Mettler Toledo Driver for DeltaV Programmable Serial Interface Card

USER MANUAL for SICS Protocol

Rev. 1.57

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1 INTRODUCTION

1.1 Scope

This document is the User Manual for the Mettler Toledo Weigh Scale serial communication driver firmware for the Emerson DeltaV Control System; it provides information required to install, configure, and maintain the Mettler Toledo driver firmware on the DeltaV Series 2 Programmable Serial Interface Card (PSIC). The reader should be familiar with Emerson's DeltaV control system and the Mettler Toledo Equipment.

The section *Document Format* briefly describes the contents of each section of this manual. *System Specifications* outlines hardware and software requirements for the Mettler Toledo Driver (P1.57) firmware. *Related Documents* lists other documents used to prepare this manual.

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 Mettler Toledo Weigh Scale Driver.
Downloading Firmware	Describes downloading procedures for the Mettler Toledo Driver firmware on to the DeltaV PSIC.
PSIC Configuration	Describes procedures and guidelines for configuring the DeltaV PSIC.
Driver Communications	Describes Mettler Toledo commands used and DeltaV Registers containing Weight data.
Operational Check	Provides tips and assistance to ensure PSIC is properly setup and configured.
DeltaV - Mettler Toledo Electrical Interface	Describes the electrical interface between DeltaV and the Mettler Toledo Weigh Scale. Also describes the pin assignments for RS-232 communications.
Technical Support	Describes who to call if you need assistance.

1.3 System Specifications

The following table lists the minimum hardware requirements for the Mettler Toledo Weigh Scale Driver:

Table 1: System Specifications

Firmware	Mettler Toledo Driver Firmware (P1.57)
Protocol Compatibility	Mettler Toledo Protocol as defined in the documents listed below: Mettler Toledo SICS command set.
Software Requirements	DeltaV System Software (Release 4.2 or later) installed on a hardware-appropriate Windows NT workstation configured as a ProPlus for DeltaV Serial Interface Port License (VE4102)
Minimum 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 Mettler Toledo devices

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 Mettler Toledo protocol before operation.

The RS-232 communication settings must be configured properly to ensure accurate communication between the PSIC and Mettler Toledo devices. RS-422/485 may be used if the Mettler Toledo devices support this electrical standard, or an RS232/RS485 converter is used to multi-drop more than one scale from a single port.

This driver functions as a master only. In master mode, the PSIC continuously sends weight and status read commands to the connected scale devices. The received responses are reported to DeltaV via dataset registers. When a user command is detected (commands are listed below), that command is sent out to the scale. The corresponding response Ack or Nak is reported back to the dataset.

In general, the primary functions of the driver are listed below:

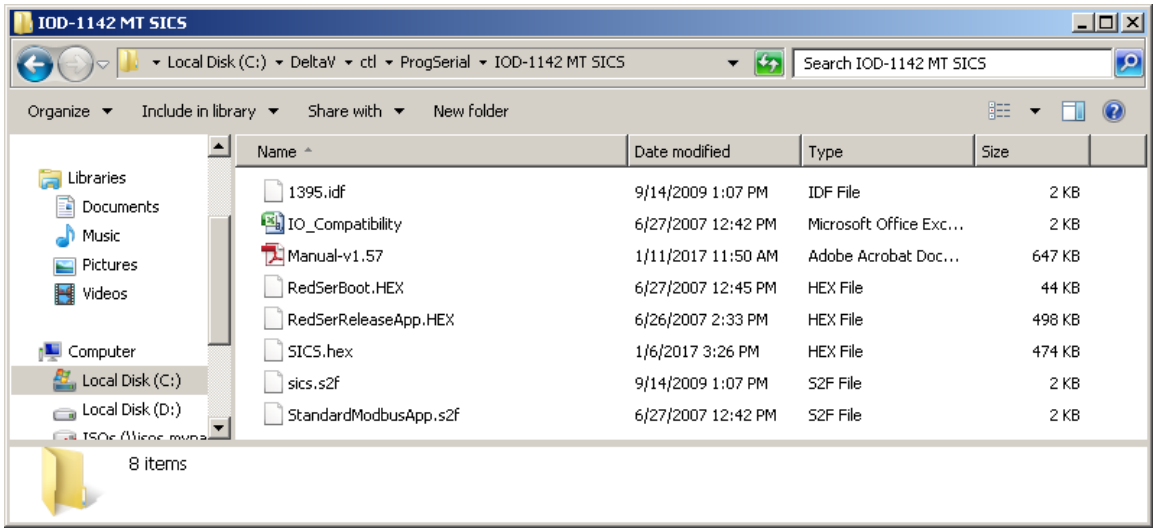
- Performs data and message handling between DeltaV and Mettler Toledo devices.
- Checks validity of messages received from the Mettler Toledo devices.
- Processes reply information and updates the corresponding dataset registers
- Update dataset register status and data block status to indicate the communication state.

