



M Y N A HSM

Special Modbus Driver Programmable Serial Interface Card

USER MANUAL

Rev. P1.58 Simplex

January 2017

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1 INTRODUCTION

1.1 Scope

This document is the User Manual for the Special Modbus serial communication driver firmware for the Emerson Process Management (EPM) DeltaV Control System; it provides information required to install, configure, and maintain the driver firmware on the DeltaV Programmable Serial Interface Card (PSIC). The reader should be familiar with EPM's DeltaV PSIC and connected field devices supporting the Modbus protocol.

The section *Document Format* briefly describes the contents of each section of this manual. *System Specifications* outlines hardware and software requirements for the Special Modbus Driver firmware.

1.2 Document Format

This document is organized as follows:

Introduction	Describes the scope and purpose of this document.
Theory of Operation	Provides a general functional overview of the Special Modbus Driver.
Downloading Firmware	Describes downloading procedures for the Special Modbus Driver firmware on to the DeltaV PSIC.
Configuration Information	Describes procedures and guidelines for configuring the DeltaV PSIC.
Operational Check	Provides tips and assistance to ensure PSIC is properly setup and configured.
DeltaV–Field Device Electrical Interface	Describes the electrical interface between DeltaV and the Field Device. Also describes the cable pin assignments for RS-232 and RS-422/485 communications.
Technical Support	Describes who to call if you need assistance.



1.3 System Specifications

The following table lists the minimum system requirements for the Special Modbus Driver:

Table 1: System Specifications

Firmware	Special Modbus Driver Firmware
Protocol Compatibility	Modbus Protocol is based on the Modbus protocol defined by Gould Modicon in their publication PI-MBUS-300 Rev B.
Software Requirements	DeltaV System Software (Release 4.2 or later) installed on a hardware-appropriate Windows NT workstation configured as a ProfessionalPlus for DeltaV Serial Interface Port License (VE4102) if required.
Minimum DeltaV Hardware Requirements	DeltaV Series 2 Serial Module, M- or S-Series DeltaV MD, MD Plus, MX or SX Controller, Power Supply and 2 wide controller carrier and 8 wide I/O card carrier



2 THEORY OF OPERATION

As part of the serial interface port license, a standard Modbus protocol is installed on the DeltaV PSIC prior to customization. The PSIC needs to be flash upgraded from the Modbus protocol to the Special Modbus firmware before operation.

The Programmable Serial Interface Card (PSIC) supports RS-232, RS-422/RS-485 Half Duplex and RS-422/RS-485 Full Duplex communications with external devices. For communications with Modbus devices, any of these methods can be utilized. The electrical connection and communication settings must be configured properly to ensure accurate communication between the PSIC and field devices. These are described in Section 4.1.

The primary functions of the driver are listed below:

- Perform data and message handling between DeltaV and Modbus devices as defined by the Modbus protocol.
- This driver supports both Master mode and Slave modes.
- This driver provides user configurability to handle 32-bit Integer and Floating Point data. Specifically, users can specify byte swapping for these data types to accommodate Big/Little Endian field devices.
- This driver supports full 16-bit address offsets for each Modbus table type. By not requiring specification of the table type prefix (for example, 4xxxx for holding registers), address offsets from 0 to 65535 can be used.

Each PSIC, when loaded with the Special Modbus Driver, is capable of communicating with field devices over one or both of its two ports, depending upon your application.

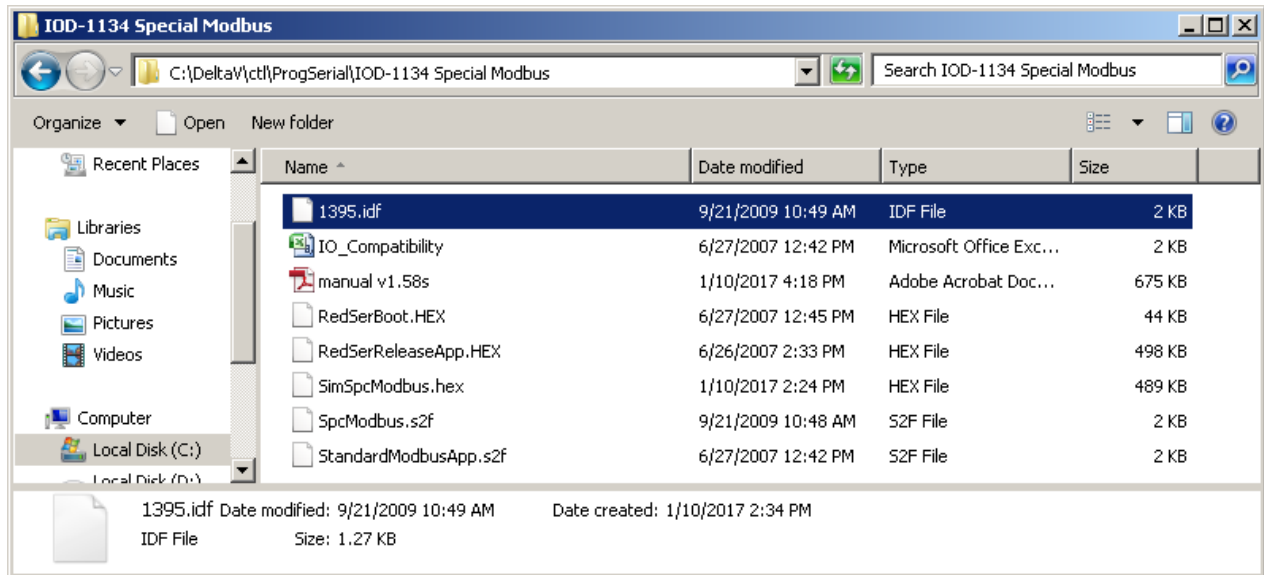


3 Downloading the firmware

The driver software distribution comprises 8 files. These files must be copied to the DeltaV directory on your ProPlus Workstation. The path is:

\\DeltaV\ctl\ProgSerial\IOD-1134 Special Modbus

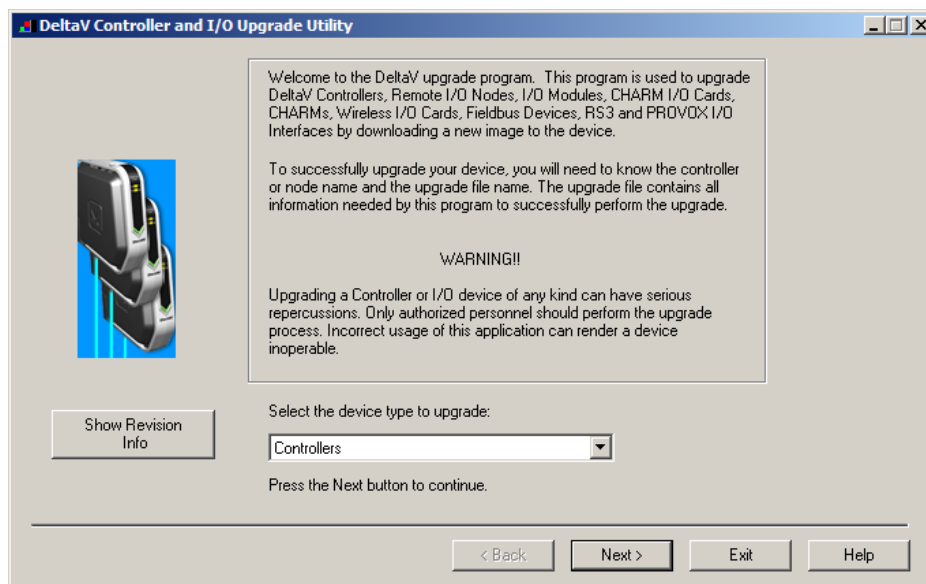
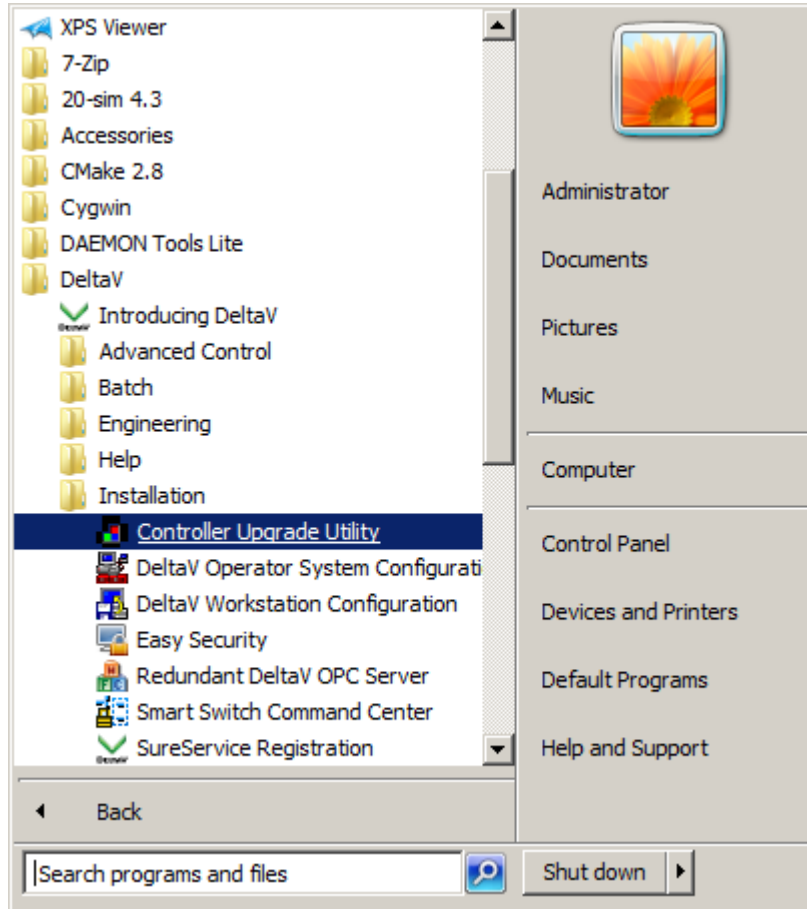
Note that you will have to create this subdirectory. The following shows a completed copy operation:



After copy completion, you are ready to program (or upgrade) the Programmable Serial Card with the supplied custom driver software. The steps are as follows:

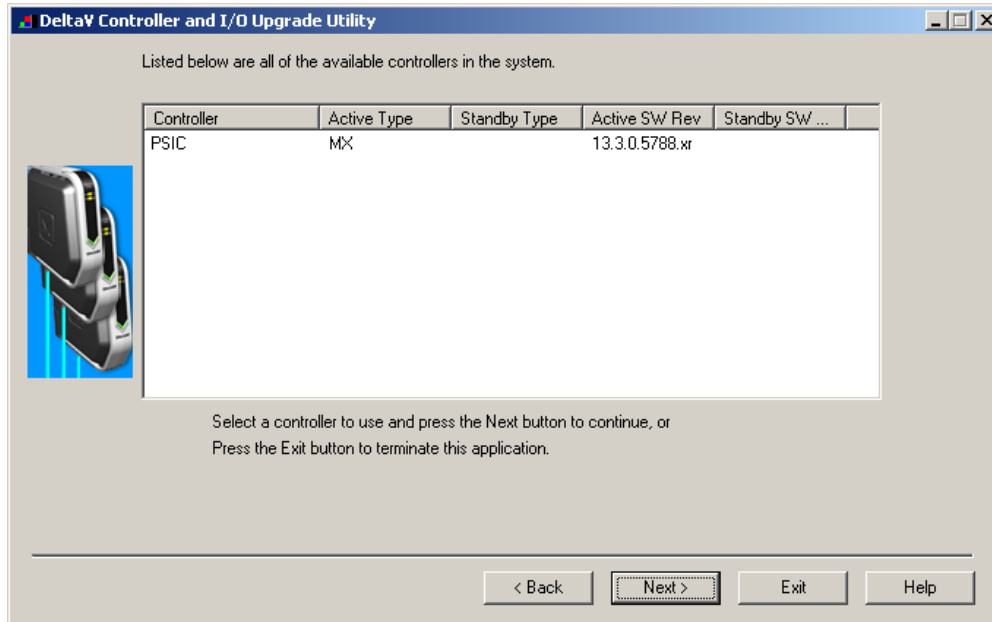
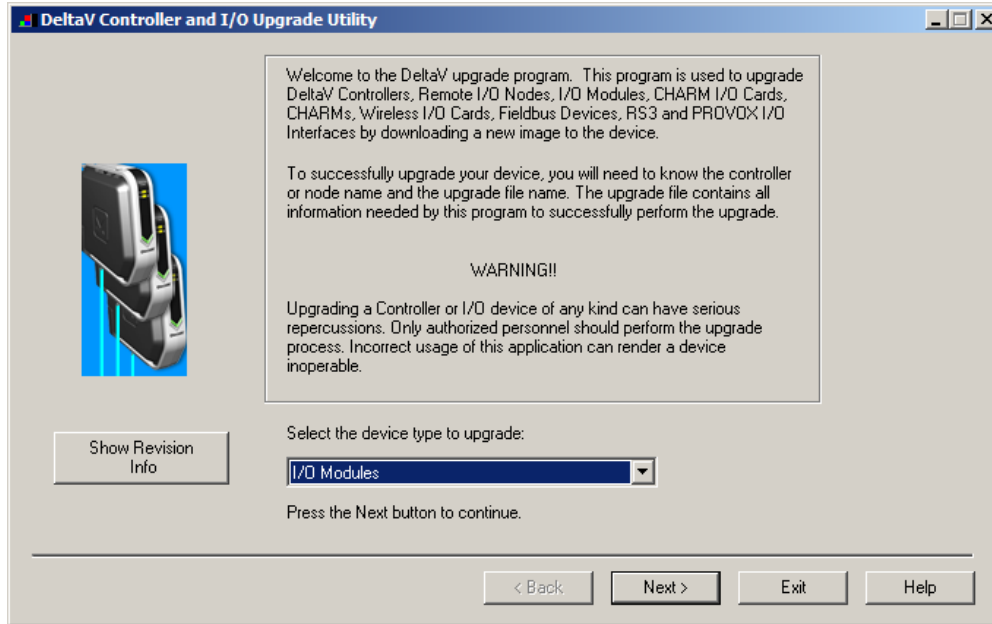


