

Intech Micro 2400-M-R



Installation Guide.

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Intech Micro

2400-M-R

Up to 16 Non-Isolated RTD Pt100/Pt1000 Inputs.
 4 Digital Inputs.
 2 Analogue 4~20mA Outputs.
 2 Relay Outputs.

Description.

The 2400-M-R can multiplex up to 16 Non-Isolated RTD Pt100/Pt1000, into one output, selectable by a PLC or a Data Logging System. It uses solid state switches, making it extremely reliable and durable. The PLC only requires two digital outputs and one analogue input to select and receive data from the 2400-M-R. For each additional 2400-M-R added to the system only one more analogue input is required. (The typical fan-out for most PLC's digital outputs is eight 2400-M-Rs.)



The 2400-M-R are software programmable via USB. The 2400-M-R is used extensively in industrial plants, with proven reliability and accuracy. It comes complete and ready to operate in a DIN rail mount enclosure.

Features.

- Up to 16 Channel Multiplexer.
- Field Programmable Non-Isolated Inputs.
- Input Types RTD: Pt100 & Pt1000.
- Clock/Reset Channel Selection, or Binary Channel Selection.
- High Accuracy 0.1%.
- Compact DIN Rail Mount Enclosure.
- Easy to Install.
- Low Cost Expansion for PLCs.
- Solid State Switches for Reliability.

Other 2400 Models Include:

- 2400-IS: Isolated Auto-Detecting USB/RS232 to RS485/422/232 Converter.
- 2400-A16: Field Station with up to 16 Isolated Universal Inputs, 4 Digital Inputs, 2 Relay Outputs, and 2 Analogue 4~20mA Outputs.
- 2400-R2: 16 Channel Relay Output Expander.
- 2400-RB: Wireless Base/Remote for RS485/422/232 Comms.
- 2400-TCP: Wireless Base only for Ethernet TCP/IP Comms.
- 2400-Sleeper: Wireless Battery Option for 2 Universal Inputs.

Ordering Information.

All 2400-M-R stations come standard (Default ex factory calibration) with:

All Input Channels Configured to RTD Pt100 0~100°C.
 4 Digital Inputs.
 2 Analogue 4~20mA Outputs.
 2 Relay Outputs.
 RS485 or RS232 on Comms Port 2.

ITEM	CODE		DESCRIPTION
SERIES	2400-M-R-		
Input Channel Options	N16-		16 Non-Isolated RTD Pt100/Pt1000 Input Channels.
	N8-		8 Non-Isolated RTD Pt100/Pt1000 Input Channels.
Comms (Port 1)	485-		Port 1 Fitted with RS485/RS422 Comms.
Power Supply Options		H	85~264Vac/dc, 95~370Vdc.
		M	24~48Vac, 17~72Vdc.
		L	10~30Vdc.

Ordering Example.

2400-M-R-N16-485-L: 2400-M-R with 16 Non-Isolated RTD Pt100/Pt1000 Input Channels, RS485 Comms, 10~30Vdc Power Supply.

2400-RS232:	Optional 5m RS232 Cable for the 2400-M-R (Comms Port 2).
XU-USB:	USB Programming Key for programming 2400-M-R using Station Programmer software. (Same Key as used for programming XU Series transmitters and Z-2400-Sleeper.) Note: 2400-M-R can also be programmed via the Comms Ports using MicroScan v5.1 software.

Product Liability. This information describes our products. It does not constitute guaranteed properties and is not intended to affirm the suitability of a product for a particular application. Due to on-going research and development, designs, specifications, and documentation are subject to change without notification. Regrettably, omissions and exceptions cannot be completely ruled out. No liability will be accepted for errors, omissions or amendments to this specification. Technical data are always specified by their average values and are based on Standard Calibration Units at 25C, unless otherwise specified. Each product is subject to the 'Conditions of Sale'.

Warning: These products are not designed for use in, and should not be used for patient connected applications. In any critical installation an independent fail-safe back-up system must always be implemented.

2400-M-R Input Specifications.

RTD Inputs 1~16 Specifications:	Non-Isolated.
Pt100 RTD Type	3 Wire Pt100 RTD DIN 43760:1980 Standard Input.
Pt1000 RTD Type	3 Wire Pt1000 RTD Standard Input.
Sensor Current	0.6mA Continuous.
Lead Wire Resistance	Pt100: 10Ω/wire Max. Pt1000: 5Ω/wire Max.
	0.1% FSO Offset Error per Ω of Lead Resistance.
Sensor Fail	Upscale or Downscale Selectable (Upscale Default).
Ambient Drift	0.003°C/°C Typical.
Accuracy	0~300°C ±0.1°C.
Resolution	0.01°C for -200~250°C, (-320~320°F).

Digital Input 1~4 Specifications:	4 Opto Isolated Digital Inputs with LED Indication On Each Input.
Applications	Meter Pulses, Frequency, Counter or On/Off State Inputs.
Functions	Up Count On Each Pulse.
Input Voltage	5~30Vdc.
Threshold	4.6V typical.
Load @ 5V	1.1mA per Channel.
@ 24Vdc	7.0mA per Channel.
Counter Register Output	32bit.
Frequency Range	0~8000Hz.
Frequency	Debounce 5msec.
Debounce Counter Range	0~100Hz.

Output Specifications.

Dual Analogue Outputs Source:	2 Isolated Analogue Outputs (not isolated from each other).
mA Range	4~20mA Only.
Resolution	12bit, 4096 steps.
Output Drive	500Ω Max @ 24V Supply.

Relay Outputs:	2 Isolated Relays with LED Indication On Each Output.
Functions	2 on Board Controllers (16 with 2400-R2), can be used as Set Point (SV), Switching Differential, Auto/Manual, Manual Output Setting, Dual Action Control, Single Action Control, Heat/Cool, Cool Only, Heat Only.
Contact Material	Gold Clad Silver.
Relay Ratings	30Vdc, 3A Max.
Approved to Standard	UL.

2400-M-R General Specifications.

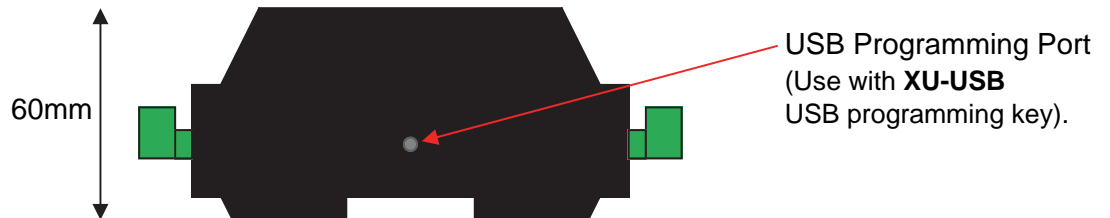
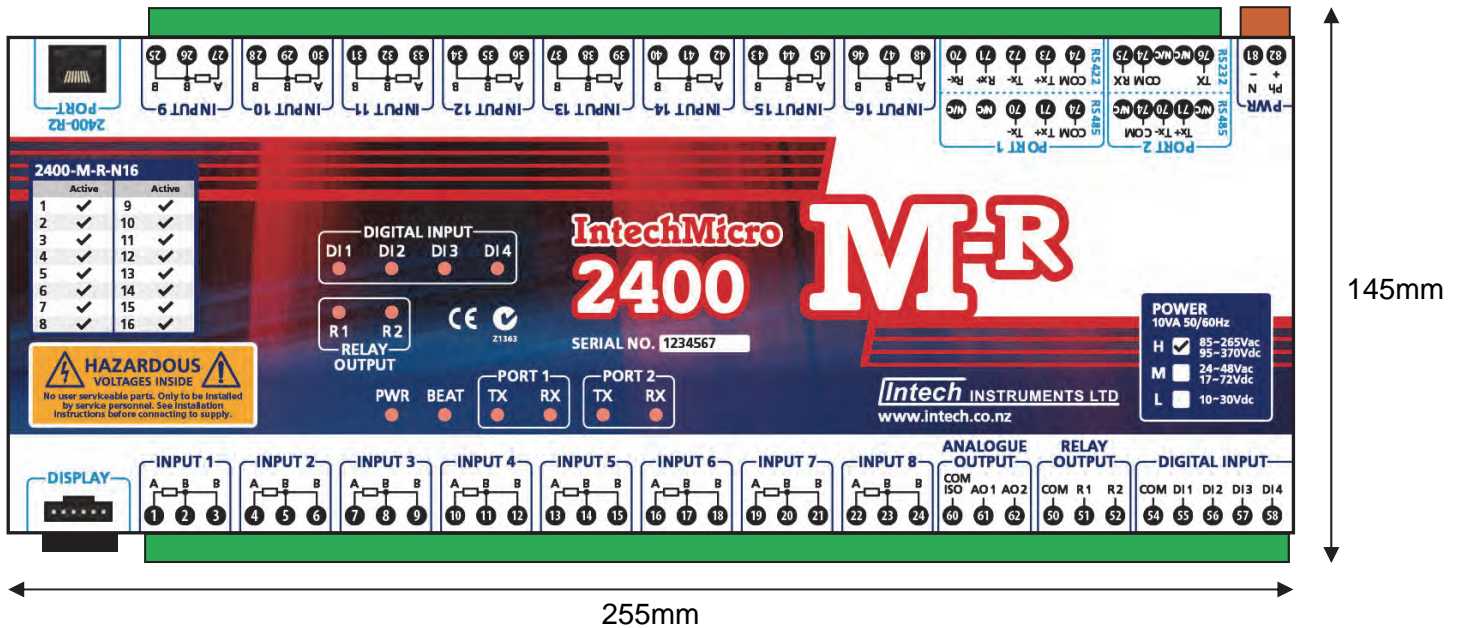
Comms Ports:	
Port 1	RS422/RS485.
Port 2	RS232/RS485.
Data Rate	9600 (MicroScan), 19200, 57600 or 115200 baud.
Parity bit	Even or None (MicroScan).
Protocols	ASCII. Std (MicroScan), Modbus RTU/TCP Auto Detect.
Power Options:	10VA.
Factory set: H	85~265Vac, 95~370Vdc.
M	24~48Vac, 17~72Vdc.
L	10~30Vdc (recommend 1A power supply).

Safety Compliance:	
EMC Emissions	EN55022-A.
EMC Immunity	EN50082-1.
Safety	EN60950.
Mains isolation	250Vac.
Isolation test voltages:	
Mains to output	3000Vac, 50Hz.
Mains to earth	1500Vac, 50Hz.

General Specifications:	
Accurate to	≤ ±0.1%/°C FSO typical.
Linear Repeatability	≤ ±0.1%/°C FSO typical.
Ambient drift	≤ ±0.01%/°C FSO typical.
Isolation Test Voltages	Between Input and Output: 3750Vac for 1min.
Response Time	400msec Typical (10~90% 300msec Typical).
Noise Immunity	125dB CMRR Average (2.0kVdc Limit).
RF immunity	< 1% effect FSO typical.
Operating temperature	0~60°C.
Storage temperature	-20~80°C.
Operating humidity	5~85% RH max.
Housing:	Material ABS Inflammability V0 (UL94).
Mounting	35mm symmetrical DIN rail.
Dimensions	L=255, W=145, H=60mm.
Weight	0.9kg Includes Packaging.

