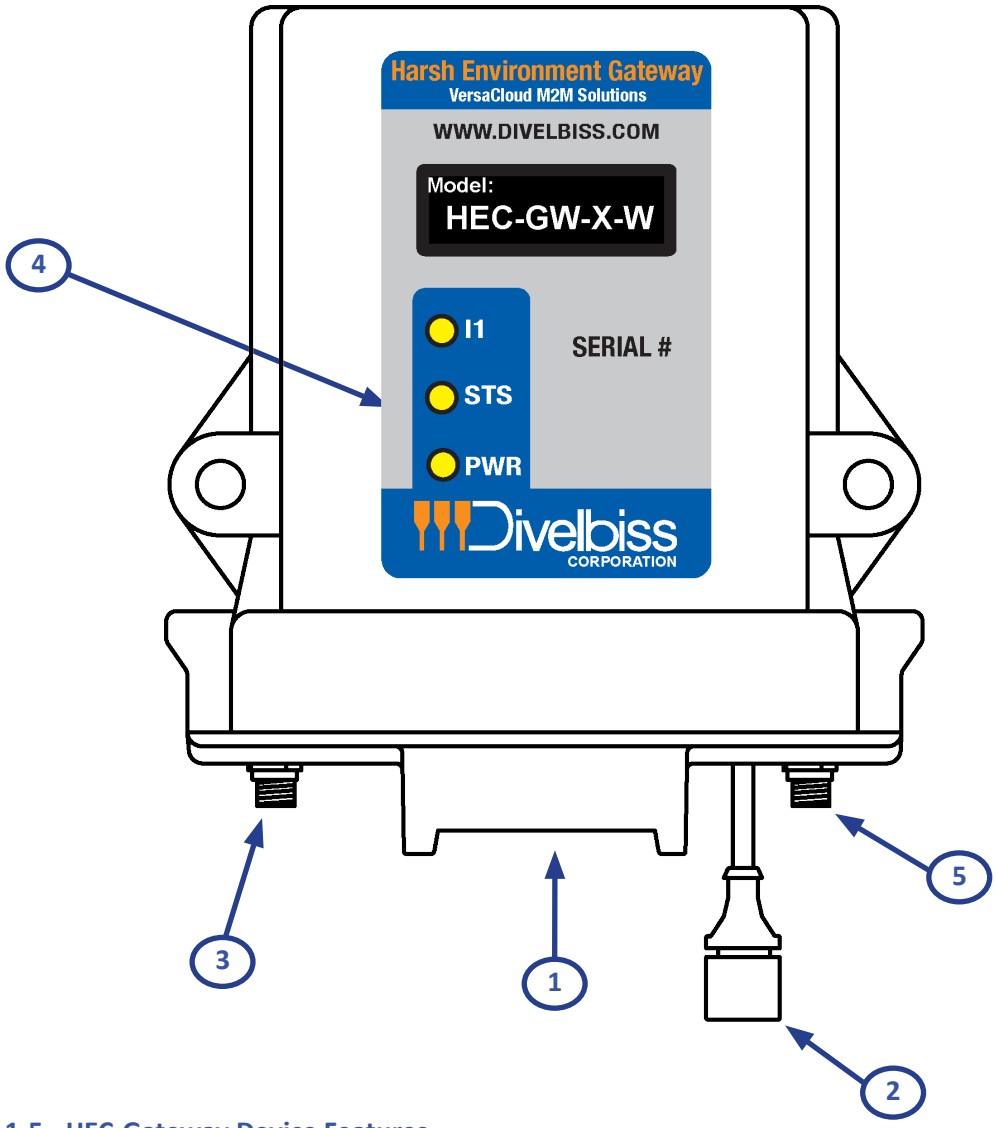


Figure 1-5 - HEC-Gateway Device Features

1. 'A' Connector (Deutsch)
2. Serial Port Connector / Cable
3. Wi-Fi Antenna Port
4. Watchdog/Status LED, Power Status LEDs and Programmable LED
5. Cellular Data Modem Antenna Port

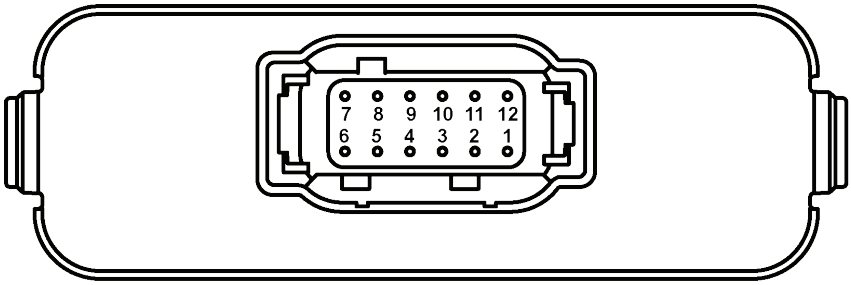


Figure 1-6 - HEC-Gateway 'A' Connector Pin out

A Connector Pin Assignments

Pin 1	CAN 1 Hi	Pin 7	+VDC Input Power
Pin 2	CAN 1 Low	Pin 8	Output 0 (DOT 0)
Pin 3	CAN 1 +V	Pin 9	Input 0 (DIN0 / CNTR0)
Pin 4	CAN 1 GND	Pin 10	-DC / Input Power Common
Pin 5	Programming Port TX	Pin 11	Analog Input 1
Pin 6	Programming Port RX	Pin 12	Analog Input 0

HEC-Gateway Mounting

The HEC-Gateway devices are designed to be subplate / panel mounted using screws. Refer to Figure 1-7 for mounting dimensions. When mounting, it is recommended the HEC-Gateway be mounted with the 'A' connector facing down as shown to reduce moisture build-up on the connector.

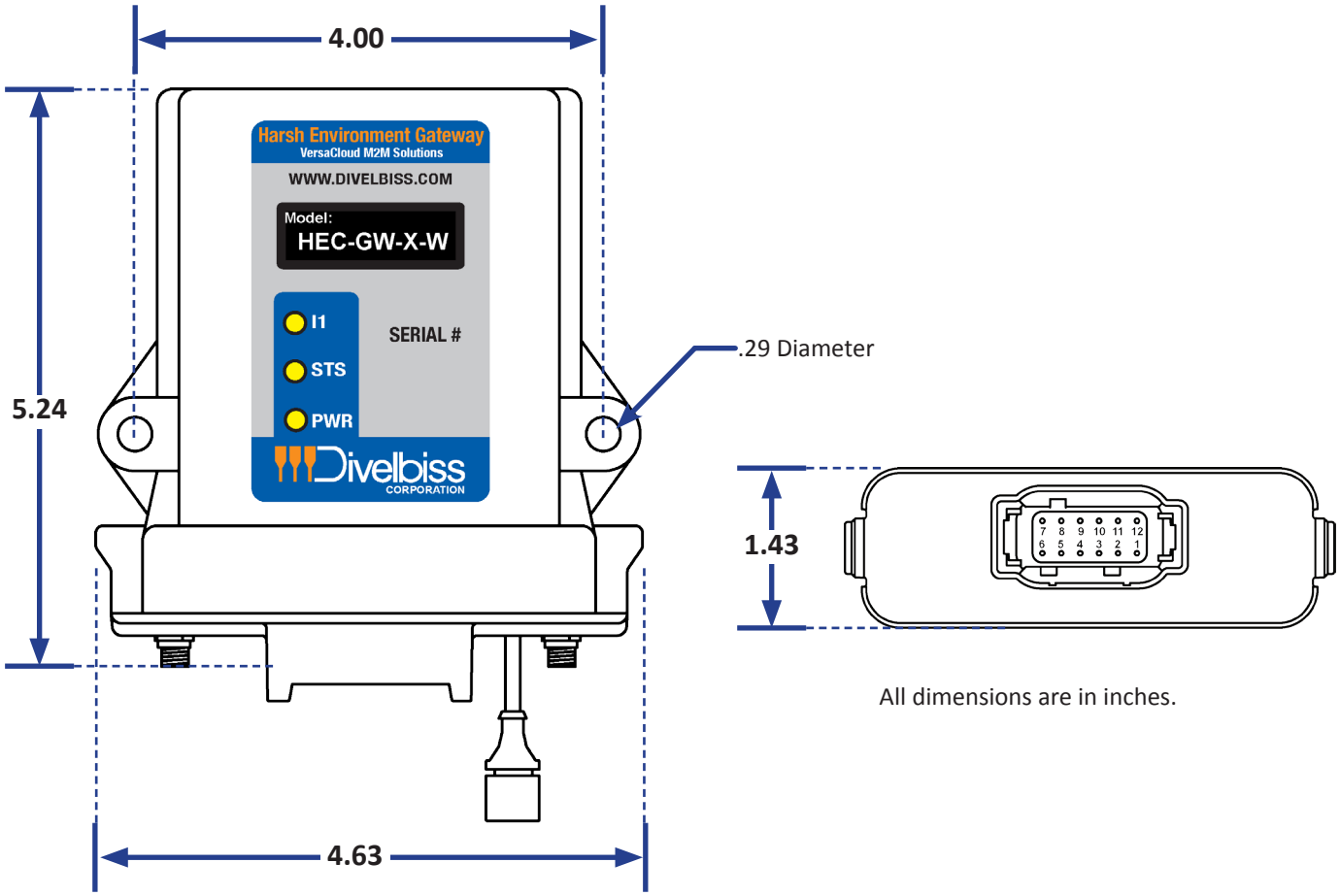


Figure 1-7 - HEC-Gateway Mounting Dimensions

Assembling / Dis-Assembling the HEC-Gateway

To dis-assemble the HEC-Gateway you will need a flat-head screwdriver.

1. Place the screwdriver as shown, press in on the locking latch (of the connector assembly) and push forward gently simultaneously to slide the locking latch out of the enclosure .

2. Repeat this for the second side and slide the entire connector assembly with the printed circuit board out of the enclosure.

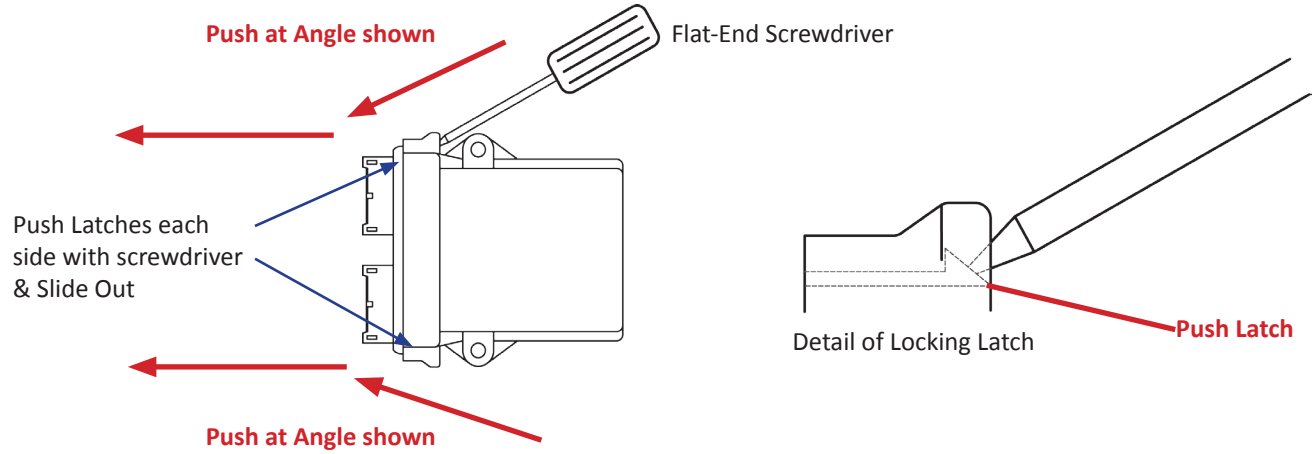


Figure 1-8 - HEC-Gateway Dis-Assembly

To assemble the HEC Gateway:

1. Align the connector assembly with printed circuit board into the enclosure. The printed circuit board wil align with the slots in the enclosure.

2. Slide the assembly completely into the enclosure until the locking latches are secure. Please note: Care must be taken when sliding the assembly into the enclosure due to the serial port cable and antenna wires.

Configuration Jumpers & Switches

Some features of the HEC-Gateway have configurable options such as the CAN port, analog inputs and digital input. These options are configured using on-board switches and jumpers / shunts. Refer to Figure 1-9 for general switch and jumper locations. Each of these switches and jumpers with their specific operational characteristics is detailed in later sections of this manual. Please refer to these sections before changing switch or jumper settings.

CONFIGURATION SWITCHES SUMMARY		
SWITCH ID	SWITCH to ON Position	SWITCH to OFF Position
SW1-1	User Programmable Switch Input - True	User Programmable Switch Input - False
SW1-2	Analog Input 0 - Configured for 0-20mADC Operation	Analog Input 0 - Configured for Voltage Operation
SW1-3	Analog Input 0 Voltage Mode 0-10VDC*	Analog Input 0 Voltage Mode 0-5VDC*
SW1-4	Analog Input 1 - Configured for 0-20mADC Operation	Analog Input 1 - Configured for Voltage Operation
SW1-5	Analog Input 1 Voltage Mode 0-10VDC*	Analog Input 1 Voltage Mode 0-5VDC*

*When configured for 0-20mADC, switch (Voltage Mode) must be OFF (0-5VDC mode) for proper operation.

CONFIGURATION JUMPERS SUMMARY		
JUMPER ID	JUMPER SETTING	DESCRIPTION
JP1	Shunt installed Pins 1-2	Digital Input 0 / Counter Input 0 Configured for NPN
	Shunt installed Pins 2-3	Digital Input 0 / Counter Input 0 Configured for PNP
CP1	Shunt installed Pins 1-2	CAN Port 1, External Power Source 9-32VDC*
	Shunt installed Pins 2-3	CAN Port 1, External Power Source 5VDC*
	Shunts installed Pin 1-2 & 3-4	CAN Port 1, Internal (on-board) Power Source*
CP2	Shunt installed Pins 1-2	CAN Port 1, Internal Power Source*
	Shunt installed Pins 2-3	CAN Port 1, External Power Source*
JMP13	Shunt installed Pins 1-2	CAN Port 1 Terminating Resistor Disabled
	Shunt installed Pins 2-3	CAN Port 1 Terminating Resistor Enabled
* Additional Jumper Settings required - See individual manual sections to verify all jumper requirements		

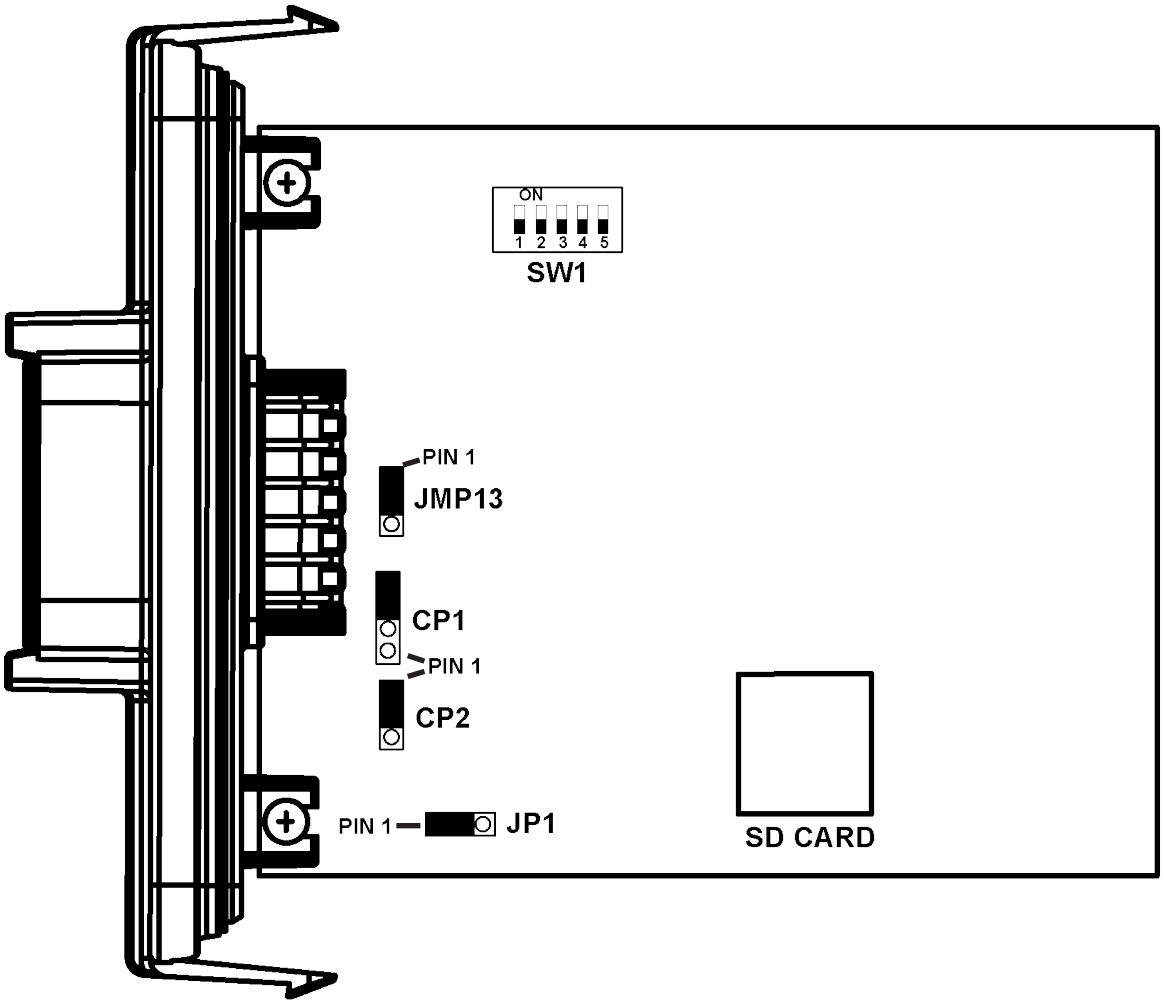


Figure 1-8 - HEC-Gateway Internal Features

Device Features

This sections explains the HEC-Gateway Device features and functions and provides hints and important information for configuring and using the HEC-Gateway.

Input Power

The HEC-Gateway main power is supplied by the pluggable 'A' connector. Refer to Figure 1-5 for location of the 'A' connector. Input current can vary based on model and mode of operation.

Power Input - Pin-Out - Connector A	
PIN #	**CONNECTION**
7	+ DC Input (9-32VDC)
10	- Input (DC Common)

The HEC-Gateway power is NOT fused on-board. It is recommended fusing the +VIN power using an external fuse. Failure to protect the HEC-Gateway may result in damage.

Programming Port

As the HEC-Gateway must be programmed with a ladder diagram, function block and structured text program to operate, it must be programmed using EZ LADDER Toolkit via the programming port that is available on Connector A.

The HEC-Gateway requires a programming cable to connect the device to a computer (with EZ LADDER Toolkit). An in-line breakout programming cable is recommended.. The part number for the programming breakout cable is HEC-910 and must be ordered separately (not included with the HEC-Gateway or EZ LADDER Toolkit).

A programming cable may also be fabricated to power and program the HEC-Gateway. Both power and communications pins must be connected. Pin 10 (DC Common) must be connected to the input power supply and the common/ground of the computer's serial (COM) port.

Input Power / Programming Port Pin-Out Connector A	
PIN #	**CONNECTION**
5	Programming Port TX (transmit)
6	Programming Port RX (receive)
7	+ DC Input (9-32VDC)
10	- Input (DC Common)

Though a cable may be fabricated for the programming port, it is high recommended that the HEC-910 programming cable be purchased and used. Most programming port connectivity issues are either computer related and / or customer fabricated programming cables.