1. Click on the Start button and select DeltaV-> Installation-> Controller Upgrade Utility as shown below, and the following dialog will appear:

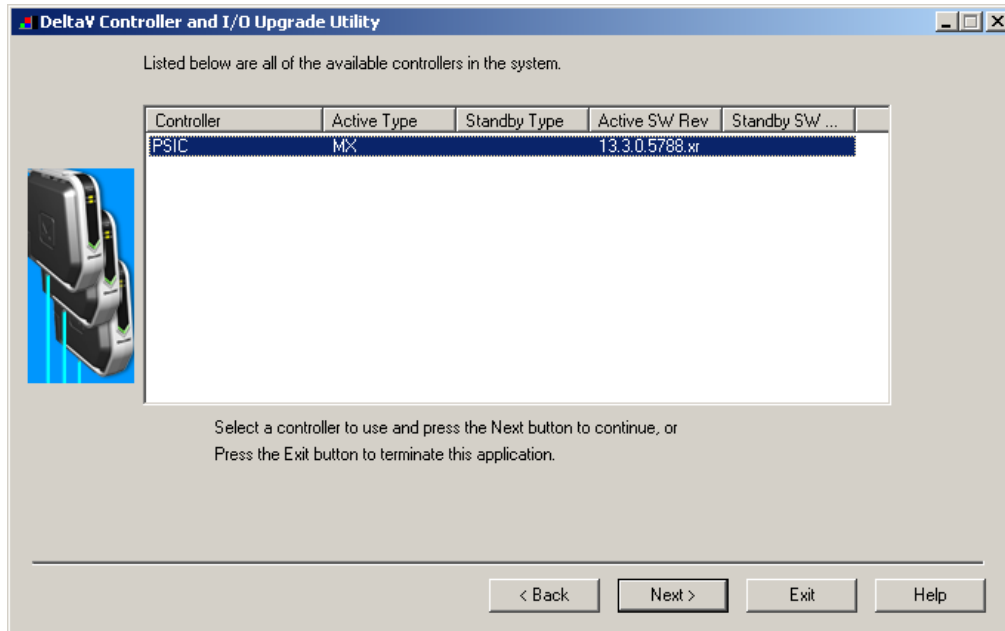




2. Click on the Upgrade I/O Modules radio button, and then click Next.

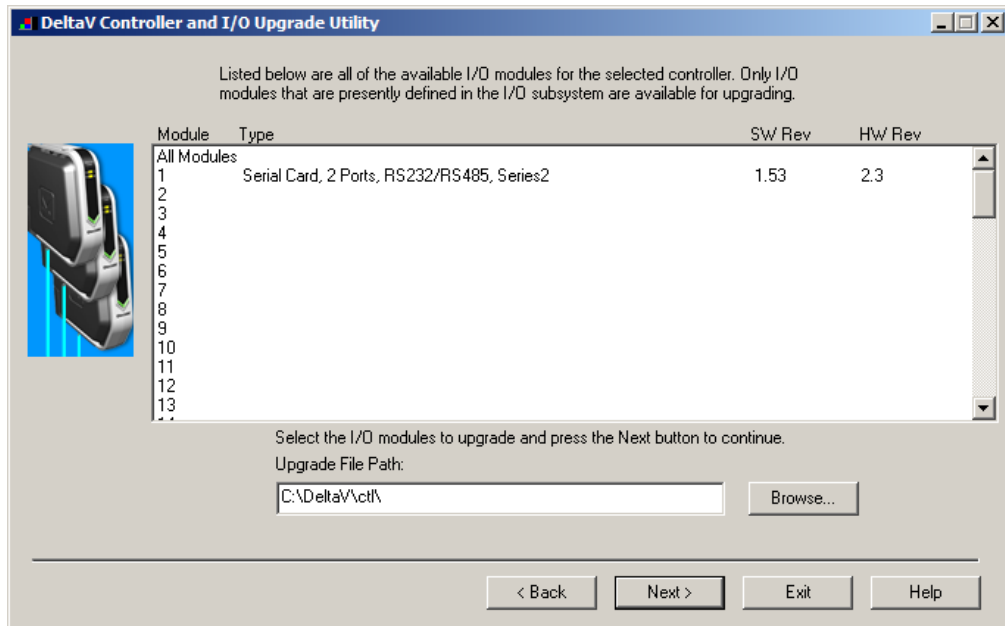


3. The above dialog will appear, listing all the available Controllers in your network. From this dialog, select the appropriate Controller and then Click Next.