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:

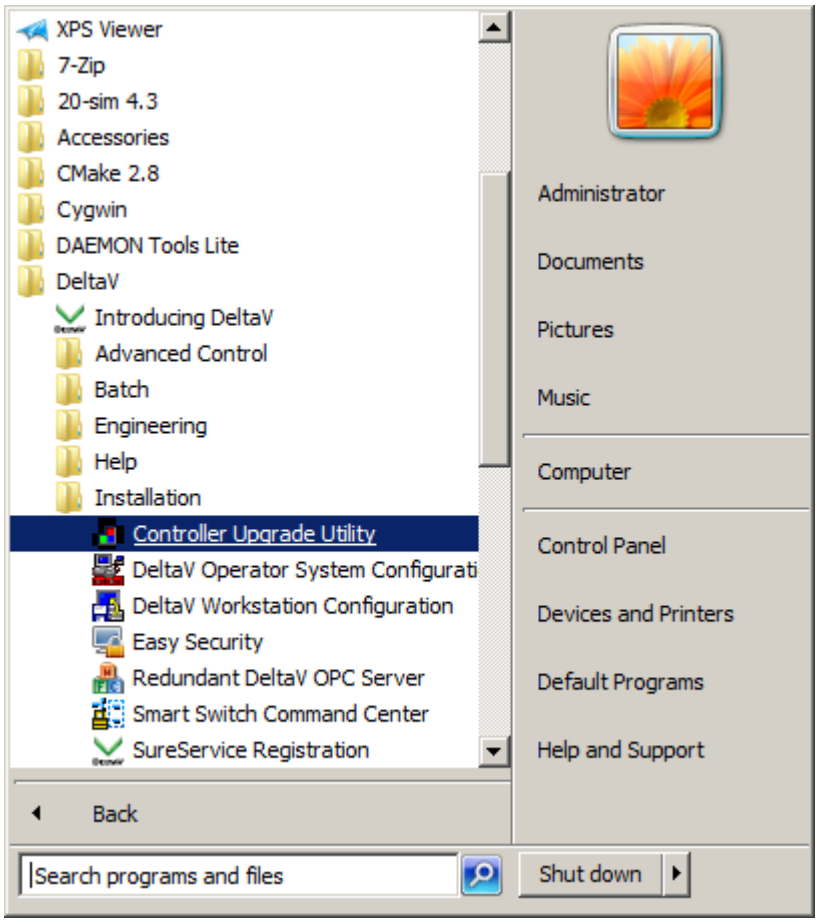
\DeltaV\ctl\ProgSerial\IOD-1142 MT SICS

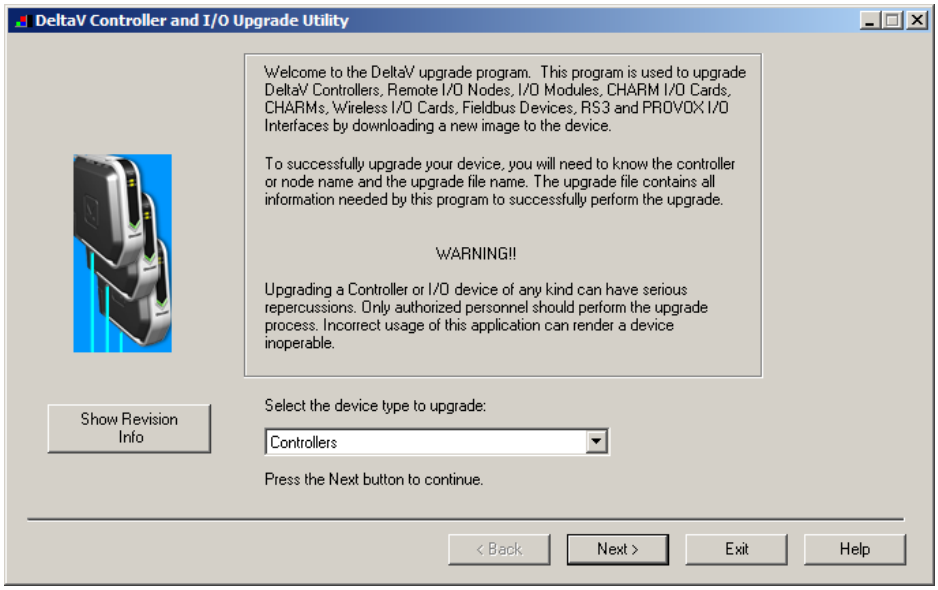
Note that you will have to create this subdirectory. The following shows a completed copy operation:



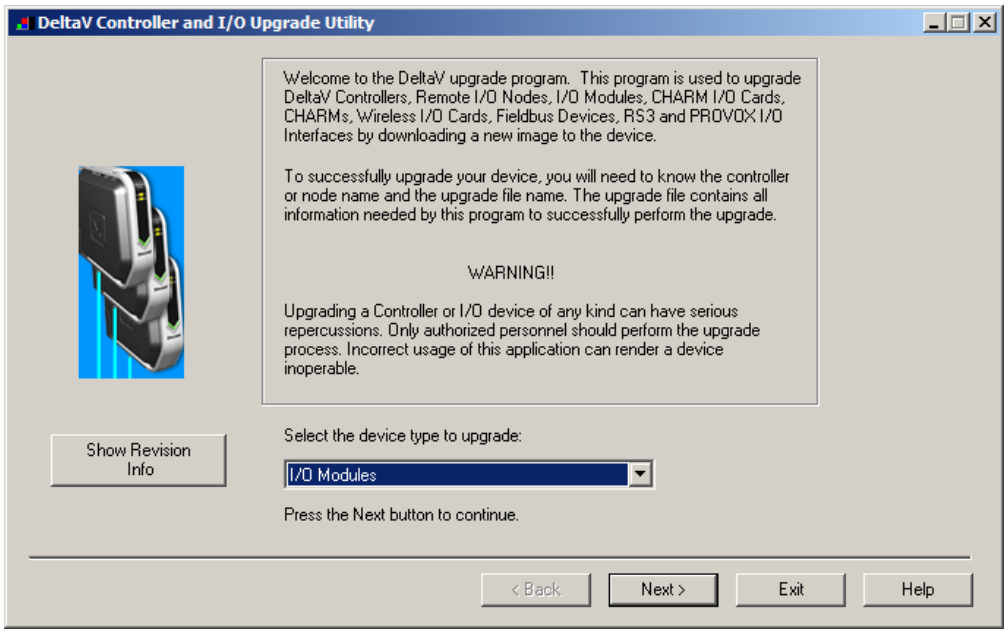
After copy completion, you are ready to program (or upgrade) the Programmable Serial Card with the supplied custom driver software. The steps are as follows:

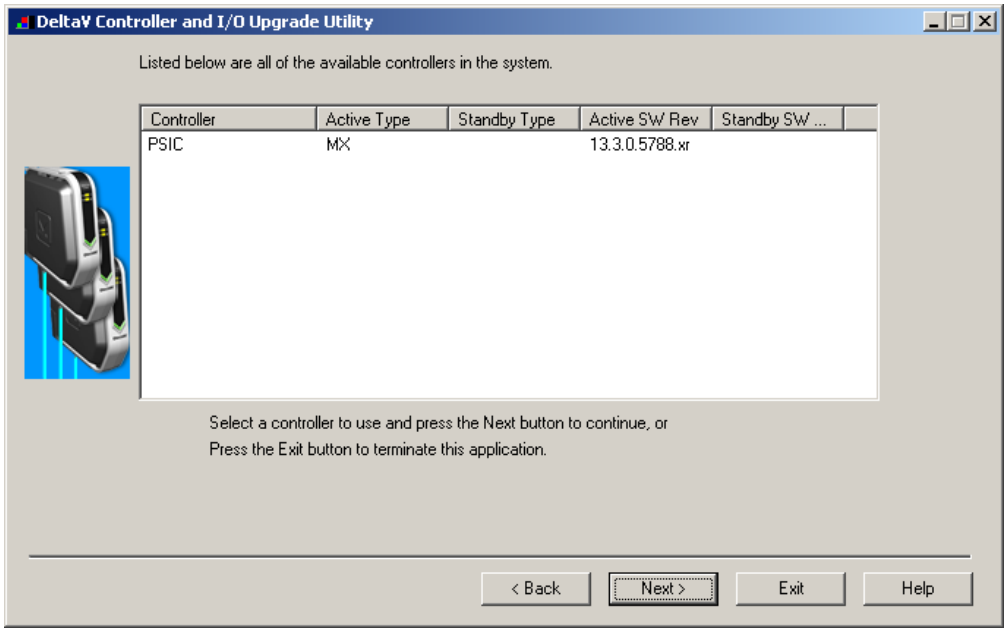
1. Click on the Start button and select DeltaV-> Installation-> Controller Upgrade Utility as shown below, and the following dialog will appear:



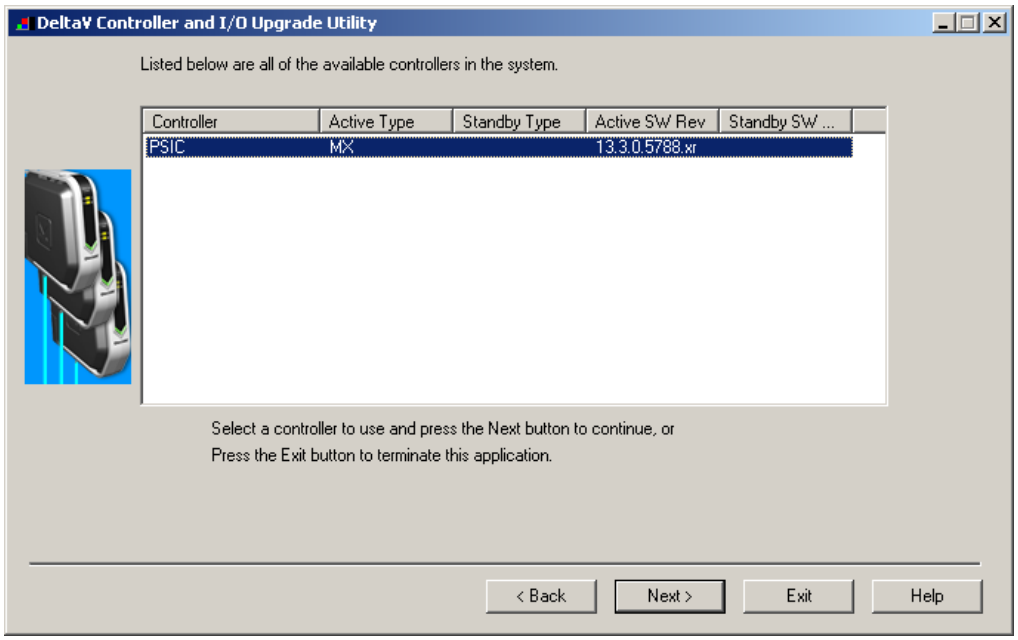


2. Click on the Upgrade I/O Modules radio button, and then click Next.



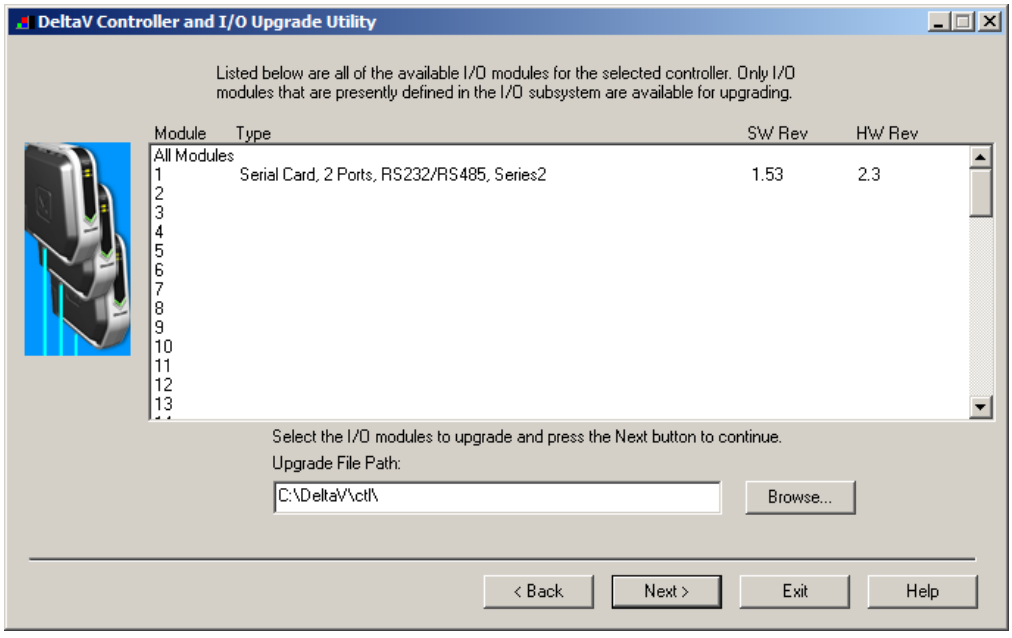


3. The above dialog will appear, listing all the available Controllers in your network. From this dialog, select the appropriate Controller and then Click Next.

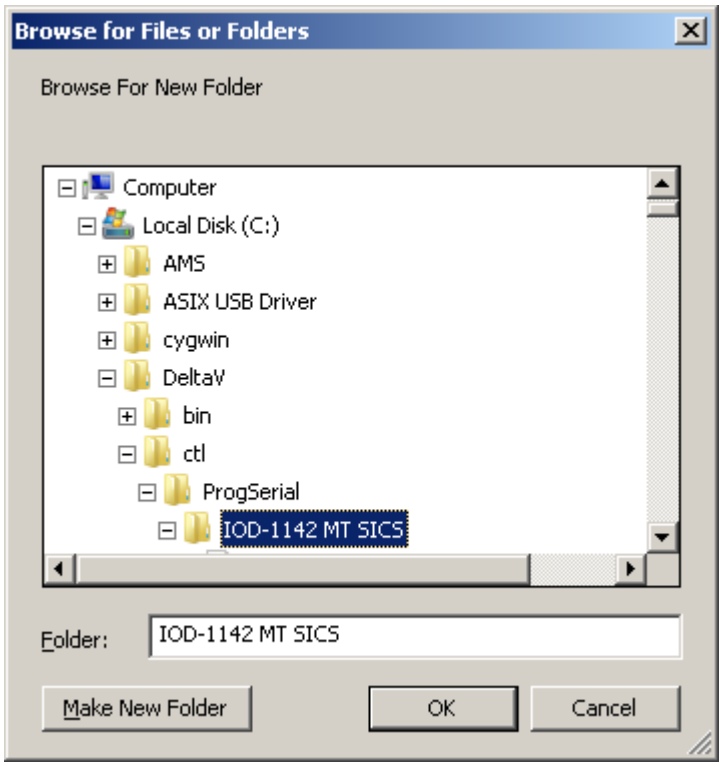


4. The following dialog will appear, listing all the I/O modules in your selected Controller. The shown list of I/O modules is an example only. Your list will be different.

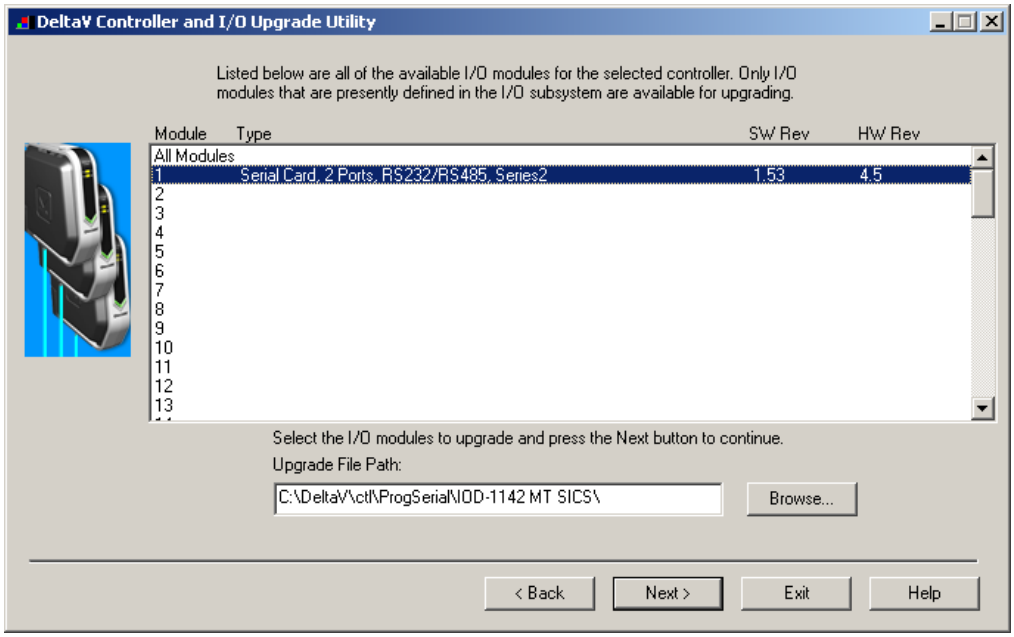
Note: The first time a standard Serial card is upgraded to the MT SICS Driver, the dialog will be as shown below. When upgrading an existing Programmable Serial Card, skip Steps 5 and 6, and go to Step 7.