If the computer does not have a serial port, a USB to Serial adapter must be used. We recommend a high quality USB-Serial adapter similar to the 138-106865 that we offer separately.

EZ LADDER Toolkit automatically configures the programming port on the computer for communications to the HEC-Gateway (57600, N, 8, 1).

The programming port cannot be used in any capacity other than device programming.

The HEC-910 programming breakout cable plugs into the A connector and provides a connection point (socket) that allows the normal 'A' cable for input power and field devices to be plugged into. This makes the HEC-910 an in-line programming cable that allows for full I/O functionality. A NULL modem communcations cable (also available for purchase) connects the breakout DB9 connector on the HEC-910 to the computer's serial port (COM port). Refer to Figure 2-1.

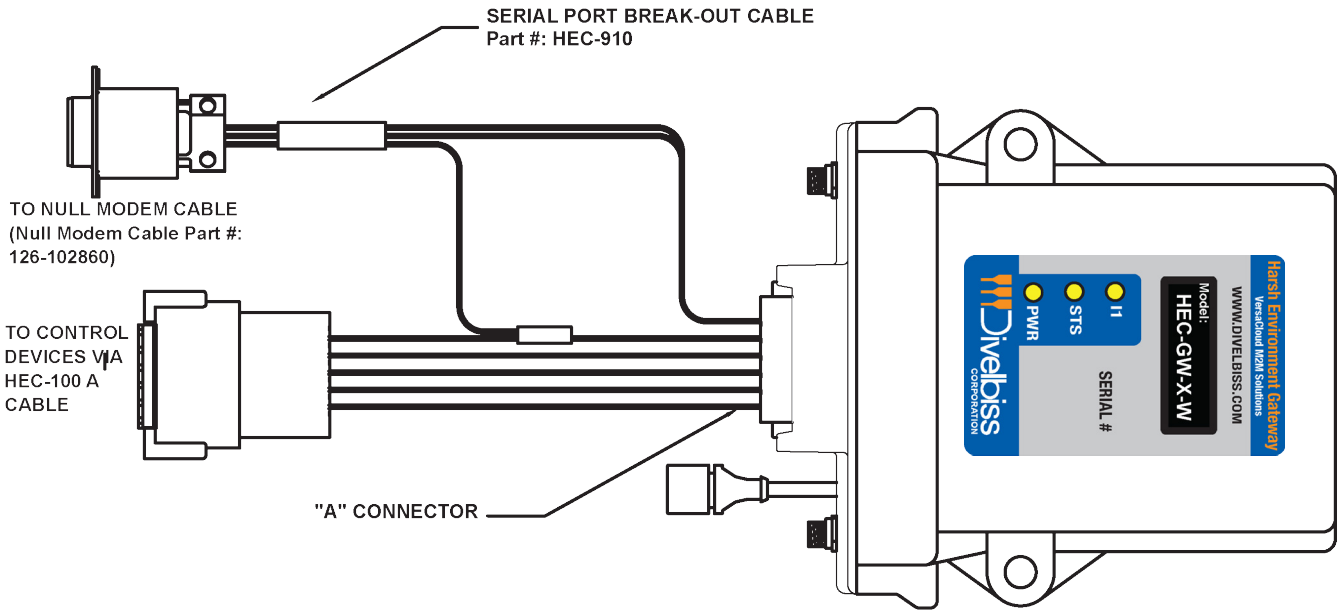


Figure 2-1 - Programming Port - HEC-910

Status LED Indicators

The HEC-Gateway Device provides two pre-defined on-board LED indicators. Refer to Figure 1-5 for general locations of the LED indicators which are viewable externally. The two indicators are: PWR and STS.

PRE-DEFINED LED INDICATORS	
LED NAME	**DESCRIPTION**
PWR	Power OK (green). On when proper input power is detected.
STS	Status/Watchdog (green). Flickers when no KERNEL is installed. Flashes slowly when KERNEL is installed, but no ladder diagram is running. Flashes about 4x per second when a ladder program is executing.

Programmable LED Indicators

There is one (1) user programmable LED indicator (Green) on the HEC-Gateway. This LED indicator is available for use in the ladder diagram program for any purpose. Refer to Figure 1-5 for the LED indicator location which is viewable externally..

When the HEC-Gateway is selected as the target in EZ LADDER Toolkit, the programmable user LED indicator (I1) is automatically added and a boolean variable automatically created. This variable may be added to the ladder diagram project workspace as needed as a boolean variable or coil and be connected to functions and function blocks. The variable for the programmable user LED indicator is named I1, the same as its external label. Refer to the P-Series EZ LADDER Toolkit manual for details using contacts, coils and boolean variables in ladder diagrams.

PROGRAMMABLE LED INDICATOR	
LED NAME	**DESCRIPTION**
I1	Indicator 1 (green). General Use based on I1 boolean variable in ladder diagram program.

CAN Port 1 - NMEA COMPLIANT

The HEC-Gateway Device provides an NMEA Compliant CAN port (CAN Port 1) for communications to / from external devices. As a NMEA Compliant Port, it can be connected directly to an NMEA 2000 bus or it may be used as any standard CAN port. The CAN port is accessed by Connector A (See Figure 1-5 for location of Connector A)

The HEC-Gateway supports all CAN communications supported by it's base P-Series PLC on a Chip, including SAE J1939, NMEA 2000 and Divelbiss OptiCAN. Refer to the P-Series EZ LADDER Toolkit manual for details on supported CAN protocols and how to implement them.

Using the OptiCAN network, the HEC-Gateway can communicate to other Divelbiss I/O devices and programmable logic controllers (based on PLC on a Chip). Multiple devices may be connected to the CAN port provided they all use the same protocol.

CAN port 1 can be configured with multiple options including the choice of on-board power (standard) or external power (NMEA Compliant) as well as the choice of external supply voltage. These options are all configured using on-board jumpers. Refer to Figure 1-8 for the location of the configuration jumpers. Refer to the **JUMPER CONFIGURATION SETTINGS** later in this section.

CAN PORT 1 CONNECTIONS

CAN port 1 is connected using the A connector. Refer to Figure 2-2 for an example CAN bus connected to CAN 1 and termination locations.

CAN 1 Port Connector A Pin-Out	
PIN #	**CONNECTION**
1	CAN Port 1 HI connection
2	CAN Port 1 LO connection
3	+VDC CAN Power Source (External) Input
4	- CAN Power Source (External) Input

CAN PORT 1 TERMINATION

CAN port 1 requires the use of terminating resistors. The HEC-Gateway devices have an on-board terminating resistor that may be enabled or disabled based on the system layout needs. Only the ends of the CAN network should be terminated using the terminating resistors. The terminator is configured using an on-board configuration Jumper - JMP13. Refer to Figure 1-8 for general location of the JMP13 configuration jumper and for JMP13 Pin 1 location.

CAN PORT 0 TERMINATOR JUMPER		
Jumper ID	**Shunt Installation**	**Description**
JMP13	Shunt installed Pins 1-2	CAN Port 1 Terminating Resistor Disabled
	Shunt installed Pins 2-3	CAN Port 1 Terminating Resistor Enabled

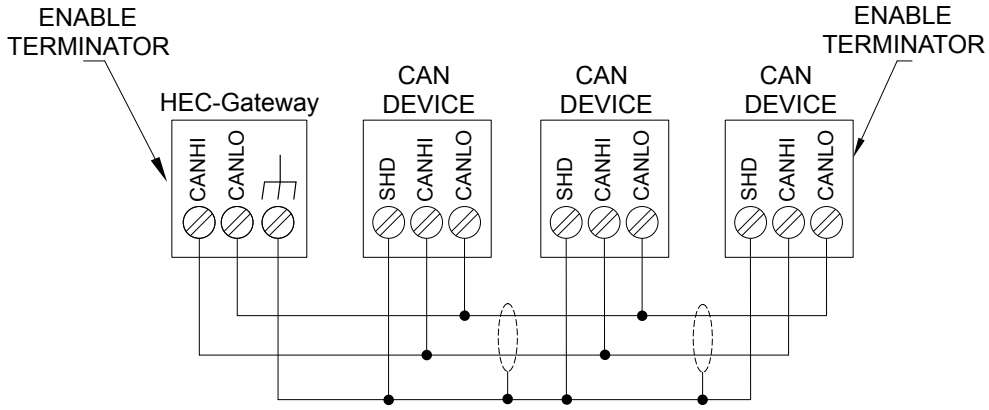


Figure 2-2- CAN Connections & Bus Terminating

CAN PORT 1 JUMPER CONFIGURATIONS

CAN port 1 can be configured with multiple options including the choice of on-board power (standard) or external power (NMEA Compliant) as well as the choice of external supply voltage (if configured for external power). These options are all configured using on-board jumpers. Refer to Figure 1-8 for the location of the configuration jumpers and for CAN Port Jumpers Pin 1 locations.

Both CP1 and CP2 Jumper blocks must be configured for CAN port 1 to be completely configured.

CAN PORT 1 CONFIGURATION JUMPERS		
Jumper ID	**Shunt Installation**	**Description**
CP1	Shunt installed Pins 1-2	CAN Port 1 NMEA Compliant, External 9-32VDC Powered
	Shunt installed Pins 2-3	CAN Port 1 Non-NMEA Compliant, External 5VDC Powered
	Shunts installed Pins 1-2 & 3-4	CAN Port 1 Non-NMEA Compliant, Internally Powered
CP2	Shunt installed Pins 1-2	CAN Port 1 Internally Powered
	Shunt installed Pins 2-3	CAN Port 1 Externally Powered

INSTALLING CAN PORT 1 IN EZ LADDER TOOLKIT

CAN Port 1 must be installed in the ladder diagram program using EZ LADDER Toolkit before it may be used in the ladder diagram program. To install the CAN1 port, it must be configured in the program's target settings using the EZ LADDER Toolkit's Project Settings Menu.

1. In EZ LADDER, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the ***Project Settings*** Window. Select **HEC-Gateway** as the target from the choices.

2. Click the **PROPERTIES** button to the right side of the window. The ***HEC-Gateway Properties*** Window will open. Make sure the proper model (HEC-GW-X-X) is selected in the drop-down menu.

3. If CAN1 were already installed, it would appear under the Bus, CAN heading as CAN1. Click the **ADD DEVICE** button. The *PLCHIP-PXX Devices* window will open.

4. Locate **CAN1** in the *Devices* pane. Click to select (highlight) CAN1. Refer to Figure 2-3. Click **OK**.

5. You will now see CAN1 listed under the Bus - CAN heading. Click **OK** to close the *HEC-Gateway Properties*.

7. Click **OK** to close the *Project Settings* window.

8. Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS** to save the current settings in your program.

The CAN (CAN1) port is now available to use in the ladder diagram program. Additional configurations for OptiCAN or other supported CAN networks may be required to use the CAN port. Refer to the P-Series EZ LADDER Toolkit Manual for details on implementing OptiCAN, J1939 or other supported CAN networks.

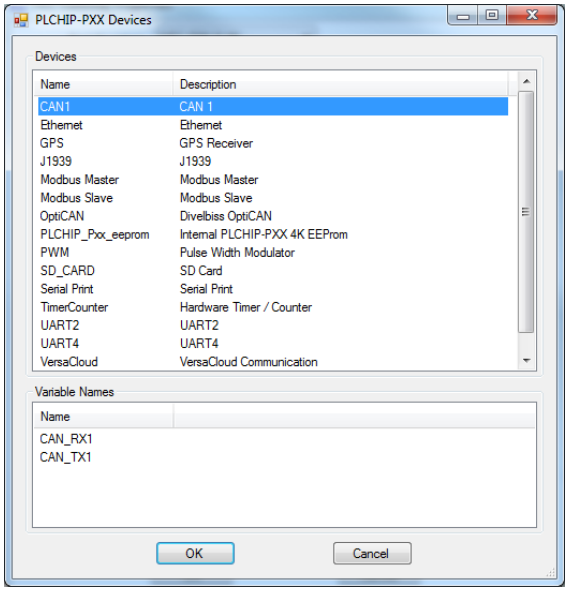


Figure 2-3 - Install CAN1 Device

User Programmable Switch

The HEC-Gateway has one on-board programmable selector switch (SW1-1). Refer to Figure 1-8 for locating SW1. This switch's state may be read (Off = 0 / On = 1) as a digital input in the ladder diagram program. This switch may be used for any function needed in the ladder diagram such as a software configuration switch or configurable *option*. This input is accessed in the ladder diagram using the USR_IN boolean variable. This variable is automatically created when the HEC-Gateway target (HEC-GW-X-X) is selected in the Project Settings.

Digital / Counter Input

The HEC-Gateway includes one on-board digital that will operate from 8VDC to 32VDC. This input may be used individually as a digital input or as high speed counter input. This inputs may be configured as NPN or PNP inputs based on the configuration Jumper JP1. Refer to Figure 1-8 for the location of jumper JP1 and the location the jumper's Pin 1. Refer to Figure 2-4 for a typical connection to the digital input / counter input. Figure 2-5 illustrates the internal digital input / counter circuit.

AS A DIGITAL INPUT

The digital input is available to be read in the ladder diagram as a boolean variable or as a contact. The digital input is identified in the ladder diagram by the variable name DIN0 which is automatically created when the HEC-Gateway target is selected. To read a digital input status in a ladder diagram, place and connect the appropriate contact for your needs. The DIRECT CONTACT and INVERTED CONTACT functions are used to read digital inputs in the ladder diagram. When placing the contact, verify you select the correct variable (DIN0) from the provided drop-down menu.

The digital input (DIN0) has software enabled de-bounce circuitry. This circuitry typically should be enabled when this input is being used as a digital input. When configured as a counter/timer input, the de-bounce should typically be disabled.

The de-bounce circuit for DIN0 is enabled and disabled by adding the variables (coils) named DIN0_DEB. When the variable (coil) is true, the de-bounce circuit is enabled and when the coil is false, the de-bounce circuit is disabled. The variables DIN0_DEB is automatically created by EZ LADDER when the HEC-Gateway target is selected.

Deleting the de-bounce variable from the program will cause the de-bounce circuit to be enabled. This will reduce the frequency the input can read, resulting in inputs not operating properly depending upon the application.

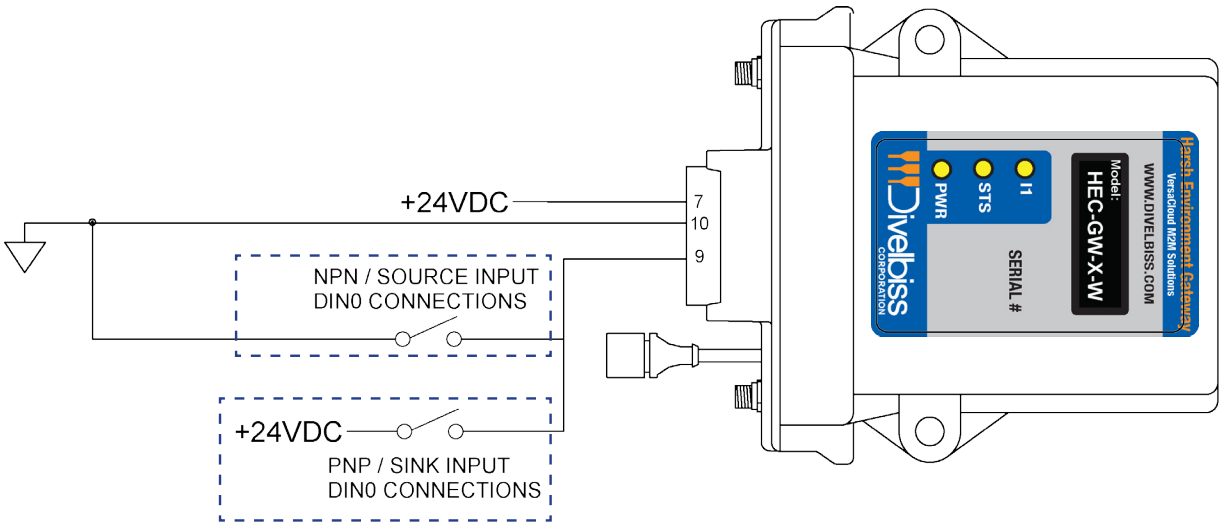


Figure 2-4 - DIN0 Connections

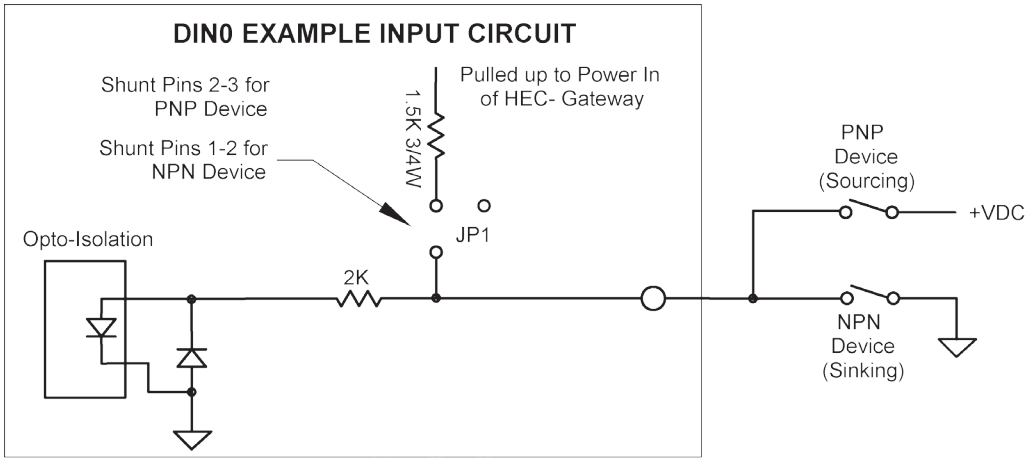


Figure 2-5 - DIN0 Internal Circuit

AS A COUNTER INPUT

As was noted previously the digital input (DIN0) may be utilized as a high speed counter. This counter may be configured in EZ LADDER to operate as an up counter, free running timer and triggered timer. This input will accept a maximum frequency of 100KHz and is optically isolated to promote noise immunity. This input is ideal to anywhere that high speed counting is required; such as calculating RPM, batch counting and more.

Prior to using the high speed counter / timer input in the ladder diagram, the counter / timer functionality must be installed and configured in the ladder diagram's Project Settings.

The first step to installing the counter / timer functionality is to install the TimerCounter feature. Using menu, click **PROJECT** then **SETTINGS** to open the Project Settings window. With the target HEC-Gateway selected still, click the **PROPERTIES** button. The HEC-Gateway Properties Window will open. Verify the proper actual part number is selected in the Drop-down Part Number select box. If the counter/ timer were already installed, it would be listed under the Devices, Internal section.

To install the counter / timer, click the **ADD DEVICE** button. The *PLCHIP-PXX Devices* window will open. From the available devices, select *TimerCounter* and click **OK**. Refer to Figure 2.6.