Note: The 2400-M-R is °C and °F selectable. This selection affects all temperature readings.

2400-M-R-485 Terminals and Layout & Dimensions.



2400-M-R LED Descriptions.

LED Name	LED Functions
PWR	On Indicates Power Is Applied.
BEAT	Heart Beat. Continual Flashing indicates the Station is healthy.
TX Port 1~2	Active when stations is transmitting serial data.
RX Port 1~2	Active when stations is receiving serial data.
Relay Output R1~R2	Indicates when their respective output relay is energised.
Digital Input D1~D4	Indicates when their respective input is energised, or counting.

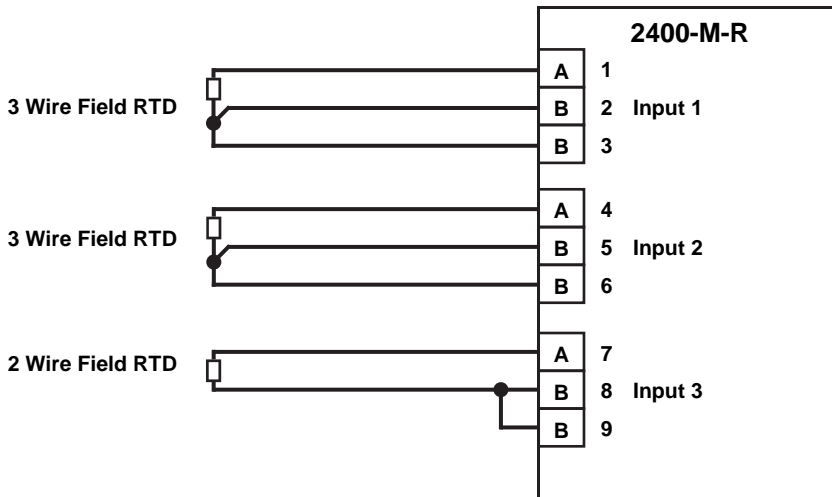
2400-M-R Power Supply Connections.

Terminals:	81	82
H:	N	P
M:	-	+
L:	-	+

Note. H: 85~265Vac, 95~370Vdc.
M: 24~48Vac, 17~72Vdc.
L: 10~30Vdc.
Power Rating: 10VA.

Input and Output Connection Diagrams.

2400-M-R Input Connection Diagram for RTD Inputs.



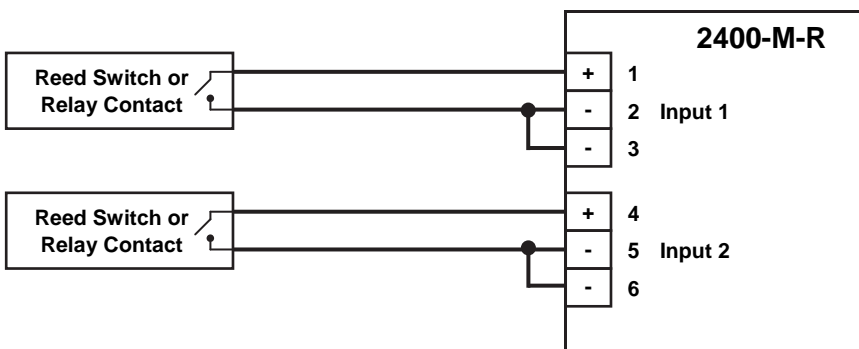
Note 1. To minimise lead resistance errors, 3 wire RTDs should be used. If 2 wire RTDs are used, small offset errors can be compensated for in the software.

Note 2. All RTD cable to be screened, and the screens earthed at one end only. The three wires must be the same resistance. (i.e. the same type and size.) Refer to '2400-M-R Wiring and Installation' for recommended types.

RTD Pt1000 Selection: The 2400-M-R comes with the default setting of RTD Pt100 0~100°C. To change inputs 1~16 from Pt100 to Pt1000, refer to '2400 Station Software Programming' on page 13 to connect the 2400-M-R to your PC. Once you have the 'Program Outstation' window open on you PC: click on the 'Advanced' button and then the 'RTD Pt100 / Pt1000' button. Within the 'RTD Pt100 / Pt1000' window you can select individual channels to be either Pt100 or Pt1000. Once you have finished, click 'OK', then 'OK'. Now you can use the drop-down boxes to choose the desired temperature ranges. When finished remember to 'Program' the station before disconnecting.

2400-M-R On/Off State Input Connections.

Both the 16 non isolated inputs (terminals 1~48) plus the 4 dedicated digital inputs (terminals 54~58) can be used for on/off state inputs.

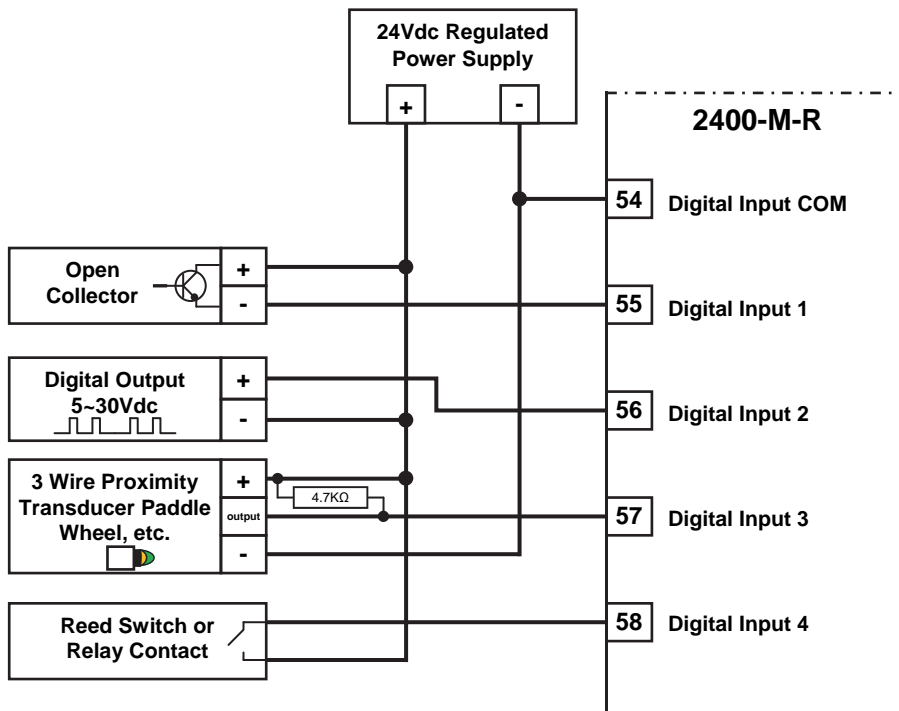


Note 1. Inputs can be used as state Pseudo Digital inputs for sensing a clean, voltage free, field contact.

Note 2. Select input range PD1, PD2 for Pseudo Digital inputs.

Note 3. All cables to be screened, and the screens earthed at one end only. The three wires must be the same resistance. (i.e. the same type and size.) Refer to '2400-M-R Wiring and Installation' for recommended types.

2400-M-R Input Connection Diagram for Digital Inputs.



Note 1. Inputs can be either:
State - i.e. ON / OFF or
Frequency - 0~8000Hz (e.g. flow and energy meters).

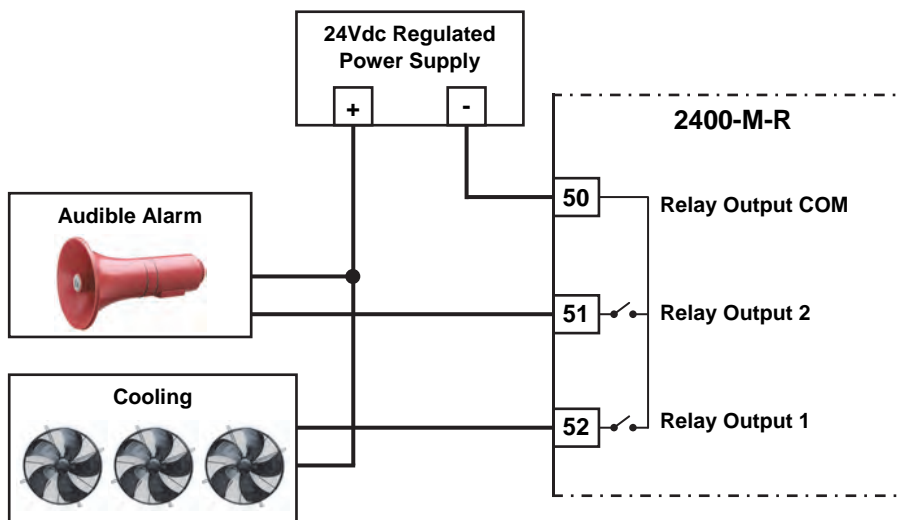
Note 2. LED indication per input. Refer to 'Specifications' for input loads.

Note 3. For Scaling of counter inputs, totalising and flow data conversion, refer to MicroScan Help, line setup/counter scaling.

Note 4. Do not fit the 4K7 resistor for 3 wire PNP transducers.

Note 5. All cables must be screened, and the screens earthed at one end only. Refer to '2400-M-R Wiring and Installation'.

2400-M-R Connection Diagram for Digital Outputs.



Note 1. Both relays are Normally Open, and share a common.

Note 2. LED indication per output when relay is energised.

Note 3. Contact rating of 30Vdc, 3A Max.

Note 4. For additional Relay Expansion refer to 2400-R2.

Note 5. Each relay can be configured for a 'Normally ON' or 'Normally OFF' output state (e.g. for fail safe operation). The 'Normally ON/OFF' settings are retained in software on power down, but the relays are de-energised. Refer to MicroScan Help.

Note 6. Relay 2 can be selected as a Comms failure time-out alarm. The relay is normally active and deactivates after 5mins if no Comms messages are received. This function does not detect microprocessor failure. When used for this function the relay cannot be used for any other function (adjustable delay in seconds).

Note 7. Digital Outputs are not available when used as an intelligent multiplexer.

Note 8. All cables must be screened, and the screens earthed at one end only. Refer '2400-M-R Wiring and Installation'.

