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Programmable Serial Interface Card Driver Horiba D-54 pH Conductivity Meter

USER MANUAL

Rev. P1.56

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1 INTRODUCTION

1.1 Scope

This document is the User Manual for the Horiba D-54 pH Conductivity meter (D-54) 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 D-54 devices.

The section *Document Format* briefly describes the contents of each section of this manual. *System Specifications* outlines hardware and software requirements for the D-54 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 D-54 Driver.
Flashing Firmware	Describes flashing procedures for the D-54 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 PSIC and the D-54 Device. Also describes the cable pin assignments for RS232 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 D-54 Driver:

Table 1: System Specifications

Firmware	D-54 Driver Firmware v1.56 or later
Protocol Compatibility	Communications with the D-54 are based on the following document: Horiba pH Meter Instruction Manual, Chapter 4, titled RS-232C Communications.
Software Requirements	DeltaV System Software (Release 4.2 or later) installed on a hardware-appropriate Windows workstation configured as a ProfessionalPlus for DeltaV Serial Interface Port License (VE4102) if required.
Minimum DeltaV Hardware Requirements	DeltaV Series 2 Serial Module, Hardware Rev 1.1r or later DeltaV M3, M5, M5+, MD, MD Plus or MX Controller, Power Supply and 8 wide controller carrier
Other Required Hardware	The D-54 has an RS232 serial interface port which cannot be directly connected to the DeltaV Serial card. The D-54 requires the CTS signal, which the serial terminal block does not supply. Furthermore, the serial is limited to 50 feet or less. To gain distance and to multi-drop multiple D-54 devices from a single serial port, the user must use a specially modified Technman Control-It 5258, which is an addressable RS485/RS232 converter. The modification (made by Mynah) is for the CTS signal generation. In general, any intermediate device which actively generates the CTS signal may be installed between the serial term block and the D-54. The DeltaV serial card port is configured as RS485, and connected to the 5258, which then connects to the D-54. In this way, more than one 5258 converters can be multi-dropped from the serial port, with each converter connected to a single D-54 device. Maximum D-54 devices support by a single serial port is eight (8).



2 THEORY OF OPERATION

DeltaV comprises an I/O sub-system, in which the PSIC is one type of card. The purpose of the PSIC is to serially integrate third-party devices, allowing data to be read into and written out from DeltaV. Each PSIC has 2 communication ports that can be configured as Master or Slave, using RS-232, RS-485 (Half Duplex), or RS-422 (Full Duplex). Various communications parameters, such as baud rate, are configurable.

The D-54 devices communicate using RS232 only. Furthermore, there is no unique identifying address. Use of the addressable RS485/RS232 converter provides the required unique address so that multiple D-54 devices can be multi-dropped from the same serial port in the PSIC. One RS485/RS232 converter is used for each D-54. Dip switches are used to configure the converter address. Please refer to the Technman Control-It 5258 product manual for additional wiring and configuration details.

The driver capacity is limited to a maximum of eight (8) D-54 devices per port, where each D-54 is uniquely identified by the attached 5258 converter. Each D-54 is assigned two datasets which contain the run time data.

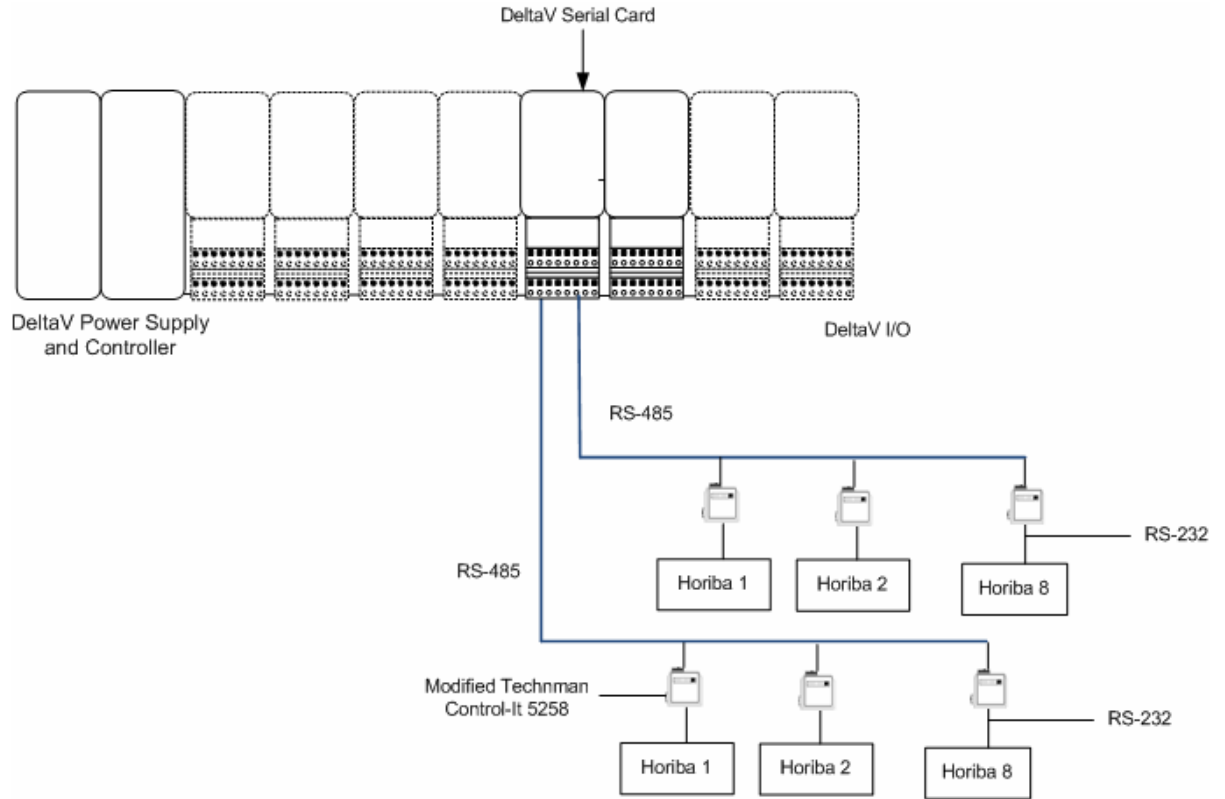
The D-54 has only one channel. There are three modes of operation: (1) pH Mode; (2) mV Mode; and (3) Conductivity Mode. All three modes are supported by the driver. In addition, users can select which modes to scan, with the pH mode being the default at power-up.

The PSIC driver functions only in Master mode, while the D-54 devices function as the communications Slave. On power-up, the PSIC driver receives its configuration from the DeltaV Controller. As part of its normal continuous scan, the driver sets the mode to pH and then reads the data available in the D-54. The data is retrieved from the response messages and reported up to the DeltaV Controller in dataset registers.

