

AIMS-4/8X



PPI

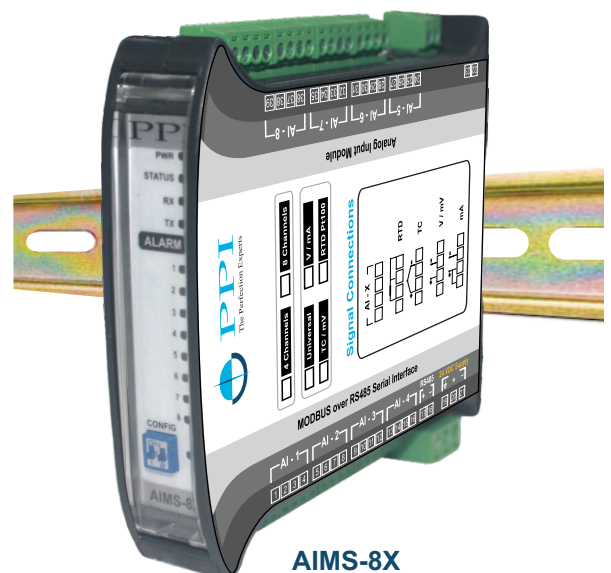
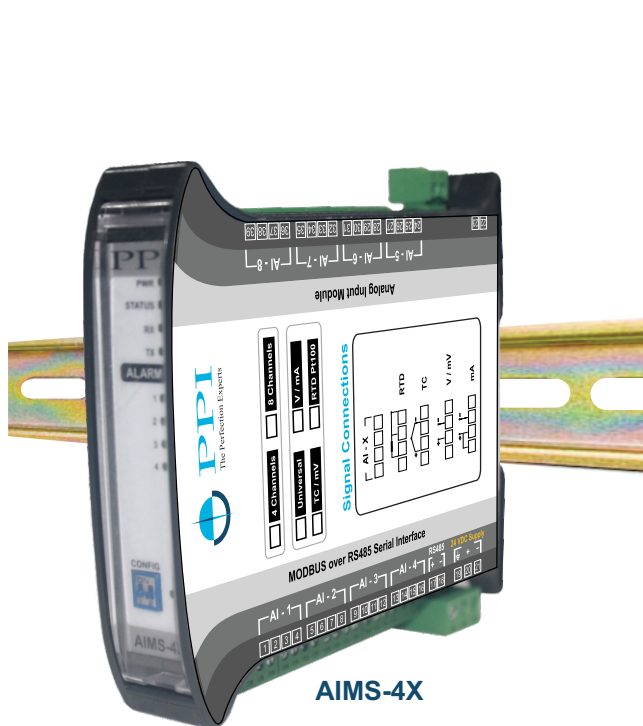
The Perfection Experts

4 / 8 Channel DIN-Rail Analog Input Modules MODBUS over RS485 Serial Interface

20~32 VDC Supply Operated

Input Type Versions

- **U** : Each Channel Independently Configurable for Thermocouples, RTD Pt100, Volts, mV and mA (No Jumper Settings)
- **P** : All Channels RTD Pt100 (3-Wire)
- **T** : All Channels Thermocouples / mV
- **D** : All Channels DC V/mA

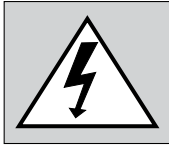


User Manual

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Section 1 ELECTRICAL CONNECTIONS



