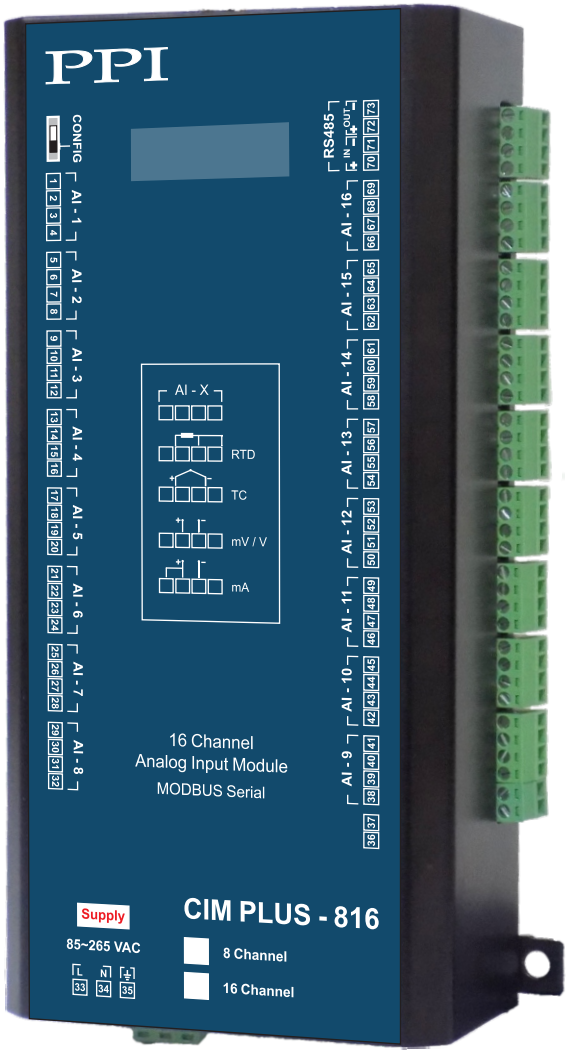
CIM Plus - 816

PPI
The Perfection Experts

8/16 Universal Channel Analog Input Module

85~265 VAC Supply Operated



User Manual

CONTENTS

1. MOUNTING & ELECTRICAL CONNECTIONS **1**

2. PARAMETERS **5**

3. CONFIGURING COMMUNICATION PARAMETER **12**

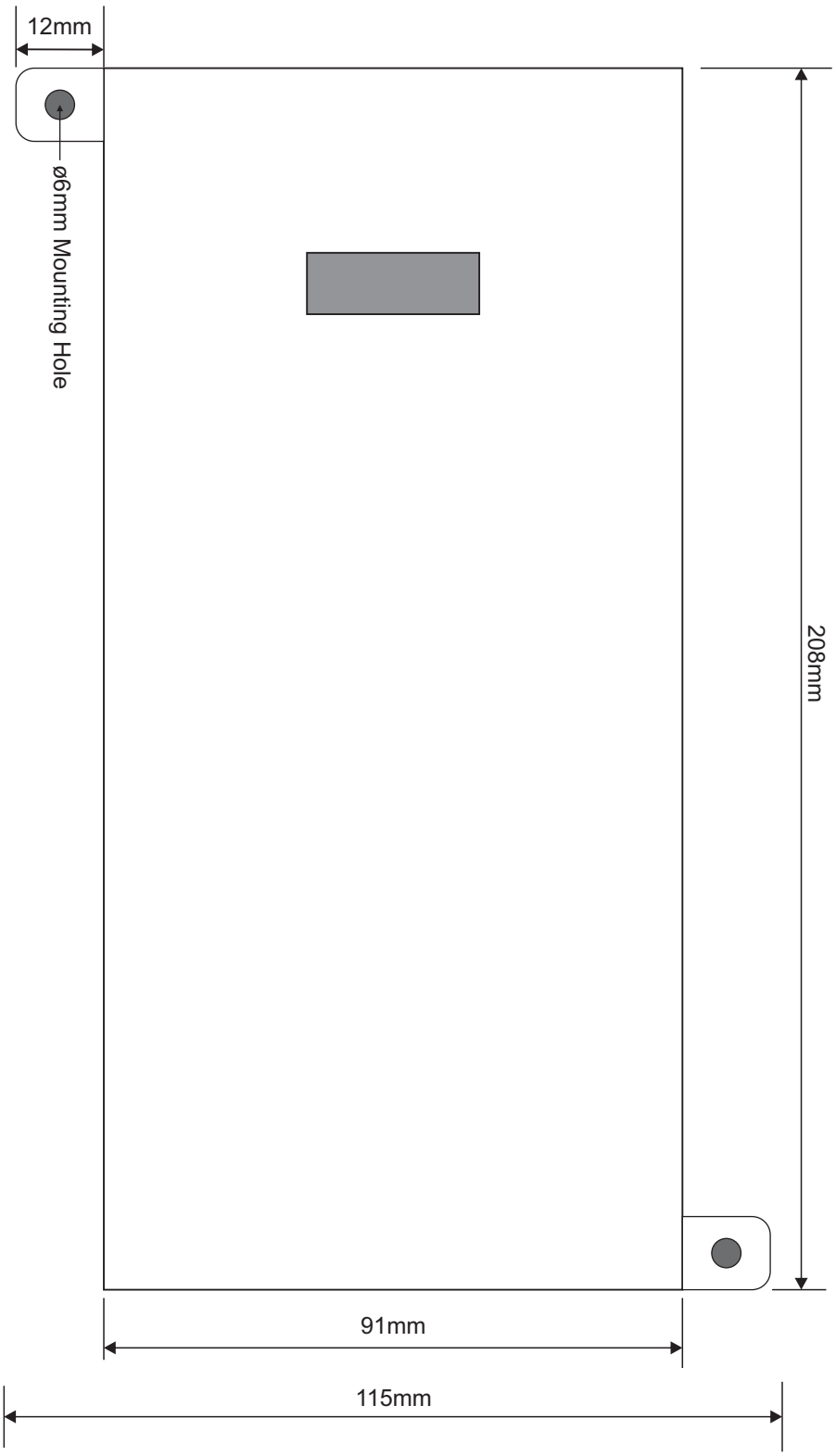
APPENDIX A : DC LINEAR SIGNAL INTERFACE **14**

APPENDIX B : BOTTOM / TOP CLIPPING **16**

APPENDIX C : PROCESS VALUE IN 'FLOAT' DATA FORMAT **17**

Section 1
MOUNTING & ELECTRICAL CONNECTIONS

Figure 1.1 : CIM Plus 16 Channel Mounting (Base / Wall Mounting)