When the driver is online with the D-54, all D-54 keypad entries are locked and unavailable. To regain keypad usage, the user has the ability to take the driver offline. This releases the keypad. Subsequently, the user can place the driver in online mode to start scanning the D-54 for run-time data.



The physical architecture will be as follows:



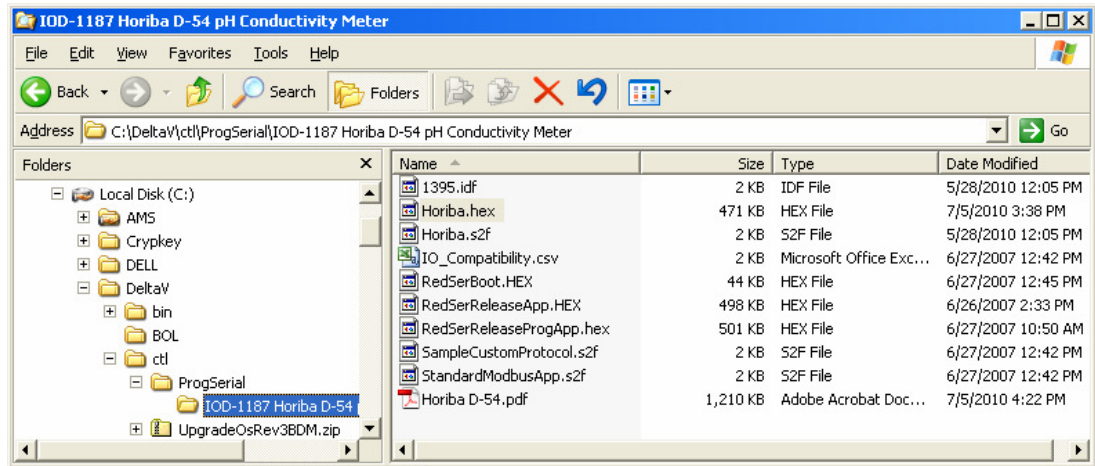


3 Flashing the firmware

The driver software distribution contains 10 files. These files must be copied to the DeltaV directory on your ProPlus Workstation. The path is:

\DeltaV\ctl\ProgSerial\IOD-1187 Horiba D-54 pH Conductivity Meter

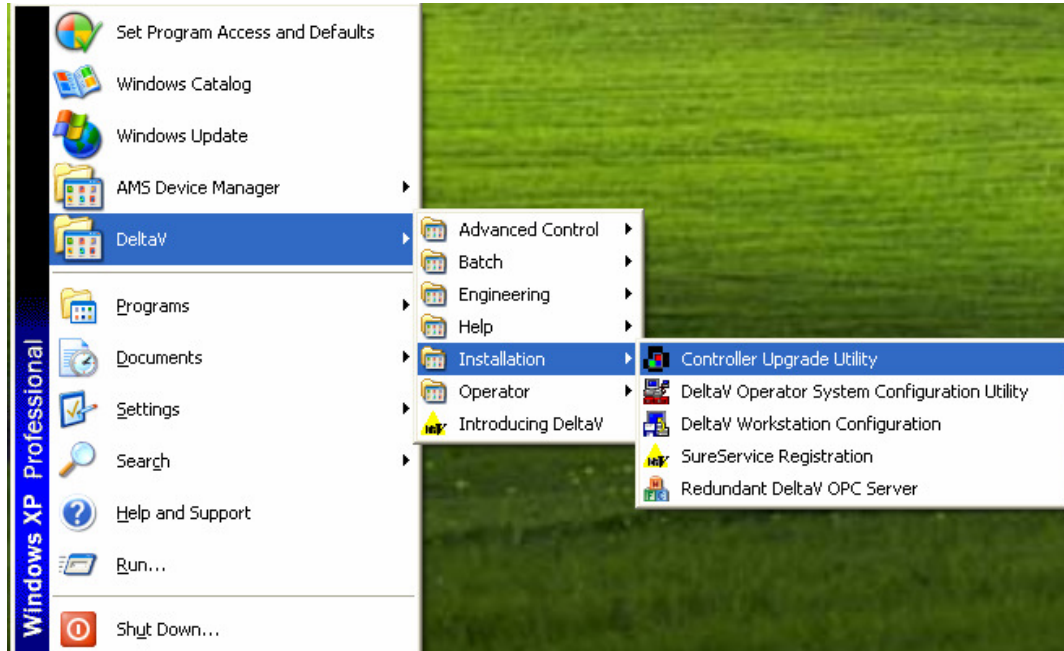
Note that you will have to create this subdirectory. The following shows a completed copy operation:



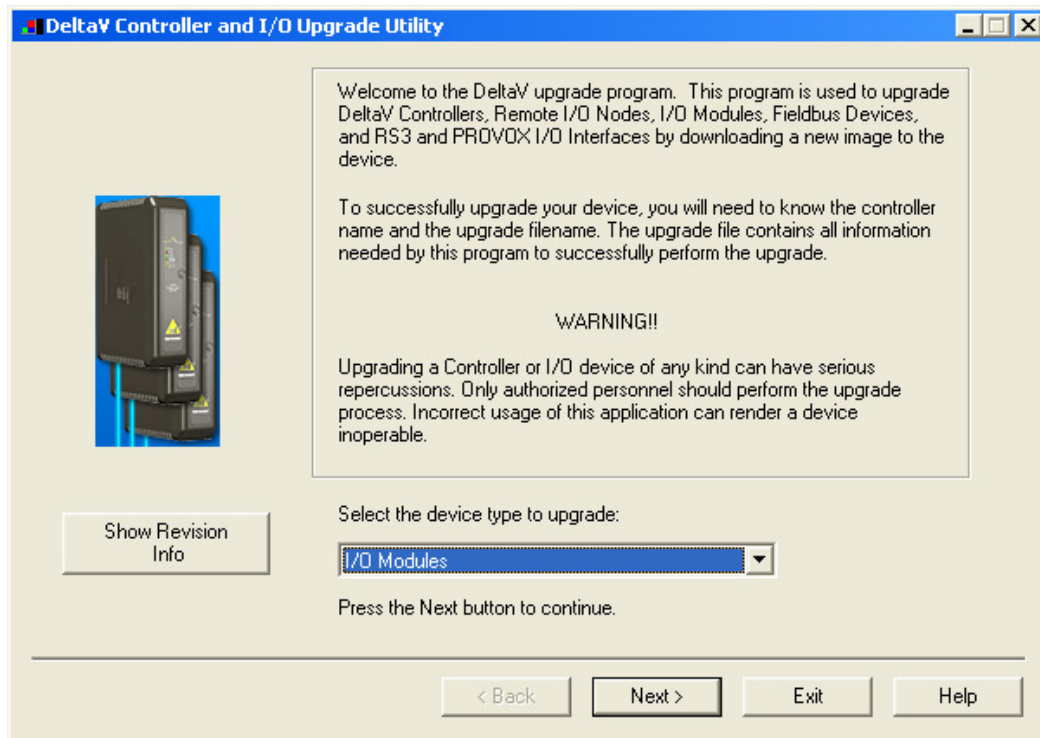
After copy completion, you are ready to program (or upgrade) the Programmable Serial Card with the supplied custom driver software. The steps are as follows:

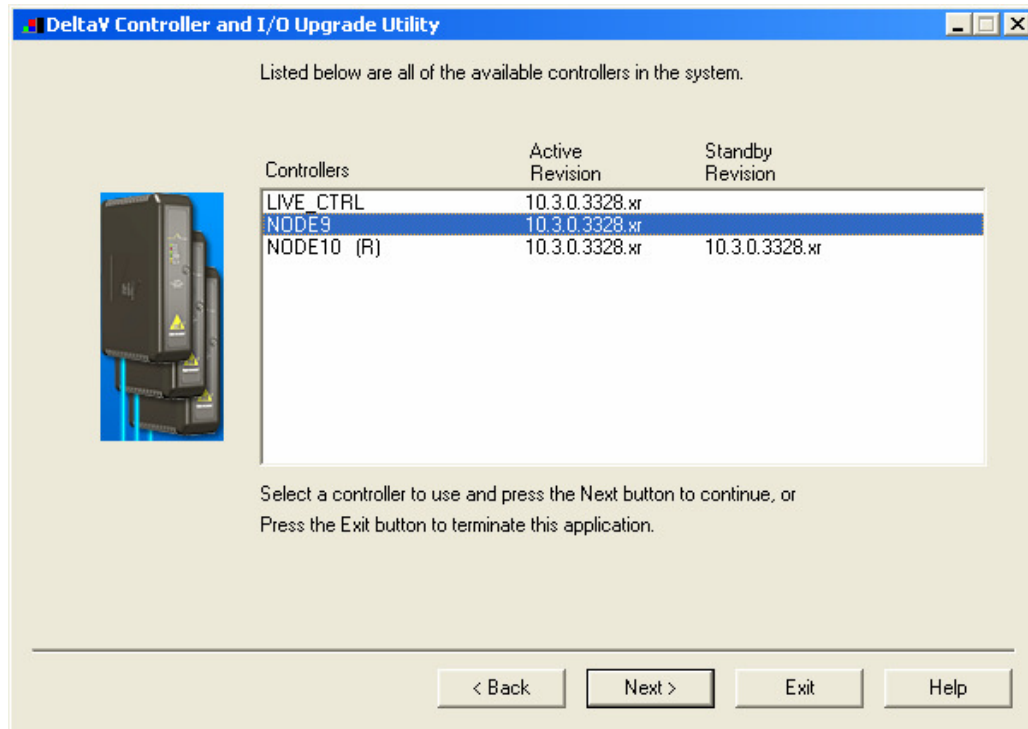


1. Click on the Start button and select DeltaV-> Installation-> Controller Upgrade Utility as shown below, and the following dialog will appear:



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

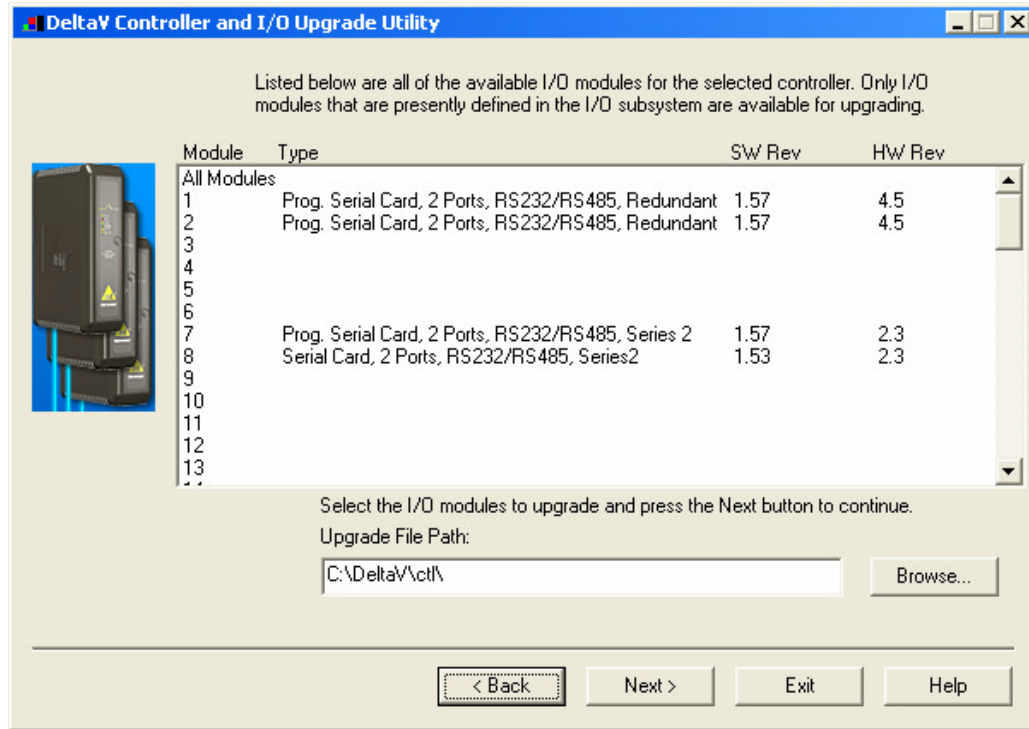




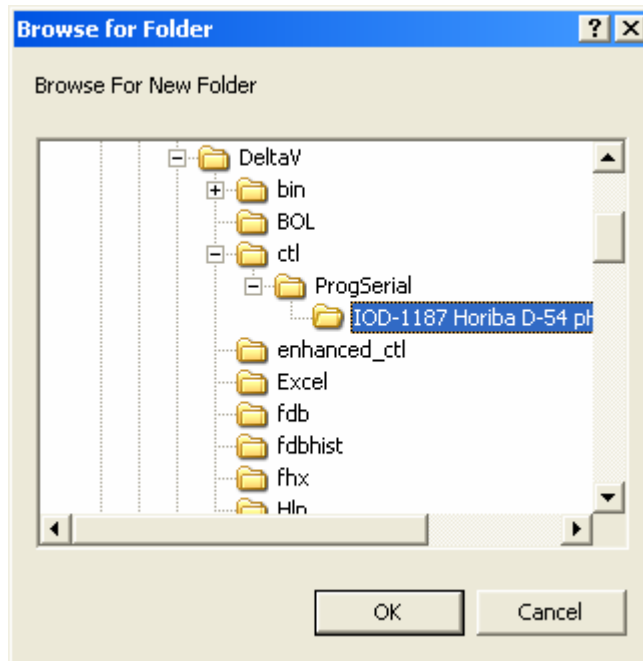
3. The above dialog will appear, listing all the available Controllers in your network. From this dialog, select the appropriate Controller and then Click Next.