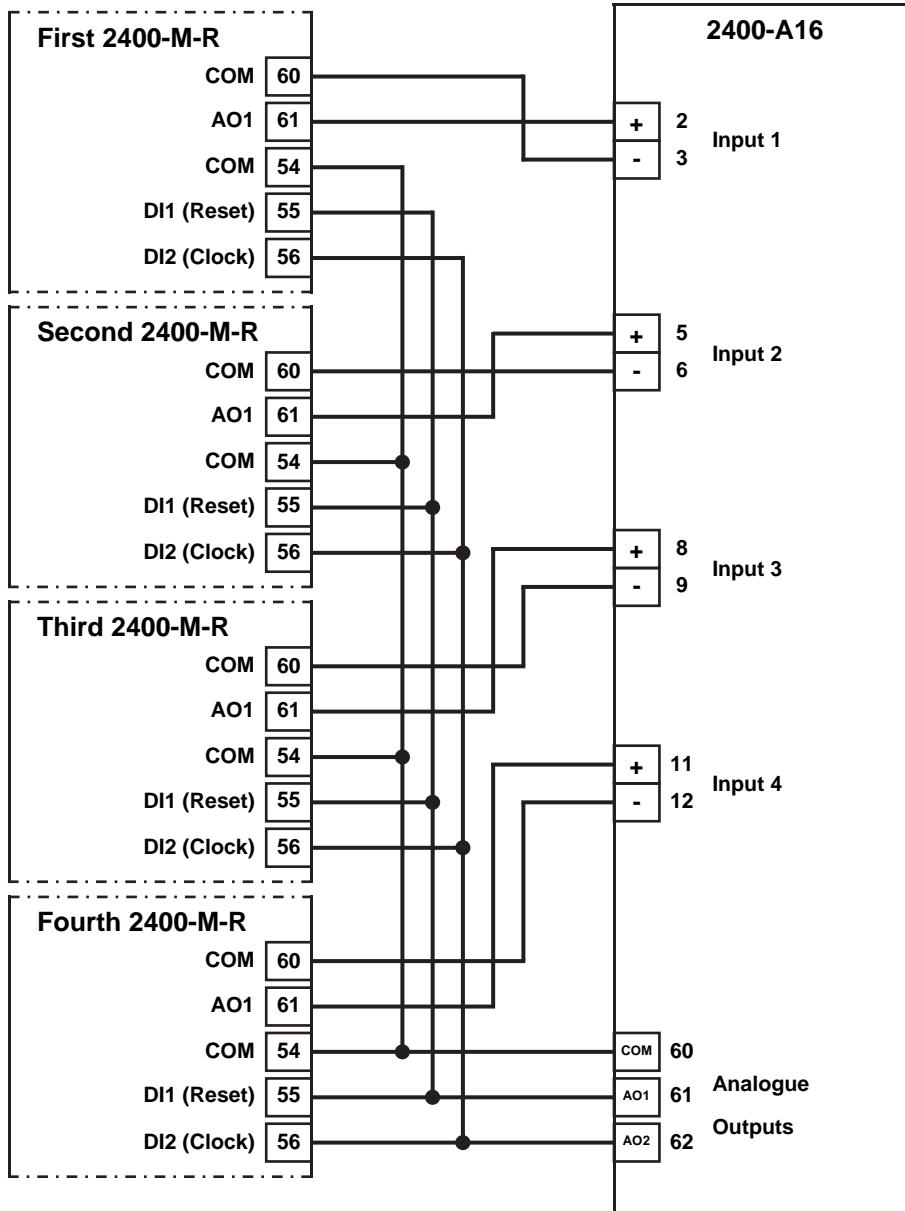
Connecting to a MicroScan SCADA System.

Using The 2400-M-R Input Multiplexer For Analogue Input Expansion On The 2400-A16.

Analogue input expansion can be achieved using up to four 2400-M-R 16 Channel RTD Input Multiplexers. This gives a total of 76 RTD inputs. Channel select control for the 2400-M-R is through the Analogue Output 1 and Analogue Output 2 on the 2400-A16 (Refer to Note 2 below). One 2400-A16 analogue input is required per 2400-M-R, and each 2400-M-R input must be of the same type and range.

Option 1. Five Wire Connection Diagram.

This uses 5 wires for the first 2400-M-R with 2 additional wires for each additional 2400-M-R.



Note 1. The 2400-A16 resolution on the 2400-M-R multiplexer inputs is 12 bits, (4096 steps).

Note 2. When connecting from the 2400-A16 to the 2400-M-Rs:
AO COM connects to CS COM.
AO1 is used for the RESET pulse.
AO2 is used for the CLOCK pulse.
AO1 & AO2 are not available for any other use.

Note 3. All cable must be screened, and the screens earthed at one end only.

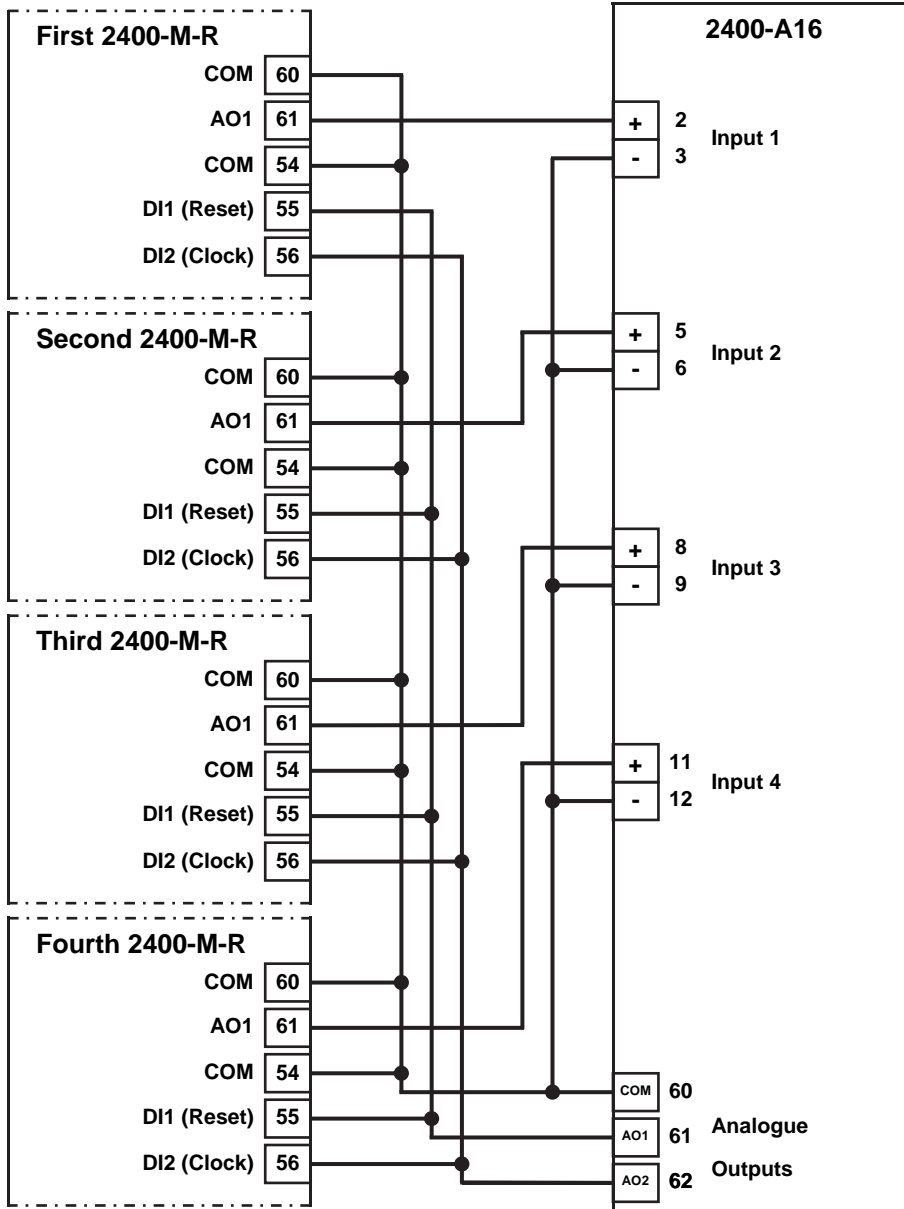
Note 4. Any 2400-A16 Analogue input can be used as a Multiplexer input.

Note 5. The 2400-A16 does not have a Multiplexer priority scan mode.

Note 6. For detailed programming info, refer to 'Programming 2400-Series Remote Station' in the MicroScan Help.

Option 2. Four Wire Connection Diagram

This uses 4 wires (two pair) for the first 2400-M-R, with 1 additional wire for each additional 2400-M-R. In this configuration the analogue inputs are single ended. i.e. All the -ve inputs are all commoned.



Note 1. The 2400-A16 resolution on the 2400-M-R/2100-M multiplexer inputs is 12 bits (4096 steps).

Note 2. When 2400-M-R/2100-M multiplexers are used:
AO COM connects to CS COM.
AO1 is used for the RESET pulse.
AO2 is used for the CLOCK pulse.
AO1 & AO2 are not available for any other use.

Note 3. All cable must be screened, and the screens earthed at one end only.

Note 4. For detailed programming info, refer to 'programming 2400-Series Remote Station' in the MicroScan Help.

The analogue output mode on the 2400-A16 is set in the Station Software Programming under 'PLC RTX Mode'. For 2400-M-R / 2100-M Driver select Mode 1.

For detailed programming info, refer to 'programming 2400-Series Remote Station' in the MicroScan Help.

2400-M-R Analogue Outputs Controlled by SCADA.

The analogue output mode is set in the Station Software Programming under 'PLC RTX Mode'.

For SCADA outputs select **Mode 1**.

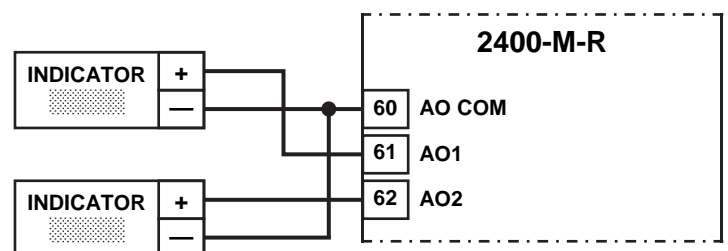
For detailed programming info, refer to 'Programming 2400-Series Remote Station' in the MicroScan Help.

AO1 & AO2 are controlled by the SCADA software.

4~20mA output (0~4096 steps).

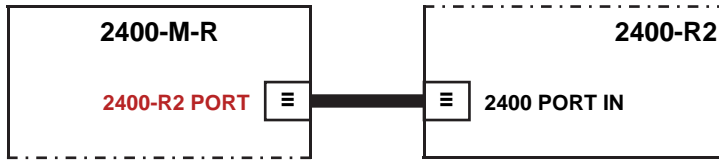
Outputs are powered (sourced).

The example shows two 4~20mA indicators that are powered by the 4~20mA loop.



2400-M-R Relay Output Expansion - Using the 2400-R2 Relay Output Expansion Modules.