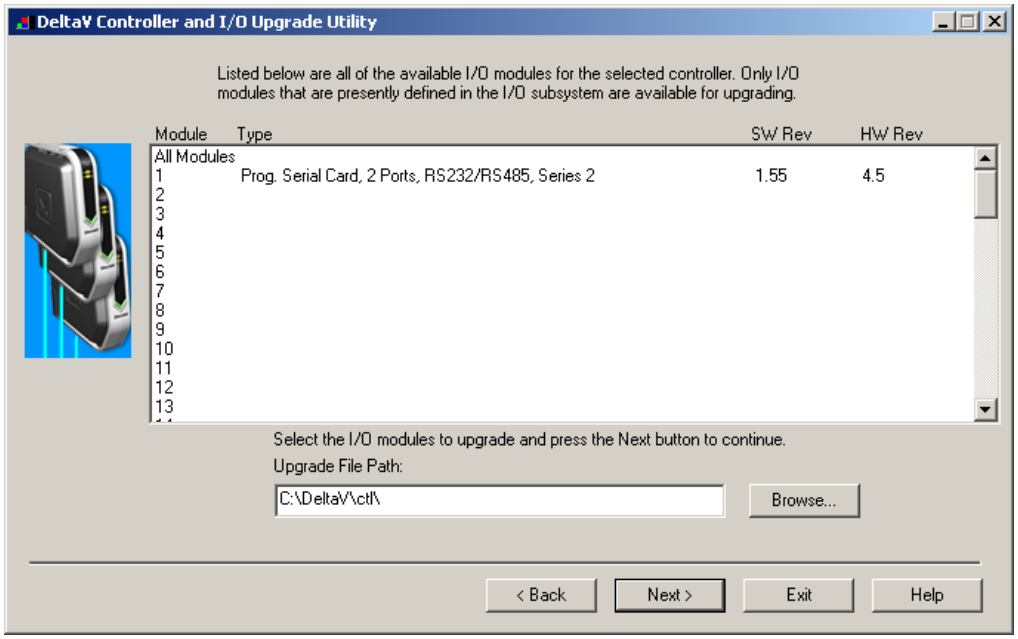
5. Click the Browse button and select the DeltaV path as shown below, and then click Ok. Note that the disk drive could be C or D.



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



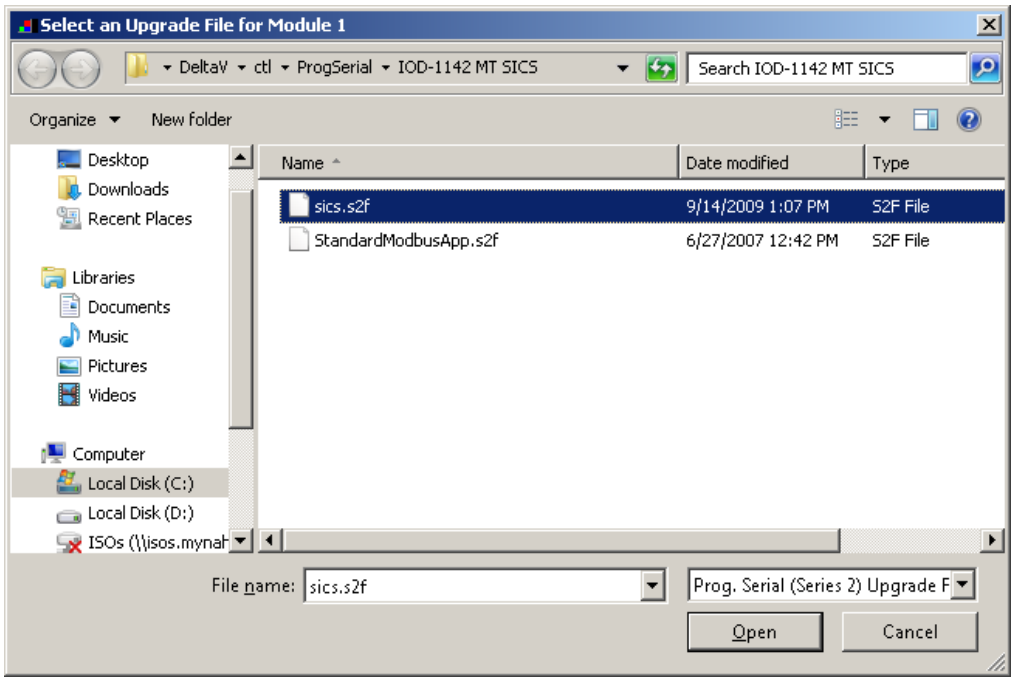
7. If you are upgrading an existing Programmable Serial Card, the dialog will be as shown below. From this dialog, select the Programmable Serial Card I/O Module in the list.