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 Horiba Driver, the dialog will be as shown below (card 8). When upgrading an existing Programmable Serial Card, skip Steps 5 and 6, and go to Step 7.

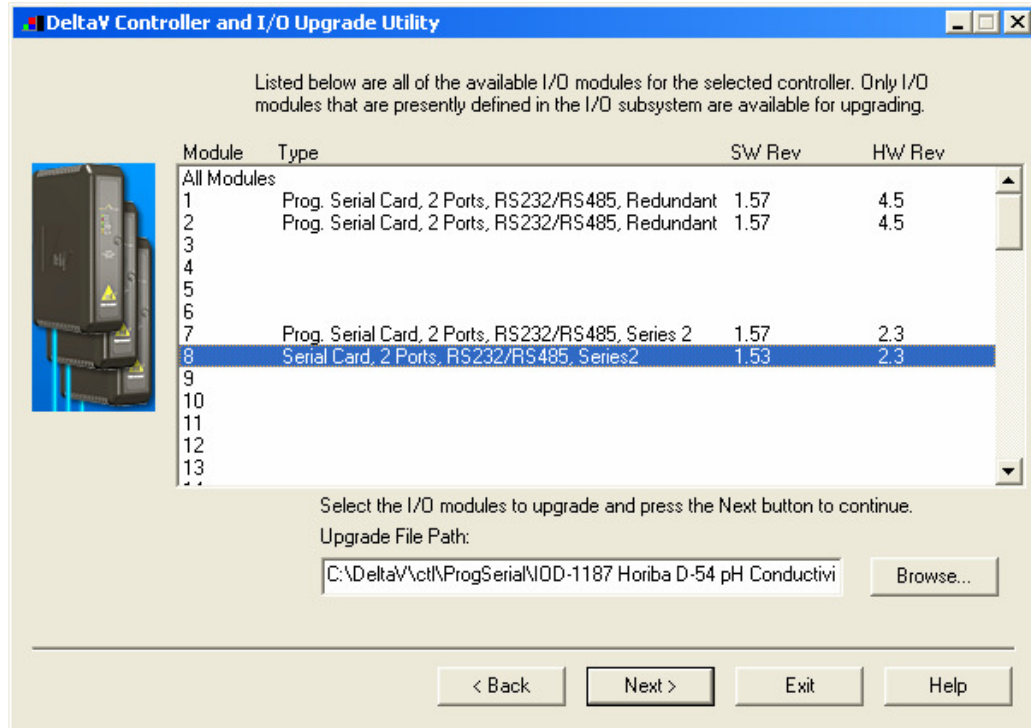


5. Click the Browse button and select the DeltaV path as shown below, and then click Ok. Note that the disk drive could be C or D.



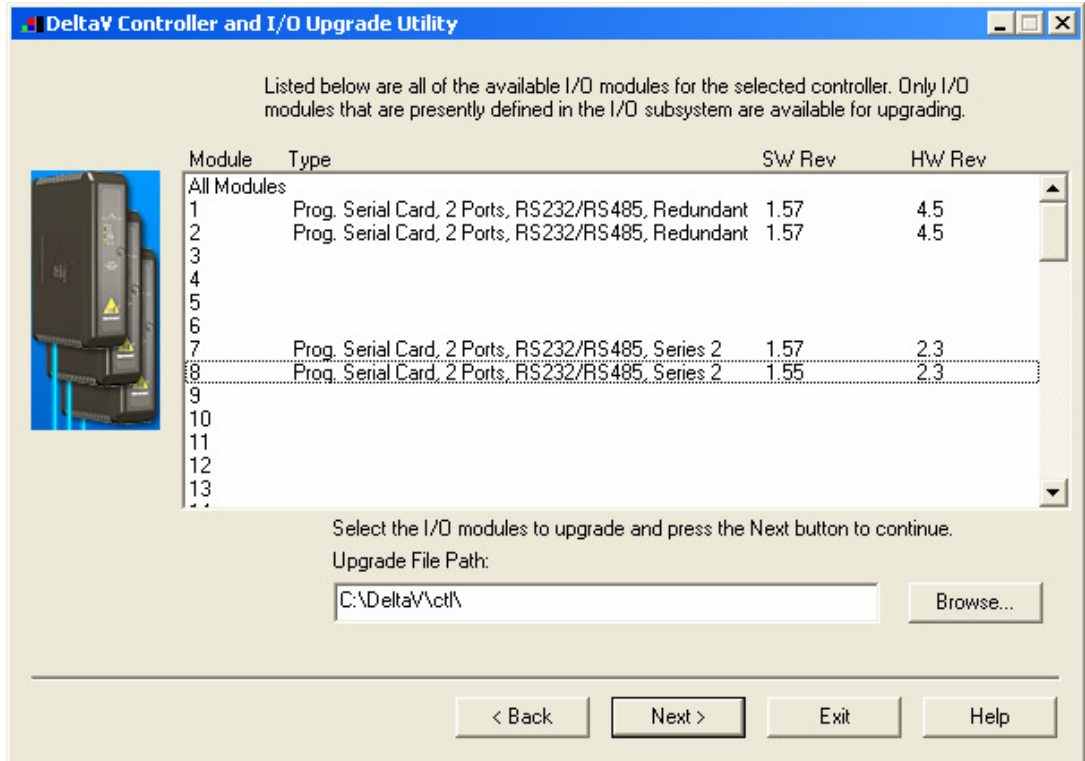


6. Select the I/O module again as shown below and then click Next. Go to Step 9.





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.