2400-M-R Relay Output Connection Example Diagrams:

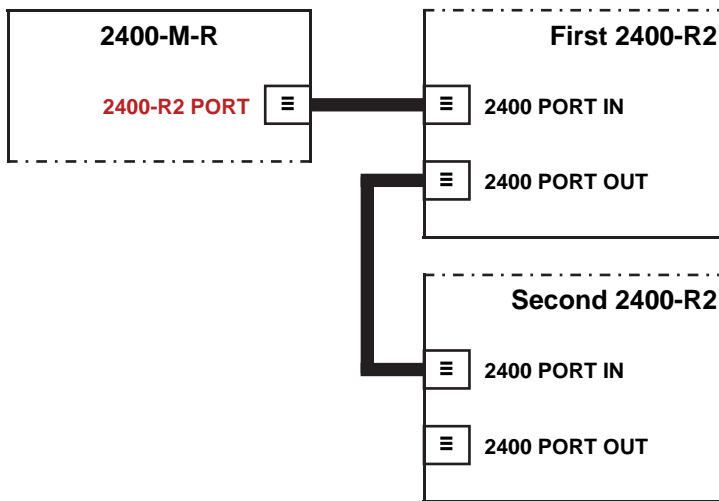


2400-R2 Specifications:

Relay Ratings:	Rating	Approved
	250Vac, 5A	UL
	30Vdc, 5A	

Note 1. The 2400-M-R Connects to the **2400-R2** via standard Ethernet cable (note this is not an Ethernet port).

Note 2. The 2400-M-R does **not** connect to the **2100-R2** or **2100-R**.



Output relay expansion is available using the 2400-R2, 16 relay output expansion module. This allows the 2400-M-R to stand alone as a 16 channel controller and/or alarm unit. The 2400-R2 relay outputs can be used for any combination of control and alarm functions. The control parameters for each of the 16 controllers is downloaded from user friendly MicroScan Software, and stored in permanent memory on the 2400-M-R.

These parameters include Setpoint (SV), Output Switching Differential, Auto/Manual, Manual Output Setting, Dual Action Control, Single Action Control, Heat/Cool, Heat Only, Cool Only. The 16 controller/alarms will operate unaffected by computer power downs, reboots, etc. The relay outputs can also be accessed directly from the SCADA.

Note: For detailed programming information, refer to 'Programming 2400-Series Remote Station's in the MicroScan Help.

Serial Communications Ports.

Fitted with two serial communications ports plus a third port for programming.

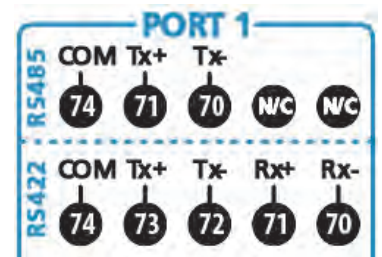
Port 1:

Default port for connecting to the SCADA computer or PLC, and supports RS422 or RS485, with total isolation; except Port 3.

Note: RS422 & RS485 wiring use separate terminal blocks - see diagram >>

Port 2:

Auxiliary port for programming the configuration settings, or secondary MicroScan system. Supports RS485 or RS232, with total isolation from all other inputs and outputs.



RS232 Connection to DB9:

2400-M-R terminal No	DB9 Pin No (Computer)
Tx 76	2
Rx 75	3
COM 74	5



Note: The **2400-RS232** comes as an optional 5m RS232 cable for the 2400-A16 / 2400-M-R.

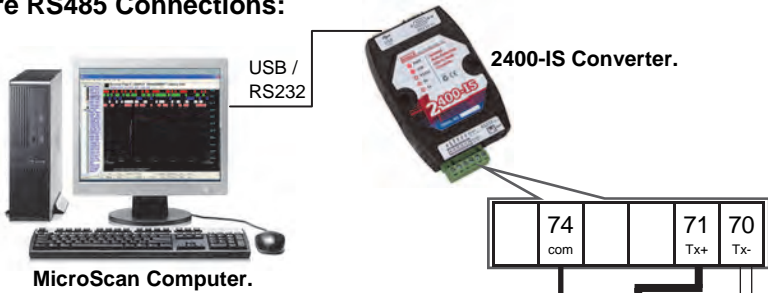
Port 3:

Programming port via the **XU-USB** programming Cable. (located on end of 2400-M-R module, see page 5).



Outstation Layout - RS485:

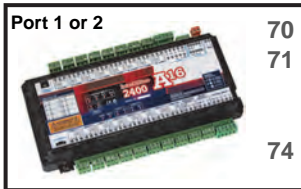
2 Wire RS485 Connections:



Never guess Tx or Rx connections.
Follow the terminal numbers in the serial connections diagrams exactly.

Important:

1. All cables must be screened.
2. All screens must be connected together.
3. The screen must not be earthed at any point.



2400-A16 / 2400-M-R Remote Station.



Shimaden SD16A/24/20 with RS485 option.



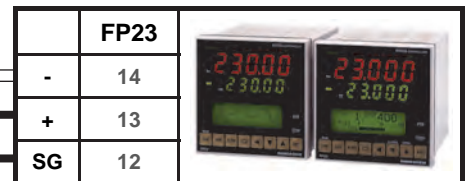
2100-A16 / 2100-A4 Remote Station.



Shimaden SR23 with RS485 option.



2100-D Remote Station.



Shimaden FP23 with RS485 option.



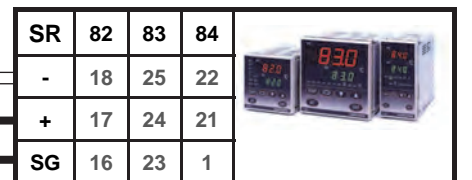
2100-AO Remote Station.



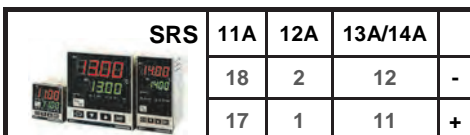
Shimaden FP93 with RS485 option.



Shimaden SR90 Series with RS485 option.

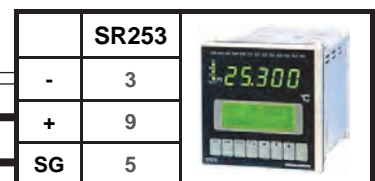


Shimaden SR80 Series with RS485 option.

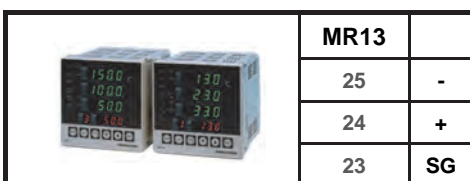


Shimaden SRS10A Series with RS485 option.

**RS485 DATA HI-WAY.
CABLE POLARITY
MUST BE OBSERVED.**



Shimaden SR253 with RS485 option.



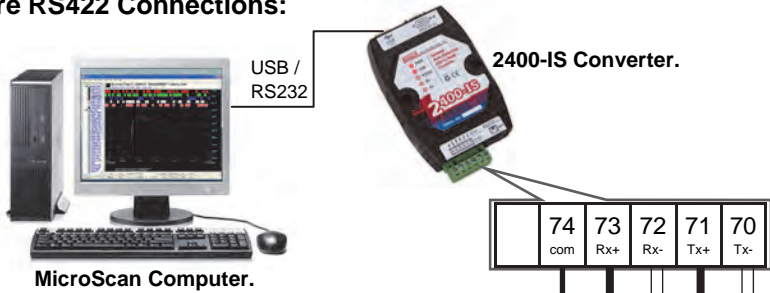
Shimaden MR13 with RS485 option.

TWISTED PAIR

1KΩ End of Data Highway Junction Box;
Resistor = 1KΩ.

Outstation Layout - RS422:

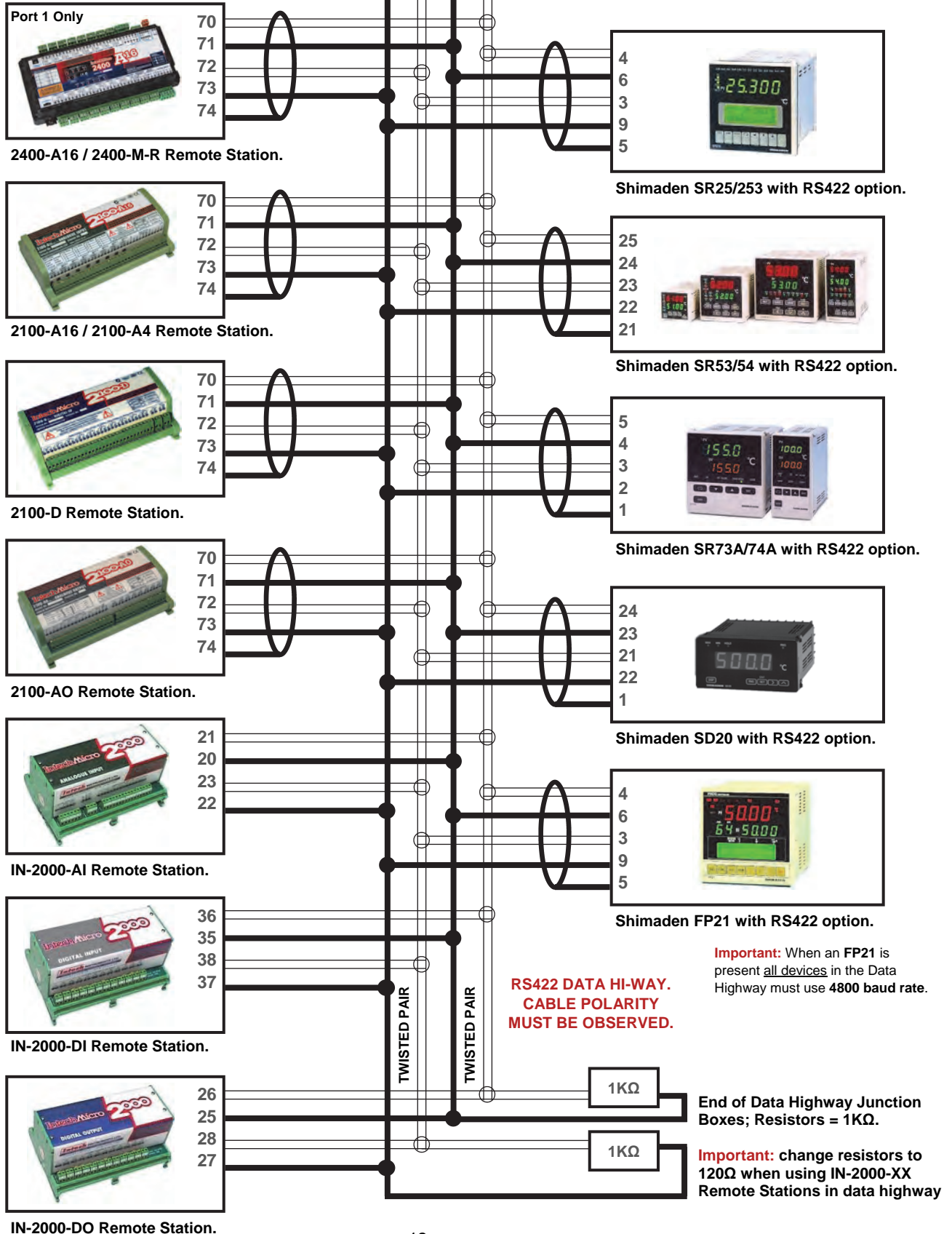
4 Wire RS422 Connections:



Never guess Tx or Rx connections.
Follow the terminal numbers in the serial connections diagrams exactly.