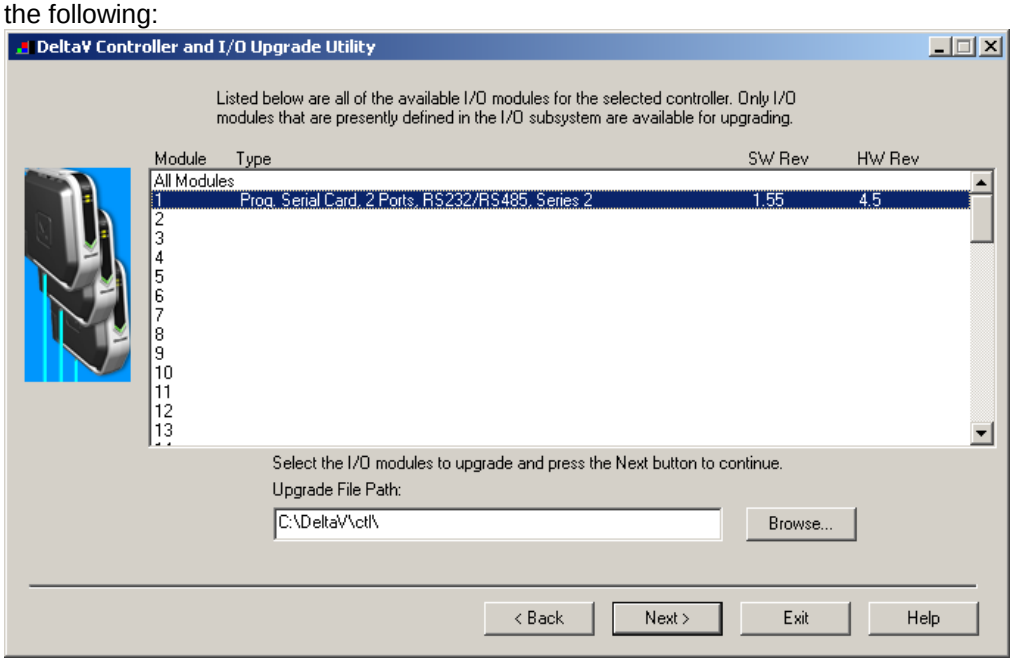
For example, we will select I/O Module 7. This will give you a dialog, from which you will select the file path to where the driver software is located. This path will be:

\DeltaV\ctl\ProgSerial\IOD-1142 MT SICS

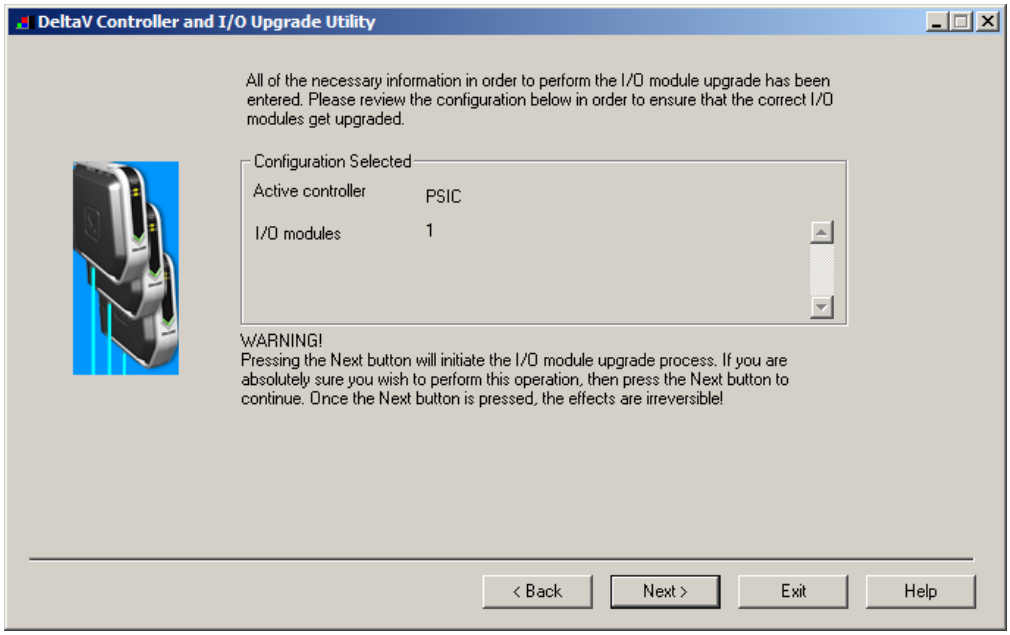
Once you are in the specified directory, you will need to select the file: **SICS.S2F**