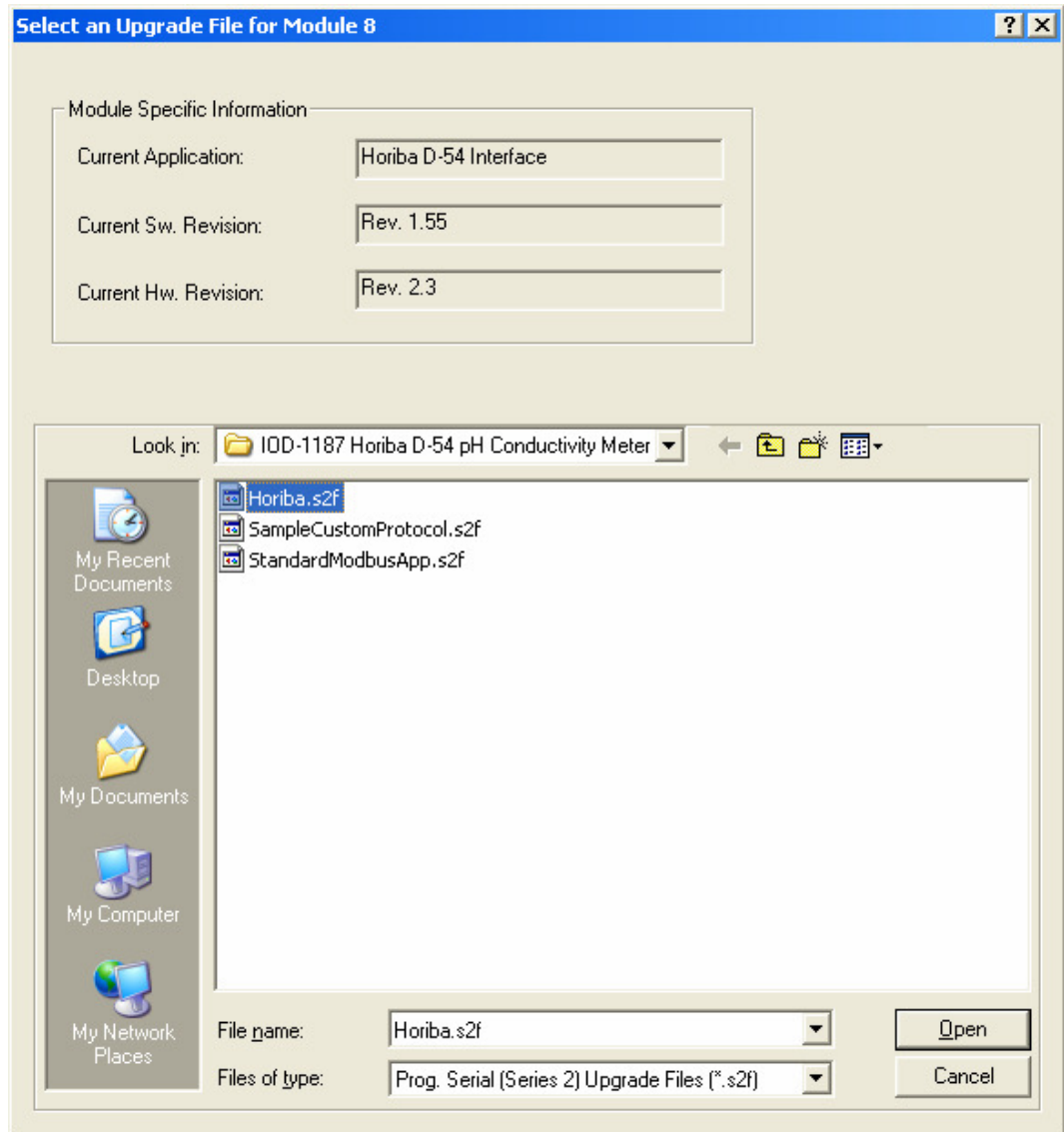
For example, we will select I/O Module 8. This will give you a dialog, from which you will select the file path to where the driver software is located. This path will be:

\\DeltaVctl\ProgSerial\IOD-1187 Horiba D-54 pH Conductivity Meter

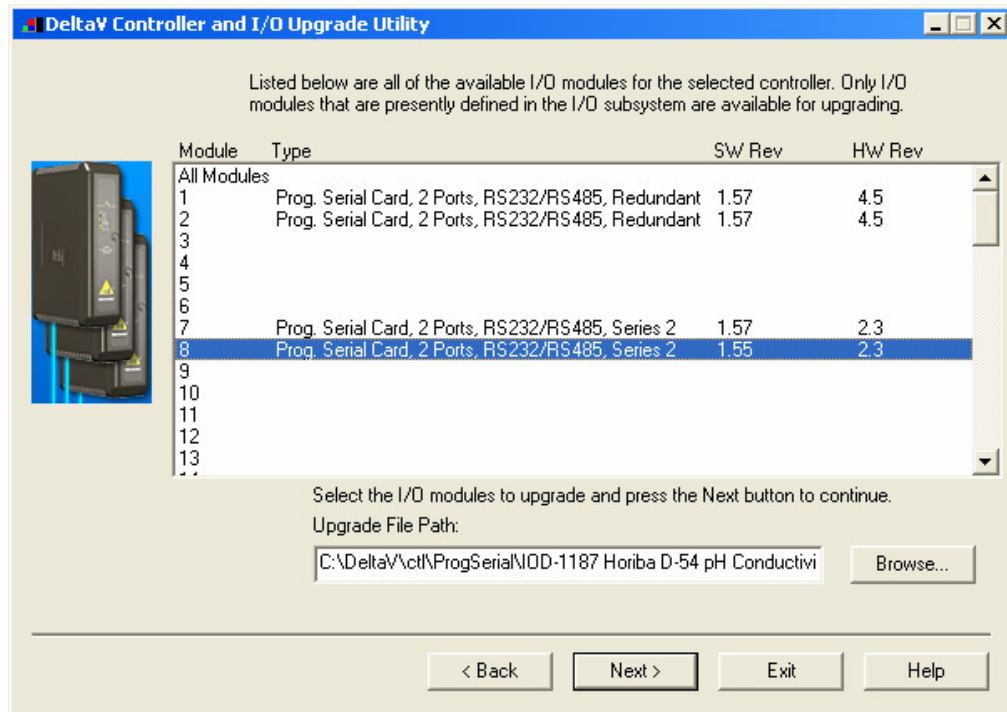
Once you are in the specified directory, you will need to select the following file:

Horiba.S2F

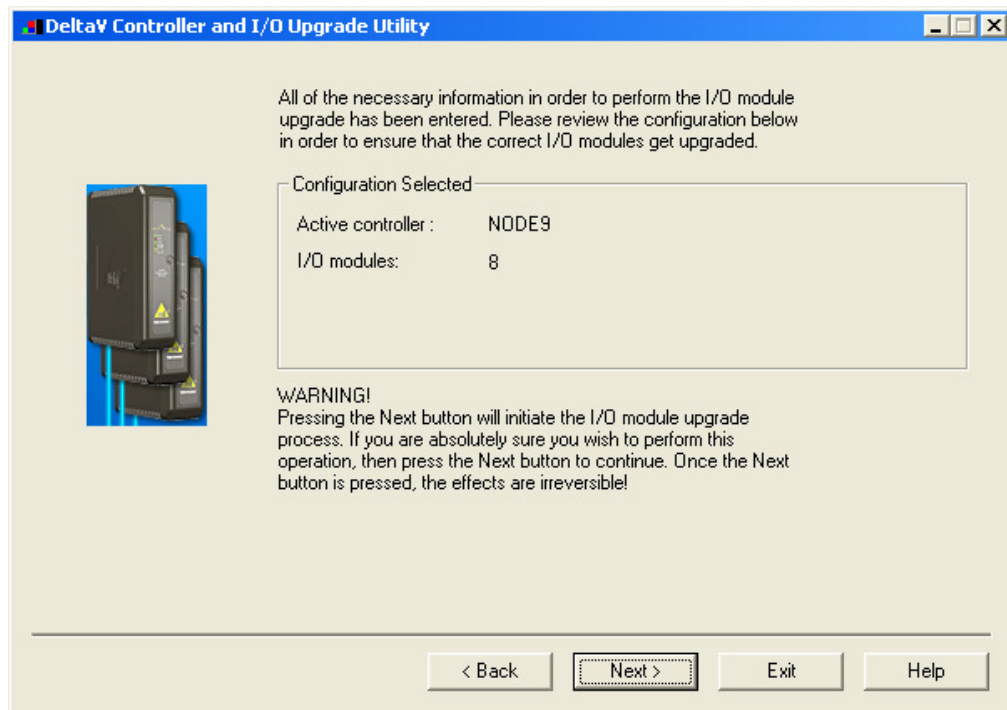
This is shown in the following dialog.