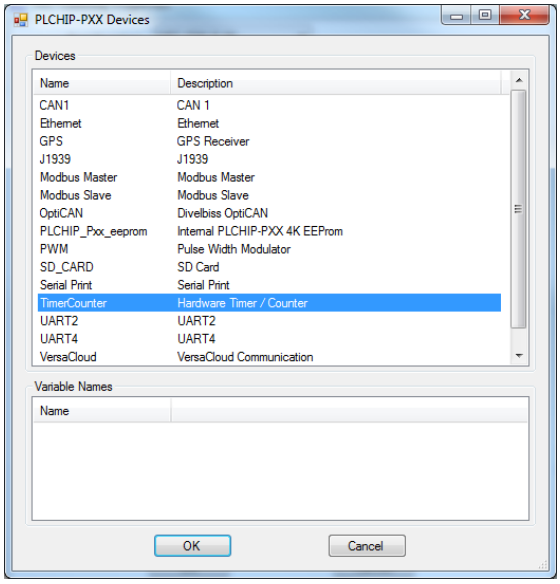


Figure 2-6 - Add TimeCounter Feature

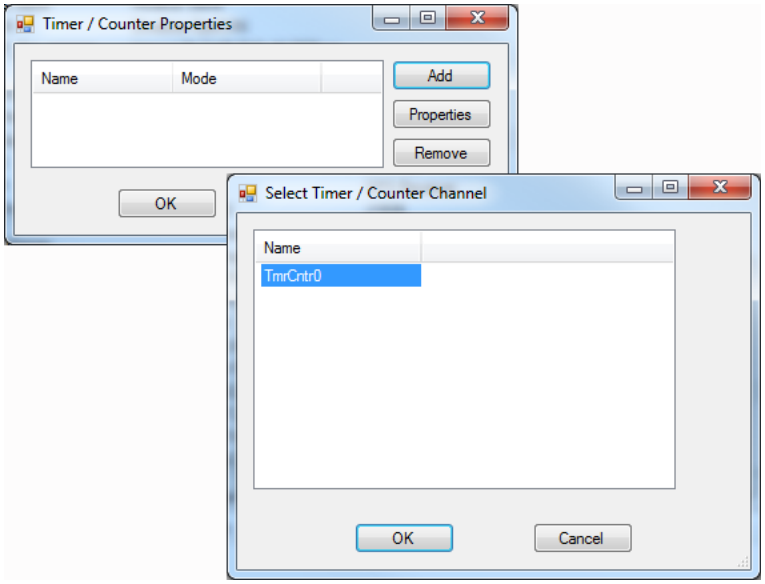


Figure 2-7 - Selecting TimerCounter Channel

The Timer / Counter Properties window will now appear. From this window, the actual counter/timer channel hardware will be installed. Click the **ADD** button. The Select Timer/Counter Channel window will appear. From the list provided, select the counter / timer channel to use. Refer to Figure 2.7. When selected, click **OK**.

1. TmrCntr0 is DIN0

The Tmr/Cntr Channel properties window will now open. Using the Drop-down Mode select box, select the type of operation for this particular counter / timer input. The choices are:

Free Running Timer

The input when configured as a Free Running Timer actually has no input functionality external to the HEC-Gateway. The counter/timer channel on the PLC on a Chip™ uses an internal 1MHz reference clock and will count up at a 1 micro-second resolution. The **TimerCounter** function block in EZ LADDER provides additional controls for the timer/counter functionality.

When the Free Running Timer mode is selected, no other configuration is required. Refer to Figure 2.8.

When the free-running timer reaches it's upper counting limit, it will wrap negative and begin counting toward zero. This can be avoided by resetting the timer using the function block.

Counter

When configured as a counter, this input will count in the up direction. The *Counter Mode* can be configured for Rising Edge, Falling Edge or Both Edges. The number of counts per pulse on the input depends on the *Counter Mode* configuration.

Select the Counter Mode using the provided Drop-down *Counter Mode* select box. Refer to Figure 2.9. The Pin should be set to the appropriate input (TMR_CAP0.0 for DIN0).

If the number of input pulses exceeds the counter's upper counting limit, it will wrap negative and begin counting towards zero. This can be avoided by resetting the counter using the function block.

Timer

When configured as a timer, frequency or period may be measured of the signal to the input. This signal is referenced to a 24MHz clock internally. The operation is dependent on the configuration of the Timer Mode.

Select the Timer Mode using the provided Drop-down *Timer Mode* select box. Selecting *Frequency* will configure for measuring the frequency of the signal on the input while selecting *Period* will configure for measuring period. Refer to Figure 2.10.

Click **OK**. the number of times necessary to close and save all the configurations. You should return to the EZ LADDER Toolkit's Edit workspace by clicking **OK**. the number of times required. Remember to Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS.**

To use DIN0 in a ladder diagram, you must use the TIMERCOUNTER function block. This block, when placed in the ladder diagram, will provide a drop-down menu to select which counter to use. Refer to the P-Series EZ LADDER Toolkit User's Manual for details on the TIMERCOUNTER and other function blocks. TmrCntr0 is DIN0.

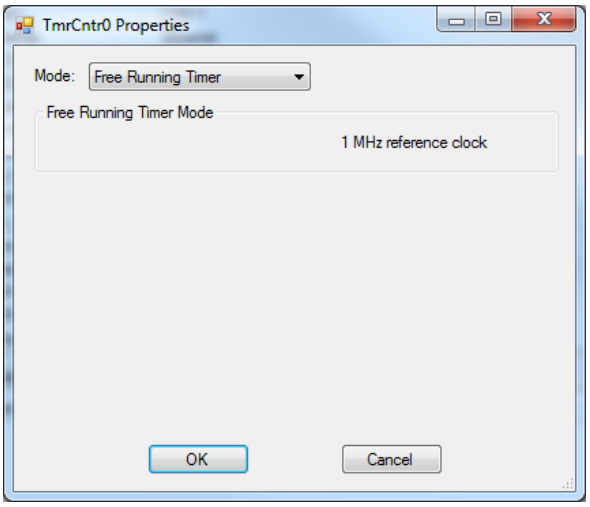


Figure 2-8 - Timer/Counter as Free Running Timer

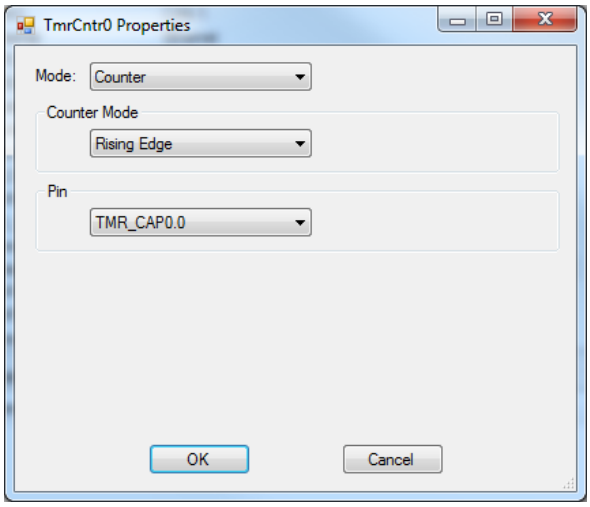


Figure 2-9 - Timer/Counter as Counter

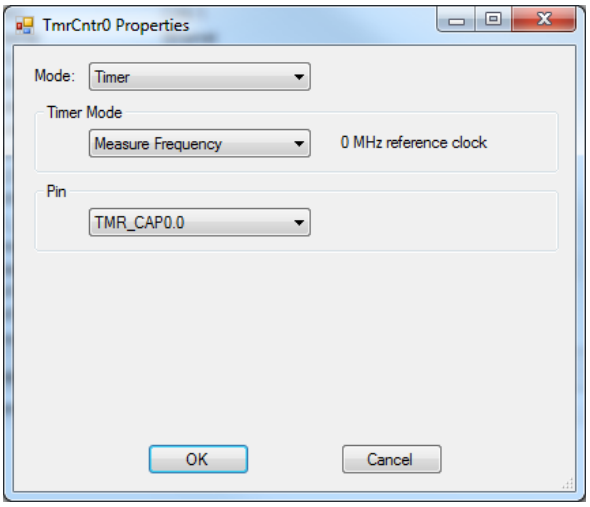


Figure 2-10 - Timer/Counter Timer

Please note: Individually, the DIN0 input is designed to be used as a digital input only or high speed counter/timer input only. EZ LADDER will allow the placement of contacts and /or TIMERCOUNTER function in any program. Therefore, you can place and use the contacts and the TIMERCOUNTER function block in the same program with the same digital input selected. This can be useful in some programs based on the application, but it is important to know that input contacts will only operate at a fraction of the frequency that the TIMERCOUNTER function block can accurately read.

` The digital input / counter input can be field selected as either PNP (current sinking) or NPN (to accept signals from open-collector output devices). The type of device is selected by internal jumper settings (JP1) on the HEC-Gateway. To gain access to these dip-switches, the HEC-Gatewaymust be dis-assembled. See the Assembling / Dis-assembling the HEC-Gateway section of this manual. Refer to Figure 1-8 for the location of the JP1 jumper.

The digital input (DIN0) has software enabled de-bounce circuitry. This circuitry typically should be disabled when this input is being used as a counter input. When configured as a digital input, the de-bounce should typically be enabled.

The de-bounce circuit for DIN0 is enabled and disabled by adding the variables (coils) named DIN0_DEB. When the variable (coil) is true, the de-bounce circuit is enabled and when the coil is false, the de-bounce circuit is disabled. The variables DIN0_DEB is automatically created by EZ LADDER when the HEC-Gateway target is selected.

Deleting the de-bounce variable from the program will cause the de-bounce circuit to be enabled. This will reduce the frequency the input can read, resulting in inputs not operating properly depending upon the application.

Digital Output

The HEC-Gateway provides 1 on-board digital output. It is identified in the EZ LADDER Toolkit and this manual as DOT0 . The DOT0 output is sourcing and may be configured to operate as an ON/OFF digital output or a Pulse Width Modulation (PWM) output.

The DOT0 output power is sourced from the HEC-Gateway input power. Any load connected to the DOT0 output must use the same ground / common as the HEC-Gateway input power (Pin 10 on the A connector). Failure to connect the output to the same ground may result in undesired operation or may even damage the HEC-Gateway device.

Refer to Figure 2.11 for typical connections for the HEC-P5XXX outputs.

Protection diodes are provided internally on the HEC-Gateway. No additional external diodes are required for protection under normal application installations.

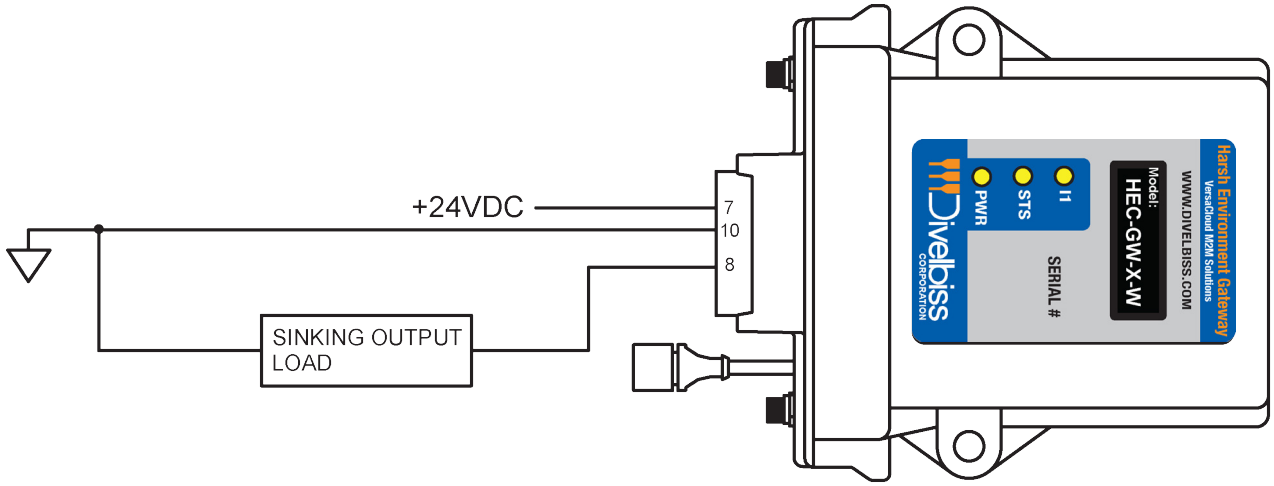


Figure 2-11 - Digital Output Connections

The output can drive a load up to maximum current rating listed in the specifications section (resistive) and includes an automatic over-current shutdown safety. In the event an over current condition exists, the output will shut down. This shut down condition is reset when the output is turned off (set to false) in the ladder diagram.

The output requires a minimum load to operate correctly. Depending upon the device connected to an output, a minimum load resistor may be required. If the output is ON or true regardless of the ladder diagram program, connect a 470Ω to 1KΩ load from the output to input power common.

DOT0 AS A DIGITAL ON/OFF OUTPUT

To control the digital output in a ladder diagram based on an ON/OFF functionality, place and connect the DOT0 coil for your needs. The DIRECT COIL and INVERTED COIL functions are used to control digital outputs in the ladder diagram. When placing the coil, verify you select the correct output variable (DOT0) from the provided drop-down menu.

DOT0 AS A PWM OUTPUT

As previously noted, the HEC-Gateway DOT0 output may be configured either a digital output or pulse width modulation output.

The DOT0 output may only be used as either digital output or PWM output and can only be used in the ladder diagram as one or the other (not both). Figure 2.11 for typical DOT0 output connections. When used as PWM, DOT0 is referred to in the ladder diagram as PWM0.

Before Pulse Width Modulation outputs may be used in the ladder diagram, the Pulse Width Modulation Properties must be configured in EZ LADDER Toolkit. To Configure Pulse Width Modulation (PWM) Outputs in EZ LADDER Toolkit:

In EZ LADDER, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the Project Settings Window. The HEC-Gateway was previously selected.

Click the **PROPERTIES** button. The HEC-Gateway Properties Window will open. Verify the proper model number in the drop-down menu.

If the Pulse Width Modulator were installed, it would be listed under the Devices, Internal section. Click the **ADD DEVICE** button. This will open the PLCHIP-PXX Devices window. Select PWM (Pulse Width Modulator) from the Devices pane. See Figure 2.12. Click **OK.** The PWM Properties window will open.

In the PWM Properties Window, using the **ADD** button, add the channel of the Output to operate as PWM (PWM0). PWM0 is the DOT0 output (hardware).

Enter the desired base frequency for the PWM. The frequency must be greater than 0 and not more than 10MHz. With the PWM0 channel added and frequency set, click **OK** the number of times required to close each of the open windows until you have returned to the main EDIT workspace. Remember to Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS.**

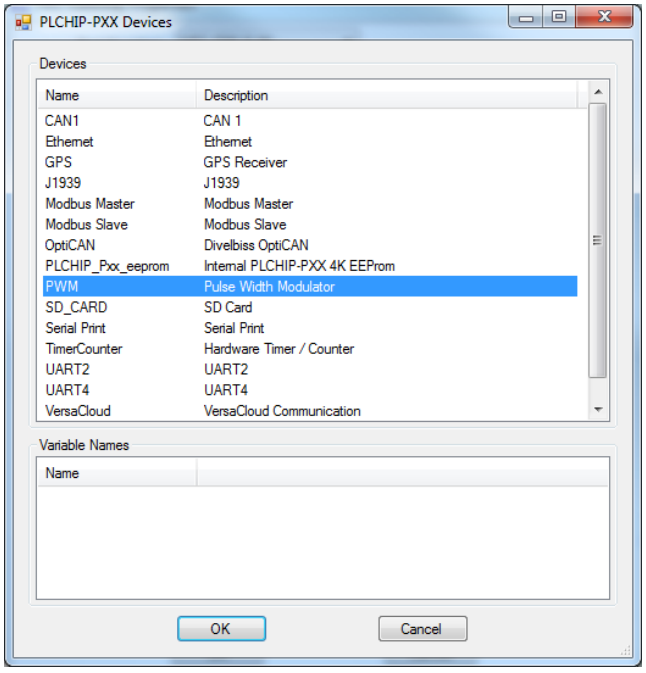


Figure 2-12 - Add PWM Device

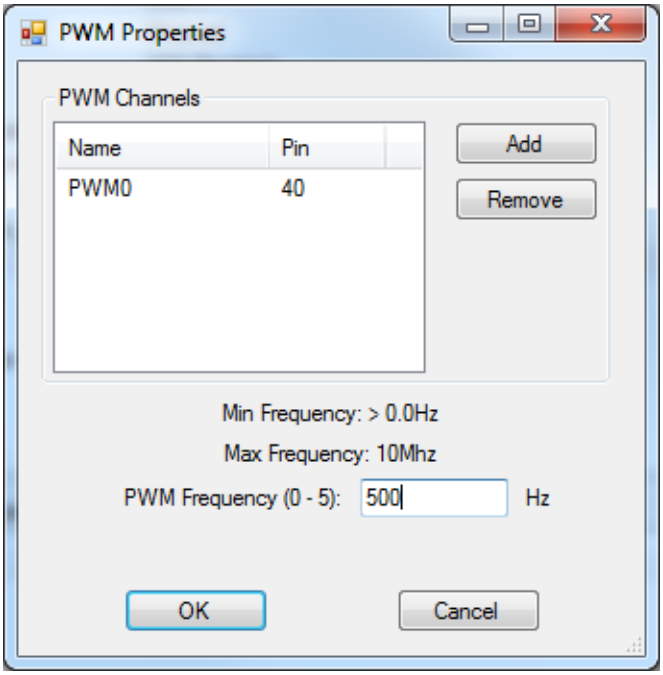


Figure 2-13 - PWM Properties

Due to limitations of hardware, the Desired Frequency and Actual Frequency may vary. The Actual Frequency will be the closest attainable frequency to the entered Desired Frequency.

To operate PWM outputs, use the PWM and PWM_FREQ function blocks. For details on using function blocks, refer to the P-Series EZ LADDER User's Manual

Real Time Clock

HEC-Gateway Devices include a Real Time Clock. The real time clock (after being set) provides the Month, Day, Day of the Week, Year, Hour, Minute and Second. The real time clock maintains time when power is off as long as the on-board lithium battery is good. The real time clock device is automatically installed and enabled when the HEC-Gateway target is selected.

The battery for the real time clock generally has years of life before replacement is needed. Should the battery need to be replaced, replace the battery with the same type and size as the original. Contact Divelbiss product support for information about changing the battery.

To use the Real Time Clock functionality in a ladder diagram, several function blocks are available. To read current Time or Date, use the GETTIME and GETDATE function blocks. To set the current Time or Date, use the SETTIME and SETDATE function blocks. For details on using function blocks, refer to the P-Series EZ LADDER Toolkit Manual

The HEC-Gateway ships from the factory with the real time clock battery disabled (paper between battery and battery clip) to conserve battery life. You must enable the battery by removing the paper.

Failure to enable the battery will result in loss of actual date and time when unit is not powered.

FRAM (Retentive) Memory

The HEC-Gateway Devices support two types of on-board non-volatile memory: EEPROM and FRAM. The EEPROM memory is on-chip (on-board the PLC on a Chip) while the FRAM is an independent device.

FRAM is the memory that is used to store all *Retentive* variables in the ladder program. Retentive variables automatically store their values into the FRAM device when a power loss is detected and then the values are read from FRAM and restored automatically when power is restored.

When the HEC-Gateway is selected in the Project Settings, the FRAM (FM24CL04) device is automatically installed as well as any required devices necessary for retentive memory to operate. The amount of retentive memory may be set, but is default to 100 bytes.

To use the retentive features, variables (and/or function blocks) must be flagged as retentive items when they are placed in the ladder diagram. For more details on using retentive variables, refer to the P-Series EZ LADDER Toolkit manual.

CONFIGURING RETENTIVE MEMORY IN EZ LADDER TOOLKIT

The retentive memory is installed automatically when the HEC-Gateway device is selected in the Project Settings. To adjust the amount of retentive memory, it must be configured in the program's target settings using the EZ LADDER Toolkit's Project Settings Menu.

1. In EZ LADDER, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the Project Settings Window. Select **HEC-Gateway** as the target from the choices.