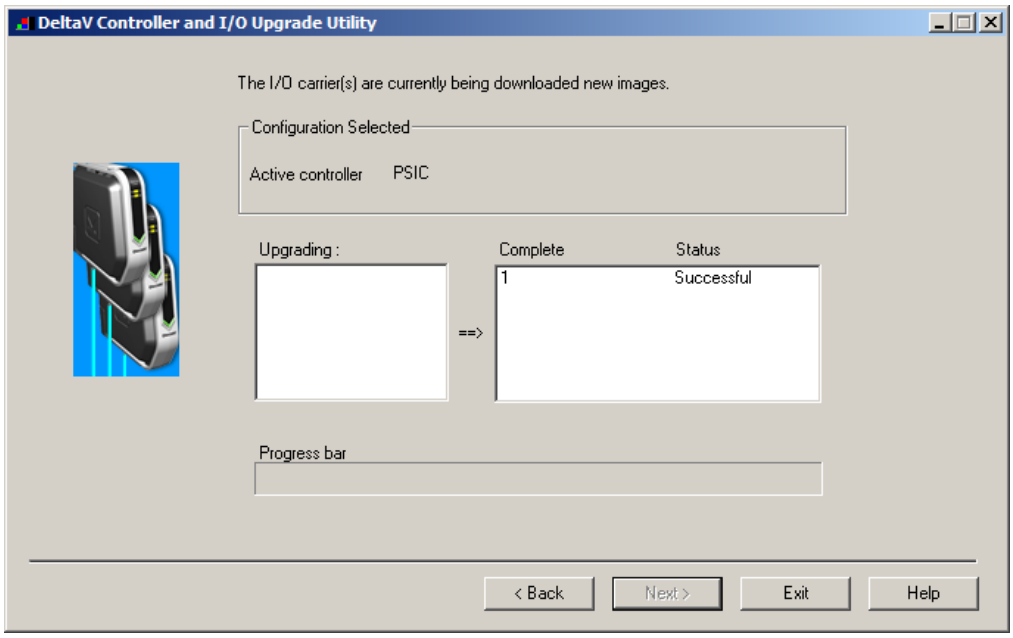
8. After selecting the .S2F file, Click on Open. This dialog will close and you will be back to the following:



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 and the Mettler Toledo Weigh Scale to obtain proper communication.

4.1 Device And Dataset Configuration

The following paragraphs discuss some attributes in the device and dataset configuration:

4.1.1 Device Address:

When using RS232, configure a single device representing a weigh scale connected to a PSIC port. The device address is not used in communications.

When using RS485, more than one device can be configured (maximum 16). The devices must reside in a multi-drop environment, either directly connected on an RS485 half-duplex line, or via RS485/RS232 converters. In either case, the maximum device address supported will be 63. For example, this driver was tested with a Technman Control-It 5258 converter (www.technman.com). Note that this converter auto-detects the baud rate. However, the parity, byte size and stop bits are fixed at None, 8, and 1 respectively.

4.1.2 Output Mode:

Two output modes are available in the DeltaV PSIC: block output (0) and single output (1). This value is a don't care for the driver. Leave this value at its default setting of 0.

4.1.3 DeltaV Data Type:

DeltaV data type can be configured as Floating point with status, or string, depending on the type of data requested. This is described below.

4.1.4 DeviceDataType

The Device Data Type value determines the communication command used. The following Data Types are supported:

Table 1 – Device Types

Device Data Type	DeltaV Data Type	Description
1	Floating Point	Data values (Read/Write) SICS Read commands: S, SI, SX, SXI SICS Write commands: @, Z, T, TI, TA, TAC, R0, R1, U
2	String	SICS I2 command -Weighing Terminal and Weighing Platform data (Read only)
3	String	SICS I3 command – Software version (Read only)
4	String	SICS I4 command – Serial number (Read only)
5	String or UINT8	SICS AR command – Application Block Read only
6	Floating Point	SICS AW command – Application Block Write only

4.1.5 Data Start Address and Number of Values

Configure the Start Address as the default value of 9. The Number of values in each dataset will vary as described below:

Table 2 – Number of Values

Device Data Type	Number of Values	Description
1	21	Maximum 21 values
2	100	String Length
3	100	String Length
4	100	String Length
5	100	String Length or number of 8-bit registers
6	50	Maximum 50 values. This is based on Application Block size.

4.1.6 Special Data 1-5

Under the Special data tab, only the Special data 1 and Special data 2 fields are used as follows:

Table 3 – Special Data Values

Special Data	Value	Usage
1	n	a. When the Device Data Type is 1 (DATA), this value is used to determine which SICS read command to use: 1 = S command 2 = SI command 3 = SX command 4 = SXI command. All other values are ignored. b. When the Device Data Type is 5 (AR) or 6 (A6), this value can be set 1-999 representing the application block number to read or write. NOTE: The most significant two bits of this register are reserved for a specific RS232/RS485 converter to be used when multi-dropping more than one scale on a single port. Do one of the following if using the Technman Control-It 5258 converter: a. Configure the converter for STX header. Add 16384 to the above command values. b. Configure the converter for HeAdEr header. Add 32768 to the above command values. Do not use both 16384 and 32768 at the same time. Use the flag on all Input and Output datasets in the device.
2	n	When the Device Data Type is 5 (AR) or 6 (AW), this value can be set 1-100 representing the application sub-block number to read or write.
3	n	When the Device Data Type is 5 (AR), and the data read is a string, you can use this value to extract a sub-string. For sub-string extraction, this value can be set to represent the starting position of the sub-string. Starting position is always < 100.
4	n	When the Device Data Type is 5 (AR), and the data read is a string, you can use this value to extract a sub-string. For sub-string extraction, this value can be set to represent the length, in characters, of the required sub-string. Length is always < 100. Furthermore, starting position + length must represent a sub-string within the original string.
5	n	When the Device Data Type is 1 (DATA), this value is used to time how often to read the scale status. The default is 0, i.e., the status is read in each scan. Enter the time in milliseconds, e.g., 5000 is 5 seconds. In this case, the status will be read once every 5 seconds. For all other datasets, this flag is used in conjunction with Special Data 3 and 4. After sub-string extraction, leading spaces are stripped off if this flag is a 1. For all other values, the sub-string is left unmodified.