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

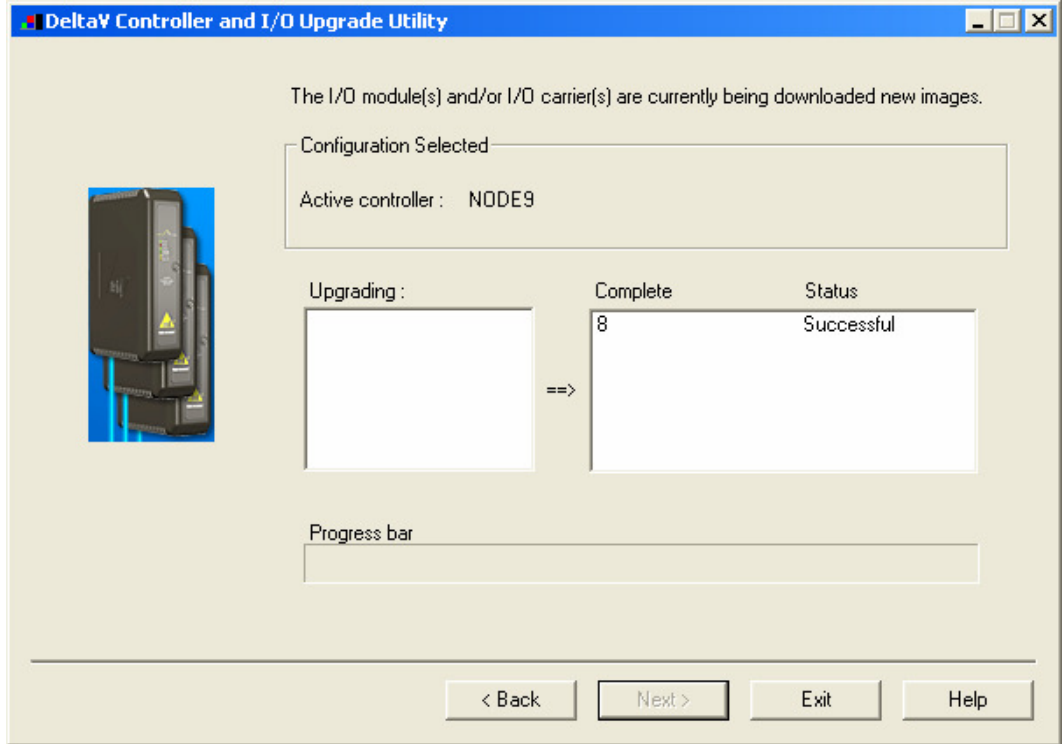


9. In this dialog, Click Next again. You will get the following dialog, confirming the Controller and I/O Module to program.





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



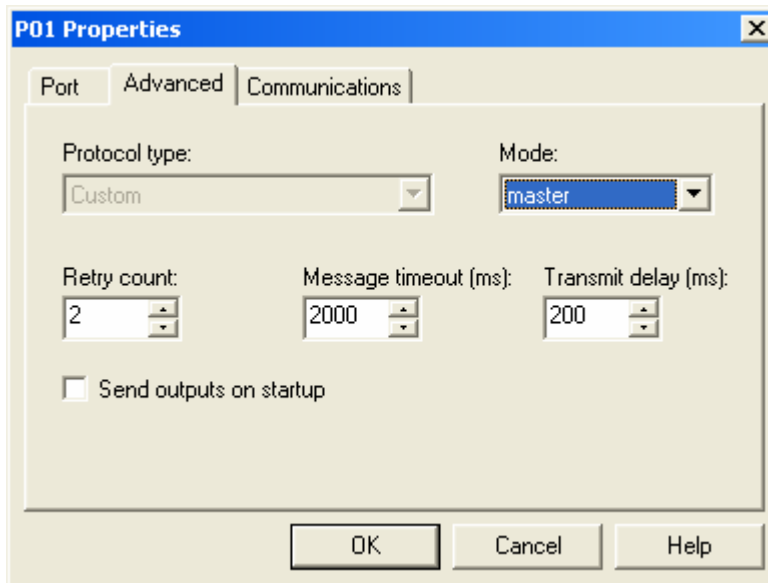
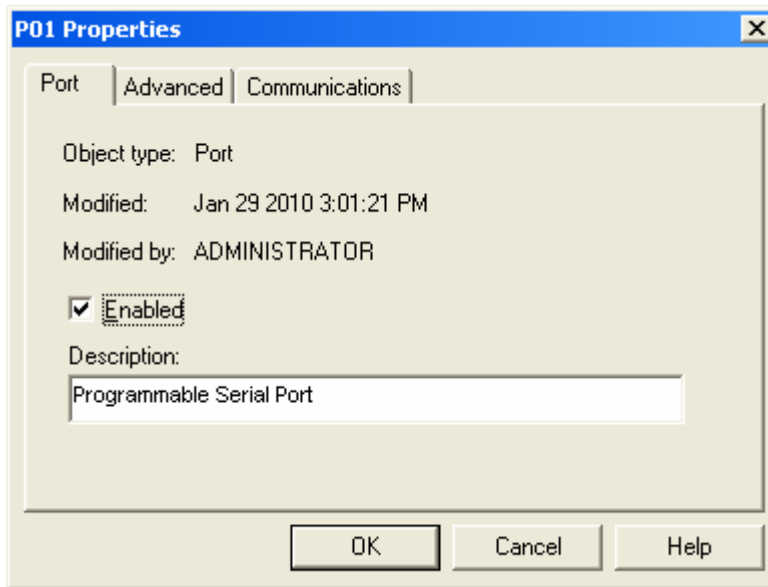
11. This completes the I/O Module upgrade process.