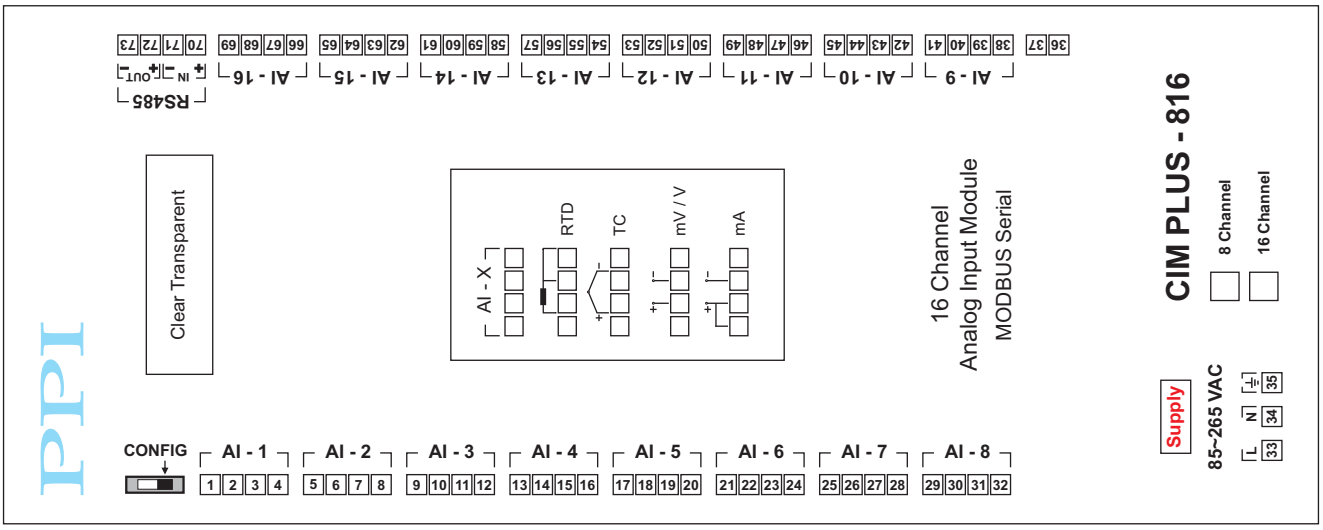
WARNING
MISHANDLING / NEGLIGENCE CAN RESULT IN PERSONAL DEATH OR SERIOUS INJURY.

1. The user must rigidly observe the Local Electrical Regulations.
2. Do not make any connections to the unused terminals for making a tie-point for other wires (or for any other reasons) as they may have some internal connections. Failing to observe this may result in permanent damage to the indicator.
3. Run power supply cables separated from the low-level signal cables (like RTD, Thermocouples, DC Linear Current / Voltage etc.). If the cables are run through conduits, use separate conduits for power supply cable and low-level signal cables.
4. Use appropriate fuses and switches, wherever necessary, for driving the high voltage loads to protect the module from any possible damage due to high voltage surges of extended duration or short-circuits on loads.
5. Take care not to over-tighten the terminal screws while making connections.
6. Make sure that the module supply is switched-off while making/removing any connections.

CONNECTION DIAGRAM

The Figure 1.2 illustrate Electrical Connection Diagrams for 8 & 16 Channel Version respectively.

Figure 1.2 : 8 & 16 Channel Module



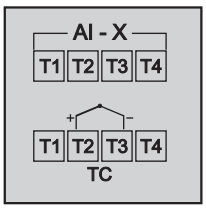
Input Channels (1 to 8 OR 1 to 16)

Each of the 8 or 16 input channels are identical from wiring connection viewpoint. For explanation purpose, the 4 terminals pertaining to each channel have been marked as T1, T2 ,T3 & T4 in the following pages. The descriptions below apply to all the channels with no deviations.

Thermocouple

Connect Thermocouple Positive (+) to terminal T2 and Negative (-) to terminal T3 as shown in **Figure 1.3**. Use the correct type of Thermocouple extension lead wires or compensating cable for the entire distance ensuring the correct polarity throughout. Avoid joints in the cable.

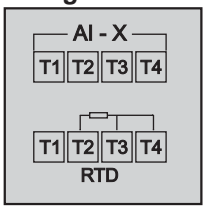
Figure 1.3



RTD Pt100, 3-wire

Connect single leaded end of **RTD** bulb to terminal T2 and the double leaded ends to terminals T3 and T4 (interchangeable) as shown in **Figure 1.4.** Use copper conductor leads of very low resistance ensuring that all 3 leads are of the same gauge and length. Avoid joints in the cable.

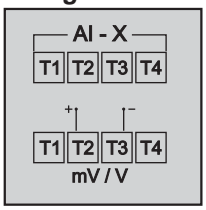
Figure 1.4



DC Linear Voltage (mV / V)

Use a shielded twisted pair with the shield grounded at the signal source for connecting mA / mV / V source. Connect common (-) to terminal T3 and the signal (+) to terminal T2, as shown in **Figure 1.5.**

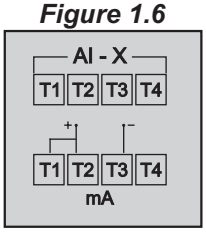
Figure 1.5



DC Linear Current (mA)

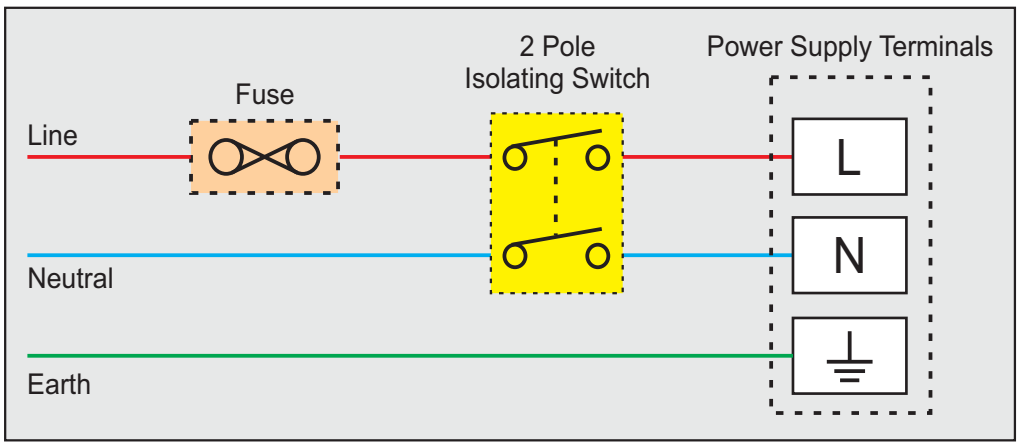
Use a shielded twisted pair with the shield grounded at the signal source for connecting mA source. Connect common (-) to terminal T3 and the signal (+) to terminal T2. Also **short** terminals T1 & T2. Refer **Figure 1.6.**