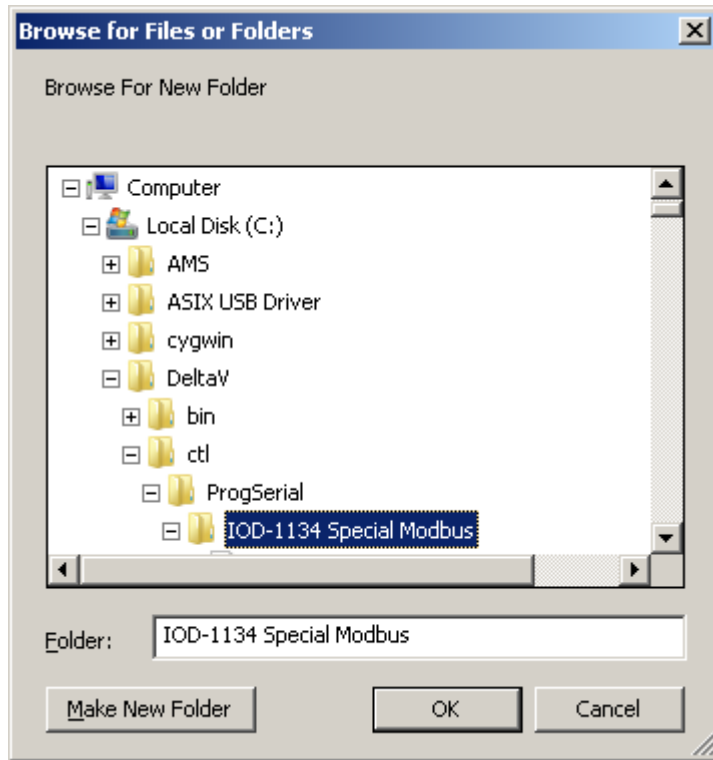


4. The following dialog will appear, listing all the I/O modules in your selected Controller. The shown list of I/O modules is an example only. Your list will be different.

Note: The first time a standard Serial card is upgraded to the Special Modbus Driver, the dialog will be as shown below. When upgrading an existing Programmable Serial Card, skip Steps 5 and 6, and go to Step 7.

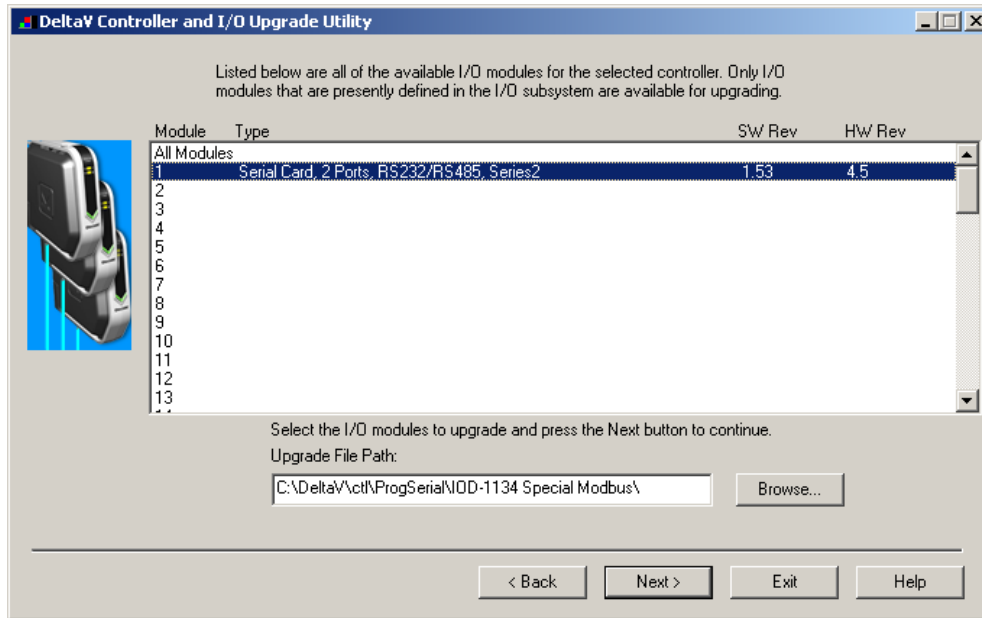


5. Click the Browse button and select the DeltaV path as shown below, and then click Ok. Note that the disk drive could be C or D.



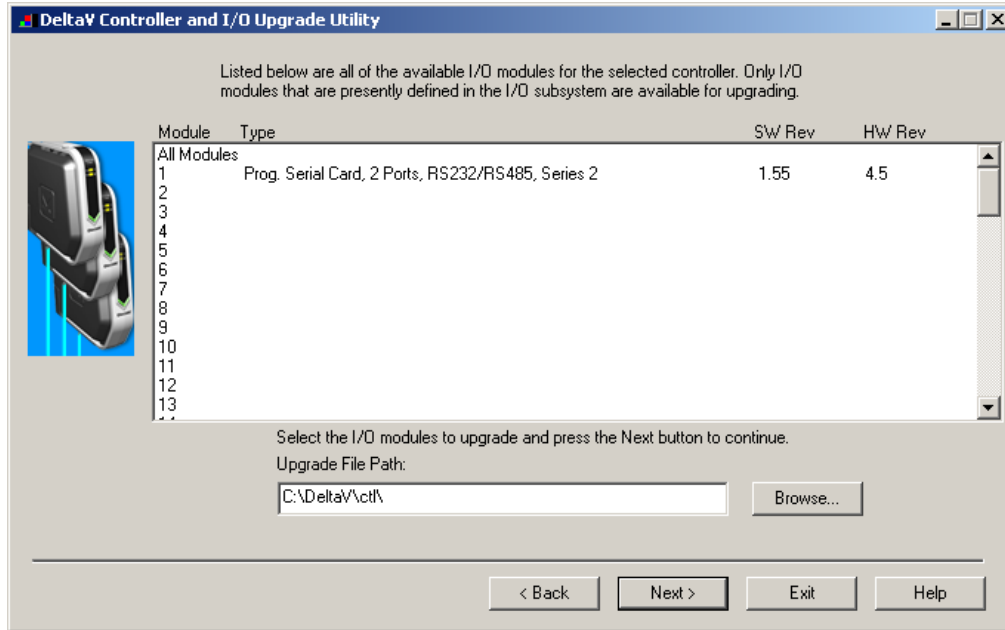


6. Select the I/O module again as shown below and then click Next. Go to Step 9.





7. If you are upgrading an existing Programmable Serial Card, the dialog will be as shown below. From this dialog, select the Programmable Serial Card I/O Module in the list.