4.3 Serial Driver Communications

The driver will continuously send commands to read the weight and status from the Weigh Scales. If there are communication errors, these are reported up to DeltaV. Each weigh scale will always have only the following registers configured:

Table 4 - DATA Register Assignments

Data Name	Assigned Register	Type
Command Type	R1	Write from DeltaV
Parameter	R2	Write from DeltaV
Unit Type	R3	Write from DeltaV
Weight Data	R4	Read from Scale (Command S and SI)
Weight Units	R5	Read from Scale (Command S and SI)
Weight Quality	R6	Read from Scale (Command S and SI)
Tare Data	R7	Read from Scale (Command T and TI)
Tare Units	R8	Read from Scale (Command T and TI)
Tare Quality	R9	Read from Scale (Command T and TI)
Gross Weight	R10	Read from Scale (Command SX and SXI)
Gross Units	R11	Read from Scale (Command SX and SXI)
Net Weight	R12	Read from Scale (Command SX and SXI)
Net Units	R13	Read from Scale (Command SX and SXI)
Tare Weight	R14	Read from Scale (Command SX and SXI)
Tare Units	R15	Read from Scale (Command SX and SXI)
Data Quality	R16	Read from Scale (Command SX and SXI)
	R17-R19	Reserved
Read Error	R20	
Write Error	R21	

Table 5 - Supported Commands

Command Number	Parameters Required	Description
1	0	SICS @ command – Reset Scale
2	0	SICS Z command – Zero Scale
3	0	SICS T command – Tare Scale
4	0	SICS TI command – Tare Scale
5	2 Tare Weight Units	SICS TA command – Tare Scale Write tare weight value to R2. Write Units value to R3
6	0	SICS TAC command – DeleteTare Weight
7	0	SICS R0 command – Switch Keyboard On
8	0	SICS R1 command – Switch Keyboard Off
9	1=Units Type	SICS U command – Change Units
99	0	Internal output dataset status clear

The following errors are reported upon command completion.

Table 6 - Command Errors

Command Number	Error code and Description
1	None
2	1 – Command not Executed 2 – Zero-set range dropped below 3 – Zero-set range exceeded
3	1 – Command not Executed 2 – Tare range dropped below 3 – Tare range exceeded
4	1 – Command not Executed 2 – Tare range dropped below 3 – Tare range exceeded
5	1 – Command not Executed 2 – Tare range dropped below 3 – Tare range exceeded 4 – Tare Data Invalid
6	1 – Command not Executed
7	None
8	None
9	5 – Invalid

Table 7 - Units Codes

Unit Number	Description
1	Kg
2	G
3	LB
4	OZT
5	OZ
6	SWT

4.4 Steps for User Commands

1. For commands, which do not require any parameters, simply write the command number into R1. Note: for commands, which require parameters, write the parameter values in R2 and R3 first. Then write the command number.

2. The command execution will begin. All invalid commands are ignored. The driver will format the command and send it to the weigh scale.

3. If the command completes successfully, R1 and R21 will be set to 0. If an error occurs, R1 will be set to 0 and R21 will have an error code as described above.

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 Mettler Toledo 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 Mettler Toledo 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 Mettler Toledo 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 Mettler Toledo Weigh Scale and the PSIC. For input data, the values should be changed in the Mettler Toledo and verified that the new data are correctly reported.

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 Mettler Toledo 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 - Mettler Toledo Electrical Interface

The electrical interface between DeltaV and the Mettler Toledo devices conforms to the RS-232 protocol. The RS-232 cable connecting Mettler Toledo and the DeltaV PSIC should not exceed 50 feet as specified by the EIA standard for RS-232 protocol. Refer to DeltaV Books On-Line for RS-485 connectivity information.

In some case, the Mettler Toledo scale uses an 8-pin circular connector, and a prefabricated cable. This cable must be acquired from Mettler Toledo. One end of the Mettler Toledo Cable fits the 8-pin circular socket. The other end is a 9-pin D-shell plug. To connect the DeltaV Serial Card Termination Block to the scale, fabricate a cable with a 9-pin d-shell socket on one end and open conductors on the other end. The 9-pin socket should have the following pin out.

Pin Number	Description
1	No connection
2	Rx
3	Tx
4	DTR – jumper to pin 6
5	Ground
6	DSR – jumper to pin 4
7	RTS – jumper to pin 8
8	CTS – jumper to pin 7
9	No Connection

On the open end of the cable, only 3 conductors are used. These are Rx, Tx and Gnd. Screw down these conductors to the terminal block as indicated below. Lastly, install a jumper between 7 and 8 for port 1, and 15 and 16 for port 2.

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 - Dataset 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 2 - Dataset Ready (DSR)

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 address is:

support@mynah.com

Thank you for using DeltaV.

8 Release Notes

8.1 Release Notes for v1.55

- This release is a rebuild of v1.18 under the new Emerson driver toolkit v3.01. There are no other changes.
- Added functionality to allow more than one scale to be configured on a single port. In this setup, user must use a specific RS485/RS232 addressable converter to multi-drop a maximum of 16 scales. The addressable convert supported is Tachnman Control-It 5258 (www.tachnman.com).

8.2 Release Notes for v1.56

- Corrected a defect where the weight Units code received from the Weigh Scale was not handled and reported to the DeltaV Controller correctly.

8.3 Release Notes for v1.57

- Updated to use Emerson toolkit v3.02.