2. Click the **PROPERTIES** button to the right side of the window. The ***HEC-Gateway Properties*** Window will open. Make sure the proper model is selected in the drop-down menu.

3. In the *Devices* Pane, select (highlight) the **FM24XXX** (from the I2C *heading*). Click the **PROPERTIES** button. The ***Ramtron FM24xxx Properties*** dialog will open.

4. Enter the number of retentive bytes to use in the target in the *Num Retentive Bytes* box. The maximum available to use is 480 bytes (defaulted to 100 bytes). Refer to Figure 2-32. Any bytes not configured for retentive may be used as EEPROM memory bytes. (displayed as Num User Bytes). **Do not select a different Part Number. Verify it is configured for FM24CL04 only.**

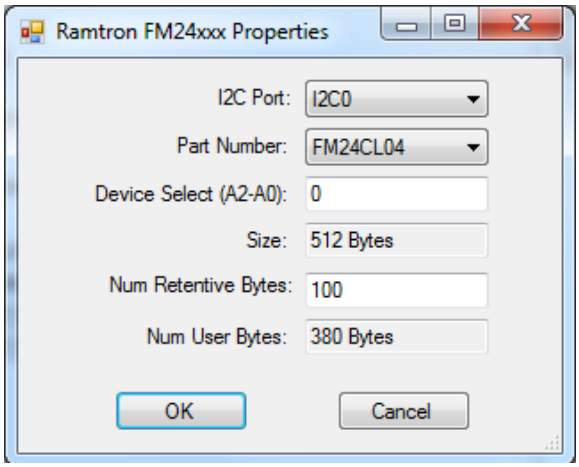


Figure 2-14 - Ramtron FM24xxx Properties

5. Click **OK** to close the *FM24xxx Properties* dialog.

6. Click **OK** to close the ***VersaGateway Properties.***

7. Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS** to save the current settings in your program.

The Retentive memory size is now configured in the ladder diagram program and may be used by setting variables and functions as retentive. Refer to the P-Series EZ LADDER Toolkit Manual for details on using retentive variables.

FRAM AS EEPROM IN EZ LADDER TOOLKIT

The FRAM may also be used in EZ LADDER Toolkit as EEPROM memory using the EEPROM_WRITE and EEPROM_READ function blocks. Any memory not allocated as ***retentive bytes*** is available to be used as general EEPROM storage.

When using the EEPROM_READ or EEPROM_WRITE function blocks, the storage device is selected. When selected as FRAM, the memory locations will not fail after repeated write cycles and therefore may be used to store any variables as often as necessary. For more details on using FRAM and EEPROM (function blocks), refer to the P-Series EZ LADDER Toolkit manual.

EEPROM Memory (ON-CHIP)

The HEC-Gateway Devices support two types of on-board non-volatile memory: EEPROM and FRAM. The EEPROM memory is on-chip (on-board the PLC on a Chip) while the FRAM is an independent device.

EEPROM memory is often useful for storing setpoint values into memory that will hold its value in the event of a loss of power. EEPROM memory is a relatively slow writing device (in terms of milliseconds) and has limitations. This EEPROM memory is located on the PLC on a Chip itself (PLCHIP-P10-51220).

EEPROM memory should not be used in applications where the values are updated (causing the stored value to update) often; such as a process variable. While EEPROM memory has a long life, repeated writing (thousands of times) can cause a memory location to fail. EEPROM memory is more oriented to be used for storage of menu changeable setpoints that may change, but infrequently.

CONFIGURING THE ON CHIP EEPROM IN EZ LADDER TOOLKIT

Before the PLC on a Chip on-board EEPROM may be used in the ladder diagram, it must be added to the program's target settings using the EZ LADDER Toolkit's Project Settings Menu.

1. In EZ LADDER, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the Project Settings Window. Select **HEC-Gateway** as the target from the choices.

2. Click the **PROPERTIES** button to the right side of the window. The ***HEC-Gateway's Properties*** Window will open. Make sure the proper model is selected in the drop-down menu. If the EEPROM feature was already installed, it would be displayed in the Devices Pane under the *Internal* heading (as PLCHIP_Pxx_eeprom). Refer to Figure 2-14.

3. Click the **ADD DEVICE** button. The *PLCHIP-PXX Devices* window will open. Locate the **PLCHIP_Pxx_eeprom** in the Devices pane of this window.

4. Click the **PLCHIP_Pxx_eeprom** device (highlight). Refer to Figure 2-15.

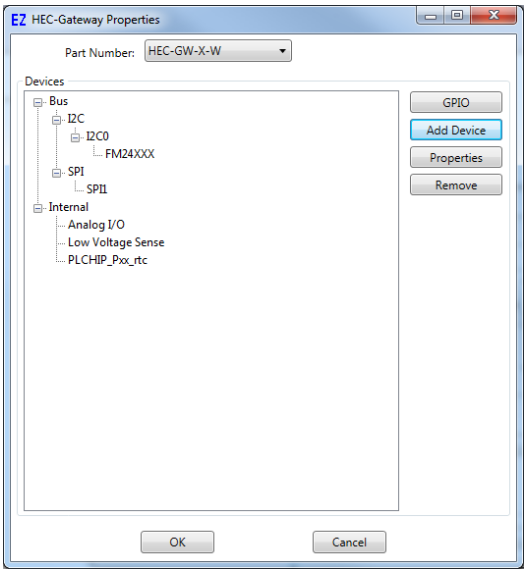


Figure 2-29 - VersaGateway Properties

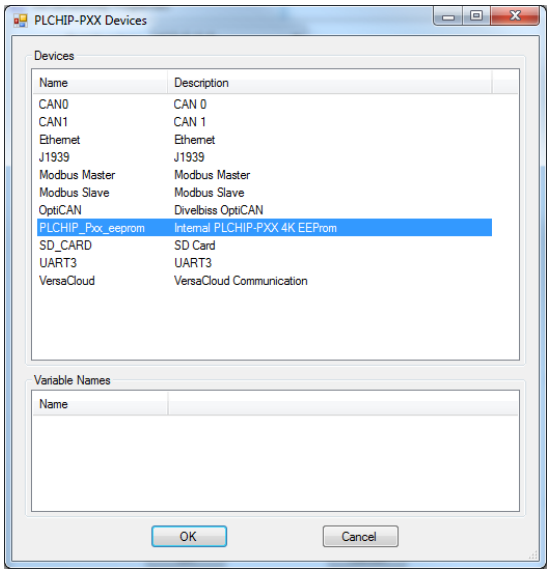


Figure 2-16 - PLCHIP-PXX Devices - EEPROM

5. Click **OK**. The ***PLCHIP_Pxx_eeprom Properties*** dialog will open. Leave the default settings (Num Retentive Bytes set to 0). See Figure 2-17. Click **OK**.

The VersaGateway's On-Chip EEPROM should not be used for Retentive Memory. All Retentive features should be configured to use FRAM. Using on-chip EEPROM for retentive features will result in retentive data being lost.

The on-chip EEPROM will now be installed and return to the ***HEC-Gateway Properties*** window.

6. The PLCHIP_Pxx_eeprom is now shown in the Devices pane (under the Internal heading). Click **OK** to close the ***HEC-Gateway's Properties***.

7. Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS** to save the current settings in your program.

The PLCHIP_Pxx_eeprom (on chip EEPROM) is now installed in EZ LADDER Toolkit ladder diagram project and is ready to use.

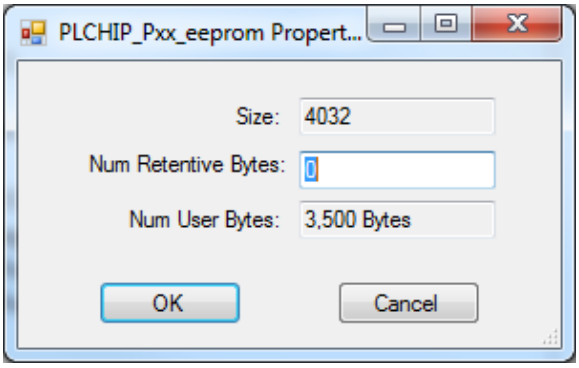


Figure 2-17 - PLCHIP Pxx_eeprom Properties

USING THE EEPROM (ON-CHIP) MEMORY IN EZ LADDER TOOLKIT

The on-board (ON-CHIP) EEPROM memory may be written to and read from using the EEPROM_WRITE and EEPROM_READ function blocks. These blocks are available for use when the EEPROM is installed in the Project Settings. There are 3500 Bytes of EEPROM memory available. The on-chip EEPROM may be read from and written to using Structured Text (using target specific Structured text functions within EZ LADDER Toolkit)

Special care must be taken when mapping and using the EEPROM on-board memory. Refer to the P-Series EZ LADDER Toolkit manual (EEPROM MEMORY section) for details on using the function blocks and how the memory is mapped including recommendations for controller where values are stored.

SD Card Features

The HEC-Gateway can accept a micro SD Flash card. This card currently may be used to install / update the kernel, the ladder diagram compiled project or can be used as a read/write access File System (using Structured Text). Installation/update of Kernel and Ladder Diagram project will only occur on power up of the HEC-Gateway (when the SD Card is installed and configured to do so). Refer to Figure 1-8 for the location of the micro SD Card socket (**SD**). Refer to the EZ LADDER Toolkit Manual and our website for more information regarding the file system.

For the SD Card ladder diagram / kernel install or updates feature to work, the SD card must have a directory named “update”. In this update directory, the kernel (.dat) and the ladder diagram compiled programs (.hex) must be placed for the SD card to update the HEC-Gateway ladder diagram and / or kernel.

Before the SD Card may be used to install or update the kernel or EZ LADDER compiled project to the HEC-Gateway, it must be configured to do so. This configuration must be done in the **Bootloader** screen. The Bootloader screen will only operate if EZ LADDER is connected to an actual VersaGateway Device.

The kernel will only update from the SD Card when the kernel name (.dat) matches the unit to update and the version of the kernel on the SD CARD is different.

The ladder diagram program will only update from the SD Card when the name (.hex) matches the program installed on the unit to update, the kernel version is new enough to support the version the program was compiled with and the ladder diagrams version and build numbers are different. This allows a program either newer or older to be installed (updated) from the SD Card if the conditions set here are met.

When the SD is enabled and configured to update the ladder diagram program or kernel, there will be small delay from when power is applied until the program executes while the update options are evaluated and applied. This could be a few hundred milliseconds.

Before the SD Card features may be used, it must be installed from the EZ LADDER Toolkit / HEC-Gateway device’s bootloader screen.

To Access the Bootloader:

1. Verify the target has been configured (see *Configuring the HEC-Gateway Target in EZ LADDER Toolkit*).

2. Connect the Programming cable (HEC-910) from the computer to the VersaGateway device. See *Programming Port* in the *Devices Features* section.

3. Create a small one-rung program with a normally open (direct contact) and an output tied together. You may also open a pre-existing program for the HEC-Gateway. EZ LADDER Toolkit includes a sub-directory (...EZ LADDER\P-Series Example Programs\)which has starter programs for each target to load the kernel. Choose ***GetStarted_HEC-GW-X-X.dld***. (where X-X is the model of VersaGateway device).

4. Click the 

(Compile) button

5. Click the 

(Monitor) button to change from the 'Edit' to 'Monitor' Mode.

6. Click the 
(Connect) button to connect to the target. A dialog will appear automatically when no kernel is loaded. If this dialog does not appear, click **PROJECT** then **BOOTLOADER**.

7. Using the menu, click **PROJECT** then **BOOTLOADER.** You may see a window momentarily while EZ LADDER connects to the HEC-Gateway device bootloader. See Figure 2-18.

8. Click the **TARGET OPTIONS** button. The Target Options window will open. There will be two tabs in this window. Click the **SD CARD OPTIONS** tab. See Figure 2-19.

9. Check boxes are provided to configure the SD Card features. Check the boxes that apply to your needs.

SD Card Enabled:	This enables the SD Card functionality. This box must be checked if the SD Card features are to be implemented.
Allow Kernel Updates:	When selected, this box will cause the kernel to be updated to the kernel on the SD card (if present). This only occurs on the controller's power up.
Allow LD Updates:	When selected, this box will cause the compiled Ladder Diagram Project to be updated to the Ladder Diagram Project on the SD card (if present). This only occurs on the device's power up.

10. When all the SD Card features are configured, click **OK** to save the settings of the SD Card and close the Target Options window. Click the **RESTART TARGET** button to exit the bootloader and restart the HEC-Gateway Device.

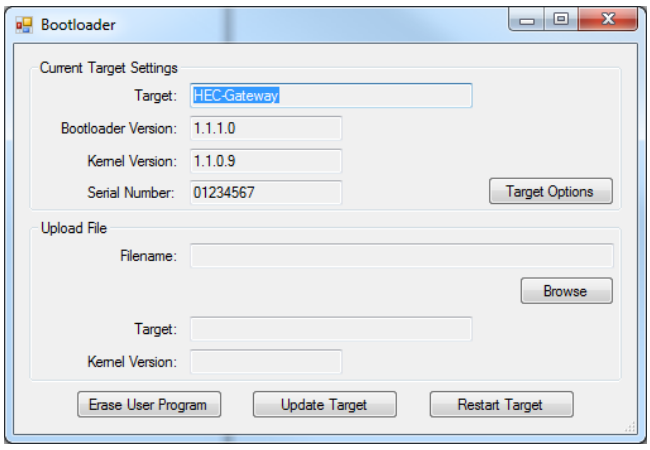


Figure 2-18 - Bootloader Screen

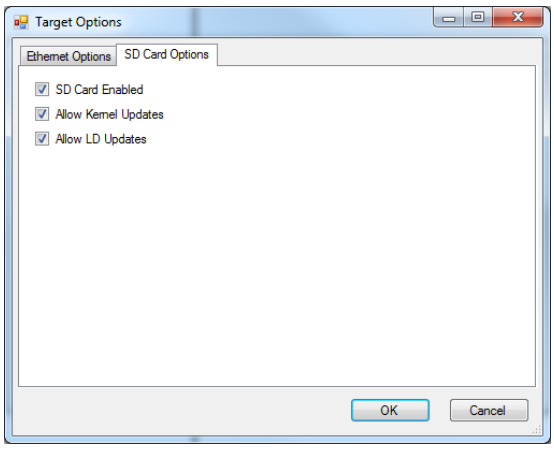


Figure 2-19 - SD Card Options

The SD Card is now enabled and configure to install the options selected including updating kernel and ladder diagrams.

The SD Card may used for read/write (File System) using Structured Text. For more information on the SD Card File System using Structured Text, refer to the P-Series EZ LADDER Toolkit and our website for the latest Application Notes (AN-XXX).

On power-up, if the SD Card is configured and enabled to update the ladder diagram or the kernel, a delay will occur if the SD card is not present or if the SD Card is corrupted. This is a time-out issue if the SD Card cannot be read successfully.

Battery Backed up S-RAM Memory

The HEC-Gateway supports 4, 1 Mbit Static RAM (512K) integrated circuits (S-RAM ICs). These four individual chips hold data on power loss as they alternately powered by the on-board lithium battery. This RAM is suited for data-buffering for communications like VersaCloud M2M Connectivity.

To use this S-RAM, custom structured text functions and function blocks will have to be written to store and retrieve data.

Each chip is an SPI device and may be accessed via Structure Text only using target specific functions like the EZ_SpiWrite Data. Please see the SPI data listed to access each chip. For more detailed information how to use Structured Text, refer to the P-Series EZ LADDER Toolkit Manual.

When the HEC-Gateway is selected from the Project Settings, the SPI Port 1 (SPI1) and the Chip Select (CS) General Purpose I/O (GPIO) is automatically installed and reserved in the target settings. No Project Settings configurations are needed. The CS GPIO assignments are: GPIO11, GPIO12, GPIO13, GPIO14.

S-RAM SPI Interface Information

Function	Description	Bus / I/O Address
SPI Port	SPI Port used for S-RAM	SPI1
U2 CS	S-RAM U2, Chip Select	GPIO12
U3 CS	S-RAM U3, Chip Select	GPIO11
U4 CS	S-RAM U4, Chip Select	GPIO13
U5 CS	S-RAM U5, Chip Select	GPIO14

Battery and Voltage Monitoring

The HEC-Gateway device has an on-board analog input that monitors the on-board battery voltage. This analog input is provided for applications that wish to monitor the on-board battery and optionally display or communicate its status.

The battery analog input is automatically installed when the HEC-Gateway device target is selected in the Project Settings Menu. The analog input is represented as an integer with a range of 0-4095 for 0-3VDC. It is access in the ladder diagram by the integer variable VBAT_MON. This variable represents the current voltage battery voltage. With the battery removed, AN_BATT will read the maximum (4095) reading in the software (open-circuit).

The lithium battery is a 3VDC battery. Data retention of the Real Time Clock and SRAM storage will function down to 2.0VDC. To avoid data loss, the battery should be replaced before reaching 2.0VDC. As this is a lithium battery, the voltage curve accelerates at lower levels causing the time between the battery voltage reading 2.5VDC and the point of data loss (2.0VDC) to be short. The replacement / warning level should be set at a voltage where there is sufficient time to allow for battery replacement.

Input Voltage Monitoring

The HEC-Gateway device has an on-board analog input that monitors the input power voltage. This analog input is provided for applications that wish to monitor the input voltage and optionally use, display or communicate its status.

The input voltage analog input is automatically installed when the HEC-Gateway device target is selected in the Project Settings Menu. The analog input is represented as an integer with a range of 0-4095 for 40VDC. It is access in the ladder diagram by the integer variable SYS_VOLTAGE. This variable represents the current input voltage.

Analog Inputs

The HEC-Gateway provides 2 on-board, 12-bit resolution analog inputs. Each analog input will accept an input of 0-5VDC, 0-10VDC or 0-20mADC. The analog input ranges and types are configured using internal dip switches. These dip switches should be configured for the correct inputs prior to actually connecting the analog inputs. To gain access to these dip-switches, the HEC-Gateway must be dis-assembled. See the Assembling / Dis-assembling the HEC-Gateway section of this manual. The analog inputs are accessed using the A connector (Pin 12 for AN0, Pin 11 for AN1).

Below are the configuration switch settings for the HEC-Gateway controller. Refer to Figure 1-8 for the location of SW1.

CONFIGURATION SWITCHES SUMMARY		
SWITCH ID	SWITCH to ON Position	SWITCH to OFF Position
SW1-1	User Programmable Switch Input - True	User Programmable Switch Input - False
SW1-2	Analog Input 0 - Configured for 0-20mADC Operation	Analog Input 0 - Configured for Voltage Operation
SW1-3	Analog Input 0 Voltage Mode 0-10VDC*	Analog Input 0 Voltage Mode 0-5VDC*
SW1-4	Analog Input 1 - Configured for 0-20mADC Operation	Analog Input 1 - Configured for Voltage Operation
SW1-5	Analog Input 1 Voltage Mode 0-10VDC*	Analog Input 1 Voltage Mode 0-5VDC*

*When configured for 0-20mADC, switch (Voltage Mode) must be OFF (0-5VDC mode) for proper operation.

Each analog input is represented in the EZ LADDER Toolkit ladder diagram using variables labeled AN0 and AN1 respectively. Both variables are created automatically when the HEC-Gateway target is selected in the Project Settings Window.

Each variable (AN0 and AN1) will represent the actual voltage or current reading on the input (based on the range and type) as an integer number (0-4095). To use the analog input reading, place the appropriate analog input variable as an input to function blocks.

Figure 2.20 represents the internal analog input circuits and dip switches.

It is recommended that analog input switch settings be configured prior to connecting the analog input. In addition, when configuring for 0-20mADC (current), the voltage selector dip switch (0-5V or 0-10V) should be set for 0-5VDC or OFF. Failure to configure prior to connecting or improper configuration may result in incorrect readings or even damage to the HEC-Gateway device.