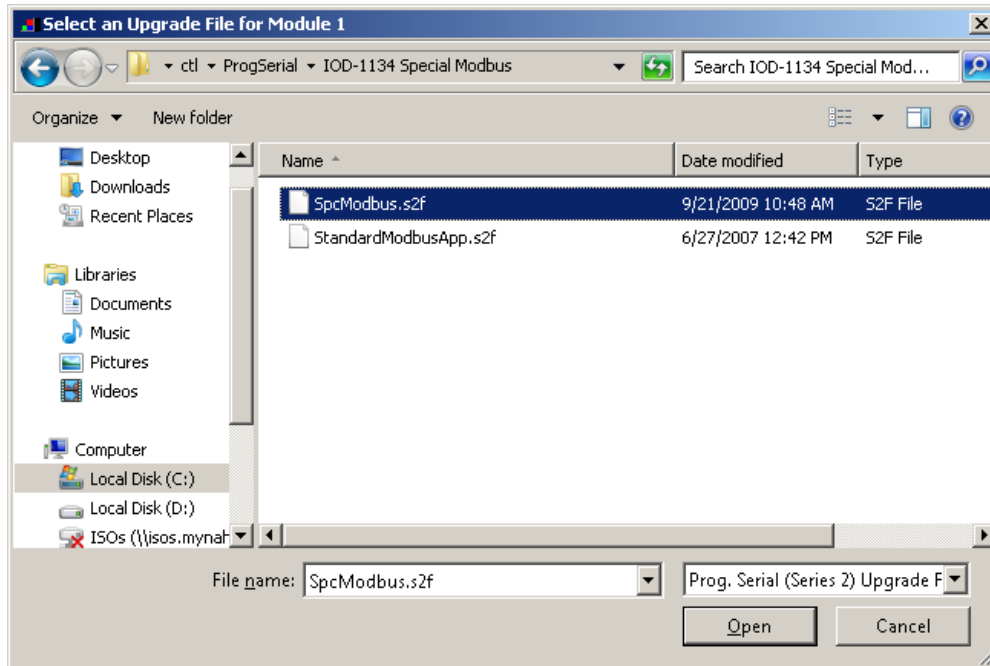
For example, we will select I/O Module 7. This will give you a dialog, from which you will select the file path to where the driver software is located. This path will be:

\\DeltaVctl\ProgSerial\NOD-1134 Special Modbus

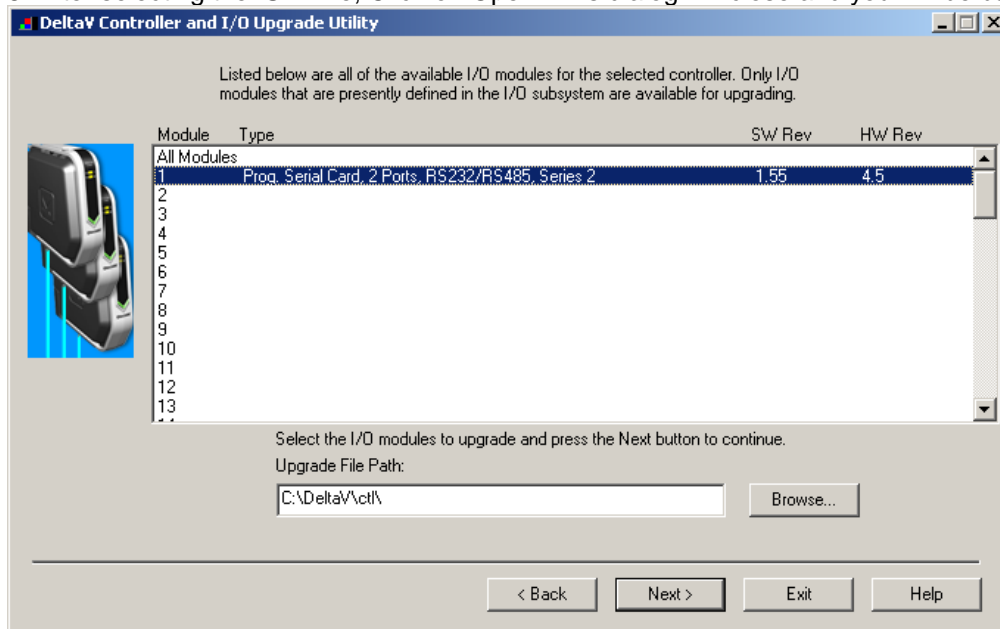
Once you are in the specified directory, you will need to select the following file:

SpcModbus.S2F

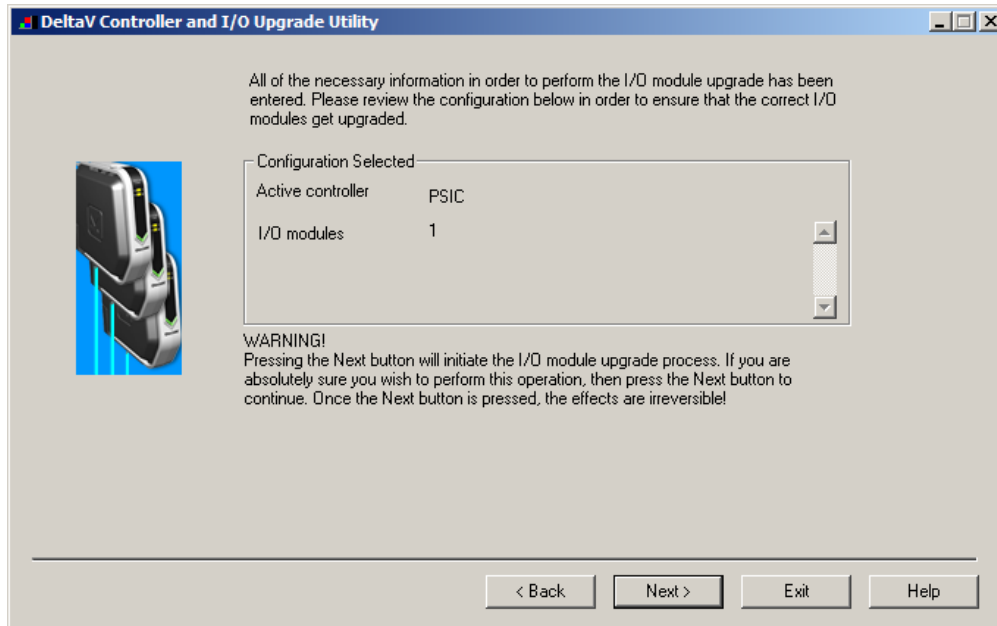
This is shown in the following dialog.