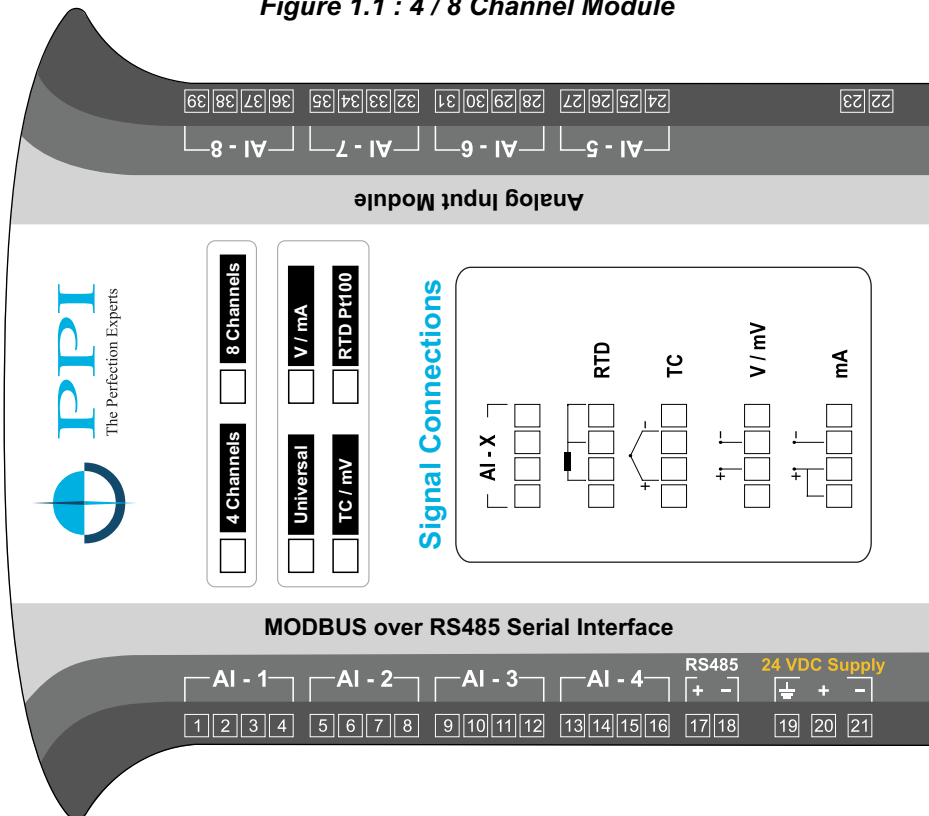
WARNING
MISHANDLING / NEGLIGENCE CAN RESULT
IN PERSONAL DEATH OR SERIOUS INJURY.

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 1.1 illustrates Electrical Connection Diagrams. For 4 Channel Version the connectors for AI-5 to AI-8 are not fitted.

Figure 1.1 : 4 / 8 Channel Module

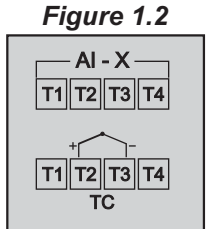


INPUT CHANNELS

Each of the 4 or 8 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.

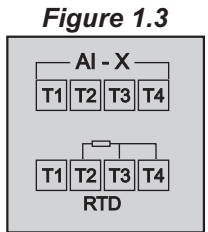
Thermocouple

Connect Thermocouple Positive (+) to terminal T2 and Negative (-) to terminal T3 as shown in **Figure 1.2**. 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.



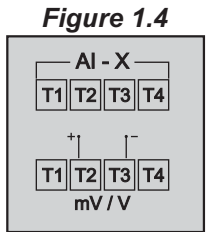
RTD Pt100, 3-wire

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 1.3**. 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.



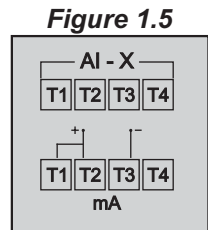
DC Linear Voltage (mV / V)

Use a shielded twisted pair with the shield grounded at the signal source for connecting mV / V source. Connect common (-) to terminal T3 and the signal (+) to terminal T2, as shown in **Figure 1.4**.



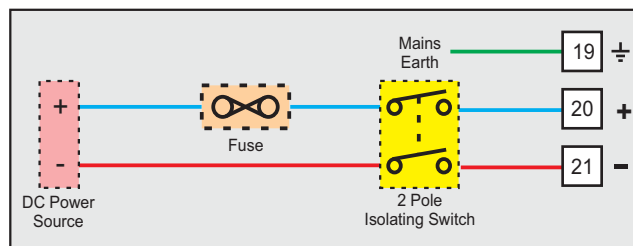
DC Linear Current (mA)

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 1.5**.



POWER SUPPLY (Terminals 20, 21)

Figure 1.6



As standard, the Module is supplied with power connections suited for 20 to 32 VDC power source. The accuracy / performance of the Module is not affected by the variations in the supply within specified limits of 20 to 32 VDC. 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 1.6. The Module is not provided with fuse and power switch. If necessary, mount them separately. Use a slow blow fuse rated for 0.5A current.

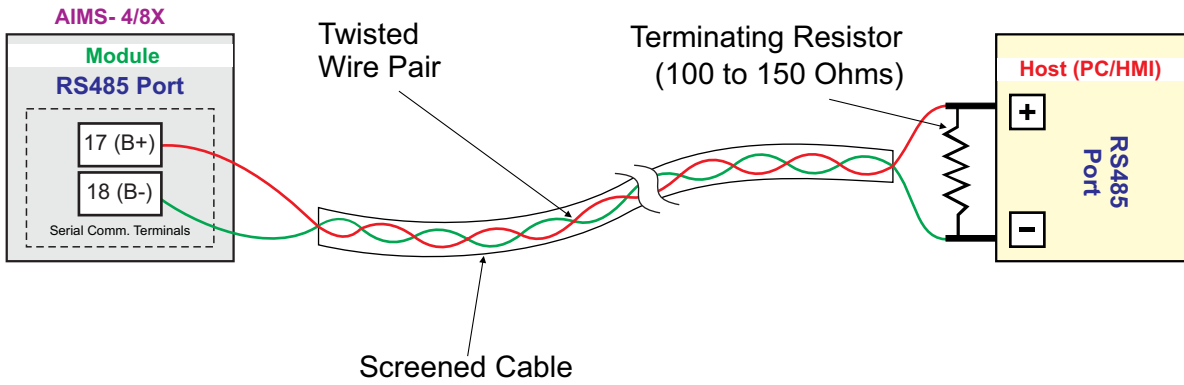
For safety and enhanced electrical noise immunity, it is highly recommended to connect Main Power Supply 'Earth' to terminal 19.