Figure 1.6



POWER SUPPLY

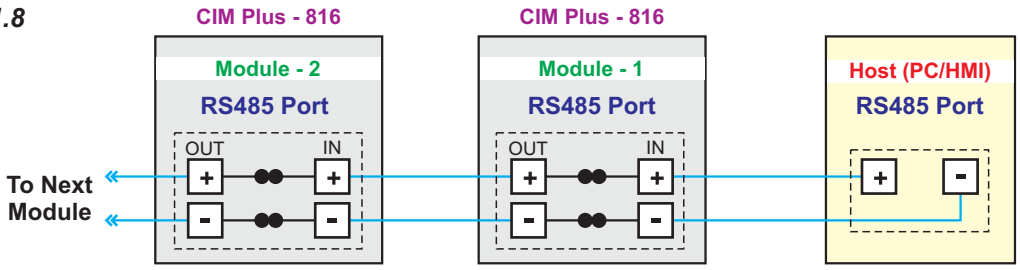
Figure 1.7



As standard, the module is supplied with power connections suited for 85 to 264 VAC line supply. Use well-insulated copper conductor wire of the size not smaller than 0.5mm² for power supply connections ensuring proper polarity as shown in Figure 1.7. The module is not provided with fuse and power switch. If necessary, mount them separately. Use a time lag fuse rated 1A @ 240 VAC.

SERIAL COMMUNICATION PORT

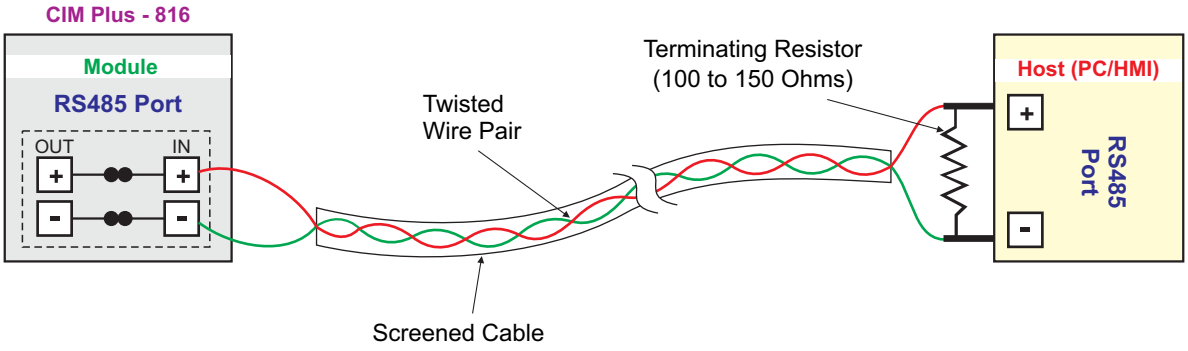
Figure 1.8



The wiring connections for interfacing the Host (PC/HMI) with one or multiple Module(s) is shown in the figure 1.8.

For reliable noise free communication, use a pair of twisted wires inside screened cable. The wire should have less than 100 ohms / km nominal DC resistance (Typically 24 AWG or thicker). Connect the terminating resistor (Typically 100 to 150 ohm) at one end to improve noise immunity. Refer Figure 1.9.

Figure 1.9



Note

In case of non-availability of RS485 port on Host PC, use appropriate **Serial Protocol Converter** to match the available serial port on the host like USB to RS485 and RS232 to RS485 (Refer few images below). Please ensure that the appropriate **Device Driver** for the selected converter is installed on the Host PC.

RS232 to RS485

USB to RS485

Section 2
PARAMETERS

The Module supports industry standard MODBUS RTU over Serial Protocol for communicating Process Values, Alarm Status & Operation Parameters for various Channels.

The communication parameter settings and the data packet format have been discussed in *Section 3 : Configuring Communication Parameters*.

To minimize the protocol complexity at Master end, all the parameters have been assembled as **Registers**. The *Read Only* parameters are specified as **Input Registers** while the *Read/Write* parameters are specified as **Holding Registers**.

The Table 2.1 describes Input Registers (Read only parameters) and Table 2.2 describes Holding Registers (Read/Write Parameters), respectively. The MODBUS addresses are also specified.

Table 2.1 : Input Registers (Read-Only Parameters)

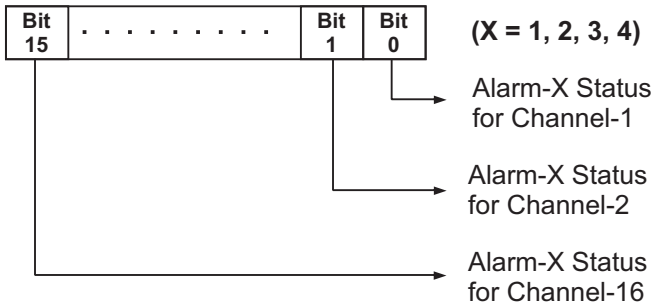
<table>
<tr><th>Parameter Description</th><th>Address</th><th>Values</th></tr>
<tr><td>Process Value (Note 1)

These parameters indicate the measured Temperature (in °C/°F) for Thermocouple / RTD inputs or Scaled Counts for DC Volts / mA inputs.

Note :
The Process Values are also available in 32-Bit Single Precision Float format. Refer Appendix-C.</td><td>1561
to
1568
(8 Channels)

1561
to
1576
(16 Channels)</td><td>Signed integer values from -30000 to +30000 representing the measured process values. Refer Table 2.3 for the various input types and the corresponding measured ranges.

The following constant counts indicate PV Errors.

<table><tr><th>Value</th><th>PV Error Type</th></tr><tr><td>-32768</td><td>Under Range</td></tr><tr><td>+32752</td><td>Over Range</td></tr><tr><td>+32767</td><td>Sensor Open</td></tr></table></td></tr>
<tr><td>Alarm-1 Status</td><td>1577</td><td rowspan="4"> 

<table><tr><th>Bit Value</th><th>Status</th></tr><tr><td>0</td><td>Alarm OFF</td></tr><tr><td>1</td><td>Alarm ON</td></tr></table>For 8 Channel Version (CIM Plus-8), ignore Bit-8 to Bit-15</td></tr>
<tr><td>Alarm-2 Status</td><td>1578</td></tr>
<tr><td>Alarm-3 Status</td><td>1579</td></tr>
<tr><td>Alarm-4 Status</td><td>1580</td></tr>
<tr><td>Ambient Temperature

This parameter indicates the room Temperature (in °C) measured by the sensor mounted inside the instrument.</td><td>82</td><td>Signed integer values from -30000 to +30000 representing the measured Ambient Temperature through the semi-conductor sensor mounted on the Module.