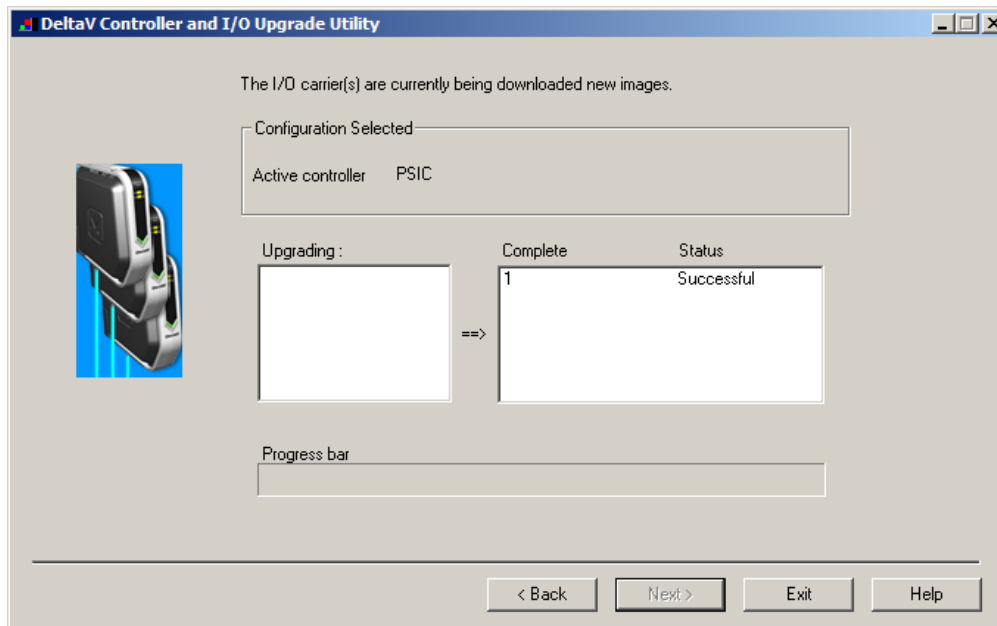
8. After selecting the .S2F file, Click on Open. This dialog will close and you will be back to the following:



9. In this dialog, Click Next again. You will get the following dialog, confirming the Controller and I/O Module to program.



10. Click Next and the I/O Module upgrade process will begin. After completion, you will receive the following dialog, indicating success.



11. This completes the I/O Module upgrade process.

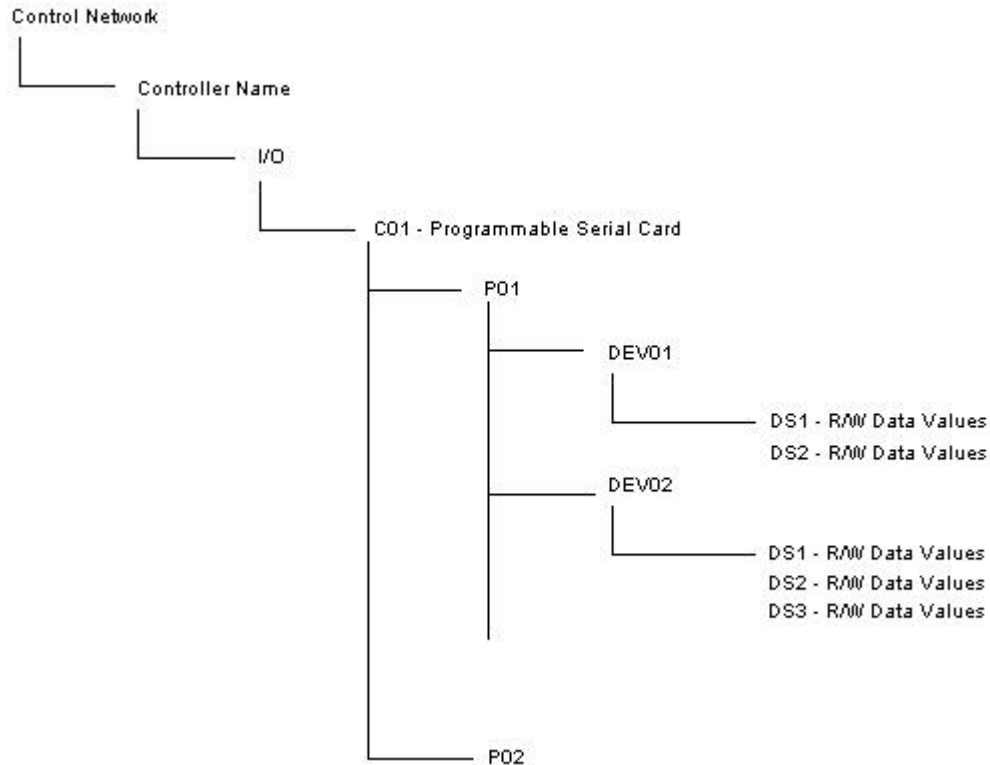


4 CONFIGURATION INFORMATION

This section describes the steps necessary to configure the DeltaV PSIC to obtain proper communication.

Each Serial Card in the I/O subsystem contains two channels or ports. Each port will be enabled or disabled individually and each port will contain some port specific configuration parameters. Port configuration comprises RS-232 or RS-422/485, baud rate, parity, byte size, and stop bits used. All selected parameters must match the connected field device(s).

The DeltaV Explorer view of a configuration containing a PSIC will be as follows, where C01 has a card type of Programmable Serial Card, P01 and P02 are the ports on the card, DEVXX are the field devices attached to the ports and DSXX are configured datasets under each device. You can have one or more field devices (each with a unique address) under each port. If a single device is configured, you can use RS-232 or RS-422/485. If configuring more than one, the communications settings must be RS-422/485 to support multi-dropped field devices. Note that the device address (under DEVXX) must match the RTU address in point-to-point and multi-dropped communications.



A total of 16 datasets can be configured under each port. The datasets are divided over the configured devices. Dataset registers are mapped to Modbus registers. However, the registers do not use the Modbus register nomenclature, i.e., the registers do not appear as R1XXXX, R3XXXX and R4XXXX.



4.1 Port Configuration

First, enable the port. Then click on the Advanced Tab and select Master or Slave. For Master mode, specify the retry count, message timeout value in milliseconds, and message delay time. In most cases, you can leave these at their default values. Next, click on the Communications Tab and specify the Port type. The Port type will be RS-232, RS-422/485 Half Duplex (2 wire), or RS-422/485 Full Duplex (4 wire). Lastly, select the Baud rate, Parity, Data bits and Stop bits parameters; these must match the RTU settings.

4.2 Device Configuration

Specify devices, one for each RTU. The device address must match the RTU address.

4.3 Dataset Configuration

Datasets contain the field values read from an RTU or DeltaV values being written to an RTU.

4.3.1 Data Direction:

The Data Direction for dataset should be defined as Input or output. This parameter is available only under Master mode.