SERIAL COMMUNICATION PORT

The wiring connections for interfacing the Host (PC/HMI) with AIMS is shown in the figure 1.7.

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.

Figure 1.7



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 4 : 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)

Parameter Description	MODBUS Address	Values												
<p>Process Value (Note1)</p> <p>Measured Temperature (in °C / °F) for Thermocouple / RTD inputs or Scaled Counts for DC Volts / mA inputs.</p> <p>Note : The Process Values are also available in 32-Bit Single Precision Float format. Refer Appendix-C.</p>	<p>1561 to 1564 (4 Channels)</p> <p>1561 to 1568 (8 Channels)</p>	<p>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.</p> <p>The following constant counts indicate PV Errors.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Value</th> <th style="width: 15%;">PV Error Type</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">-32768</td> <td style="text-align: center;">Under Range</td> </tr> <tr> <td style="text-align: center;">+32752</td> <td style="text-align: center;">Over Range</td> </tr> <tr> <td style="text-align: center;">+32767</td> <td style="text-align: center;">Sensor Open</td> </tr> </tbody> </table>	Value	PV Error Type	-32768	Under Range	+32752	Over Range	+32767	Sensor Open				
Value	PV Error Type													
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<p>Alarm-1 Status</p>	1577	<div style="display: flex; align-items: center;"> <table border="1" style="border-collapse: collapse; margin-right: 10px;"> <tr> <td style="padding: 2px;">Bit 15</td> <td style="padding: 2px;">...</td> <td style="padding: 2px;">Bit 7</td> <td style="padding: 2px;">...</td> <td style="padding: 2px;">Bit 1</td> <td style="padding: 2px;">Bit 0</td> </tr> </table> <div style="margin-left: 10px;"> <p>(X = 1, 2, 3, 4)</p> <p>Alarm-X Status for Channel-1</p> <p>Alarm-X Status for Channel-2</p> <p>Alarm-X Status for Channel-8</p> </div> </div> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 15%;">Bit Value</th> <th style="width: 15%;">Status</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">Alarm OFF</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Alarm ON</td> </tr> </tbody> </table> <p style="font-size: x-small; margin-top: 5px;">For 4 Channel Version (AIMS-4X), ignore Bit-4 to Bit-15 For 8 Channel Version (AIMS-8X), ignore Bit-8 to Bit-15</p>	Bit 15	...	Bit 7	...	Bit 1	Bit 0	Bit Value	Status	0	Alarm OFF	1	Alarm ON
Bit 15	...		Bit 7	...	Bit 1	Bit 0								
Bit Value	Status													
0	Alarm OFF													
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<p>Alarm-2 Status</p>	1578													
<p>Alarm-3 Status</p>	1579													
<p>Alarm-4 Status</p>	1580													
<p>Ambient Temperature</p> <p><i>(Applicable only for Versions supporting Thermocouple Inputs)</i></p> <p>Room Temperature (in °C) measured by the sensor mounted inside the instrument.</p>	82	<p>Signed integer values from -30000 to +30000 representing the measured Ambient Temperature through the semiconductor sensor mounted on the Module.</p> <p>The measured value is always in °C with 0.1 resolution. For example, 30.0°C is represented as 300.</p>												

Table 2.2 : Holding Registers (Read/Write Parameters)