The measured value is always in °C with 0.1 resolution. For example, 30.0°C is represented as 300.</td></tr>
</table>

Table 2.2 : Holding Registers (Read/Write Parameters)

<table>
<tr><th>Parameter Description</th><th>Address</th><th>Settings
(Default Value)</th></tr>
<tr><td>Input Type

Select Input type in accordance with the type of Thermocouple or RTD sensor or transducer output connected for process value measurement.</td><td>83 to 90
(8 Channels)

83 to 98
(16 Channels)</td><td>
<table>
<tr><th>Value</th><th>Type</th></tr>
<tr><td>0</td><td>Type J Thermocouple</td></tr>
<tr><td>1</td><td>Type K Thermocouple</td></tr>
<tr><td>2</td><td>Type T Thermocouple</td></tr>
<tr><td>3</td><td>Type R Thermocouple</td></tr>
<tr><td>4</td><td>Type S Thermocouple</td></tr>
<tr><td>5</td><td>Type B Thermocouple</td></tr>
<tr><td>6</td><td>Type N Thermocouple</td></tr>
<tr><td>7</td><td>Reserved TC</td></tr>
<tr><td>8</td><td>RTD Pt100, 3-wire</td></tr>
<tr><td>9</td><td>0 to 20 mA</td></tr>
<tr><td>10</td><td>4 to 20 mA</td></tr>
<tr><td>11</td><td>0 to 80 mV</td></tr>
<tr><td>12</td><td>Reserved</td></tr>
<tr><td>13</td><td>0 to 1.25 V</td></tr>
<tr><td>14</td><td>0 to 5 V</td></tr>
<tr><td>15</td><td>0 to 10 V</td></tr>
<tr><td>16</td><td>1 to 5 V</td></tr>
</table>
(Default : 0 to 10 V)
</td></tr>
<tr><td>Temperature Units

(Applicable only for Thermocouples & RTD Pt100 Inputs)

Selects temperature measurement units in °C or °F.</td><td>99 to 106
(8 Channels)

99 to 114
(16 Channels)</td><td>Conditional Parameter (Note2)
<table>
<tr><th>Value</th><th>Unit</th></tr>
<tr><td>0</td><td>°C</td></tr>
<tr><td>1</td><td>°F</td></tr>
</table>
(Default : °C)
</td></tr>
<tr><td>DC Resolution (Note1)

(Applicable only for mV / V / mA Inputs)

This parameter value should be used in conjunction with the process value for interpretation of decimal place.

For example if the value for this parameter is 0.01 then the measured process value of 3000 should be interpreted as 30.00.</td><td>115 to 122
(8 Channels)

115 to 130
(16 Channels)</td><td>Conditional Parameter (Note2)
<table>
<tr><th>Value</th><th>Resolution</th></tr>
<tr><td>0</td><td>1</td></tr>
<tr><td>1</td><td>0.1</td></tr>
<tr><td>2</td><td>0.01</td></tr>
<tr><td>3</td><td>0.001</td></tr>
<tr><td>4</td><td>0.0001</td></tr>
</table>
(Default : 1 Unit for DC Linear input &
0.1 for Thermocouple & RTD)
</td></tr>
</table>

<table>
<tr><th>Parameter Description</th><th>Address</th><th>Settings
(Default Value)</th></tr>
<tr><td>Signal Low

(Applicable only for mV / V / mA Inputs)

The transmitter output signal value corresponding to Range Low process value.

Refer Appendix-A : DC Linear Signal Interface for details.

Note : The value should be set as integer counts ignoring decimal value. For e.g. 4.00 mA should be set as 400 counts.</td><td>501 to 508
(8 Channels)

501 to 516
(16 Channels)</td><td>Conditional Parameter (Note2)

<table><tr><th>Input Type</th><th>Settings</th><th>Default</th></tr><tr><td>0 to 20 mA</td><td>0.00 to Signal High</td><td>0.00</td></tr><tr><td>4 to 20 mA</td><td>4.00 to Signal High</td><td>4.00</td></tr><tr><td>0 to 80 mV</td><td>0.00 to Signal High</td><td>0.00</td></tr><tr><td>0 to 1.25 V</td><td>0.000 to Signal High</td><td>0.000</td></tr><tr><td>0 to 5 V</td><td>0.000 to Signal High</td><td>0.000</td></tr><tr><td>0 to 10 V</td><td>0.00 to Signal High</td><td>0.00</td></tr><tr><td>1 to 5 V</td><td>1.000 to Signal High</td><td>1.000</td></tr></table></td></tr>
<tr><td>Signal High

(Applicable only for mV / V / mA Inputs)

The transmitter output signal value corresponding to Range High process value.

Refer Appendix-A : DC Linear Signal Interface for details.

Note : The value should be set as integer counts ignoring decimal value. For e.g. 80.00 mV should be set as 8000 counts.</td><td>517 to 524
(8 Channels)

517 to 532
(16 Channels)</td><td>Conditional Parameter (Note2)

<table><tr><th>Input Type</th><th>Settings</th><th>Default</th></tr><tr><td>0 to 20 mA</td><td>Signal Low to 20.00</td><td>20.00</td></tr><tr><td>4 to 20 mA</td><td>Signal Low to 20.00</td><td>20.00</td></tr><tr><td>0 to 80 mV</td><td>Signal Low to 80.00</td><td>80.00</td></tr><tr><td>0 to 1.25 V</td><td>Signal Low to 1.250</td><td>1.250</td></tr><tr><td>0 to 5 V</td><td>Signal Low to 5.000</td><td>5.000</td></tr><tr><td>0 to 10 V</td><td>Signal Low to 10.00</td><td>10.00</td></tr><tr><td>1 to 5 V</td><td>Signal Low to 5.000</td><td>5.000</td></tr></table></td></tr>
<tr><td>Range Low

(Applicable only for mV / V / mA Inputs)

The process value corresponding to the Signal Low value from the transmitter.

Refer Appendix-A : DC Linear Signal Interface for details.</td><td>131 to 138
(8 Channels)

131 to 146
(16 Channels)</td><td>Conditional Parameter (Note2)

-30000 to 30000
(Default : 0)</td></tr>
<tr><td>Range High

(Applicable only for mV / V / mA Inputs)

The process value corresponding to the Signal High value from the transmitter.

Refer Appendix-A : DC Linear Signal Interface for details.</td><td>147 to 154
(8 Channels)

147 to 162
(16 Channels)</td><td>Conditional Parameter (Note2)

-30000 to 30000
(Default : 1000)</td></tr>
<tr><td>Offset for PV (Note1)

This value is algebraically added to the measured PV to derive the final PV.