Important:

1. All cables must be screened.
2. All screens must be connected together.
3. The screen must not be earthed at any point.



2400-M-R Station Programming and Setup.

Important: When commissioning remote stations, you must programme a unique station number before using the 2400 station. To connect the new 2400 Station, refer to 'Wiring and Installation' and 'Commissioning' on page 23 onwards.

2400 Station Software Programming.

There are 2 methods for configuring the 2400-M-R:

A. Connecting the 2400 station to a MicroScan v5.1 SCADA software package.

Programming the 2400 station requires MicroScan version 5.1 onwards, follow the instructions in the MicroScan Help. The first step under 'Setup Tools' is to click on "Add New Station". Refer to MicroScan Help to proceed.

B. When connecting to a PLC or similar, programming station inputs using Station Programmer.

Station Programmer can be downloaded from the download area of the Intech website.

1. Once the 2400-M-R station is connected to your PC (Connection to the 2400 Stations USB Port 3 is Recommended), start by opening the Station Programmer application.

2. There are two connection tabs; 'Serial Connection' or 'Network Connection'. Select the tab which corresponds to your current station's connection. Next click on the 'Auto Detect 2400 Station' button.

Note: the 'Auto Detect' can only be used to connect to a single 2400 station at a time, i.e. it should not be used on a data loop with multiple 2400 stations attached.

3. Once your computer has found the 2400 station and has finished receiving setup data, you are able to change the necessary channels to the input ranges you require from the drop down menus.

Note 1: It is a good idea to check the serial number at the top of the window matches the 2400 station you are trying to program.

Note 2: 'Same Range' tab sets all channels to the same range, 'Mixed Ranges' tab allows you to set the channels individually.

Note 3: The 'Station Name' field can be set to identify the station with a custom user friendly name.

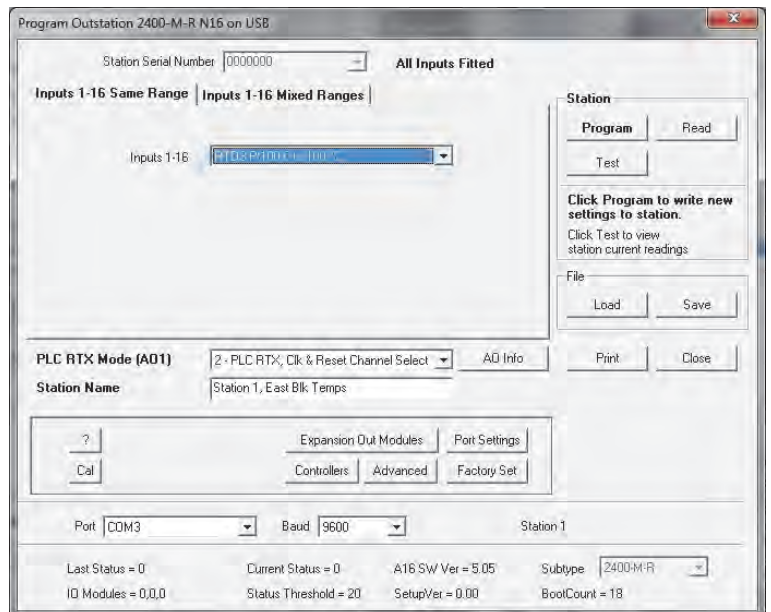
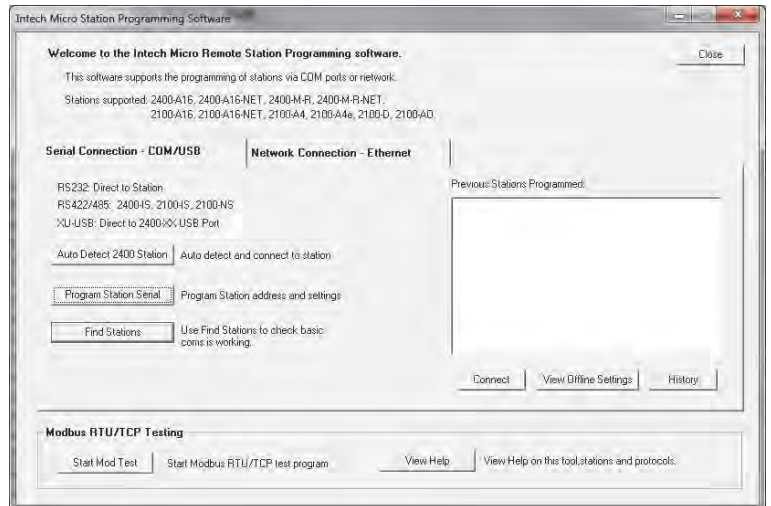
Note 4: See page 6 for selecting RTD Pt1000 inputs.

4. When you have finished setting up the channels, click 'Program'; this will then program the necessary changes into the 2400 station memory.

5. Now that the station is programmed, you can click the 'close' button to finish.

Note: Once you have programmed a 2400 Station for the first time, the Name and Serial number will be stored in your history and will appear in the 'Previous Stations Programmed' dialog box. This allows you to simply select the identified station and click connect.

For more detailed programming information, refer to 'View Help'.

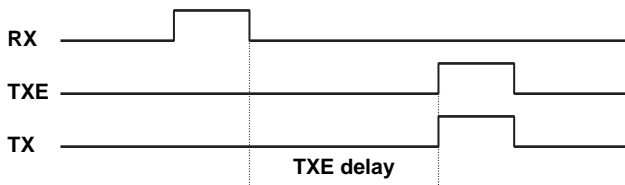


Programing the 2400-M-R Station Number.

1. The unique station number can be programmed using either MicroScan (version 5.1 onwards) or Station Programmer Software.
2. The programing software will require the 2400-M-R's serial number before allocating a station number, so remember to have it on hand before you begin.
3. Using Station Programmer: the 2400-M-R station number can be programmed by selecting 'Program Station Serial', and then clicking on either 'Add New Station' or 'Program Station Address' under Step 1. You can also program the station number via 'Port Settings' if you click the 'Auto Detect 2400 Station' option.
For MicroScan programming information, refer to 'Programming 2400-Series Remote Station' in the MicroScan Help.
4. Once programed, the station number will be stored in the 2400-M-R's permanent memory.

2400-M-R TXE Settings.

The TXE delays are software selectable in the MicroScan Outstation Programming Box.



TXE delay options: 2, 20, 50, 100ms.

These delays are used for RS422/485 operation, to control the behaviour of the transmitter on the outstation, when it is ready to send data. The TXE delay controls how long the transmitter waits before turning on.

Connecting to a PLC.

Connecting to a PLC as an Intelligent Multiplexer.

To set up the 2400-M-R as an intelligent multiplexer, a free software download is available from the Intech website Downloads area called Station Programmer. The analogue output mode must be selected as either Mode 2 or Mode 3. This is set in the 'Program Outstation' Dropdown menu 'PLC RTX Mode (AO1)'.

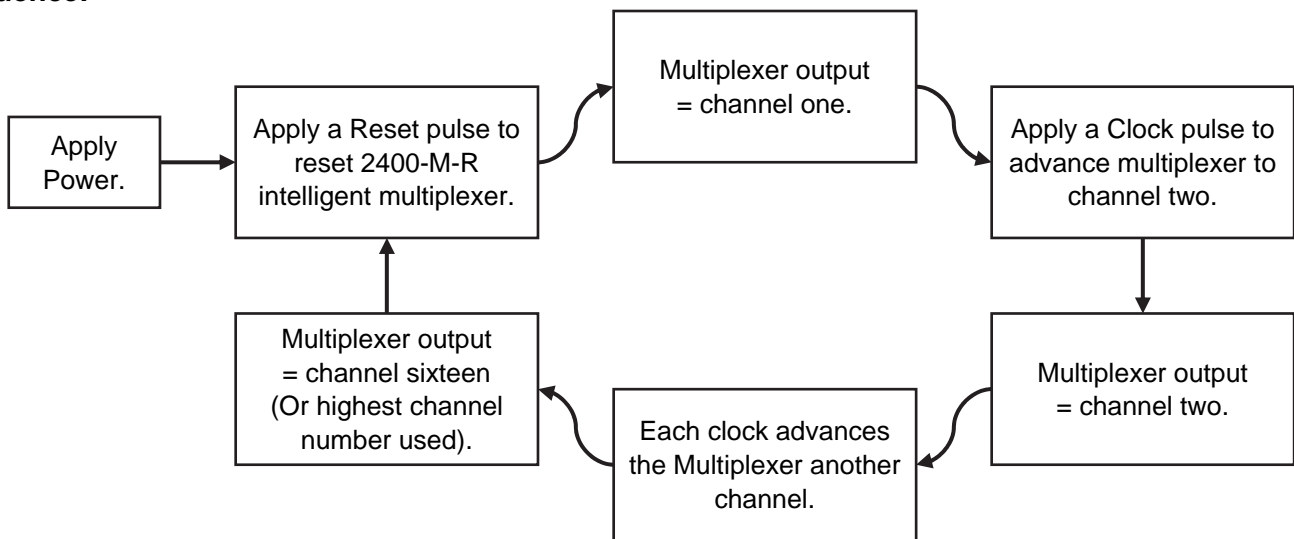
Mode 2. 2400-M-R Clock and Reset Channel Selection Mode, PLC Installation Guide.

- 2 - PLC RTX, Clk & Reset Channel Select.
- DI COM = CS COM.
- DI 1 = RESET Input.
- DI 2 = CLOCK Input.
- Issue a RESET pulse to select channel 1.
- Issue a CLOCK pulse to advance to the next channel.

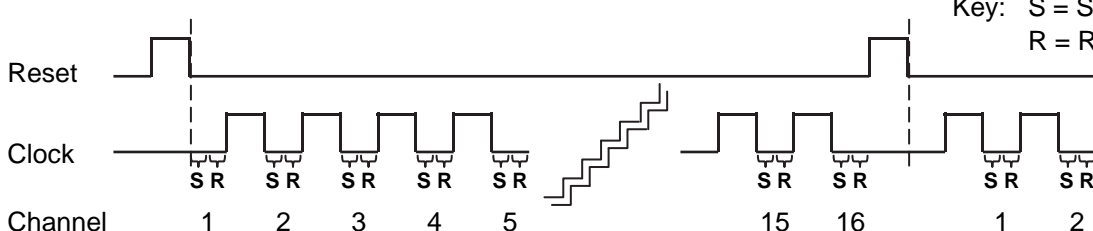
Specifications.

Clocking Speed	-Reset pulse length	20msec.
	-Clock pulse length	20msec.
Setting Times Before Reading	100msec Min. Multiple readings with averaging recommended.	
Note: Longer times may be required for longer cable lengths and higher resolution.		
Binary Signal Magnitude	-All modes	5~30Vdc.
Cycle Time	1 second to read all 16 inputs, 2 seconds to stop around all 16 inputs.	
Resolution	12Bits, 4000 steps typical.	

Sequence:



Operation:



Mode 3. 2400-M-R Clock and Reset Channel Selection Mode, PLC Installation Guide.