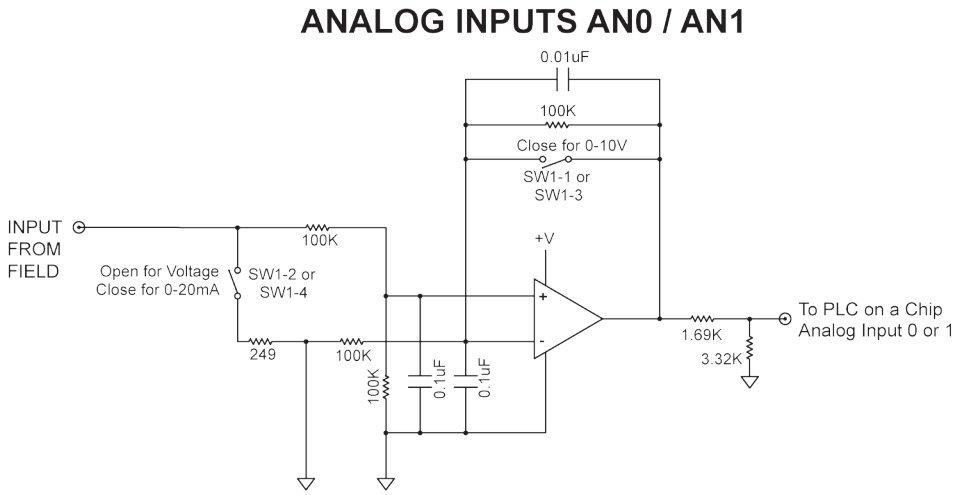


Figure 2-20 - Analog Input Circuits

SAE J1939 / NMEA 2000

The HEC-Gateway device supports SAE J1939 and NMEA 2000 communications over CAN. SAE J1939 and NMEA 2000 may be configured and installed to operate using the on-board CAN port (CAN1).

As SAE J1939 and NMEA 2000 utilize the CAN port, a CAN port must be installed prior to the installation and configuration of SAE J1939 / NMEA 2000. For CAN port installation, refer to the ***CAN Port 1 - NMEA Compliant*** Sections of this manual.

With a CAN port installed, SAE J1939 / NMEA 2000 must be installed in the ladder diagram project using the EZ LADDER Toolkit Project Settings Menu.

CONFIGURING SAEJ1939 / NMEA 2000 IN EZ LADDER TOOLKIT

1. In EZ LADDER, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the Project Settings Window. Select **HEC-Gateway** as the target from the choices.

2. Click the **PROPERTIES** button to the right side of the window. The ***HEC-Gateway Properties*** Window will open. Make sure the proper model is selected in the drop-down menu.

3. Click the **ADD DEVICE** button. The *PLCHIP-PXX Devices* window will open. Locate the **J1939** in the Devices pane of this window.

4. Click / select **J1939** (highlight). Refer to Figure 2-21.

5. Click **OK** . The ***J1939 Properties*** Window will open. The settings in this dialog box (and optional buttons) will configure the SAE J1939 / NMEA 2000.

Any J1939 or NMEA 2000 implementation will be dependent upon the actual application needs and requirements. Knowledge of these two networks is required to configure the communications. The rest of the steps in configuring J1939 / NMEA communications is a sample only. Refer to the P-Series EZ LADDER Toolkit Manual for more in-depth information on configuring and using SAE J1939 and NMEA 2000.

6. Click **ADD**. From the drop-down menu, select the CAN port to use (must have been installed prior to this step). Refer to Figure 2-22. All the configuration parameters for the J1939 / NMEA 2000 communications must be configured here. Refer to the P-Series EZ LADDER Toolkit Manual for more in-depth information on configuring and using SAE J1939 and NMEA 2000.

7. Click **OK** to as needed to close each of the open windows including the ***HEC-Gateway Properties*** window.

8. Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS** to save the current settings in your program.

SAE J1939 / NMEA 2000 communications is now configured and can be used in the ladder diagram project. SAE J1939 / NMEA 2000 use the J1939_RX_PGN and J1939_TX_PGN function blocks.

The information regarding SAE J1939 and NMEA 200 implementation shown here is for basic example only. Implementation is dependent upon the actual application requirements. For more information regarding SAE J1939 / NMEA 2000 communications including installation configuring and using, refer to the P-Series EZ LADDER Toolkit Manual.

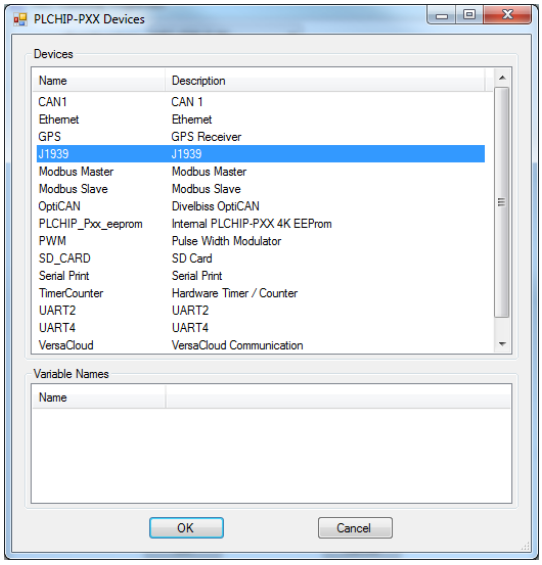


Figure 2-21 - PLCHIP-PXX Devices - J1939

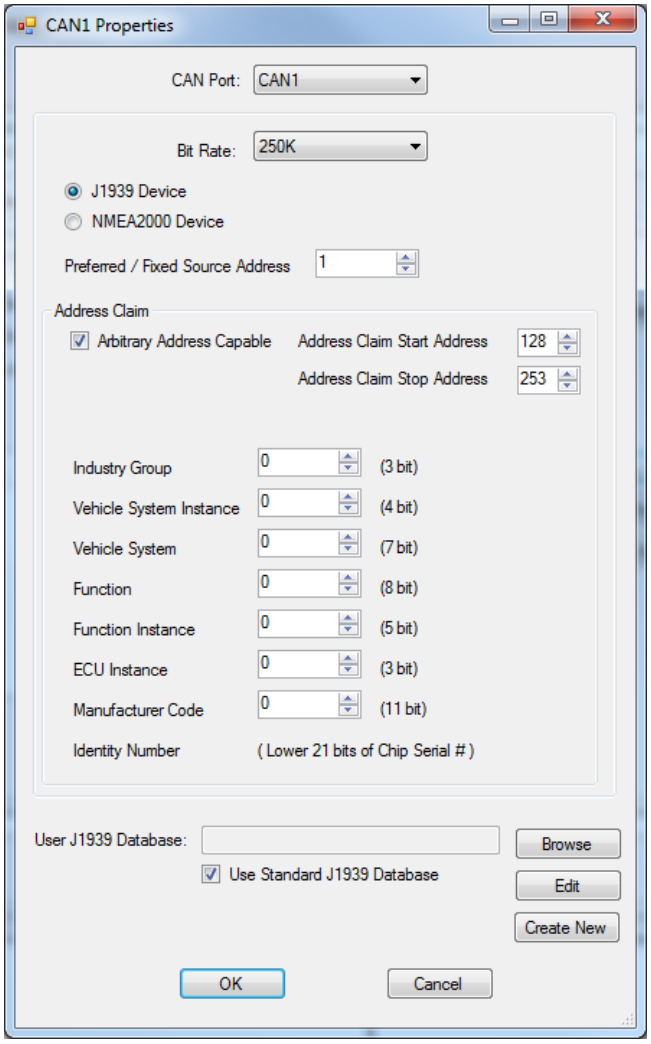


Figure 2-22- CAN / J1939 Properties

OptiCAN Networking

HEC-Gateway Devices support the Divelbiss proprietary OptiCAN (CAN Network) protocol. OptiCAN is a register based CAN network that provides a communications method between OptiCAN enabled controllers and devices (PLC on a Chip based) for transmitting / receiving variables (integer, boolean, real and timer). The OptiCAN network provides communications with error and status monitoring of the connected devices.

As OptiCAN utilizes the CAN port, a CAN port must be installed prior to the installation and configuration OptiCAN. For CAN port installation, refer to the ***CAN Port 1 - NMEA Compliant*** Sections of this manual.

With a CAN port installed, OptiCAN network must be installed in the ladder diagram project using the EZ LADDER Toolkit Project Settings Menu.

CONFIGURING OPTICAN IN EZ LADDER TOOLKIT

1. In EZ LADDER, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the Project Settings Window. Select **HEC-Gateway** as the target from the choices.

2. Click the **PROPERTIES** button to the right side of the window. The ***HEC-Gateway Properties*** Window will open. Make sure the proper model is selected in the drop-down menu.

3. Click the **ADD DEVICE** button. The *PLCHIP-PXX Devices* window will open. Locate the **OptiCAN** in the Devices pane of this window.

4. Click / select **OptiCAN** (highlight). Refer to Figure 2-23.

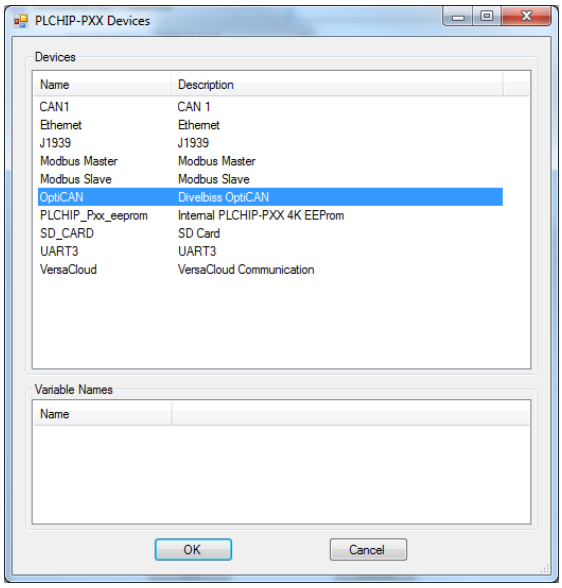


Figure 2-23 - PLCHIP-PXX Devices - OptiCAN

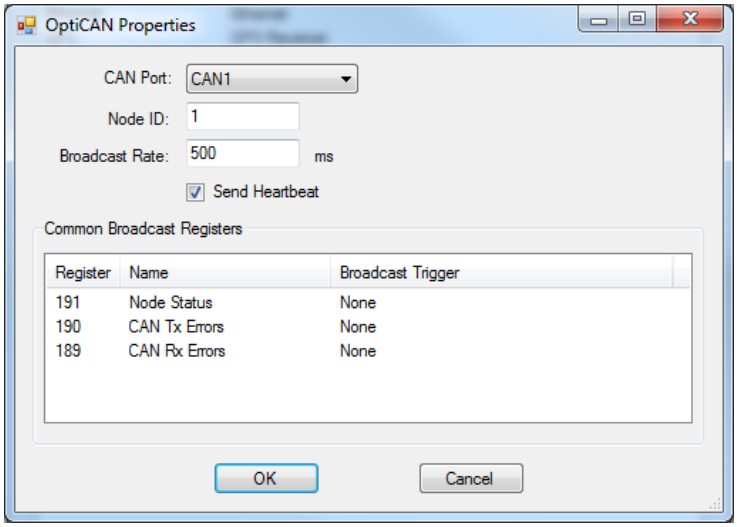


Figure 2-24 - OptiCAN Properties

5. Click **OK** . The ***OptiCAN Properties*** Window will open. The settings in this dialog box will configure the OptiCAN network

Any OptiCAN network implementation will be dependent upon the actual applications needs and requirements. Knowledge of the OptiCAN network is required to configure the communications. Refer to the P-Series EZ LADDER Toolkit Manual for details on how the OptiCAN network functions, how to implement it and how to use it.

6. Enter the setup information for the OptiCAN network. Refer to Figure 2-24.

CAN Port:	Select the CAN Port to use the OptiCAN network on.
Node ID:	Network address (ID) for identify this equipment on the OptiCAN network.
Broadcast Rate:	Rate at which network registers are transmitted across the network (when based on interval). In milliseconds.
Send Heartbeat:	Check this box if this device is to send the network heartbeat (only one device per network).
Common Broadcast Registers:	Used to configure the Broadcast trigger of the Status and Error registers.

The information regarding OptiCAN shown here is for basic example only. Implementation is dependent upon the actual application requirements. For more information regarding OptiCAN communications including installation configuring and using, refer to the P-Series EZ LADDER Toolkit Manual. The P-Series EZ LADDER Toolkit Manual (OptiCAN) section should be read before an attempt to implement an OptiCAN network.

7. Click **OK** to as needed to close each of the open windows including the ***HEC-Gateway Properties*** window.

8. Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS** to save the current settings in your program.

OptiCAN communications is now configured and can be used in the ladder diagram project. OptiCAN uses the OPTICAN_TXNETMSG and OPTICAN_NODESTATUS function blocks.

WI-FI Option

For HEC-Gateway models that support Wi-Fi (HEC-GW-X-W), a Wi-Fi connection is available for using Modbus TCP, Programming Port or VersaCloud M2M Connectivity.

WI-FI ANTENNA

For Wi-Fi supporting models of HEC-Gateway, the unit ships with a loose - packed antenna that must be installed before the Wi-Fi will be able to function. Refer to Figure 1-5 for the location of the Antennal plug-in connection on the HEC-Gateway.

If the HEC-Gateway will be installed in an open-air environment or an plastic / fiberglass enclosure, the antenna may be directly mounted to the VersaGateway. Screw the antenna into position (See Figure 1-5).

If the HEC-Gateway is to mounted in a metal enclosure (or any box/enclosure that may block the Wi-Fi signal), the antenna will need to be mounted external to the box / enclosure that could block the Wi-Fi signal. Externally connecting the antenna in this method will require additional cables and a bulk-head fitting (not included). Refer to Figure 2-11 for mounting method examples.

When mounting antennas, Antennas must be electrically isolated from panel ground / common. If not isolated, damage to the HEC-Gateway device will result. When using multiple communication antennas (Wi-Fi, Cellular), sufficient spacing must be kept between them to prevent interference between them. If interference is suspected, increase the space between the antennas.

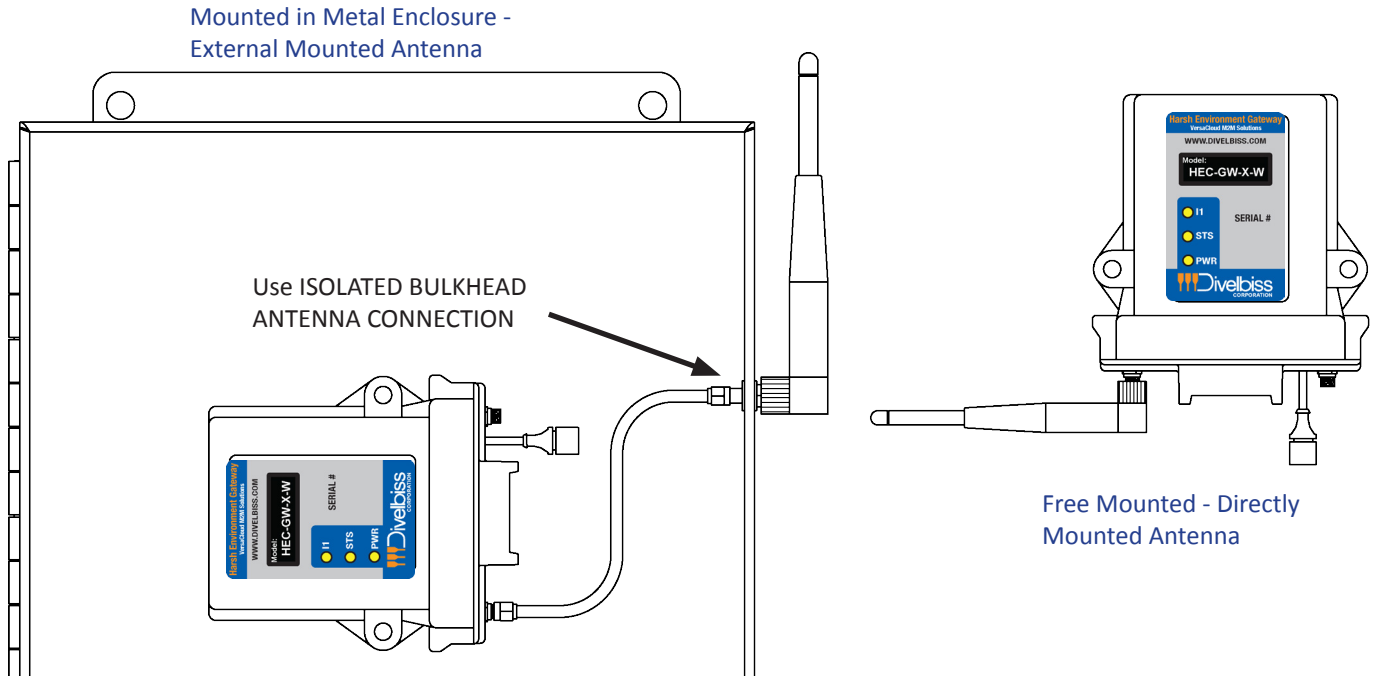


Figure 2-25 -Antenna Mounting Options

INSTALLING WI-FI IN EZ LADDER TOOLKIT

To use Wi-Fi, both the Ethernet option and Wi-Fi option must be enabled in the HEC-Gateway's bootloader.

To Access the Bootloader:

1. Verify the target has been configured (see *Configuring the HEC-Gateway Target in EZ LADDER Toolkit*).

2. Connect the Programming cable (HEC-910) from the computer to the VersaGateway device. See *Programming Port* in the *Devices Features* section.

3. Create a small one-rung program with a normally open (direct contact) and an output tied together. You may also open a pre-existing program for the HEC-Gateway. EZ LADDER Toolkit includes a sub-directory (...EZ LADDER\P-Series Example Programs\)which has starter programs for each target to load the kernel. Choose ***GetStarted_HEC-GW-X-X.dld***. (where X-X is the model of VersaGateway device).

4. Click the C (Compile) button

5. Click the MON (Monitor) button to change from the 'Edit' to 'Monitor' Mode.

6. Click the (Connect) button to connect to the target. A dialog will appear automatically when no kernel is loaded. If this dialog does not appear, click **PROJECT** then **BOOTLOADER**.

7. Using the menu, click **PROJECT** then **BOOTLOADER.** You may see a window momentarily while EZ LADDER connects to the HEC-Gateway device bootloader. See Figure 2-26.

8. Click the **TARGET OPTIONS** button. The Target Options window will open. There will be two tabs in this window. Click the **ETHERNET** tab. See Figure 2-27.