Final PV = Measured PV + Offset</td><td>163 to 170
(8 Channels)

163 to 178
(16 Channels)</td><td>-30000 to 30000
(Default : 0)</td></tr>
</table>

<table>
<tr><th>Parameter Description</th><th>Address</th><th>Settings
(Default Value)</th></tr>
<tr><td>Alarm-1 Type

Refer Alarm-4 Type</td><td>179 to 186
(8 Channels)
179 to 194
(16 Channels)</td><td rowspan="3"><table><tr><th>Value</th><th>Type</th></tr><tr><td>0</td><td>None</td></tr><tr><td>1</td><td>Process Low</td></tr><tr><td>2</td><td>Process High</td></tr></table>
(Default : None)</td></tr>
<tr><td>Alarm-2 Type

Refer Alarm-4 Type</td><td>243 to 250
(8 Channels)
243 to 258
(16 Channels)</td></tr>
<tr><td>Alarm-3 Type

Refer Alarm-4 Type</td><td>307 to 314
(8 Channels)
307 to 322
(16 Channels)</td></tr>
<tr><td>Alarm-4 Type

None
The Alarm function is disabled.

Process Low
The Alarm is activated upon the PV equaling or falling below the ‘Alarm Set-point’ value.

Process High
The Alarm is activated upon the PV equaling or rising above the ‘Alarm Set-point’ value.</td><td>371 to 378
(8 Channels)
371 to 386
(16 Channels)</td><td></td></tr>
<tr><td>Alarm-1 Set-point (Note 1)

Refer Alarm-4 Set-point</td><td>195 to 202
(8 Channels)
195 to 210
(16 Channels)</td><td rowspan="4">Min. to Max. Range specified for the selected Input Type
Refer Table 2.3

(Default : Min or Max Range depending on the Alarm type)</td></tr>
<tr><td>Alarm-2 Set-point (Note 1)

Refer Alarm-4 Set-point</td><td>259 to 266
(8 Channels)
259 to 274
(16 Channels)</td></tr>
<tr><td>Alarm-3 Set-point (Note 1)

Refer Alarm-4 Set-point</td><td>323 to 330
(8 Channels)
323 to 338
(16 Channels)</td></tr>
<tr><td>Alarm-4 Set-point (Note 1)

Sets limit for Process-High or Process-Low Alarm.</td><td>387 to 394
(8 Channels)
387 to 402
(16 Channels)</td></tr>
</table>

<table>
<tr><th>Parameter Description</th><th>Address</th><th>Settings
(Default Value)</th></tr>
<tr><td>Alarm-1 Hysteresis (Note 1)

Refer Alarm-4 Hysteresis</td><td>211 to 218
(8 Channels)
211 to 226
(16 Channels)</td><td rowspan="4">1 to 30000
(Default : 20)</td></tr>
<tr><td>Alarm-2 Hysteresis (Note 1)

Refer Alarm-4 Hysteresis</td><td>275 to 282
(8 Channels)
275 to 290
(16 Channels)</td></tr>
<tr><td>Alarm-3 Hysteresis (Note 1)

Refer Alarm-4 Hysteresis</td><td>339 to 346
(8 Channels)
339 to 354
(16 Channels)</td></tr>
<tr><td>Alarm-4 Hysteresis (Note 1)

Sets differential (dead) band between Alarm switching ON and OFF states.</td><td>403 to 410
(8 Channels)
403 to 418
(16 Channels)</td></tr>
<tr><td>Alarm-1 Inhibit

Refer Alarm-4 Inhibit</td><td>227 to 234
(8 Channels)
227 to 242
(16 Channels)</td><td rowspan="4"><table><tr><th>Value</th><th>Inhibit</th></tr><tr><td>0</td><td>Disable</td></tr><tr><td>1</td><td>Enable</td></tr></table>(Default : Disable)</td></tr>
<tr><td>Alarm-2 Inhibit

Refer Alarm-4 Inhibit</td><td>291 to 298
(8 Channels)
291 to 306
(16 Channels)</td></tr>
<tr><td>Alarm-3 Inhibit

Refer Alarm-4 Inhibit</td><td>355 to 362
(8 Channels)
355 to 370
(16 Channels)</td></tr>
<tr><td>Alarm-4 Inhibit

Enable
The Alarm activation is suppressed until the PV is within Alarm limits from the time the Module is Powered-on. This allows suppressing the Alarm during the start-up Alarm conditions.

Disable
The Alarm is not suppressed during the start-up Alarm conditions.</td><td>419 to 426
(8 Channels)
419 to 434
(16 Channels)</td></tr>
</table>

<table>
<tr><th>Parameter Description</th><th>Address</th><th>Settings
(Default Value)</th></tr>
<tr><td>Enable Bottom Clipping
(Applicable only for mV / V / mA Inputs)
Refer Appendix-B.</td><td>435 to 442
(8 Channels)
435 to 450
(16 Channels)</td><td><table><tr><th>Value</th><th>Enable</th></tr><tr><td>0</td><td>No</td></tr><tr><td>1</td><td>Yes</td></tr></table>(Default : No)</td></tr>
<tr><td>Bottom Clip Value
(Applicable only for mV / V / mA Inputs)
Refer Appendix-B.</td><td>451 to 458
(8 Channels)
451 to 466
(16 Channels)</td><td>-30000 to 30000
(Default : 0)</td></tr>
<tr><td>Enable Top Clipping
(Applicable only for mV / V / mA Inputs)
Refer Appendix-B.</td><td>467 to 474
(8 Channels)
467 to 482
(16 Channels)</td><td><table><tr><th>Value</th><th>Enable</th></tr><tr><td>0</td><td>No</td></tr><tr><td>1</td><td>Yes</td></tr></table>(Default : No)</td></tr>
<tr><td>Top Clip Value
(Applicable only for mV / V / mA Inputs)
Refer Appendix-B.</td><td>483 to 490
(8 Channels)
483 to 498
(16 Channels)</td><td>-30000 to 30000
(Default : 1000)</td></tr>
</table>

Note 1

Thermocouples (J, K, T, R, S, B, N) and RTD Pt100 (3-wire) Inputs

The process value is always measured in 0.1°C/°F resolution. That is, for example, the value 300 means 30.0°C / °F.

The same should be followed while setting the values for the parameters that are resolution based (like Zero Offset, Alarm Set-point, Alarm Hysteresis, etc.). That is for example, set 300 counts for 30.0°C / °F.