3 - PLC RTX, BCD Channel Select. Allows direct selection of input channel number.

Bin channel selection is by digital inputs D1~D4.

DI COM = CS COM.

DI 1 = BIN 1.

DI 2 = BIN 2.

DI 3 = BIN 4.

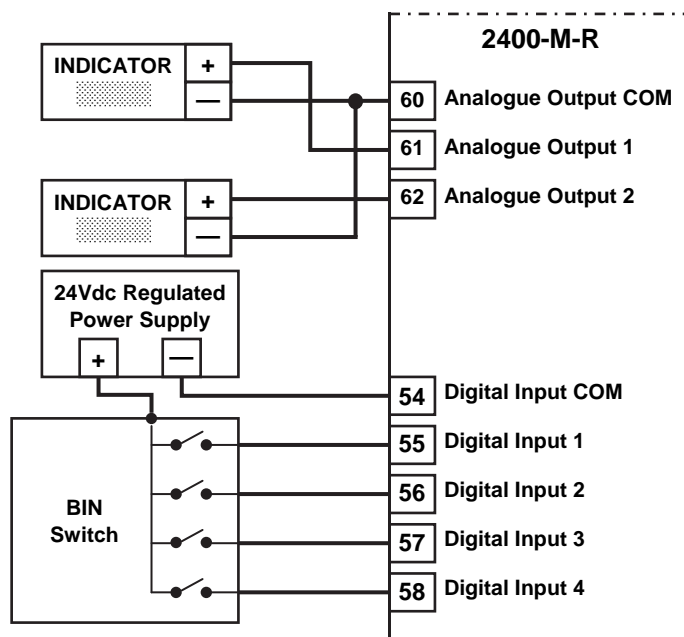
DI 4 = BIN 8.

Specifications.

Setting Times Before Readings	-All modes	100msec Min. Multiple readings with averaging recommended.
		-Note: Longer times may be required for longer cable lengths and higher resolution.
Binary Signal Magnitude	-All modes	5~30Vdc.
Cycle Time		4sec minimum to cycle through all 16 inputs.
Resolution		12Bits, 4000 steps typical.

2400-M-R Binary Channel Selection Mode Table.

Bin Channel Selection				Retransmission Channel
DI 1 BIN 1	DI 2 BIN 2	DI 3 BIN 4	DI 4 BIN 8	
0	0	0	0	1
1	0	0	0	2
0	1	0	0	3
1	1	0	0	4
0	0	1	0	5
1	0	1	0	6
0	1	1	0	7
1	1	1	0	8
0	0	0	1	9
1	0	0	1	10
0	1	0	1	11
1	1	0	1	12
0	0	1	1	13
1	0	1	1	14
0	1	1	1	15
1	1	1	1	16



Notes:

- Note 1. '0' = No voltage on the terminal.
'1' = 5~30Vdc on the terminal.
- Note 2. Ensure that if the analogue output from each 2400-M-R is fed into the same unit (e.g. PLC), then it is recommended that the analogue inputs to the PLC, etc, be isolated.
- Note 3. Analogue Output 1 = Retransmission of input process value 1~16.
Analogue Output 2 = Retransmission of controller setpoints 1~16.
- Note 4. The input and output always share the same range.
E.g. if input 1 is ranged 0~100°C and retransmission channel 1 is selected on Digital Input 1~4, then Analogue Outputs 1 & 2 are both transmitted as 4~20mA = 0~100°C.
Similarly if input 2 is ranged for 0~250°C, then Analogue Outputs 1 & 2 are transmitted as 4~20mA = 0~250°C.
- Note 5. If Analogue Output 1 process value or Analogue Output 2 are transmitted to an indicator, then all inputs must be ranged the same, unless the indicator is ranged 0~100%.
- Note 6. The PLC RTX modes can operate simultaneously with the SCADA COMMS, allowing a PLC to read back data that the SCADA will be showing.
- Note 7. Digital inputs and digital outputs are not available in the mode.

2400-M-R Used as an Intelligent Multiplexer. Connection Examples to a PLC With Open Collectors.

Connection Example 1 - Commoned to 24V.

Connection of a 2400-M-R to a PLC with open collectors, commoned to 24V of an external power supply.

Note 1. In this configuration the 2400-M-R Digital Input COM and Digital Inputs are isolated from the 2400-M-R inputs and outputs. The 24Vdc external power supply can therefore be used to power transmitters connected to the 2400-M-R inputs.

Note 2. There is no limit to the number of 2400-M-Rs that can be connected, except that the power supply and open collector outputs must be able to handle the load.

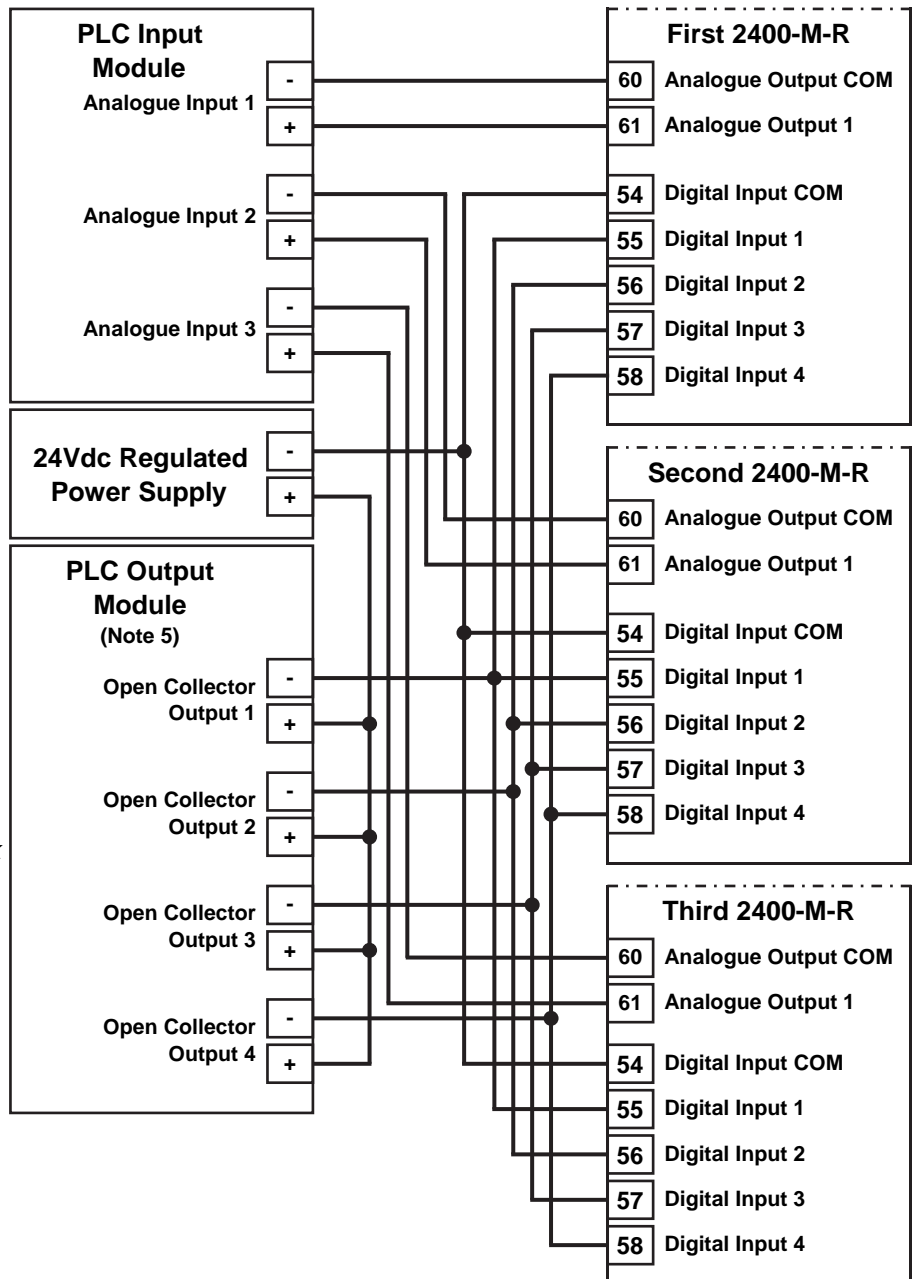
Note 3. Each digital input draws 10mA at 24Vdc.

Note 4. All cables must be screened, and the screens earthed at on end only.

Note 5. For Clock/Reset Channel Selection DO NOT connect PLC Outputs 3 & 4 to Digital Inputs 3 & 4 of the 2400-M-R.

* For PLC RTX, Clock & Reset Channel Selection refer to 'Mode 2. 2400-M-R Clock and Reset Channel Selection Mode' on page 14.

* For PLC RTX, Bin Channel Selection refer to 'Mode 3. 2400-M-R Clock and Reset Channel Selection Mode' on page 15.



Connection Example 2. - Commoned to 0V.

Connection of a 2400-M-R to a PLC with open collectors, commoned to 0V of an external power supply.

Note 1. This configuration reverses the logic so when the PLC digital output is off, the 2400-M-R is on.

Note 2. With 1K Ω resistor, up to four 2400-M-Rs can be connected in this configuration, provided the open collector outputs can handle the load.