4.3.2 Output Mode:

Two output modes are available in the DeltaV PSIC: Block Output (0) and Single Value Output (1). In block mode, any register change in the dataset will trigger the entire dataset to be written to the RTU. In single value mode, only the changed register is written out.

The selected mode is dependent on the field device, whether it supports block output or not, and on your specific application. Please refer to the field device documentation. This parameter is available only under Master mode.

4.3.3 DeltaV Data Type:

The type of Modbus register being mapped will determine the Dataset Data Type. This is described in the following table:

Table 1

Modbus Register Type	Dataset Register Type
Coils	Boolean with status or Discrete with status
Input Status	Boolean with status or Discrete with status
Input Registers	16 bit Int with status, 16 bit Uint with status, Floating Point with status
Holding Registers	16 bit Int with status, 16 bit Uint with status, Floating Point with status



4.3.4 DeviceDataType

The Device DataType determines which Modbus command is being sent to the RTU. This is described in the following table:

Table 2

Device Data Type	Modbus Register Type
0	Coils
1	Input Status
2	Input Registers
3	Holding Registers
4	Reserved
5	Reserved
6	8 Byte ASCII read (OMNI flow computer specific)

Note: Device Data Type 6 is specifically used for OMNI flow computers to read or write the 8-byte ASCII data elements. This device data type is not applicable to other, non OMNI, devices.

4.3.5 Data Start Address and Number of Values

The Data start address specifies where in the field device we will read/write the data. This can be any field device specific address. Note that since the dataset registers are indexed starting with 1, the Start Address must be configured such that (Start Address + 1) is the first available Modbus register in the field device.

The following table shows some examples.

Table 3

Register Type	Start Address	Number Of Values	First Modbus Register	Last Modbus Register
Coils	0	100	1	100
Coils	500	100	501	600
Input Status	10000	50	10001	10050
Input Register	30000	100	30001	30100
Holding Register	40000	100	40001	40100



Each dataset has a maximum of 100 values of DeltaV data type (as configured in the previous dialog). Each DeltaV value is mapped to one or more PLC registers. If two registers are required, they must be consecutive. The following table describes the mapping:

Table 4

DeltaV Data Type	PLC Register Type	PLC Registers Required	Number of Values
Boolean	Coils Input Status	1 – 16-bit word	100
Discrete	Coils Input Status	1 – 16-bit word	100
Signed and Unsigned 8-bit Integer	Coils Input Status	1 – 16-bit word	100
	8-byte ASCII	4 – 16-bit words	96
Signed and Unsigned 16-bit Integer	Coils Input Status Input Registers Holding Registers	1 – 16-bit word	100
Signed and Unsigned 32-bit Integer	Holding Registers	2 – 16-bit words	50
Floating Point	Input Registers Holding Registers	2 – 16-bit words	50
String	Holding Registers	1 Byte	100
	8-Byte ASCII	4 – 16-bit words	96



4.3.6 Special Data 1-5

By using Special Data 1 and 2, this driver allows you to customize MODBUS communications and representation of data. Modification of data representation is typically only required when reading/writing Floating Point, or Signed/Unsigned 32-bit Integer registers. However, in some cases, you may need to use Special Data 1 for 16-bit byte swapping as well. Furthermore, this driver allows register addresses to be user defined, i.e., the user is not constrained to use 0X, 1X, 3X or 4X MODBUS addresses.

To customize data representation in a Dataset the Special data 1 and 2 registers are used as flags. This is described below.

Assume a Floating-point number 123.45, and its representation in IEEE 754 format as follows:

Floating Point Number	Representation as 2 16-bit words	Representation as 4 bytes
123.45	58982, 17142	230, 102, 66, 246

Special Data	Value and Description
1	0 – Default is no customization – Floating Point and 32-bit data is represented as received. The transmitted byte order is 230, 102, 66, 246 1 – The transmitted byte order is 66, 246, 230, 102 2 – The transmitted byte order is 246, 66, 102, 230 3 – The transmitted byte order is 102, 230, 246, 66
2	0 – Default setting where 2 Modbus 16-bit registers are equivalent to 1 Floating Point or 32-bit value in DeltaV. There is a 1-2 correspondence between DeltaV value and read values. 1 – Data is not read as 2 Modbus 16-bit registers but as individual Floating Point or 32-bit values. There is a 1-1 correspondence between DeltaV value and read value.
3	Not Used
4	Not Used
5	Not Used



5 Operational Check

5.1 Scope

The following sections provide some assistance to ensure the interface is working properly.

5.2 Verify Hardware and Software Version Number

The user can verify that the Special Modbus driver has been installed using the DeltaV Diagnostics tool. The Diagnostics tool will show the Hardware Revision No. (HwRev) and the Software Revision No. (SwRev).

To begin the DeltaV Diagnostic tool select Start-> DeltaV-> Operator-> Diagnostics. In the Diagnostics tool expand the Controller, I/O and then double click on the Programmable Serial Interface Card that has the driver installed.

The following information will be displayed:

:	:	:
HwRev	Hardware Revision	1.1 (or later)
SwRev	Software Revision	P1.55 (or later)

5.3 Verify Configuration

- Verify port configuration: The serial port must be enabled. User needs to make sure communication settings such as baud rate, parity, and number of data bits match the field device settings.
- Verify dataset configuration: The datasets configured must be as shown above.

5.4 Verify I/O Communication With Control Studio

User can create I/O modules in the control studio to verify correct values are read from the PSIC. For AI and DI data, the values should be changed in the field device and verified that the new data are correctly reported in DeltaV. Similarly, verify that the AO and DO data is being written correctly from DeltaV to the field device.

5.5 Using Diagnostics

- Verify PSIC communication: Select the PSIC on Diagnostics and press the right mouse button. Select Display Real -Time Statistics from the drop down menu. If the Programmable Serial Interface Card is functioning then the user will see the Valid Responses counter and the Async and/or Sync Transactions counters incrementing. There will not be any error counting up.
- Verify port statistics: Select the Port on the Programmable Serial Interface Card and press the right mouse button. Then select Display Port Statistics form the drop down menu. Verify that the port communications statistics are being displayed properly and are counting as expected for the protocol's functionality.



- Verify dataset values: Select a dataset and press the right mouse button. Select View Dataset Registers from the Drop down window. Verify that the dataset values are displayed as expected.

5.6 LED Indication

The Yellow LED for the port should be on solid when all communications on that port are valid. The Yellow LED should be blinking if there is some valid communications and some communications with errors on that port. The Yellow LED should be OFF if there are no valid communications on that port.