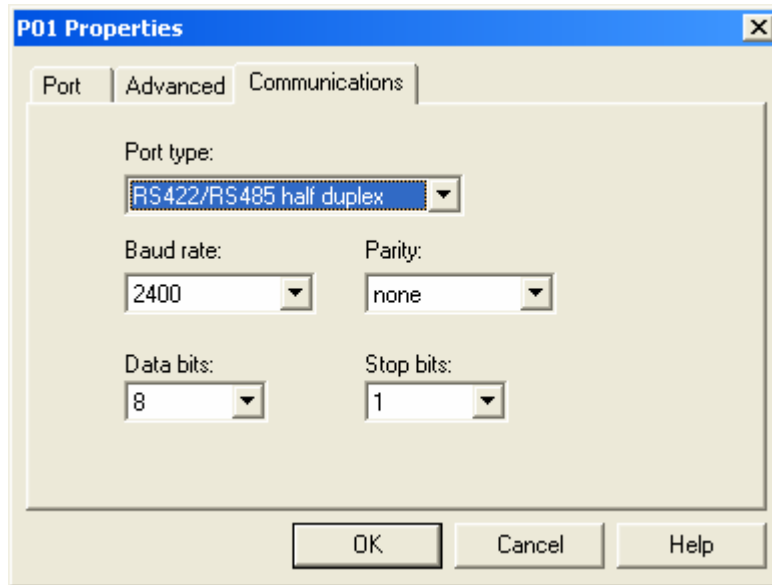


4 CONFIGURATION INFORMATION

4.1 Port Configuration

First, enable the port. Then click on the Advanced Tab and select Master. Next, click on the Communications Tab and specify the Port type. The Port type will be RS-422/485 Half Duplex (2 wire). Use of a modified Technman Control-IT 5258 converter is assumed. Lastly, select the Baud rate, Data bits, Parity and Stop bits parameters; these must match the D-54 configuration which defaults to 2400, 8, N, 1. The following screen shots show the configuration:

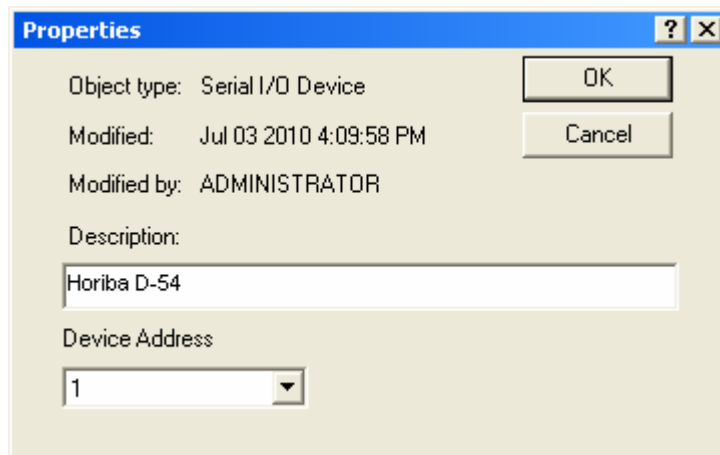




4.2 Device Configuration

Specify a device corresponding to each connected D-54 device. The device address must match the connected 5258 converter. Valid addresses are 1-63. A maximum of eight D-54 devices may be configured under a single PSIC port.

Note: The device address is used by the driver to enable the 5258 converter, and should match the dip-switches on the 5258.





4.3.1 Dataset 1 Configuration:

Configure the dataset as follows:

Direction	Output with Readback
DeltaV Data Type	32-bit UINT w/status
Device Data Type	0
Start Address	0
Number of Values	32
Special Data 1	16384 or 32768. See description below.
Special Data 2	0
Special Data 3	0
Special Data 4	0
Special Data 5	Time in 100ms increments. The driver pauses for this amount of time after sending the mode switch command to the D-54, and before sending the scan command. Use 1000 for a 1 second pause.

When using the Technman Control-It 5258 to multi-drop D-54 devices, the Special Data 1 register of the first dataset in each configured device must be configured as follows:

16384	If the Technman Control-It 5258 is configured (via dip switches) for STX as the enabling message, then configure 16384 into Special Data 1.
32768	If the Technman Control-It 5258 is configured (via dip switches) for HeAdEr as the enabling message, then configure 32768 into Special Data 1.



The data values read from the D-54 are stored in this dataset as follows.

Register	Description
R1	0=Scan is Offline 1=Scan is Online 2=Read Calibration History data once, then go offline
R2	Scan Map Bit 0=1 => Scan pH Bit 1=1 => Scan mV Bit 2 =1 => Scan Conductivity
R3	Measurement mode
R4	0=measurement; 1=calibration
R5	Measurement status
R6	ION measurement
R7	Year (4 digits)
R8	Month (2 digits)
R9	Day (2 digits)
R10	Hours (2 digits)
R11	Minutes (2 digits)
R12	Seconds (2 digits)
R13	Supplementary Unit 0=None; 1=μ; 2=m; 3=k; 4=M
R14	Units (Conductivity) 0=S/cm; 1=S/m
R15	Temperature setting 0=ATC; 1=MTC
R16	Error code
R17	Sample ID
R18-R19	Reserved
R20	Calibration Points (0-3)
R21	Calibration Result (0: Good; 1:Check; 2:Error; 3:Uncalibrated)
R22	Calibration Temperature
R23-R24	Reserved
R25	Date - Calibration Point1
R26	Time – Calibration Point1
R27	Date – Calibration Point2
R28	Time – Calibration Point2
R29	Date – Calibration Point3
R30	Time – Calibration Point3
R31	Date – Data Check
R32	Time – Data Check



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Note that on serial card power up, register R1 is 0. Hence the driver is offline. A Control Module must be created in DeltaV to place the driver in online mode. The procedure is as follows:

1. Write a 1 into R1 to place driver in Online mode. The driver will respond by changing the value to 101, indicating that the online command is acknowledged and the driver is online. Only the selected D-54 scan is online. Other D-54's are controlled by their individual scan flags.
2. Write a 0 into R1 to place driver in Offline mode, The driver will respond by changing the value to 100, indicating that the offline command is acknowledged and the driver is offline. Only the selected D-54 scan is offline.
3. In online mode, the driver examines register R2. If the value is 0, the pH scan is assumed. Otherwise, the user specified flags determine the scan modes. The register value is treated as a scan mask, with 7 indicating a scan of all three modes, i.e., pH, mV and CO.



4.3.2 Dataset 2 Configuration:

Configure the dataset as follows:

Direction	Input
DeltaV Data Type	Floating Point w/status
Device Data Type	1
Start Address	0
Number of Values	26
Special Data 1	0
Special Data 2	0
Special Data 3	0
Special Data 4	0
Special Data 5	0

The data values read from the D-54 are stored in this dataset as follows.

Register	Description
R1	pH Measurement value
R2	pH Potential value
R3	mV Measurement value
R4	mV Potential value
R5	CO Measurement value
R6	CO Potential value
R7	Temperature (°C)
R8-R9	Reserved
R10	Calibration Point1 Solution Value
R11	Calibration Point1 Temperature
R12	Calibration Point1 Potential
R13	Calibration Point1 Slope
R14	Calibration Point2 Solution Value
R15	Calibration Point2 Temperature
R16	Calibration Point2 Potential
R17	Calibration Point2 Slope
R18	Calibration Point3 Solution Value
R19	Calibration Point3 Temperature
R20	Calibration Point3 Potential
R21	Unused
R22	Calibration Point4 Solution Value
R23	Calibration Point4 Temperature
R24	Calibration Point4 Potential
R25	Calibration Point4 Repeatability
R26	Asymmetric Potential



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 D-54 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.