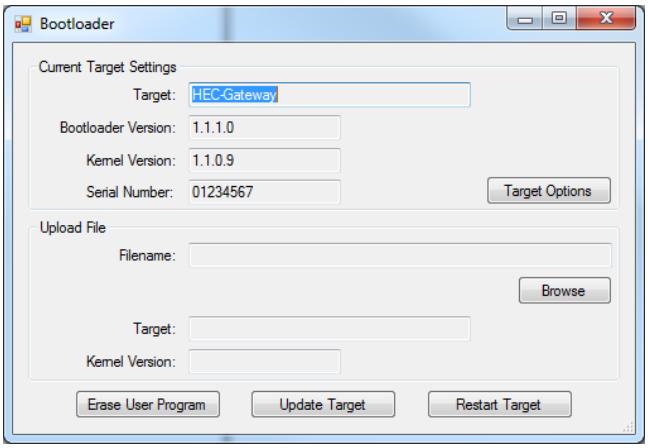


Figure 2-26 - Bootloader Screen

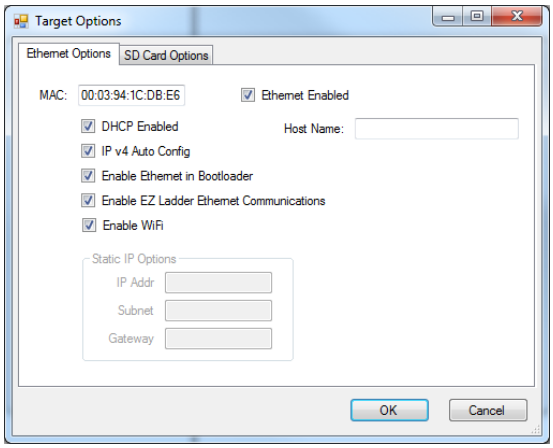


Figure 2-27 - SD Card Options

9. To enable the Wi-Fi (as Ethernet), click the **Ethernet Enabled** check box.

10. Enter a Host Name for this HEC-Gateway Controller in the **Host Name** box. This name is used to identify this controller on an Wi-Fi (as Ethernet) network.

11. It is recommended that the **DHCP Enabled** and **IP v4 auto Config** check boxes be left in their default condition (checked). This allows the HEC-Gateway to get its IP (Internet Protocol) from the network DHCP server. If you require a static IP address, un-check both boxes and enter the static IP information in the **Static IP Options section**.

12. It is generally recommended to keep the **Enable Ethernet in Bootloader** and **Enable EZ Ladder Ethernet Communications** check boxes be checked.

13. Check the **Wi-Fi** checkbox to install the Wi-Fi option (for models that support Wi-Fi only).

14. The Enable Ethernet in Bootloader when unchecked prevents the bootloader screen that you are in from being accessed via Wi-Fi (as Ethernet). The Enable EZ Ladder Ethernet Communications when unchecked prevents the Wi-Fi (as Ethernet) port from functioning as a programming port within EZ LADDER.

15. When all the Wi-Fi and Ethernet Options are configured, click **OK** to save the settings of the Wi-Fi and Ethernet and close the Target Options window. Click the **RESTART TARGET** button to exit the bootloader and restart the HEC-Gateway.

The HEC-Gateway's Wi-Fi (as Ethernet) Port is now enabled. It can be now used to communicate to EZ LADDER Toolkit without additional configurations (provided it is configured to do so) by changing the COM (serial) port in the Target Settings to Eth: xxxxxx. To use the Wi-Fi (as Ethernet) Port for Modbus TCP, additional configuration is required.

To configure Modbus TCP for use over Wi-Fi, see the ***Modbus TCP Section*** of this manual.
To configure VersaCloud M2M Connectivity over Wi-Fi, see the ***VersaCloud M2M Connectivity Section*** of this manual.

To configure for a Wi-Fi network

1. Open a program or create a simple program and Compile the program (if necessary)

2. Change EZ LADDER to the Monitor mode by clicking the 

button.

3. Make sure the target is connected to the computer and click the  button to connect EZ LADDER Toolkit to the hardware the HEC-Gateway target.

4. From the menu at the top, select **PROJECT** then select **WIFI SETUP.** Refer to Figure 2-28.

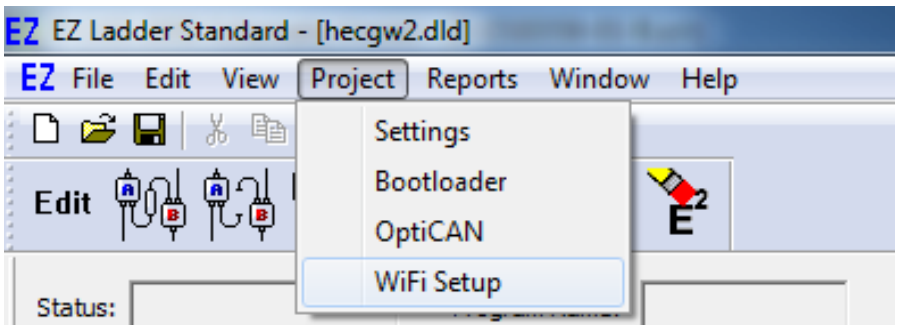


Figure 2-28 - Access WiFi Setup

5. The ***WiFi Setup and Status*** window will open. An intermediate temporary dialog may be seen while the on-board Wi-Fi module is accessed and the current Wi-Fi setup read. Refer to Figure 2-29.

6. Referring to Figure 2-29, the *Currently Visible Access Points* (item A) pane shows all the networks currently in-range for the Wi-Fi to detect. **The network must be in-range to be configured**.

7. In the Access Points Settings, enter the **SSID** and **Passcode** in their respective places (item B). It will be necessary to double-click to enter the values. Refer to Figure 2-29.

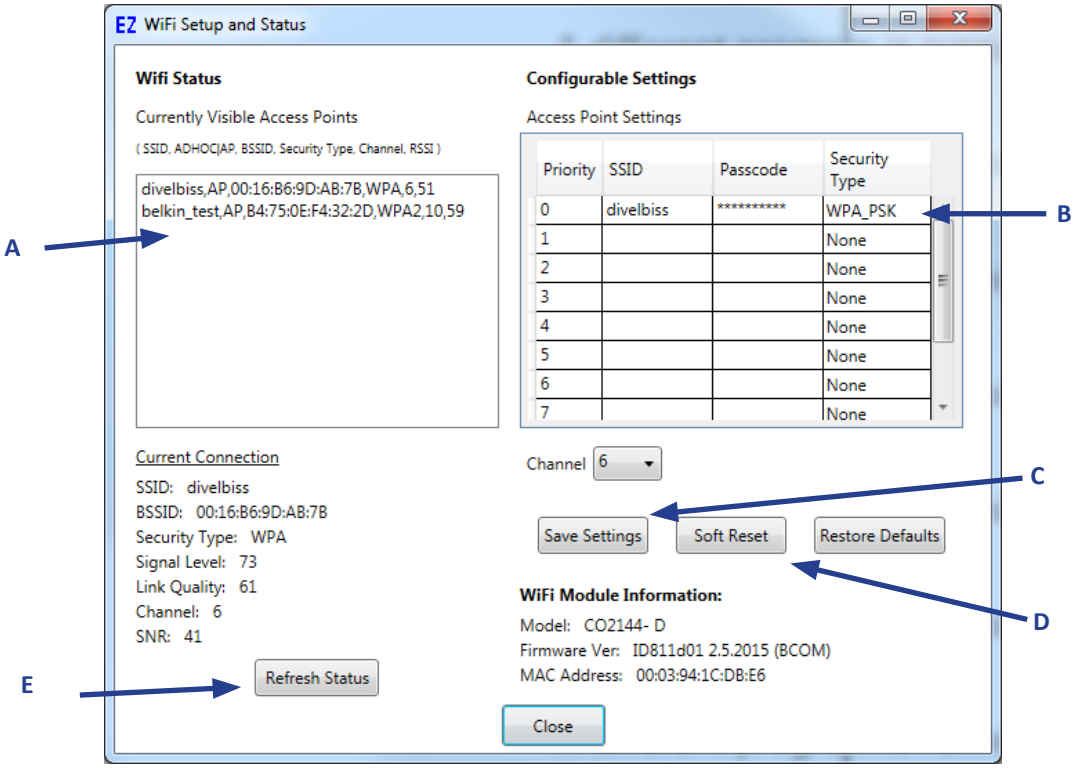


Figure 2-29 - WiFi Setup and Status

8. Select the **Security Type** for the network (item B).

9. With the information entered, click the **SAVE SETTINGS** button (Item C) to save the current settings for the Wi-Fi network.

Multiple Wi-Fi networks may be saved by adding them to list shown in Figure 2-29. Each setting is stored in the on-board Wi-Fi module and is maintained during a power loss. The priority of Wi-Fi network to connect to is based on the priority number in the list.

Up to 10 SSID / Passwords may be saved on the on-board Wi-Fi module. The module searches through the list for in-range SSIDs (APs) and attempts to connect with them based on priority. When removing (deleting) SSIDs, the list should be edited as all remaining SSIDs are listed beginning with the top and leaving no empty spaces in the list. When operating, the module searches the list in order, if an empty location is detected, the module will stop searching for an SSID match. There should be no empty locations except at the end of the list (if less than 10 entries).

10. Click the **SOFT RESET** button (Item D). This forces the Wi-Fi connectivity to reset. After the reset, the HEC-Gateway should connect to the Wi-Fi network.

11. Click the **REFRESH STATUS** button (Item E). The information under the ***Current Connection*** should update and show the network currently connected to.

12. Click **CLOSE** to close the WiFi Setup and Status window.

The Wi-Fi connectivity is now configured and connected to Wi-Fi network and can be used as the programming port. For Modbus TCP or VersaCloud M2M communications, additional configuration is required.

Wi-Fi connectivity depends upon the target being in range, with sufficient signal strength and being configured properly for communications over the Wi-Fi network.

Modbus TCP

To use the **HEC-Gateway** Wi-Fi connection for Modbus, in EZ LADDER Toolkit, from the File Menu at the top, click PROJECT then SETTINGS. This will open the Project Settings Window. The HEC-Gateway was previously selected.

Click the **PROPERTIES** button. The ***HEC-Gateway's Properties*** Window will open. Verify the correct model number from the drop-down menu.

If Modbus Master or Slave is installed, it will be listed under the Devices, *Internal* section. Click the **ADD DEVICE** button. This will open the ***PLCHIP-PXX Devices*** window. See Figure 2-30. Select **Modbus Master** or **Modbus Slave** from the choices. Click **OK.** The Modbus Slave or Modbus Master Properties window will open depending on the type of Modbus port you selected. See Figure 2-31.

For purposes of configuration, the Slave option will be shown. For Modbus Master configuration details, refer to the P-Series EZ LADDER Toolkit Manual

Click the **ADD** button to open the ***Add Interface*** window. See Figure 2-32. Select **Ethernet** (Wi-Fi as Ethernet) from the Interface Drop-down select box. For Modbus Slave, Set the **Number of TCP Sockets**. The default is 1. For Modbus Master, set the **Response Timeout** (ms).

Click **OK** the number of times required to save the Modbus Settings and return to the EDIT workspace. Remember to Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS.**

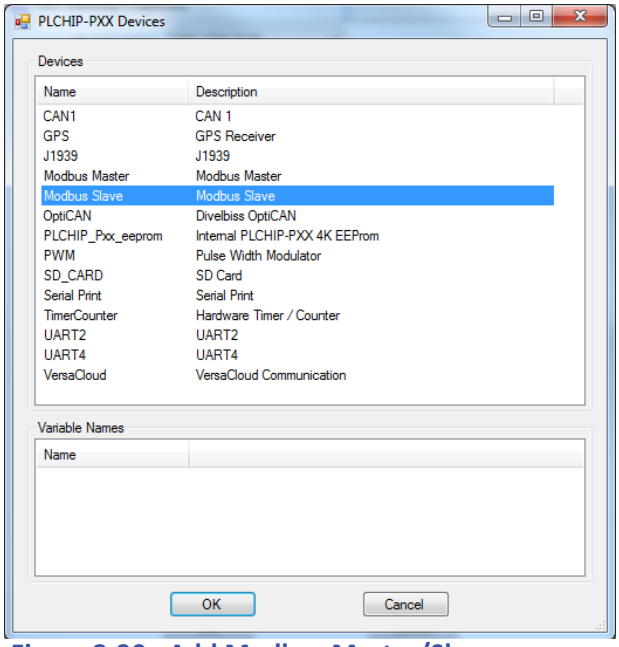


Figure 2-30 - Add Modbus Master/Slave

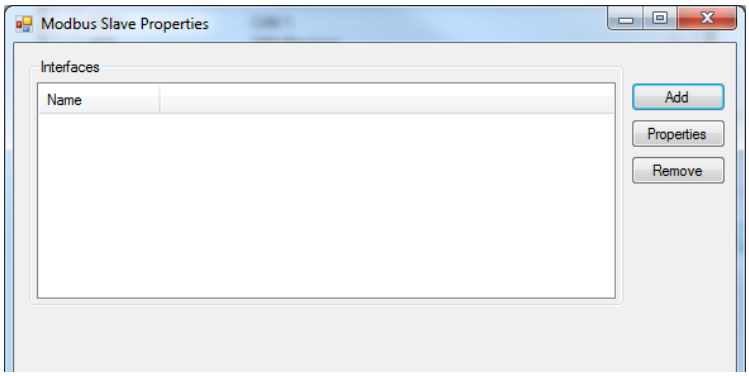


Figure 2-31 - Modbus Properties

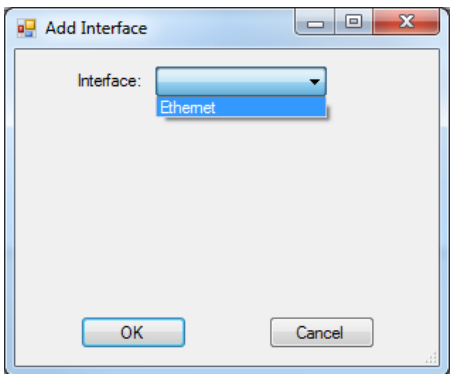


Figure 2-32 - Add Interface

Modbus TCP (over Wi-Fi as Ethernet) is now ready to be used on the HEC-Gateway. Several additional function blocks are used with the Modbus TCP Ethernet port in the ladder diagram project. More on Modbus and the required function blocks is detailed in the P-Series EZ LADDER User's Manual.

For details on configuring and using Modbus TCP (Master or Slave), refer to the P-Series EZ LADDER Toolkit Manual. It contains in-depth information regarding using variables and Modbus.

Serial Ports- COM 2 / COM 4

The HEC-Gateway includes two general purpose RS232 Serial Ports (COM2 and COM4). These ports are used for general communications including Modbus Master, Modbus Slave or communications to other devices using customized drivers (structured Text). The serial (COM) ports are accessed via the external M12 cable. Refer to Figure 1-5 for the location. Refer to the P-Series EZ LADDER Toolkit Manual for details regarding supported baud rates and structured text functions.

SERIAL PORT PIN-OUTS

The serial ports are accessed from the external serial port cable - refer to Figure 1-5 for the location. This cable is a female, M12 connector with 8 conductors / pins and is sealed for harsh environment installation. Refer to Figure 2-33 for the connector pin-out.

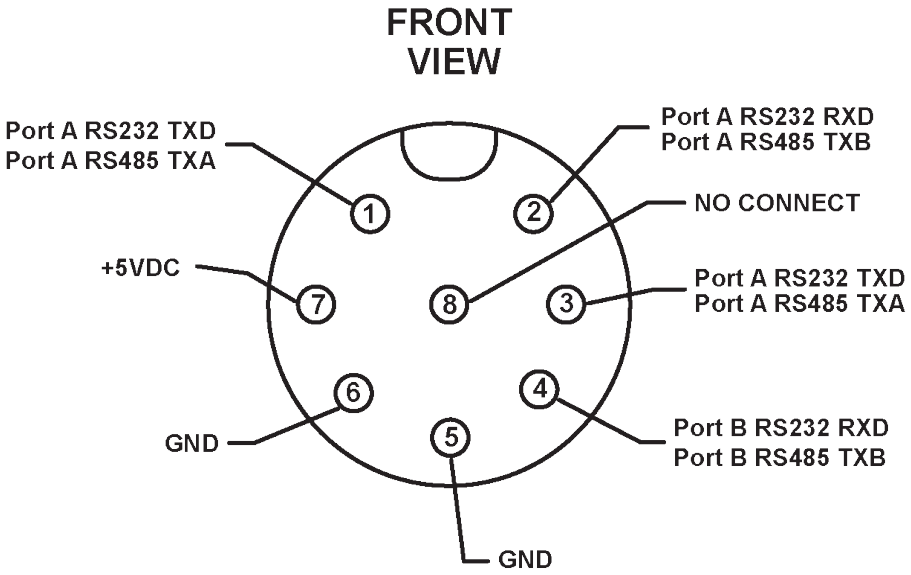


Figure 2-33 - Serlai Port Cable Connector Pin-Out

CONFIGURING SERIAL PORTS (COM2 / COM4) IN EZ LADDER TOOLKIT

The Serial Ports must be installed on the target and in the ladder diagram program using EZ LADDER Toolkit before it may be used in the ladder diagram program. To install a Serial/COM port, it must be configured in the program's target settings using the EZ LADDER Toolkit's Project Settings Menu.

1. In EZ LADDER, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the Project Settings Window. Select HEC-Gateway as the target from the choices.

2. Click the **PROPERTIES** button to the right side of the window. The ***HEC-Gateway Properties*** Window will open. Make sure the proper model is selected in the drop-down menu.

3. If either COM2 or COM4 were previously installed, they would appear under the Bus, Uart heading as **UART2** or **UART3** (for COM2 and COM4 respectively). Click the **ADD DEVICE** button. The ***PLCHIP-PXX Devices*** window will open.

4. Locate **UART2 or UART4** in the *Devices* pane. Click to select (highlight) the **UART#** required. Refer to Figure 2-34. Click **OK**. The *UARTX Properties* dialog will open.

5. Using the drop-down menu items, select the parity, data bits, stop bits, baud rate and Comm Mode pin from the available drop down options. If you are planning to use structured text to communicate with devices on this port, click the Enable ST buffers checkbox and enter the transmit and receive buffer size. Refer to Figure 2-35. Click **OK**. The *UARTx Properties* dialog will close.

6. You will now see UART2 listed under the Bus..Uart heading. Click **OK** to close the *HEC-Gateway's Properties*.

7. Click **OK** to close the *Project Settings* window.

8. Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS** to save the current settings in your program.

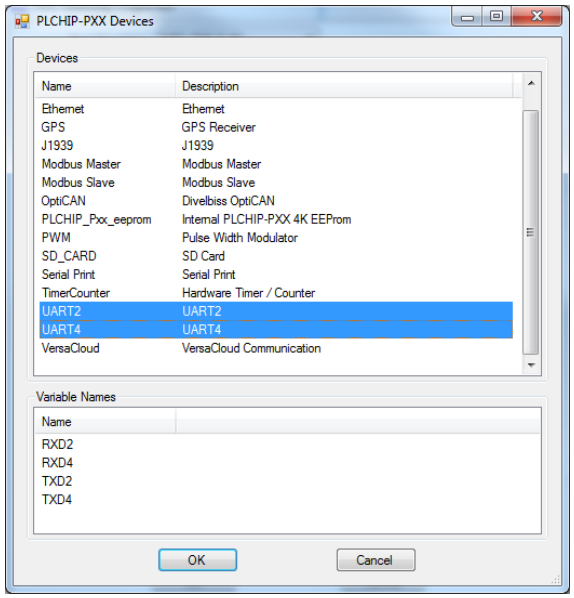


Figure 2-34 - Select UART for Serial Port

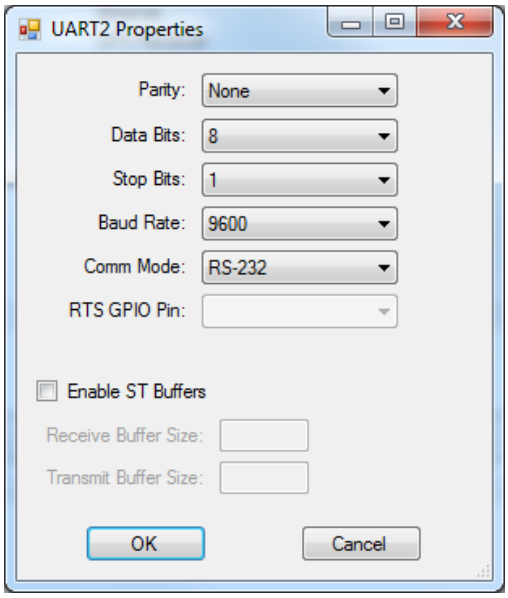


Figure 2-35 - UART Properties

Repeat these steps for all Serial Ports (UARTs) to be utilized on the HEC-Gateway Device. Once completed, the Serial (COM Ports / UARTs) are now ready to be used in the ladder program. The Serial Ports may be used as Modbus Master / Slave, to Serially Print to externally connected devices or can be used to communicate other devices by writing custom serial port drivers using Structured Text.