6 DeltaV–Field Device Electrical Interface

The electrical interface between DeltaV and field devices conforms to the RS-232 and RS-422/485 standards.

Each PSIC has 2 ports, which function independently. The distance between the serial card and the field device can be as much as 5000 feet, per the RS-422/485 standard. When using RS-232, the distance is limited to 50 feet. Section 6.1 shows the pin assignments for the PSIC serial terminal block.

6.1 Pin Assignments for DeltaV PSIC

RS-232 Standard

Terminal Number	Signal Description
1	Port 1 - Isolated Ground (GND)
2	Unused
3	Port 1 – Transmit Data (TxD)
4	Unused
5	Port 1 – Receive Data (RxD)
6	Unused
7	Port 1 – Data Terminal Ready (DTR)
8	Port 1 – Data Set Ready (DSR)
9	Port 2 - Isolated Ground (GND)
10	Unused
11	Port 2 – Transmit Data (TxD)
12	Unused
13	Port 2 – Receive Data (RxD)
14	Unused
15	Port 2 – Data Terminal Ready (DTR)
16	Port 1 – Data Set Ready (DSR)



RS-422/485 Half Duplex Standard

Terminal Number	Signal Description
1	Port 1 - Isolated Ground (GND)
2	Port 1 - Data +
3	Unused
4	Port 1 - Data -
5	Unused
6	Unused
7	Unused
8	Unused
9	Port 2 - Isolated Ground (GND)
10	Port 2 - Data +
11	Unused
12	Port 2 - Data -
13	Unused
14	Unused
15	Unused
16	Unused

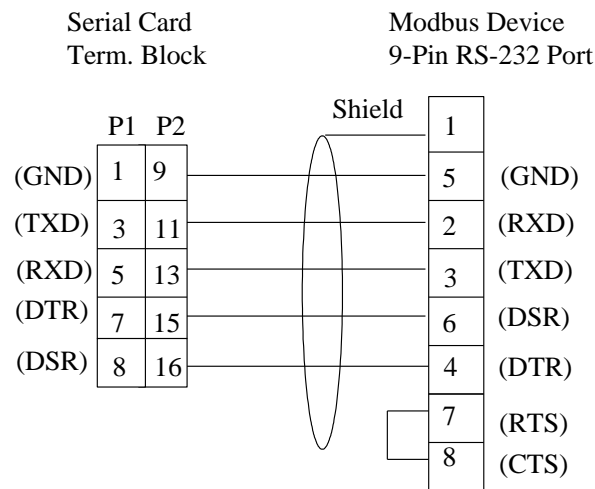
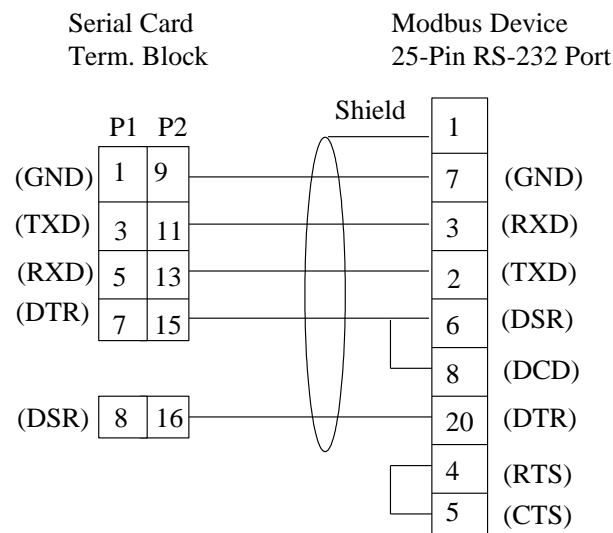
RS-422/485 Full Duplex Standard

Terminal Number	Signal Description
1	Port 1 - Isolated Ground (GND)
2	Port 1 - TxD +
3	Unused
4	Port 1 - TxD -
5	Unused
6	Port 1 - RxD +
7	Unused
8	Port 1 - RxD -
9	Port 2 - Isolated Ground (GND)
10	Port 2 - TxD +
11	Unused
12	Port 2 - TxD -
13	Unused
14	Port 2 - RxD +
15	Unused
16	Port 2 - RxD -



6.2 Wiring Connections

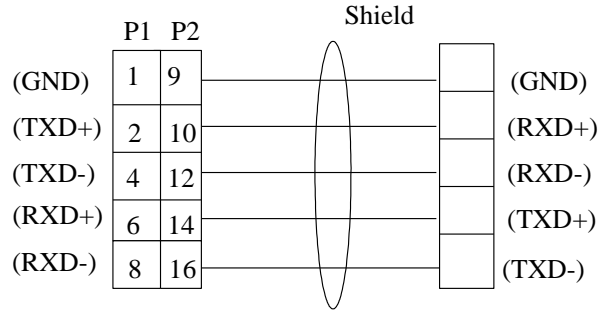
In general, the figure below shows the connections between the Field Device and the PSIC termination block. In some cases, RxD and TxD signals need to be swapped to create a NULL cable. This can be done easily at the PSIC termination block. If the device does not supply DTR and DSR, insert jumpers on the serial card term block between screw term 7 and 8, and 15 and 16. This eliminates the need for a wire connection between these screw terms and the field device.





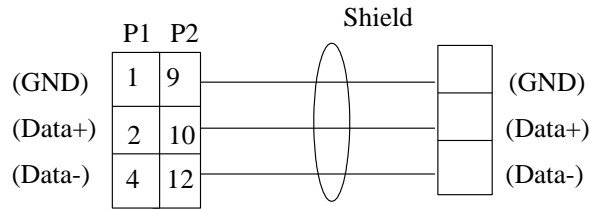
Serial Card
Term. Block

Modbus Device
RS-422/485 Full Duplex



Serial Card
Term. Block

Modbus Device
RS-422/485 Half Duplex





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7 Technical Support

For technical support or to report a defect, please give MYNAH Technologies a call at (636) 728-2000. If a defect is discovered, please document it in as much detail as possible and then fax your report to us at (636) 728-2001.

You can also send us your questions via e-mail. Our addresses are:

support@mynah.com

Thank you for using DeltaV.



8 Revision History

Revision Number	Checked By	Approved By	Date	Description
1.17	NFW	NFW	Sep, 2008	Initial Release
1.55	NFW	NFW	Sep, 2009	Updated to use Emerson toolkit 3.01
1.58	NFW	NFW	Jan, 2017	Updated to use Emerson toolkit v3.02.