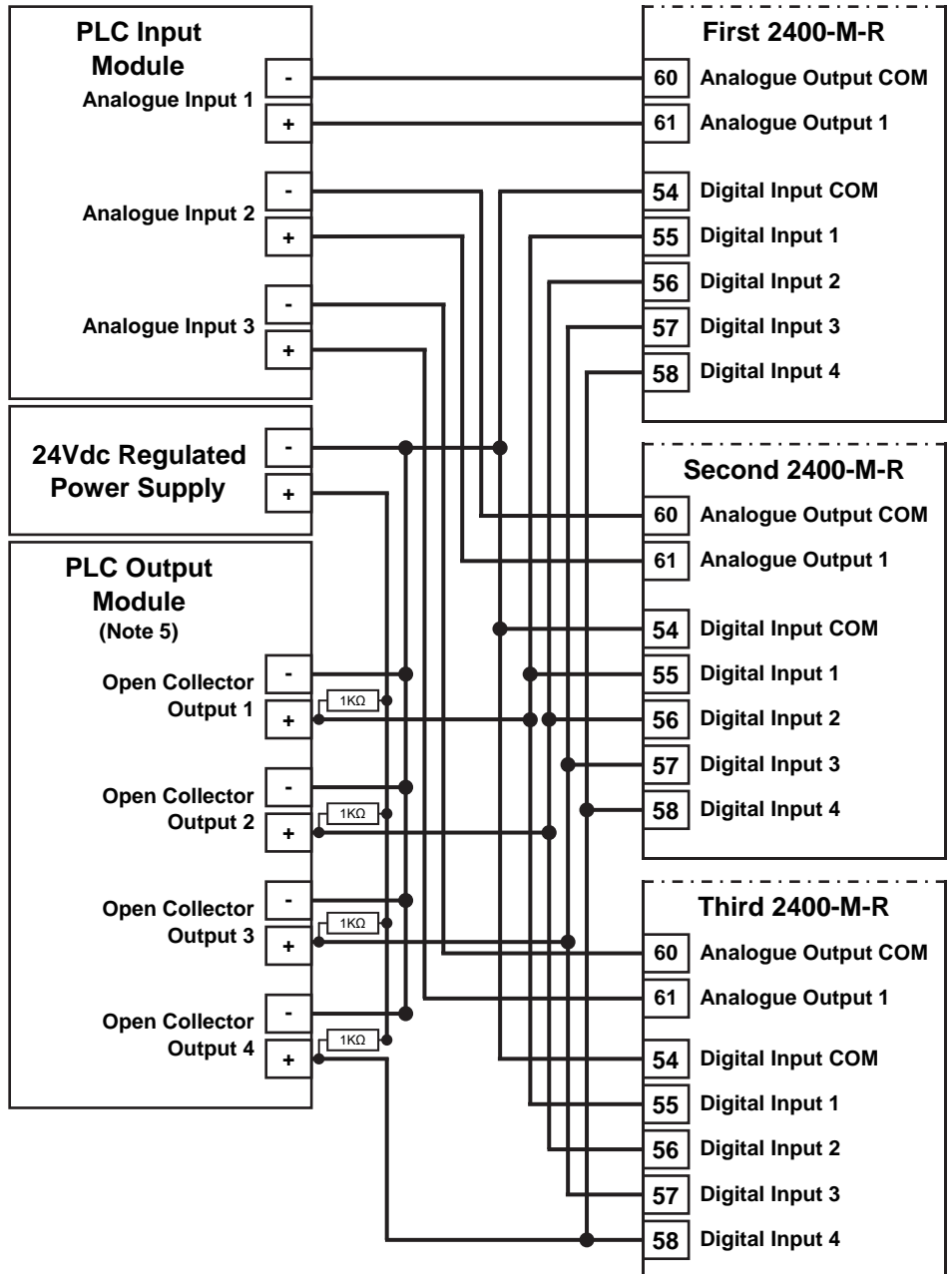
Note 3. Each digital input draws 10mA at 24Vdc.

Note 4. All cables must be screened, and the screens earthed at one end only.

Note 5. For Clock/Reset Channel Selection DO NOT connect PLC Outputs 3 & 4 to Digital Inputs 3 & 4 of the 2400-M-R.

* For PLC RTX, Clock & Reset Channel Selection refer to 'Mode 2. 2400-M-R Clock and Reset Channel Selection Mode' on page 14.

* For PLC RTX, Bin Channel Selection refer to 'Mode 3. 2400-M-R Clock and Reset Channel Selection Mode' on page 15.



2400-M-R PLC RTX Fail Safe System.

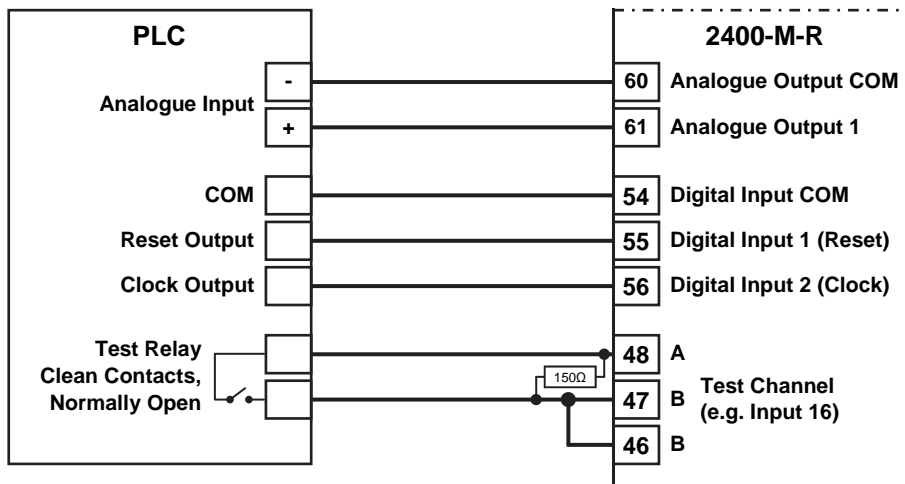
The PLC uses one channel of the 2400-M-R to verify that the 2400-M-R is reading the channel correctly, Analogue Output 1 is working, and the clock and reset/BCD channel select is working.

Test Channel = spare channel on 2400-M-R, set to RTD 0~250°C. This has a PLC relay connected which is used to short out A-B, under the PLCs command. Do not use Channel 1 as a test channel.

Sequence of Operation:

1. The PLC reads the required channels as normal.
2. The PLC then advances to the test channel (the next free channel or channel 16).
3. The test channel is read.
4. The relay changes state to alter the reading of the test channel.
5. Steps 1. to 4. are repeated. If the reading on the test channel does not alternate between 4mA & 12mA as the relay changes state, within the specified tolerances as listed below, then there is a fault in the system. The PLC software should be setup to detect these values as the relay changes state.

Relay State	Test Channel Reading	Output Value	PLC Test Value
Closed	Less than -15°C	4mA	Test for 5mA and below
Open	Approx. 130°C $\pm 10^{\circ}\text{C}$	12.3mA	Test for above 11.8mA and below 13mA



Communications.

2400-M-R 'Modbus RTU/TCP' Communication Protocol.

Note: This section only applies to Modbus Protocol resident on all 2400-M-R's.

Modbus RTU COMMS Specifications:

Error Check Standard Modbus CRC.

End of message framing delay Min: 5msec, Max: 7msec. (Minimum specification is 3.5sec @ 9600 baud).

Counting is based on internal 2.5msec timer.

Product Liability. Due to ongoing research and development, designs, specifications, and documentation are subject to change without notification.

2400-M-R Modbus Bridge.

For instructions covering MODBUS Bridge to the MicroScan protocol, please refer online:

www.intech.co.nz/2400-m-r

2400-M-R Modbus RTU Station Addresses.

Station addresses 1~64. The station number is programmed via the Program Address dialog box, which ties a station number to the serial number of the station which the Modbus protocol then uses. The Factory set default station number for all stations is Station #1. Station 0, broadcast commands are not supported.

Station address and input range configuration etc. are set using either MicroScan (version 5.1 onwards) or Station Programmer software. Setup of on-board station controllers and other station parameters supported in eeprom are also set via the programming dialog boxes. These parameters are not accessible via the protocol.

The station can be tested with the Stations test dialog box which shows the current values of the inputs and relay states, analogue output values can be set.

Using the Modbus Protocol.

The MicroScan/Modbus protocol selection is automatic.

2400-M-R Modbus RTU/TCP Address Map.

Coil Addresses (Relay Outputs)			
Coil (000xx)	Output	Coil (000xx)	Output
01	Internal Relay 1		
02	Internal Relay 2		
03-16	Reserved		
17	2400-R2 #1 Relay 1	33	2400-R2 #2 Relay 1
18	2400-R2 #1 Relay 2	34	2400-R2 #2 Relay 2
19	2400-R2 #1 Relay 3	35	2400-R2 #2 Relay 3
20	2400-R2 #1 Relay 4	36	2400-R2 #2 Relay 4
21	2400-R2 #1 Relay 5	37	2400-R2 #2 Relay 5
22	2400-R2 #1 Relay 6	38	2400-R2 #2 Relay 6
23	2400-R2 #1 Relay 7	39	2400-R2 #2 Relay 7
24	2400-R2 #1 Relay 8	40	2400-R2 #2 Relay 8
25	2400-R2 #1 Relay 9	41	2400-R2 #2 Relay 9
26	2400-R2 #1 Relay 10	42	2400-R2 #2 Relay 10
27	2400-R2 #1 Relay 11	43	2400-R2 #2 Relay 11
28	2400-R2 #1 Relay 12	44	2400-R2 #2 Relay 12
29	2400-R2 #1 Relay 13	45	2400-R2 #2 Relay 13
30	2400-R2 #1 Relay 14	46	2400-R2 #2 Relay 14
31	2400-R2 #1 Relay 15	47	2400-R2 #2 Relay 15
32	2400-R2 #1 Relay 16	48	2400-R2 #2 Relay 16

Note 1 2400-R2 must be fitted to access 2400-R2 relays 1~16, plus 2400-R2 enabled on Station Programming dialog box.

Note 2 Coils 3~16 reserved for future expansion.

2400-M-R Modbus RTU/TCP Inputs.

Digital Inputs	
Inputs (1 XXXX)	
10001	Digital Input 1
10002	Digital Input 2
10003	Digital Input 3
10004	Digital Input 4
10005-10016	Reserved

Note Inputs 5~16 reserved for future expansion.

2400-M-R Modbus RTU/TCP Address Map.

Input Registers (Analogue Inputs)	
(3XXXX, 4XXXX)	Input
30001	Input 1 (12 Bit 000-FFF) * Note 1
30002	Input 2 (12 Bit 000-FFF) * Note 1
30003	Input 3 (12 Bit 000-FFF) * Note 1
30004	Input 4 (12 Bit 000-FFF) * Note 1
30005	Input 5 (12 Bit 000-FFF) * Note 1
30006	Input 6 (12 Bit 000-FFF) * Note 1
30007	Input 7 (12 Bit 000-FFF) * Note 1
30008	Input 8 (12 Bit 000-FFF) * Note 1
30009	Input 9 (12 Bit 000-FFF) * Note 1
30010	Input 10 (12 Bit 000-FFF) * Note 1
30011	Input 11 (12 Bit 000-FFF) * Note 1
30012	Input 12 (12 Bit 000-FFF) * Note 1
30013	Input 13 (12 Bit 000-FFF) * Note 1
30014	Input 14 (12 Bit 000-FFF) * Note 1
30015	Input 15 (12 Bit 000-FFF) * Note 1
30016	Input 16 (12 Bit 000-FFF) * Note 1
30017	Input 1 (IEEE 754 - 2 Words)
30019	Input 2 (IEEE 754 - 2 Words)
30021	Input 3 (IEEE 754 - 2 Words)
30023	Input 4 (IEEE 754 - 2 Words)
30025	Input 5 (IEEE 754 - 2 Words)
30027	Input 6 (IEEE 754 - 2 Words)
30029	Input 7 (IEEE 754 - 2 Words)
30031	Input 8 (IEEE 754 - 2 Words)
30033	Input 9 (IEEE 754 - 2 Words)
30035	Input 10 (IEEE 754 - 2 Words)
30037	Input 11 (IEEE 754 - 2 Words)
30039	Input 12 (IEEE 754 - 2 Words)
30041	Input 13 (IEEE 754 - 2 Words)
30043	Input 14 (IEEE 754 - 2 Words)
30045	Input 15 (IEEE 754 - 2 Words)
30047	Input 16 (IEEE 754 - 2 Words)
30113	Counter 1 (0-FFFF) * Note 2
30114	Counter 2 (0-FFFF) * Note 2
30115	Counter 3 (0-FFFF) * Note 2
30116	Counter 4 (0-FFFF) * Note 2
30117, 40117	Analogue Out 1 (0-FFF) * Note 3
30118, 40118	Analogue Out 2 (0-FFF) * Note 3
30119	Reserved
30120	Reserved
30121	Ambient Sensor (IEEE 754 - 2 Words)

2400-M-R Modbus Notes.