To use Modbus Master / Slave over the Serial (COM/UART) ports, Modbus must be installed in the ladder diagram project before it can be used. Refer to the ***Modbus Master/Slave (COM Port) Section*** of this manual for more information on installing the Modbus over Serial port option.

To use Serial Printing feature with the Serial (COM/UART) ports, the Serial Print option must be installed in the ladder diagram project before it can be used. Refer to the ***Serial Print (COM Port) Section*** of this manual for more information on installing the Serial Print option.

The HEC-P5-GPS is designed to connect directly to the serial port cable, providing a GPS option for the HEC-Gateway. Refer to the GPS option section for more details.

Modbus Master / Slave (COM Port)

Modbus Master or Slave may be utilized with the Serial Ports (UARTs / COM ports). To use Modbus Master or Slave over Serial Ports, Modbus Master/Slave must be installed and configured in the ladder diagram project.

Serial Port(s) (COM port / UART must be installed prior to installing or configuring the Modbus Master / Slave using Serial. Refer to the Serial Ports (COM2 / COM4) Section of this manual for details on installing the Serial Ports.

To use the **HEC-Gateway** Serial Ports for Modbus, in EZ LADDER Toolkit, from the File Menu at the top, click PROJECT then SETTINGS. This will open the Project Settings Window. The HEC-Gateway target was previously selected

Click the **PROPERTIES** button. The ***HEC-Gateway's Properties*** Window will open. Under the Devices, *Internal* section, if Modbus Master or Slave is installed, it will be listed. Click the **ADD DEVICE** button. This will open the ***PLCHIP-PXX Devices*** window. See Figure 2-36. Select **Modbus Master** or **Modbus Slave** from the choices. Click **OK.** The ***Modbus Slave or Modbus Master Properties*** window will open depending on the type of Modbus port you selected. See Figure 2-37. Click the **ADD** button to open the ***Add Interface*** window.

For Modbus Slave, see Figure 2-38. Select **UART#** from the Interface Drop-down select box. Set the **Slave ID #.** This should be the network ID for this VersaGateway on the Modbus network. Select **RTU** as the type and leave the other fields as default set.

For Modbus Master, see Figure 2-39. Select **UART#** from the Interface Drop-down select box. Set the **Response Timeout(ms).** This should delay time for a slave to respond in milliseconds. Select **RTU** as the type.

Click **OK** the number of times required to save the Modbus Settings and return to the EDIT workspace. Remember to Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS.**

Modbus Master / Slave is now installed and configured to use in the ladder diagram program on the HEC-Gateway Device.

For detailed information on how to configure variables and use Modbus in EZ LADDER Toolkit, refer to the P-Series EZ LADDER Toolkit Manual It contains information how to use Modbus Master and Slave using variables and function blocks.

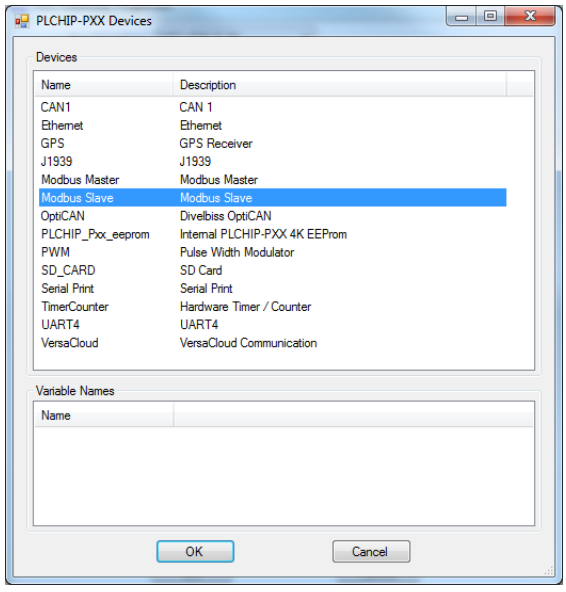


Figure 2-36 - Selecting Modbus

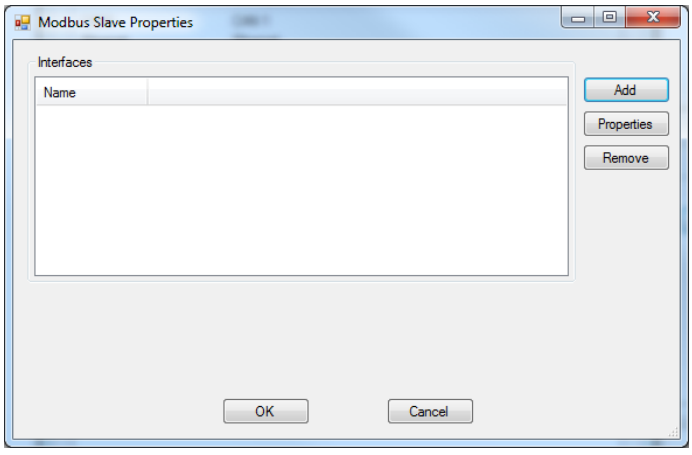


Figure 2-37 - Modbus Properties

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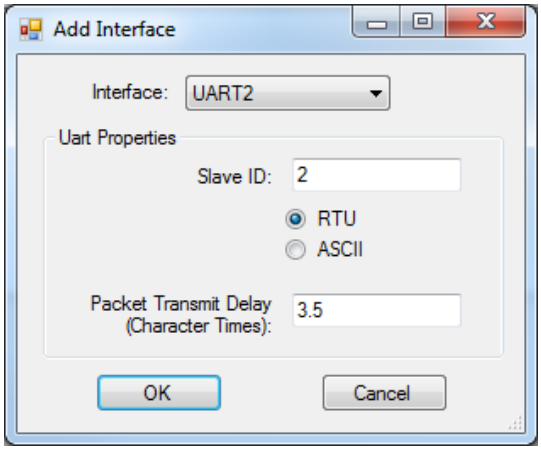

Figure 2-38 - Add UART Interface - Slave

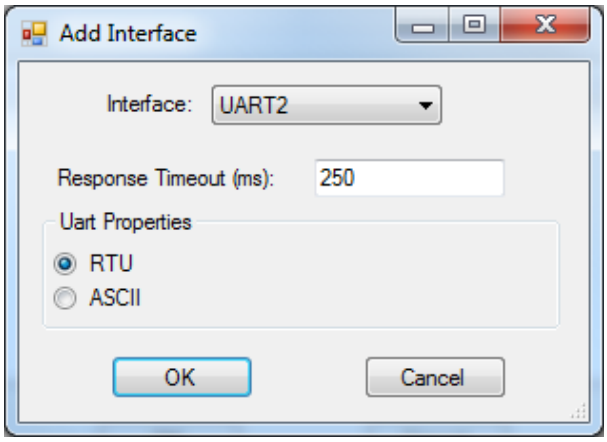

Figure 2-39 - Add UART Interface - Master

Serial Print Option (COM Port)

The Serial Ports (COM Port / UART) may be utilized to send ASCII data serially to an external device. To use the serial ports for this type of communications, the Serial Printing option must be installed in ladder diagram project before it may be used.

Serial Port(s) (COM port / UART must be installed prior to installing or configuring the Serial Print option. Refer to the Serial Ports (COM2 / COM4) Section of this manual for details on installing the Serial Ports.

To use the **HEC-Gateway** Serial Ports for Serial Printing, in EZ LADDER Toolkit, from the File Menu at the top, click PROJECT then SETTINGS. This will open the Project Settings Window. The HEC-Gateway targetwas previously selected.

Click the **PROPERTIES** button. The ***HEC-Gateway's Properties*** Window will open. Under the Devices, *Internal* section, if Serial Print is installed, it will be listed under Device. Click the **ADD DEVICE** button. This will open the ***PLCHIP-PXX Devices*** window. See Figure 2-40. Select **Serial Print** from the choices. Click **OK.** The ***Serial Print Properties*** window will open. See Figure 2-40. Click the **ADD** button to open the ***Add Uart*** window. Select the **UART#** from the drop-down menu. Set the buffer size in bytes for what would be required for your application and serial printing needs.

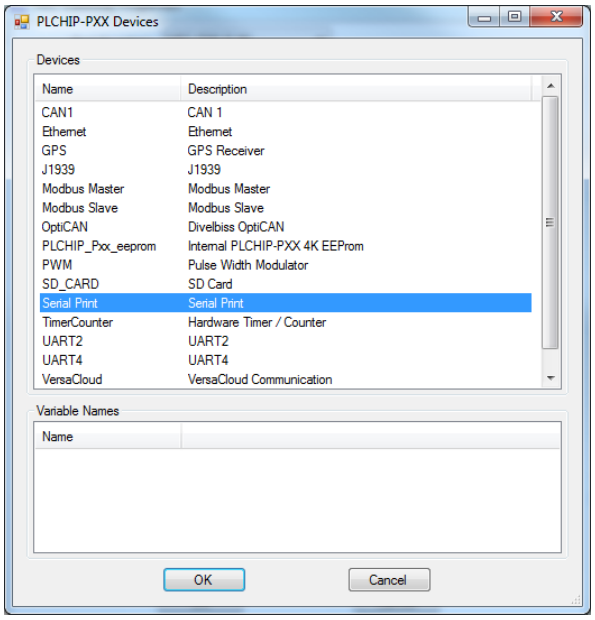

Figure 2-40 - Select Serial Print

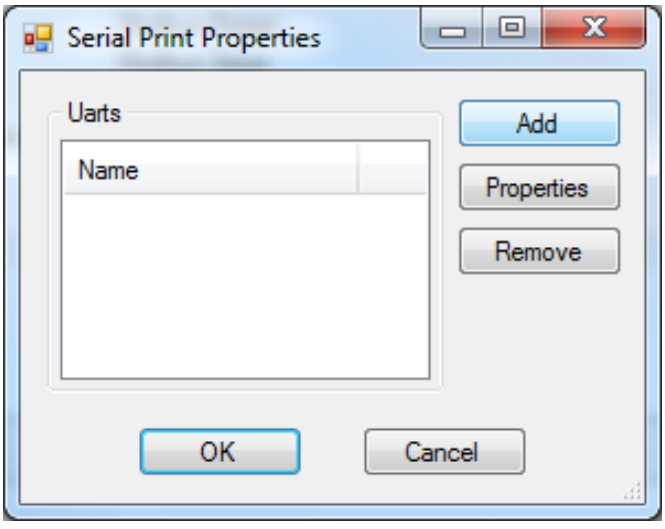

Figure 2-41- Serial Print Properties

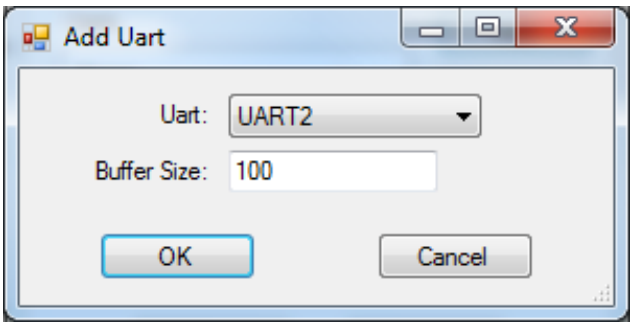

Figure 2-42- Add Uart Dialog

Click **OK** the number of times required to save the settings of the Serial Printing and return to the EDIT workspace. Remember to Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS.**

The Serial Print is now installed and configured to use in the ladder diagram program on the HEC-Gateway Device. Serial Printing uses the **SERIAL_PRINT** function block.

For detailed information on how use the Serial Printing feature, refer to the P-Series EZ LADDER Toolkit Manual.

Custom UART (serial communications) is possible to nearly any device by writing custom communications drivers in Structured Text.

GPS Option

HEC-Gateway devices support a GPS (Global Positioning Satellite) option (sold separately). The GPS option allows for identifying the current location of the HEC-Gateway device (and any equipment connected to it). This is especially useful in the case of locating mobile equipment (when combined with VersaCloud M2M).

The GPS receiver HEC-P5-GPS is sold separately and is plugged into the serial port cable. Refer to Figure 1-5 for the location of the serial port cable.

GPS RECEIVER

The GPS receiver HEC-P5-GPS is sold separately and is plugged into the serial port cable. Refer to Figure 1-5 for the location of the serial port cable.

If the HEC-Gateway will be installed in an open-air environment or an plastic / fiberglass enclosure, the receiver may be directly mounted to the HEC-Gateway by plugging the HEC-P5-GPS into the serial cable (see Figure 1-5).

If the HEC-Gateway is to mounted in a metal enclosure (or any box/enclosure that may block the GPS signal), the receiver will need to be mounted external to the box / enclosure that could block the GPS signal. Externally connecting the receiver in this method will require additional cabling. Contact Divelbiss support for extension cabling options for the HEC-P5-GPS.

With the receiver properly installed and connected, the GPS option must be installed / enabled in EZ LADDER Toolkit using the Project Settings Menu.

CONFIGURING GPS IN EZ LADDER TOOLKIT

1. In EZ LADDER, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the Project Settings Window. Select **HEC-Gateway** as the target from the choices.

2. Click the **PROPERTIES** button to the right side of the window. The ***HEC-Gateway Properties*** Window will open. Make sure the proper model is selected in the drop-down menu.

3. Click the **ADD DEVICE** button. The *PLCHIP-PXX Devices* window will open. Locate the **GPS** in the Devices pane of this window.

4. Click / select **GPS** (highlight). Refer to Figure 2-43. Click **OK**. The GPS Properties window will open identifying UART2 as the interface for the GPS. Click **OK**.

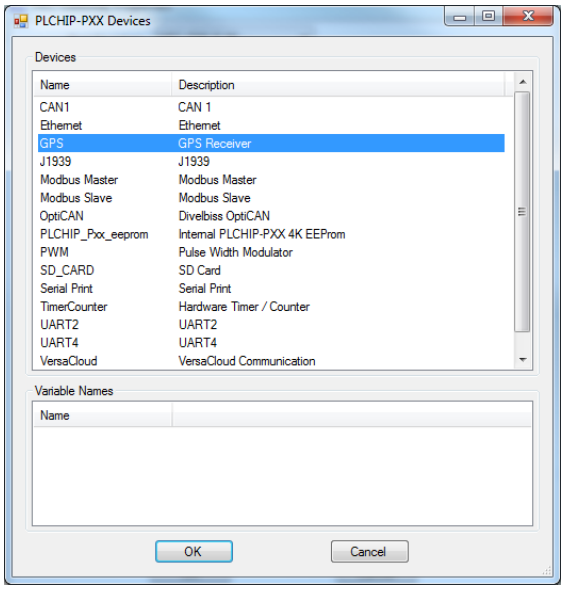

Figure 2-43 - PLCHIP-PXX Devices - GPS

5. Click **OK** to as needed to close each of the open windows including the ***HEC-Gateway Properties*** window.

6. Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS** to save the current settings in your program.

The GPS option is now installed and ready to used in the ladder diagram program / structured text.

To use the GPS option to identify location and other information, it must be accessed via Structured Text. Several Target specific structured text functions are used: EZ_GPS_GetDateTimeUTC, EZ_GPS_GetMovement, EZ_GPS_GetPosition and EZ_GPS_GetPrecision. Refer to the P-Series EZ LADDER Toolkit Manual for details on how these target specifics function, how to use GPS and using Structured Text. **GPS functionality Structured text examples are available for download**.

The GPS option (using the HEC-P5-GPS) utilizes UART2 (COM2). This makes the COM port (UART2) unavailable for any other types of communcations.

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Cellular Data Option

The HEC-Gateway optionally supports an internal Cellular Data Modem (model dependent). This internal cellular data option is designed to operate with the Divelbiss VersaCloud M2M Portal. The purpose of the cellular data feature is to allow for remote reporting, control and configuration of equipment in areas that may not have adequate communications avenues such as broadband (Wi-Fi). This cellular data option provides a communications path to the Divelbiss VersaCloud M2M portals (CLOUD) via nationwide cellular coverage.

The Cellular Data option requires cellular data coverage from Divelbiss Corporation. Monthly fees and data usage charges apply. As data fees apply, consideration should be made during the application ladder diagram program development to limit the amount and size of data to only what is required to reduce cost.

CELLULAR ANTENNA

For Cellular connection supporting models of HEC-Gateway, the unit ships with a loose - packed antenna that must be installed before the Cellular connection will be able to function. Refer to Figure 1-5 for the location of the Antenna plug-in connection on the HEC-Gateway.

If the HEC-Gateway will be installed in an open-air environment or an plastic / fiberglass enclosure, the antenna may be directly mounted to the HEC-Gateway. Screw the antenna into position (See Figure 1-5).

If the HEC-Gateway is to mounted in a metal enclosure (or any box/enclosure that may block the Cellular signal), the antenna will need to be mounted external to the box / enclosure that could block the Cellular signal. Externally connecting the antenna in this method will require additional cables and a bulk-head fitting (not included). Refer to Figure 2-44 for mounting method examples.

When mounting antennas, Antennas must be electrically isolated from panel ground / common. If not isolated, damage to the HEC-Gateway device will result. When using multiple communication antennas (Wi-Fi, Cellular), sufficient spacing must be kept between them to prevent interference between them. If interference is suspected, increase the space between the antennas.