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- 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.
- Verify that there are no errors at the dataset level.

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 Connecting DeltaV PSIC to the D-54

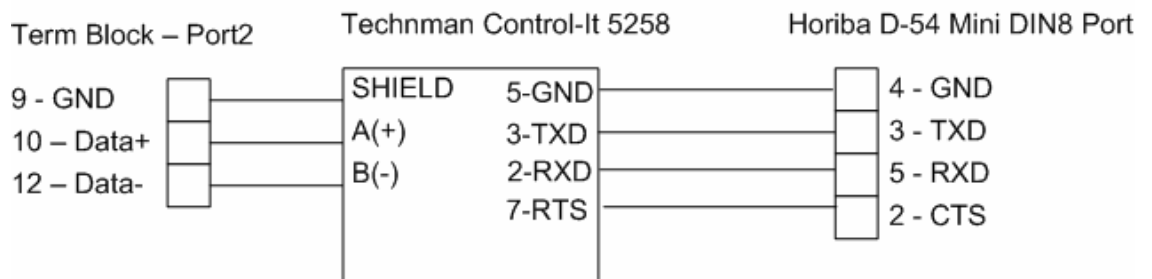
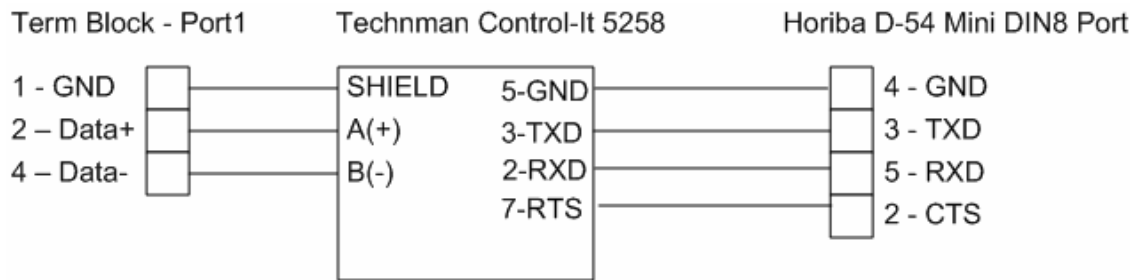
The electrical interface between DeltaV and field devices conforms to the RS-232 and RS-422/485 standards.

6.1 Direct Connection using RS232

A direct connection between the DeltaV serial term block and the Horiba D-54 is not supported.

6.2 Connection using RS485 via Technman Control-It 5258

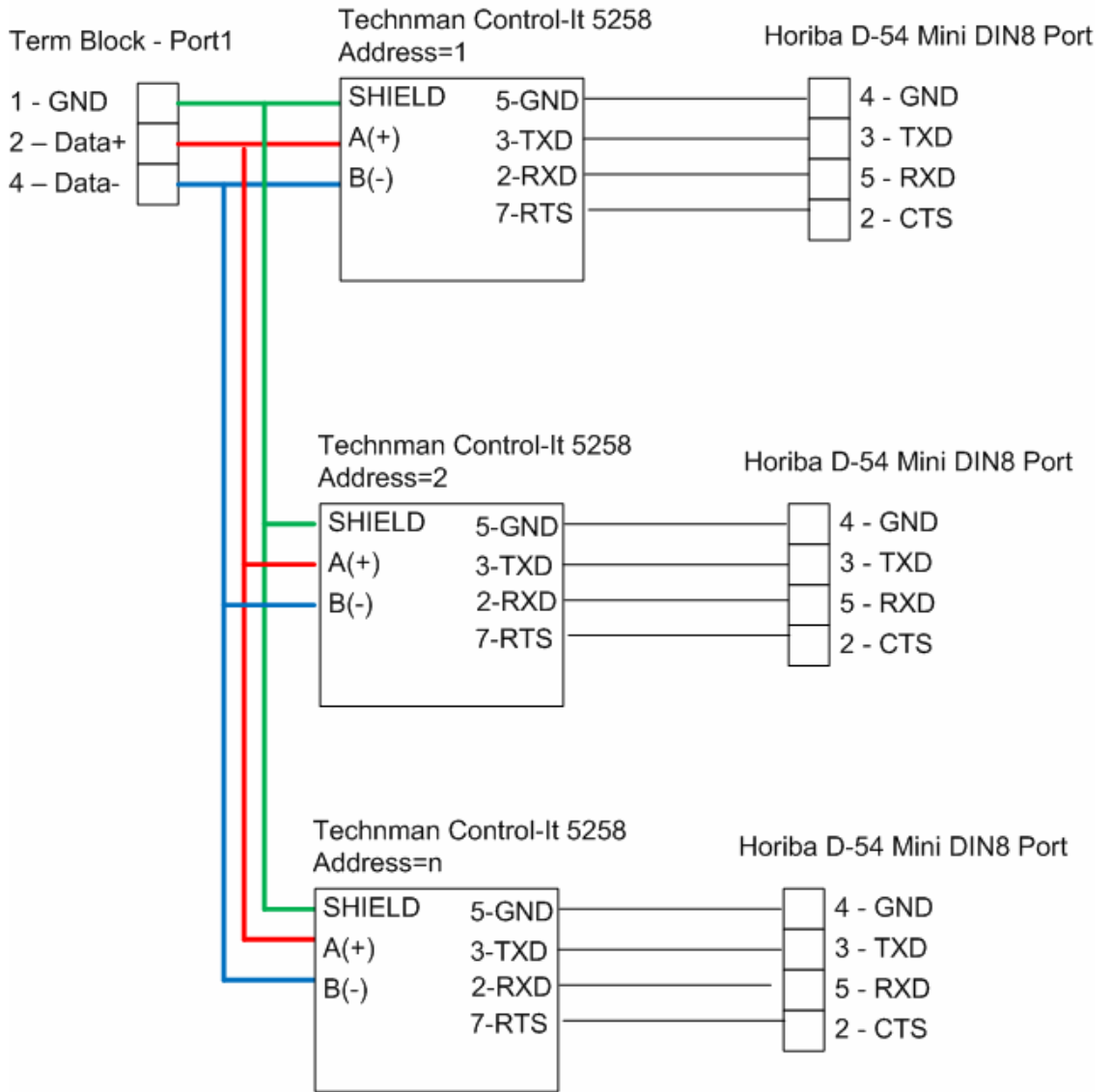
The following diagram shows the cable pinout to use. Use a Mynah modified Technman only.





6.3 Connecting Multiple D-54's using RS485 via Technman Control-It 5258

The following diagram shows the cable pinout to use. Use Mynah modified Technman only.





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7 Technical Support

For technical support or to report a defect, please give MYNAH Technologies a call at (636) 681-1555. If a defect is discovered, please document it in as much detail as possible and then fax your report to us at (636) 681-1660.

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

support@mynah.com

Thank you for using DeltaV.