DC mA/mV/V Inputs

(Also Refer *Appendix A : DC Linear Signal Interface*)

The measured PV is a Resolution-less Scaled Value derived using the values for the parameters : Signal Low, Signal High, Range Low and Range High. The parameter 'DC Resolution' holds the desired resolution that can be used to insert *appropriate Decimal Place* in the scaled PV. For example, if the DC Resolution value is 2 (0.01) then the scaled value of 3000 can be read as 30.00.

Similarly the corresponding parameters like Zero Offset, Alarm Set-point, Alarm Hysteresis, etc., are also resolution less and, if desired, the parameter value for 'DC Resolution' should be used for *appropriate Decimal Place.*

Note 2

Conditional Parameters are those whose usage depend upon the values set for some other parameters. For example; the parameters 'Signal Low' & 'Signal High' for a selected channel are used only if the input type for the selected channel is DC Input (mV / V / mA). The access to the conditional parameters for Read / Write operation, however, is not restricted.

Table 2.3

Input Type	Range (Min. to Max.)	Resolution
Type J Thermocouple	0.0 to +960.0°C / +32.0 to +1760.0°F	0.1 °C / °F
Type K Thermocouple	-200.0 to +1376.0°C / -328.0 to +2508.0°F	
Type T Thermocouple	-200.0 to +387.0°C / -328.0 to +728.0°F	
Type R Thermocouple	0.0 to +1771.0°C / +32.0 to +3219.0°F	
Type S Thermocouple	0.0 to +1768.0°C / +32.0 to +3214.0°F	
Type B Thermocouple	0.0 to +1826.0°C / +32.0 to +3218.0°F	
Type N Thermocouple	0.0 to +1314.0°C / +32.0 to +2397.0°F	
3-wire, RTD Pt100	-199.9 to +600.0°C / -328.0 to +1112.0°F	
0 to 20mA DC current	-30000 to 30000 units	1 0.1 0.01 0.001 0.0001 Units
4 to 20mA DC current		
0 to 80mV DC voltage		
0 to 1.25V DC voltage		
0 to 5.0V DC voltage		
0 to 10.0V DC voltage		
1 to 5.0V DC voltage		

Section 3
CONFIGURING COMMUNICATION PARAMETERS

The Module (Analog Interface Module) supports industry standard **MODBUS RTU over Serial** Protocol for communicating Process Values, Alarm Status & Operation Parameters for various Channels.

The Serial Communication Port specification are shown in Table 3.1 below.

Table 3.1

Port	RS485, 2-wire, Half duplex, Start-stop synchronized	
Protocol	Modbus RTU	
Communication Parameters	**Parameter**	**Settings**
	Slave ID	1 to 247
	Baud Rate	2400, 4800, 9600, 19200, 38400, 57600, 115200 bps
	Parity	None (1 or 2 Stop Bits) Even (1 Stop Bit) odd (1 Stop Bit)
Max. No. of Units per Loop	31	
Maximum Distance	1200 Meters	

The Module is shipped from the factory with the following default values for the Communication Parameters.

Slave ID **:** 1	Baud Rate : 9600 bps	Parity : Even

The above parameters can be altered to match with the Host (Master) parameters by putting the Module in **Configuration Mode**. In Configuration Mode, the Module always communicates with the host with the **fixed** communication parameter values (Slave ID : **1**, Baud Rate : **9600** & Parity : **None**) regardless of the actual set values. The user set values are applicable only when the Module is put back in the **Normal Operation Mode**.

A Slide Switch is provided on the Module, as shown in the Figure 3.1, to select between the Configuration and Normal Operation modes. The Table 3.2 shows the Switch Position and the respective mode.

It is important to note that the switch position is detected only upon power-up. Select the desired Mode while the Module is OFF. That is changing the switch position while the Module is powered does not have any effect on the Mode.

Figure 3.1

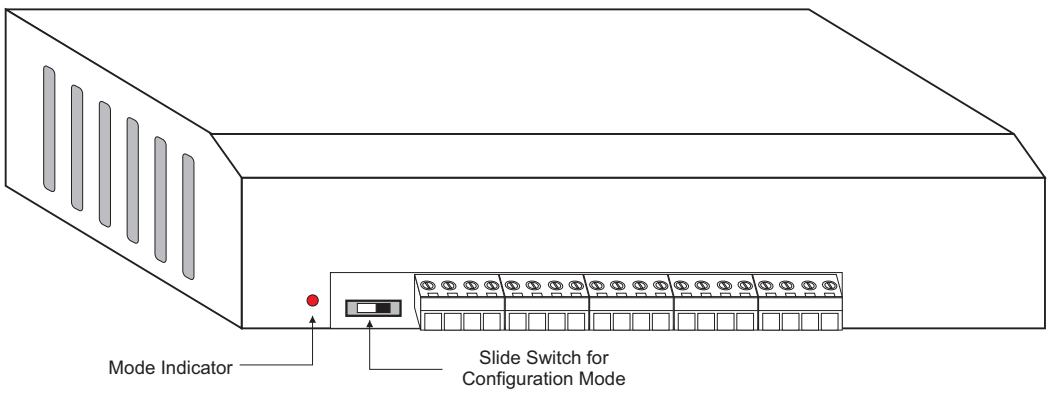


Table 3.2

Slide Switch Position	Mode Indicator	Operation Mode	Communication Parameter Values
 Switch positioned to Left	OFF	Normal	User Set values for *Module Slave ID, Baud Rate* & *Parity*
 Switch positioned to Right	ON	Configuration	*Module Slave ID : 1* *Baud Rate : 9600* *Parity : None*

The Communication Parameters values can be altered by using the MODBUS RTU protocol while the Module is in Configuration Mode. Set the host (Master) Baud Rate to “9600 bps” and Parity to “None”. The MODBUS Addresses and Settings for the Module communication parameters are listed in the Table 3.3 below.

Table 3.3

<table>
<tr><th>Parameter Description</th><th>Address</th><th>Settings
(Default Value)</th></tr>
<tr><td>Module Slave ID

Unique numeric value assigned to the indicator for identification by the host.

Set the value as required by the host.</td><td>1</td><td>1 to 247
(Default : 1)</td></tr>
<tr><td>Baud Rate

Communication speed in ‘Bits per Second’.

Set the value to match with the host baud rate.</td><td>2</td><td><table><tr><th>Value</th><th>Baud Rate</th></tr><tr><td>0</td><td>2400 bps</td></tr><tr><td>1</td><td>4800 bps</td></tr><tr><td>2</td><td>9600 bps</td></tr><tr><td>3</td><td>19200 bps</td></tr><tr><td>4</td><td>38400 bps</td></tr><tr><td>5</td><td>57600 bps</td></tr><tr><td>6</td><td>115200 bps</td></tr></table>(Default : 9600 bps)</td></tr>
<tr><td>Parity

One of the communication error trapping features.