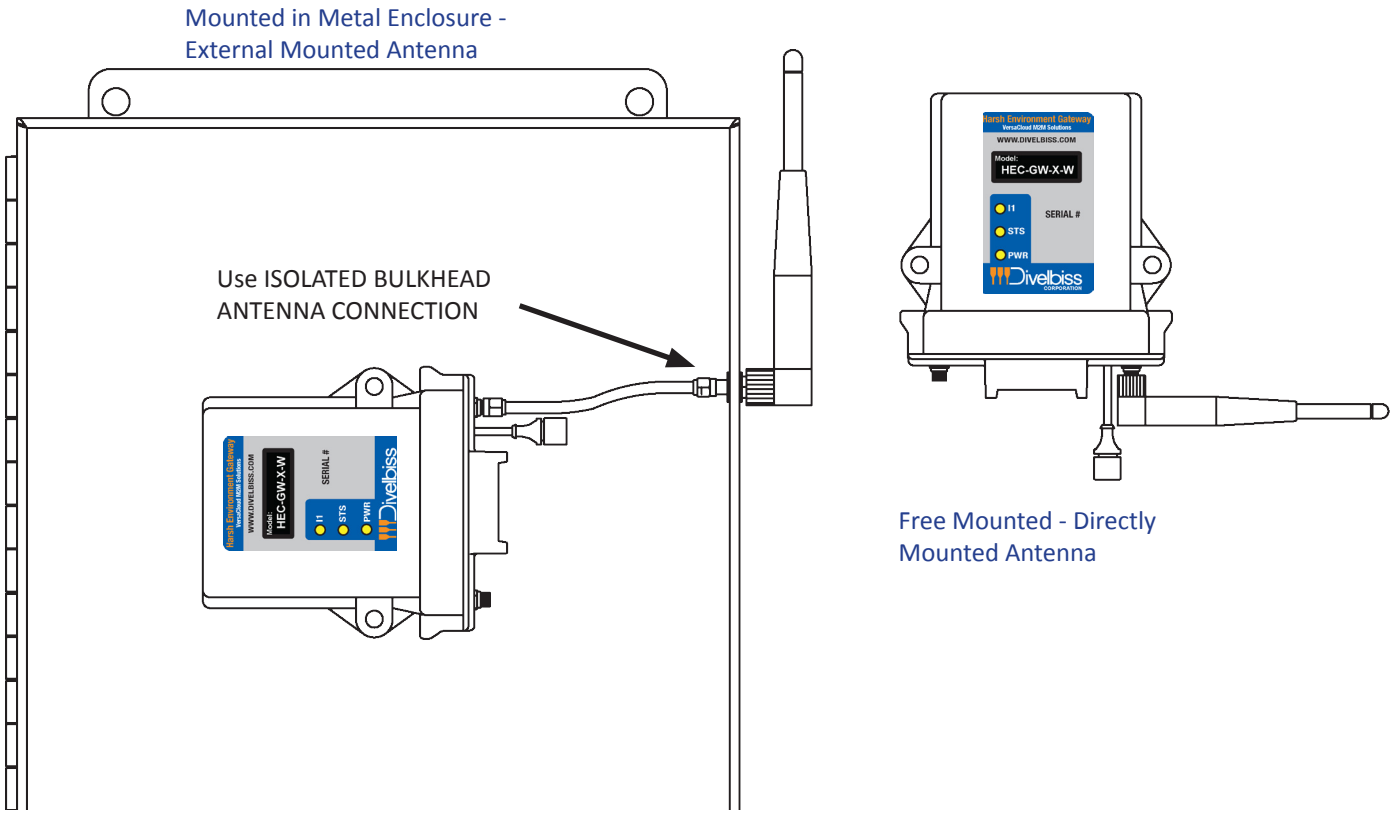

Figure 2-44 -Antenna Mounting Options

With the antenna properly installed and connected, the Cellular Data option must be installed / enabled in EZ LADDER Toolkit using the Project Settings Menu.

CONFIGURING CELLULAR DATA IN EZ LADDER TOOLKIT

1. In EZ LADDER, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the Project Settings Window. Select **HEC-Gateway** as the target from the choices.

2. Click the **PROPERTIES** button to the right side of the window. The ***HEC-Gateway Properties*** Window will open. Make sure the proper model is selected in the drop-down menu.

3. Click the **ADD DEVICE** button. The *PLCHIP-PXX Devices* window will open. Locate the **Cellular** in the Devices pane of this window.

4. Click / select **Cellular** (highlight). Refer to Figure 2-45. Click **OK**. The Cellular Properties window will open identifying UART1 as the interface for the Cellular Modem. Click **OK**.

5. Click **OK** to as needed to close each of the open windows including the ***HEC-Gateway Properties*** window.

6. Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS** to save the current settings in your program.

The Cellular Data option is now installed and ready to used in the ladder diagram program / structured text.

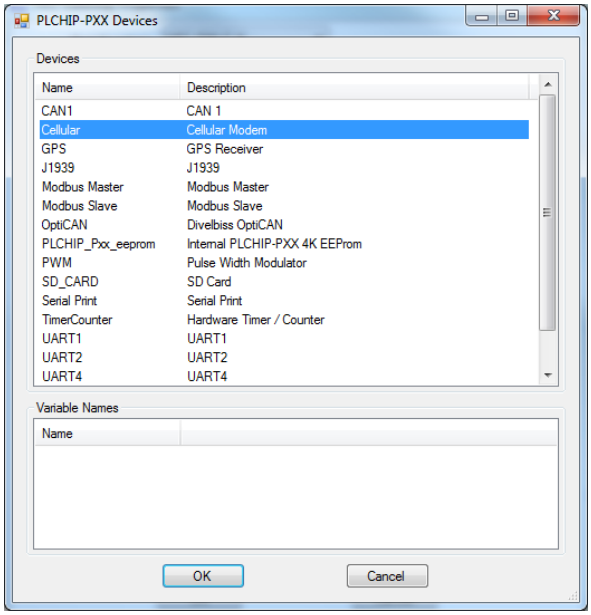

Figure 2-45 - PLCHIP-PXX Devices - Cellular

To use the Cellular data option, the cellular modem must be controlled using Structured Text. There are several target specific Structured Text functions including: EZ_Cell_Activate, EZ_Cell_ApplyPower, EZ_Cell_Connect, EZ_Cell_Deactivate, EZ_Cell_GetIpV4Addr, EZ_Cell_GetMDN, EZ_Cell_GetRegistration, EZ_Cell_GetSignalStrength, EZ_Cell_GetState. These are used in Structured text to control the cellular modems functionality (turn on, off, etc). Refer to the P-Series EZ LADDER Toolkit for more detailed information regarding the Cellular data option and Structured Text. **Cellular Data functionality Structured text examples are available for download**.

VersaCloud M2M Connectivity

VersaCloud M2M is a complete, end to end solution for remote monitoring, configuration and control. Using the HEC-Gateway (or other VersaCloud enabled devices), equipment may be monitored for current status and alarms as well as controlled including configuration changes and remote control of the process. This is accomplished as the HEC-Gateway communicates to the VersaCloud M2M Cloud Server. Data and control is accessed from any internet enabled device (tablet, phone, computer) using customizable, personal Portals (VersaCloud M2M Portals) that provide a link to the remote device and its data. Each portal can support multiple Dashboards that provide customized interfaces for the remote equipment. Using VersaCloud M2M Solutions (hardware and software), you can remote monitor and control individuals to groups of remote equipment. The VersaCloud M2M Portals can be configured to send text (SMS) or e-mail messages to pre-determined personnel based on programmable 'events' such as alarms or faults.

In addition to the HEC-Gateway communicating to local devices and systems using Modbus TCP, Modbus Slave, Modbus Master, J1939 or NMEA 2000, it supports communication directly to **VersaCloud M2M Portals**.

Using VersaCloud connectivity, the HEC-Gateway can communicate to VersaCloud Portals using the previously covered communications features including Wi-Fi and Cellular data. Additional portal, device and data charges may apply.

VersaCloud M2M functionality requires additional management steps including VersaCloud M2M Portal account setup, device setup and communications data plans based on specific needs (ie: cellular). Contact Divelbiss Corporation for details on VersaCloud M2M Solutions packages.

In addition to the management items listed previously, before VersaCloud connectivity may be used, it must be installed in the ladder diagram program using the Project Settings.

CONFIGURING VERSACLOUD M2M IN EZ LADDER TOOLKIT

1. In EZ LADDER, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the Project Settings Window. Select **HEC-Gateway** as the target from the choices.

2. Click the **PROPERTIES** button to the right side of the window. The ***HEC-Gateway Properties*** Window will open. Make sure the proper model is selected in the drop-down menu.

3. Click the **ADD DEVICE** button. The *PLCHIP-PXX Devices* window will open. Locate the **VersaCloud** in the Devices pane of this window. Click / select **VersaCloud** (highlight). Refer to Figure 2-46.

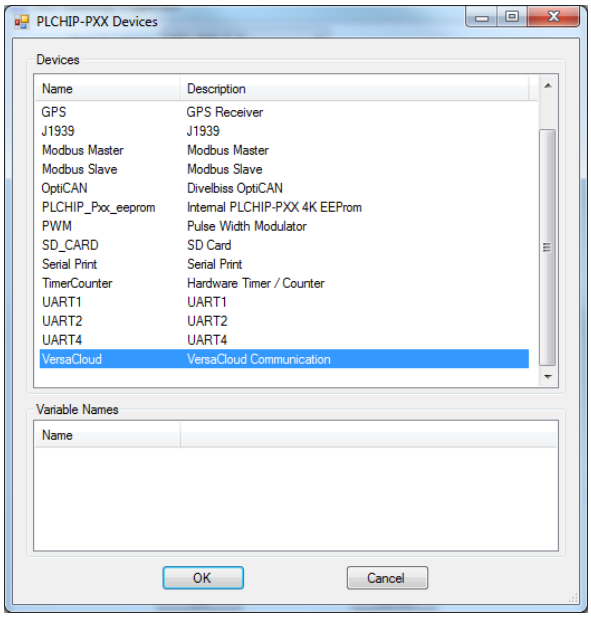

Figure 2-46 - PLCHIP-PXX Devices - VersaCloud

4. Click **OK**. The ***VersaCloud Properties*** Window will open. Refer to Figure 2-47. This window is used to select the interface (communications method) between the HEC-Gateway and the VersaCloud M2M Portal (Cloud server). The ***Available Interfaces Pane*** and the ***Selected Interfaces Pane*** are used for the selection.

   The ***Available Interfaces Pane*** lists all the current available communication methods that are available to communicate to the VersaCloud M2M Portal. To select one of the interfaces, select it (highlight) and click **ADD**. The interface will now move to the ***Selected Interfaces Pane***. Selecting an interface from the ***Selected Interfaces Pane*** and clicking **REMOVE** will remove an interface from being available for VersaCloud communications. **Ethernet would be selected for Wi-Fi models. Only interfaces in the Selected Pane can communicate to the VersaCloud M2M portals.**

Generally, the available interfaces are based on the model of the HEC-Gateway and they must have been previously installed (Wi-Fi, Cellular, etc) before they will be available in this dialog. Refer to other sections of this manual for installing specific HEC-Gateway features (using the Project Settings Menu).

   For the continuation of this configuration, select **Ethernet** from the ***Available Interfaces Pane*** and click **ADD**.

5. Leave all the other settings as default set and click **OK**.

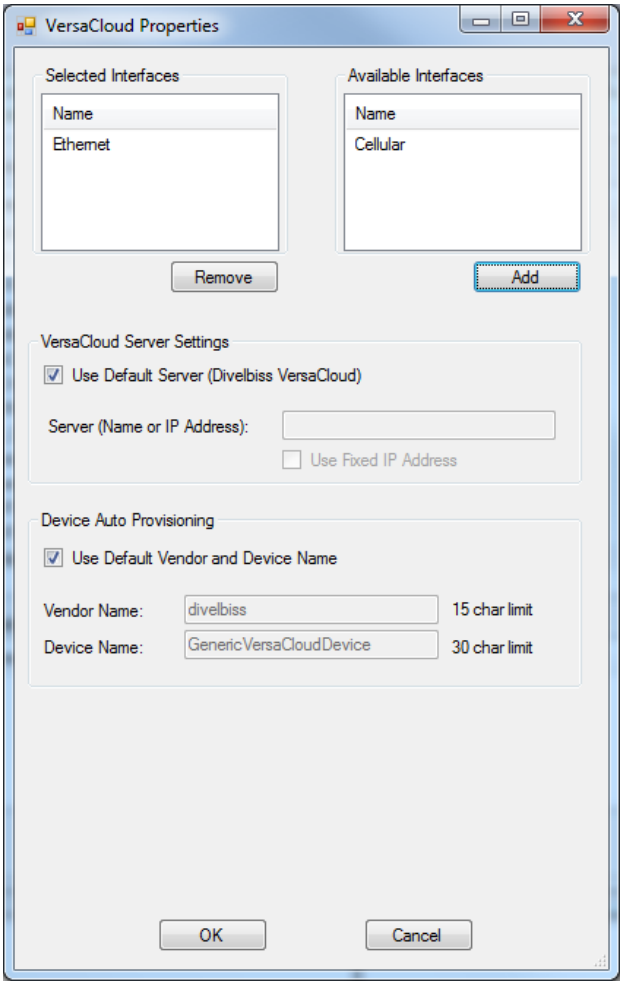

Figure 2-47 - VersaCloud Properties

6. Click **OK** to as needed to close each of the open windows including the ***HEC-Gateway Properties*** window.

7. Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS** to save the current settings in your program.

VersaCloud M2M Connectivity is now installed and ready to used in the ladder diagram program / structured text.

VersaCloud M2M communications from the HEC-Gateway to the cloud portal can use any of the Selected interfaces as shown above. By default, if Wi-Fi (as Ethernet) is available and has a good communications link (the communcations link is active), then communications will occur via Wi-Fi. If cellular communication is required and there is an active Wi-Fi connection, structured text functions must be used and programmed on a per application basis to control which device is to communicate to the VersaCloud M2M portal (Wi-Fi or Cellular). If an active cellular and active Wi-Fi connections are available, all communications will be via Wi-Fi unless specifically programmed to use cellular (structured text programming).

VersaCloud M2M Connectivity is utilized in the ladder diagram program by the VCLOUD Function block. This block is added to the ladder diagram as needed and includes a Properties window when it is placed that determines the Send and Receive variables (data). See Figure 2-48.

For details regarding VersaCloud M2M Portals, the VCLOUD Function block and using VersaCloud M2M connectivity, refer to the P-Series EZ LADDER Toolkit Manual. It contains more details on configuring and using VersaCloud and in-depth information for advanced configurations and usage.

Ladder diagram and Structured Text examples for using VersaCloud, GPS, Cellular Data and more are available for download from our website.

Contact Divelbiss Corporation for VersaCloud M2M information including available hardware, portals and communications packages including availability and pricing.

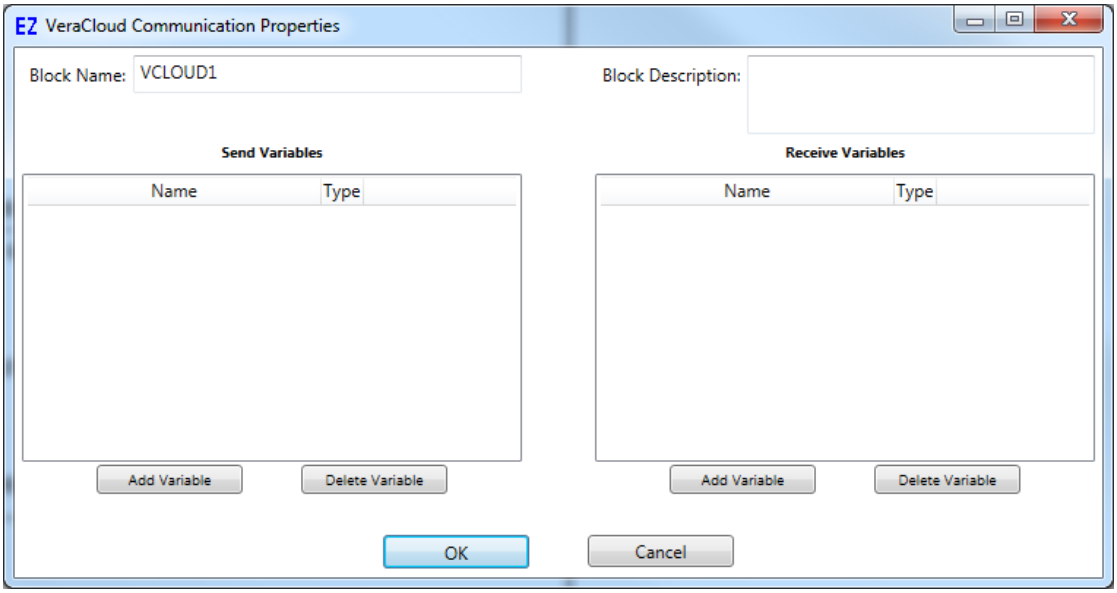

Figure 2-48 - VCLOUD Function Block Properties

Specifications

Processor	P-Series PLC on a Chip (PLCHIP-P10-51220)
Programming Language	Ladder Diagram with Function Block Supports Structured Text
RAM	32K byte total (on PLC on a Chip), 4 Mbit (512K) Battery Backed S-RAM (on 4 1Mbit SPI RAM chips)
FLASH Program Memory	512K bytes, 256K bytes User Program
EEPROM Memory	3500 bytes
FRAM Memory	480 bytes. Used for Retentive or additional EEPROM storage.
Input Power	9-32 VDC
Digital Inputs	Qty 1, User Programmable Switch SW1-1 Qty 1, 8-32VDC, Field accessible, NPN/PNP Configurable, Digital/Counter Input up to 100KHz
Analog Inputs	Qty 1, Monitors on-board Lithium battery voltage (0-3VDC / 0-4095) Qty 1, Monitors HEC-Gateway Input Voltage (0-40VDC / 0-4095) Qty 2, Field Accessible, 0-5VDC/0-10VDC/0-20mADC Switch Configurable, 12-Bit (0-4095)
Digital Outpus	Qty 1, Sourcing, 2 Amps Maximum, Voltage sourced from HEC-Gateway Input Voltage.
LED Indicators	1 Power 1 Status / Watchdog 1 User Programmable (1 Green)
Communications Ports	1 Programming Port (requires HEC-910) 2 Serial Ports Configurable RS232 - Structured Text, Modbus Master, Modbus Slave 1 Wi-Fi 802.11b/g/n Wireless LAN (Program / Modbus TCP / VersaCloud)(model dependent) 1 Cellular Data Modem - 3G(V), (VersaCloud)(Model Dependent) 1 GPS Positioning (requires HEC-P5-GPS, sold separately)
CAN Ports	1 NMEA Compliant (Isolated) CAN Port (Configurable board/external powered - 5VDC or 9-32VDC) Supports SAE J1939, NMEA 2000 and OptiCAN Networks End of Network Terminator - Jumper Configured
Real Time Clock	Month, Day, Year, Day of Week, Hour Minute, Second Battery Backed
SD Card	Supports Micro SD Card Can use to Update Ladder Diagram or Kernel or read / write file system.
Mounting	Subplate or Panel Mount
Size	L x W x H, 5.24” x 4.63” x 1.43” (Excluding antennas)
Operating Temperature	-40°C to 80°C
Cellular Antenna Mating Connection	SMA*
Wi-Fi Antenna Mating Connection	RPSMA*
***Antennas must be electrically isolated from panel ground / common. If not isolated, damage will result.**	

NOTE 1: 2 Amps Total per point @ up to 55 °C See Figure 2.49 for maximum output current per output channel based on ambient temperature.

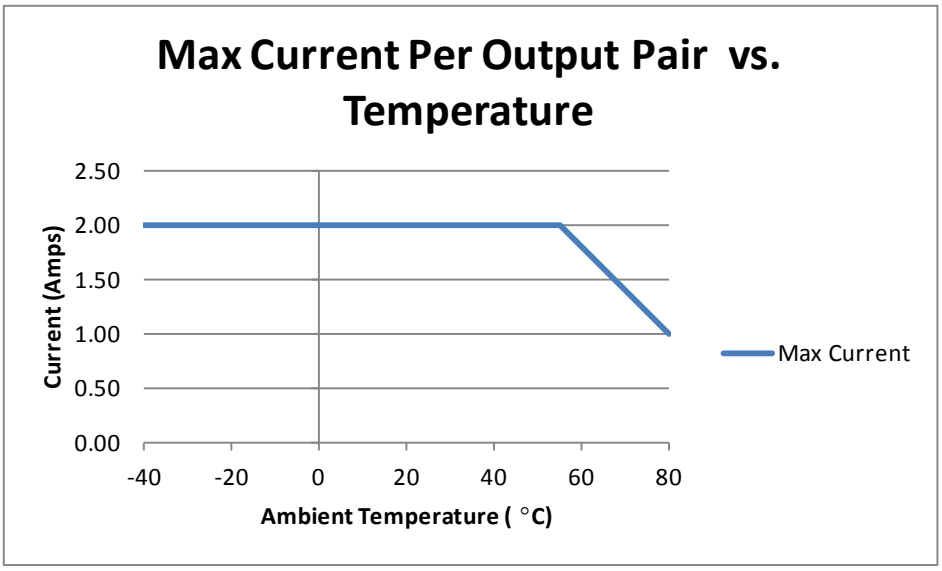

Figure 2-49 - Digital Outpu De-Rating

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