Note 1: Analogue Inputs 1~16 scaling:

0-FFF = 0~4095, which is ranged according to the range selected for each input.

For RTD -25 to +25, then 0 = -25, 4095 = +25.

For RTD 0 to +25, then 0 = 0, 4095 = +25.

Note 2: Counter Inputs:

Value ranges from 0-FFFF which is 0 - 65535.

Max speed 8,000Hz. (50~500Hz is the MicroScan limitation.)

Do not read counters when MicroScan V4 is reading counters on a different port.

Count value is reset to zero on power up.

Note 3: Analogue Outputs:

Mode is set in Station programming dialog box, AO1 & AO2 mode.

Mode 1 *Not Available on the 2400-M-R.*

Mode 2 is SCADA outputs, AO1, AO2 can be set via protocol.

Mode 3 is retransmission of input to AO1, clock and reset channel selection.

Mode 4 is retransmission of input to AO1, binary channel selection.

30117, 30118 = Read Only

40117, 40118 = Read/Write

Note 4: Analogue Input Speed:

Inputs are scanned sequentially by the 2400-M-R, a read of the data locations, reads the last value read and does not force the 2400-M-R to read the inputs requested by the protocol read.

The normal read speed with all sixteen inputs is 16 channels/second.

Channels that are not scanned can be disabled via the station programming dialog boxes.

Supported Modbus Commands.

Modbus Commands	
Command	
Read Coil	01 (0xxxx)
Force Single Coil	05 (0xxxx)
Force Multiple Coil	15 (0xxxx)
Read Input	02 (0xxxx)
Read Input Register	04 (0xxxx)
Read Holding Register	03 (0xxxx)
Write Holding Register	06 (0xxxx)
Write Multiple Holding Register	16 (0xxxx)

Notes:

Maximum length of Modbus command = 32bytes.

Maximum length of Modbus reply = 80bytes.

CITECH Floating Point Format.

Floating point Byte Order = 1 (3,2,1,0).

```
CITECH.INI
[Modbus]
FloatMode=1
```

Set using Modbus help in CITECH help file.

2400-M-R Input Counter Registers.

Digital Inputs 1~4 16bit value.

2100-A16 Compatible.

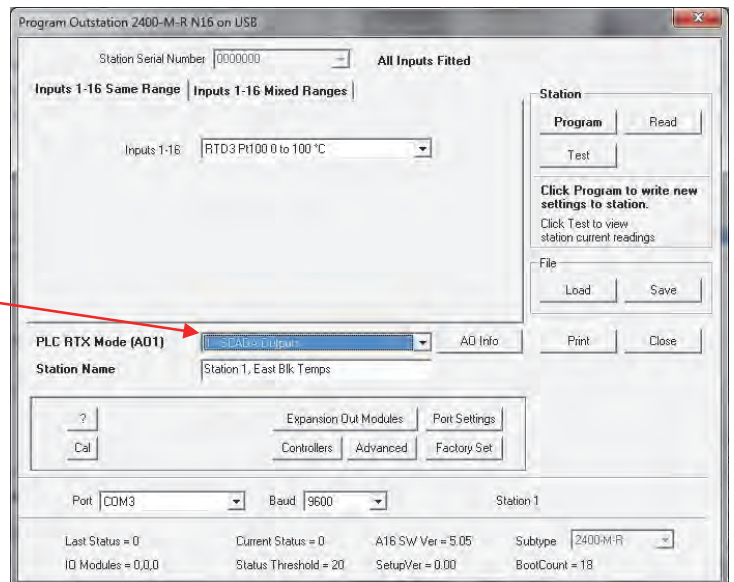
Wraps around at FFFF to 0. May speed 8KHz.

Digital Input	Address (access as holding register or input register)
1	113
2	114
3	115
4	116

Note: Counters cannot be used if PLC RTX modes are set. To use the digital inputs as counters the 2400-M-R must be put into the SCADA Outputs mode. This can be done via the Station Programmer software. Refer to '2400 Station Software Programming' on page 13.

Once you have the 'Program Outstation...' window open, select 'SCADA Outputs' from the drop down menu next to 'PLC RTX MODE (AO1)'.

Then select 'Program', and then 'Close'



Digital Inputs 1~4 32bit Counter Value.

Wraps around at FFFF FFFF to 0. May speed 8KHz.

Digital Input	Address (access as holding register or input register)
1	369
2	371
3	373
4	375

Data format Little Endian (low address = least significant, high address = most significant).

Value is continually counting. Use sequential reads and subtract values to work out count value that has occurred since last read.

Wiring, Installation and Maintenance.

2400-M-R Wiring and Installation.

THE 2400-M-R IS TO BE INSTALLED AND SERVICED BY SERVICE PERSONNEL ONLY. NO OPERATOR / USER SERVICEABLE PARTS.

All power and signals must be de-energised before connecting any wiring.

Do not start the MicroScan before programming in a unique station number. Refer 'Station Number Programming and Serial Number'.

Mounting:

* Also refer to Connection Diagrams and Notes.

- 1) Mount in a clean environment in an electrical cabinet on 35mm Symmetrical mounting rail.
- 2) Draft holes must have minimum free air space of 20mm. Foreign matter must not enter or block the draft holes.
- 3) Do not subject to vibration or excess temperature or humidity variations.
- 4) Avoid mounting in cabinets with power control equipment.
- 5) To maintain compliance with the EMC Directives, the 2400-M-R is to be mounted in a fully enclosed steel fire cabinet. The cabinet must be properly earthed, with appropriate input/output entry points and cabling.
- 6) Allow 10mm minimum clearance between the 2400-M-R terminals and ANY conductive material.

RTDs:

- 1) Avoid locating the RTD where it will be in a direct flame.
- 2) Locate it where the average temperature will be measured. It should be representative of the mass.
- 3) Immerse the RTD far enough so that the measuring point is entirely in the temperature to be measured; nine to ten times the diameter of the protection tube is recommended. Heat that is conducted away from the measuring point causes an error in reading.

Power Supply Wiring:

- 1) Use Only Instrument Quality Power Supplies.
- 2) A readily accessible disconnect device and a 1A, 250Vac overcurrent device, must be in the power supply wiring.
- 3) For power supply, connect Phase (or +Ve) to terminal 82, Neutral (or -Ve) to 81.

RS422/485 Data Hi-Way Signal Cabling:

- 1) Use only low capacitance, twisted pair, overall screened data cable. The cable must equal or better the following specifications:

Cable Specifications.		
Conductor Size		7/0.20mm, 24AWG
Conductor Resistance @ 20C		8.9Ω/100m
Maximum Working Voltage		300Vrms
Capacitance between wires of a pair		50pF/m
Capacitance between each wire to all others bunched together		95pF/m
Cross-talk between pairs	@ 1kHz @ 100kHz	>-90dB/100m >-50dB/100m
Characteristic Impedance	@ 100kHz	135Ω
Attenuation of a pair	@ 1kHz @ 10kHz @ 100kHz @ 50kHz @ 1MHz @ 1.5MHz	0.15dB/100m 0.42dB/100m 0.8dB/100m 0.9dB/100m 1.9dB/100m 2.4dB/100m

NOTE: All cables are to be subject during manufacture to in-process spark testing @ 4kVrms.
All cables are to be tested between conductors and conductors to screen for 1min @ 1500Vrms.

- 2) Minimum cable pairs: RS422 = 2. (Plus overall screen.)
RS485 = 1. (Plus overall screen.)
- 3) Take care not to stress or damage cables during installation.
- 4) Total length of trunk line, including spurs, is not to exceed 1200m without isolating boosters.
- 5) Terminating resistors -1KΩ.
- 6) Cabling paths should avoid sources of radio frequency interferences such as fluorescent lights, variable speed motor drives, welding equipment, radio transmitters, etc.
- 7) There should be a minimum of 200mm physical separation between power cables and data cables.
- 8) Data cables should not be exposed to excessive heat or moisture, and should not be buried directly in the ground without protection.
- 9) Avoid powering a remote station or controller from the same power supply as a variable speed drive.
- 10) All unused twisted pairs should be terminated at both ends with 1kΩ resistors. DO NOT ground unused pairs.

USB Programming Port:

The USB port on the 2400-M-R is the best method for programming the station before it's first use. This port can only be connect to a PC via the XU-USB Programming key. Refer to the Layout & Dimensions on page 5 to locate Port 3.

2400-M-R Commissioning.

- 1) **WARNING: Ensure that all programming is carried out BEFORE any wiring takes place!**
- 2) Check that the 2400-M-R has been set to the correct input ranges and all functions such as Upscale/Downscale Drive etc. Observe polarity and the correct terminal connections for wiring correctly. Only use certified calibration equipment.
- 3) Once the above conditions have been met, and the wiring checked, apply power to the 2400-M-R, sensors, 2400-A16s and 2400-R2s. Allow a 5 minute warm-up period.
Note 1. There is a 15sec initialisation period when the 2400-M-R is powered up, before it will communicate.
Note 2. For maximum accuracy allow a 6 hour warm up period.
- 4) **RTD Inputs Only:** A small error can occur due to differences in cable resistance in the RTD legs and errors in the RTD itself. (Usually less than 0.5°C). To check the variable being measured use a calibration standard RTD at the same immersion depth. If the Zero error is large, the readings are fluctuating or a Zero error has suddenly appeared after the 2400-M-R has been operating for some time, there could be an earth loop between two or more RTD sensors on the 2400-M-R (or between 2400-A16s if connected). Disconnect each RTD sensor individually from the 2400-M-R, and 'Megger' the RTD by shorting all three wires together and testing from this point to earth. If a path to earth is found, repair or replace the faulty RTD sensor or probe.
Warning: Do not 'Megger' RTDs while connected to the 2400-A16. Damage to the 2400-A16 or 2400-M-R will result.
- 5) **For PLC Clock/Reset or Binary Channel Selection:** Check that the red LEDs on the appropriate digital inputs on the 2400-M-R are flashing. If there are any issues, check instructions under 'Connecting to a PLC' on page 14.
- 6) **Calibration Check:** Take a reading of the value being measured on each channel, and ensure that this agrees with the level being indicated by the PLC or SCADA, for that channel. Adjust for any differences.
- 7) **Analogue Outputs:** The two 4~20mA Analogue Outputs can be changed to voltage type by using an appropriate 0.1% tolerance resistor:
 - 250ohm = 1~5V
 - 500ohm = 2~10V

2400-M-R Maintenance.

RTD Inputs.

- (1) Replace defective protection tubes - even if they look good they may not be air or gas tight.
- (2) Check cables entering the RTD sensor head.
- (3) Repeat (6) of commissioning. Do it regularly - at least once per year.