Set the data packet parity as implemented by the host protocol.</td><td>3</td><td><table><tr><th>Value</th><th>Parity</th></tr><tr><td>0</td><td>None</td></tr><tr><td>1</td><td>Even</td></tr><tr><td>2</td><td>Odd</td></tr></table>(Default : Even)</td></tr>
</table>

APPENDIX A
DC LINEAR SIGNAL INTERFACE

This appendix describes the parameters required to interface process transmitters that produce Linear DC Voltage (mV/V) or Current (mA) signals in proportion to the measured process values. A few examples of such transmitters are;

1. Pressure Transmitter producing **4 to 20 mA** for **0 to 5 psi**
2. Relative Humidity Transmitter producing **1 to 4.5 V** for **5 to 95 %RH**
3. Temperature Transmitter producing **0 to 20 mA** for **-50 to 250 °C**

The instrument (indicator / controller / recorder) that accepts the linear signal from the transmitter computes the measured process value by solving the mathematical equation for Straight-Line in the form:

$$Y = mX + C$$

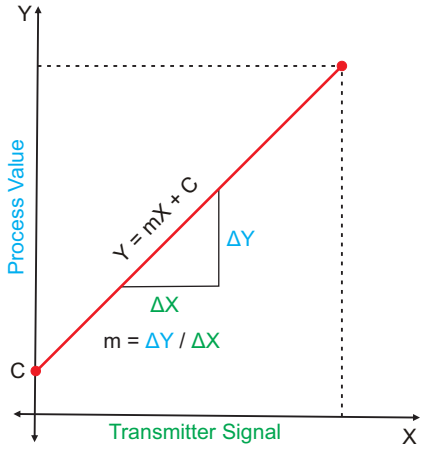
Where;

X : Signal Value from Transmitter

Y : Process Value Corresponding to Signal Value X

C : Process Value Corresponding to X = 0 (Y-intercept)

m : Change in Process Value per unit Change in Signal Value (Slope)



As is evident from the aforementioned transmitter examples, different transmitters produce signals varying both in type (mV/V/mA) and range. Most PPI instruments, thus, provide programmable Signal Type and Range to facilitate interface with a variety of transmitters. A few industry standard signal types and ranges offered by the PPI instruments are: 0-80mV, 0-5 V, 1-5 V, 0-10V, 0-20 mA, 4-20 mA, etc.

Also, the output signal range (e.g. 1 to 4.5 V) from different transmitters corresponds to different process value range (e.g. 5 to 95 %RH); the instruments thus also provide facility for programming the measured process value range with programmable Resolution.

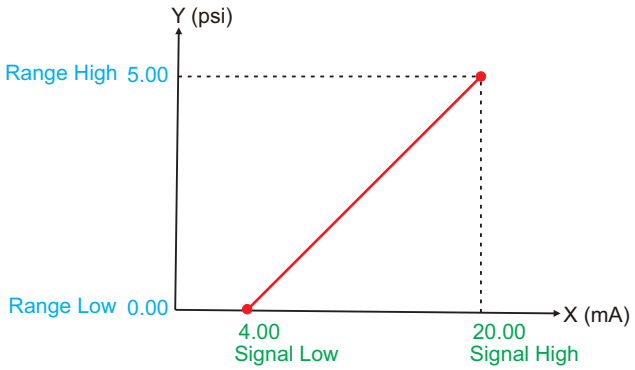
The linear transmitters usually specify two signal values (Signal Low and Signal High) and the corresponding Process Values (Range Low and Range High). In the example Pressure Transmitter above; the Signal Low, Signal High, Range Low & Range High values specified are: 4 mA, 20 mA, 0 psi & 5 psi, respectively.

In summary, the following 6 parameters are required for interfacing Linear Transmitters:

1. Input Type : Standard DC Signal Type in which the transmitter signal range fits (e.g. 4-20 mA)
2. Signal Low : Signal value corresponding to Range Low process value (e.g. 4.00 mA)
3. Signal High : Signal value corresponding to Range High process value (e.g. 20.00 mA)
4. PV Resolution : Resolution (least count) with which to compute process value (e.g. 0.01)
5. Range Low : Process value corresponding to Signal Low value (e.g. 0.00 psi)
6. Range High : Process value corresponding to Signal High value (e.g. 5.00 psi)

The following examples illustrate appropriate parameter value selections.

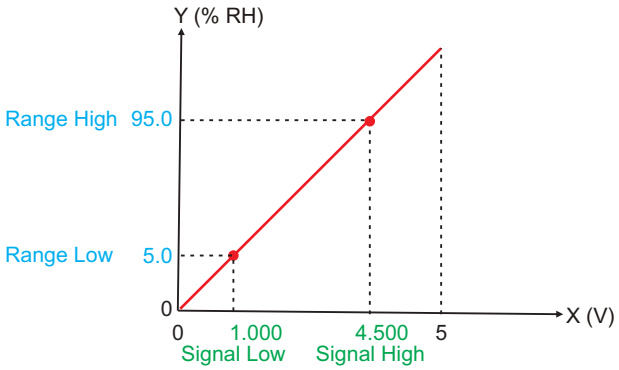
Example 1: Pressure Transmitter producing **4 to 20 mA** for **0 to 5 psi**



Presume the pressure is to be measured with 0.01 Resolution, that is 0.00 to 5.00 psi.

Input Type	:	4-20 mA
Signal Low	:	4.00 mA
Signal High	:	20.00 mA
PV Resolution	:	0.01
Range Low	:	0.00
Range High	:	5.00

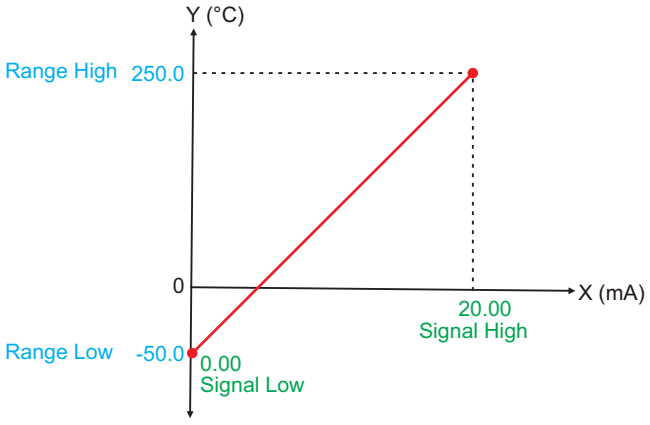
Example 2: Relative Humidity Transmitter producing **1 to 4.5 V** for **5 to 95 %RH**



Presume the humidity is to be measured with 0.1 Resolution, that is 0.0 to 100.0 %.

Input Type	:	0-5 V
Signal Low	:	1.000 V
Signal High	:	4.500 V
PV Resolution	:	0.1
Range Low	:	5.0
Range High	:	95.0

Example 3: Temperature Transmitter producing **0 to 20 mA** for **-50 to 250 °C**



Presume the Temperature is to be measured with 0.1 Resolution, that is -50.0 to 250.0°C.

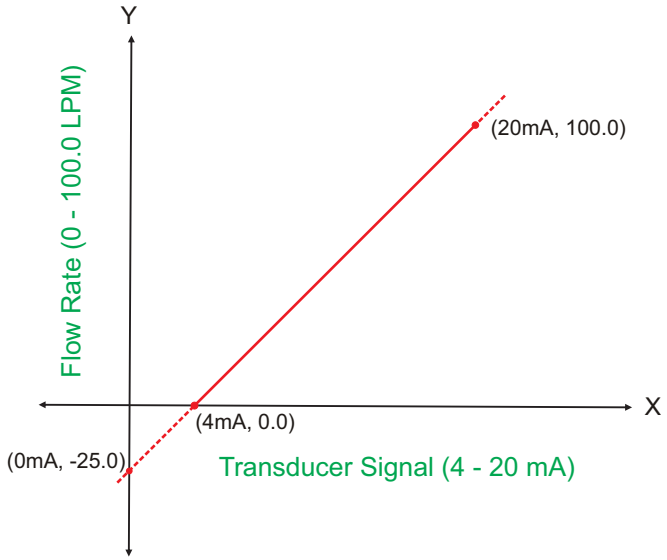
Input Type	:	0-20 mA
Signal Low	:	0.00 mA
Signal High	:	20.00 mA
PV Resolution	:	0.1
Range Low	:	-50.0
Range High	:	250.0

APPENDIX B
BOTTOM / TOP CLIPPING

For mA/mV/V inputs the measured PV is a scaled value between the set values for 'PV Range Low' and 'PV Range High' parameters corresponding to the Signal Minimum and Signal Maximum values respectively. Refer Appendix A.

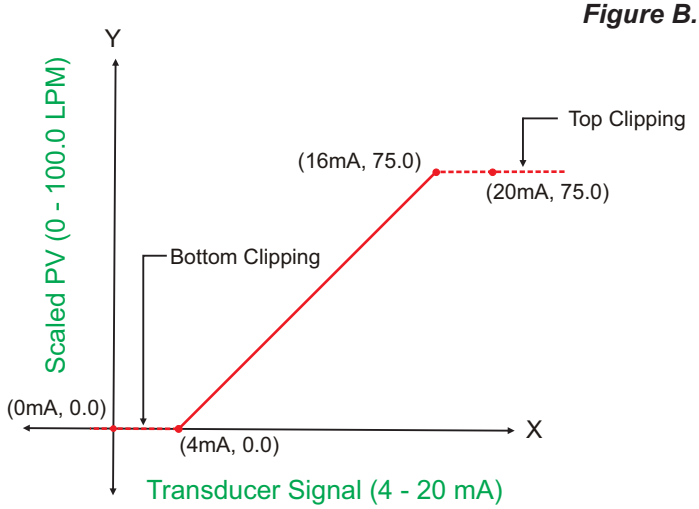
The Figure B.1 below illustrates an example of flow rate measurement using a transmitter / transducer producing a signal range of 4 - 20 mA corresponding to 0.0 to 100.0 Liters per Minute (LPM).

Figure B.1



If this transmitter is to be used for a system having a flow rate range of 0.0 to 75.0 LPM then the actual useful signal range from the example transmitter is 4 mA (~ 0.0 LPM) to 16 mA (~ 75.0 LPM) only. If no Clipping is applied on the measured flow rate then the scaled PV will also include 'out-of-range' values for the signal values below 4 mA and above 16 mA (may be due to open sensor condition or calibration errors). These out-of-range values can be suppressed by enabling the Bottom and/or Top Clippings with appropriate Clip values as shown in figure B.2 below.

Figure B.2



Parameter Values

PV Range Low	: 0.0
PV Range High	: 100.0
Enable Bottom Clipping	: Yes
Bottom Clip Value	: 0.0
Enable Top Clipping	: Yes
Top Clip Value	: 75.0

APPENDIX C
PROCESS VALUE IN 'FLOAT' DATA FORMAT

The measured Process Values for all channels can be read in 32-Bit Single Precision Float format at Modbus Addresses listed in the following table.

Note : The Process Values in 32-Bit Float are supported in version 6 and later. The module version is available at MODBUS address 1598 (16-Bit Input Register).

Read-Only Parameter

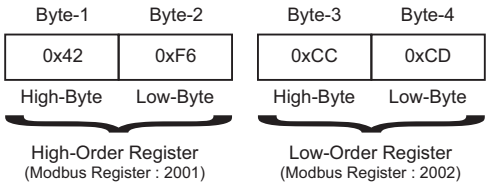
Parameter Description	MODBUS Address	Values
Process Value Measured Temperature (in °C / °F) for Thermocouple / RTD inputs or Scaled Counts for DC Volts / mA inputs.	2001 to 2016 (8 Channels) 2001 to 2032 (16 Channels)	Single Precision Float values from -30000 to +30000 representing the measured process values. Refer Table 2.3 (Section 2) for the various input types and the corresponding measured ranges. The following constant counts indicate PV Errors.

Value	PV Error Type
-32768	Under Range
+32752	Over Range
+32767	Sensor Open

The Process Values can be read in IEEE single precision floating point format in two adjacent 16-bit Modbus registers, the high order register first. The high-order register always starts at an odd Modbus address. For example, the process value for channel-1 is read in addresses 2001 (high-order register) & 2002 (low-order register). Within the register, the high-order byte is sent first in accordance to standard Modbus RTU format. The following example illustrates the register & byte sequence.

	Decimal Format	Hexa-decimal Format
Process Value for Channel-1	123.4	0x42F6CCCD

The data is transferred in the following Byte-Sequence.



The Process Values for Thermocouple & RTD Pt100 Inputs is always transferred with 0.1 count resolution.

The resolution for Process Values for DC Linear inputs is dependent on the value set for the Parameter *DC Resolution* (MODBUS Addresses : 115 to 122 for 8 Channels & 115 to 130 for 16 Channels). For example, if the dc resolution parameter value is 2 & if the measured scaled integer counts are 12345 then the communicated process value is 123.45.

PPI
The Perfection Experts

Process Precision Instruments

101, Diamond Industrial Estate, Navghar, Vasai Road (E),
Dist. Palghar - 401 210.Maharashtra, India
Sales : 8208199048 / 8208141446
Support : 07498799226 / 08767395333
sales@ppiindia.net, support@ppiindia.net

Oct 2022