Parameter Description	MODBUS Address	Settings (Default Value)																																																												
<p>Input Type</p> <p>Select Input type in accordance with the type of Thermocouple or RTD sensor or transducer output connected for process value measurement.</p>	<p>83 to 86 (4 Channels)</p> <p>83 to 90 (8 Channels)</p>	<p>Applicable for Input Type TC / RTD Pt100 / V / mV / mA</p> <table border="1" data-bbox="882 454 1410 1133"> <thead> <tr> <th>Value</th> <th>Type</th> </tr> </thead> <tbody> <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 (Default: Type J)</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 (Default: 0 to 80 mV)</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> </tbody> </table> <p>(Default : 0 to 10 V)</p> <p>Applicable for Input Type RTD Pt100</p> <table border="1" data-bbox="882 1283 1410 1402"> <thead> <tr> <th>Value</th> <th>Type</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>RTD Pt100, 3-wire (This is a Read Only parameter)</td> </tr> </tbody> </table> <p>Applicable for Input Type TC / mV</p> <table border="1" data-bbox="882 1496 1410 1879"> <thead> <tr> <th>Value</th> <th>Type</th> </tr> </thead> <tbody> <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 (Default: Type J)</td></tr> <tr><td>8</td><td>0 to 80 mV</td></tr> </tbody> </table> <p>(Default : Type K)</p>	Value	Type	0	Type J Thermocouple	1	Type K Thermocouple	2	Type T Thermocouple	3	Type R Thermocouple	4	Type S Thermocouple	5	Type B Thermocouple	6	Type N Thermocouple	7	Reserved TC (Default: Type J)	8	RTD Pt100, 3-wire	9	0 to 20 mA	10	4 to 20 mA	11	0 to 80 mV	12	Reserved (Default: 0 to 80 mV)	13	0 to 1.25 V	14	0 to 5 V	15	0 to 10 V	16	1 to 5 V	Value	Type	0	RTD Pt100, 3-wire (This is a Read Only parameter)	Value	Type	0	Type J Thermocouple	1	Type K Thermocouple	2	Type T Thermocouple	3	Type R Thermocouple	4	Type S Thermocouple	5	Type B Thermocouple	6	Type N Thermocouple	7	Reserved TC (Default: Type J)	8	0 to 80 mV
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		<p style="text-align: center;">Applicable for Input Type V / mA</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Value</th> <th>Type</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0 to 20 mA</td> </tr> <tr> <td>1</td> <td>4 to 20 mA</td> </tr> <tr> <td>2</td> <td>0 to 1.25 V</td> </tr> <tr> <td>3</td> <td>0 to 5 V</td> </tr> <tr> <td>4</td> <td>0 to 10 V</td> </tr> <tr> <td>5</td> <td>1 to 5 V</td> </tr> </tbody> </table> <p style="text-align: center;">(Default : 0 to 10 V)</p>	Value	Type	0	0 to 20 mA	1	4 to 20 mA	2	0 to 1.25 V	3	0 to 5 V	4	0 to 10 V	5	1 to 5 V
Value	Type															
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1	4 to 20 mA															
2	0 to 1.25 V															
3	0 to 5 V															
4	0 to 10 V															
5	1 to 5 V															
<p>Temperature Units</p> <p><i>(Applicable only for Versions supporting Thermocouples & RTD Pt100 Inputs)</i></p> <p>Selects temperature measurement units in °C or °F.</p>	<p>99 to 102 (4 Channels)</p> <p>99 to 106 (8 Channels)</p>	<p>Conditional Parameter <small>(Note2)</small></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Value</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>°C</td> </tr> <tr> <td>1</td> <td>°F</td> </tr> </tbody> </table> <p style="text-align: center;">(Default : °C)</p>	Value	Unit	0	°C	1	°F								
Value	Unit															
0	°C															
1	°F															
<p>DC Resolution <small>(Note1)</small></p> <p><i>(Applicable only for Versions supporting mV / V / mA Inputs)</i></p> <p>This parameter value should be used in conjunction with the process value for interpretation of decimal place.</p> <p>For example if the value for this parameter is 0.01 then the measured process value of 3000 should be interpreted as 30.00.</p>	<p>115 to 118 (4 Channels)</p> <p>115 to 122 (8 Channels)</p>	<p>Conditional Parameter <small>(Note2)</small></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Value</th> <th>Resolution</th> </tr> </thead> <tbody> <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> </tbody> </table> <p style="text-align: center;">(Default : 1 Unit for DC Linear input & 0.1 for Thermocouple & RTD)</p>	Value	Resolution	0	1	1	0.1	2	0.01	3	0.001	4	0.0001		
Value	Resolution															
0	1															
1	0.1															
2	0.01															
3	0.001															
4	0.0001															

Parameter Description	MODBUS Address	Settings (Default Value)																								
<p>Signal Low</p> <p><i>(Applicable only for Versions supporting mV / V / mA Inputs)</i></p> <p>The transmitter output signal value corresponding to Range Low process value.</p> <p>Refer <i>Appendix-A : DC Linear Signal Interface</i> for details.</p> <p>Note : The value should be set as integer counts ignoring decimal value. For e.g. 4.00 mA should be set as 400 counts.</p>	<p>501 to 504 (4 Channels)</p> <p>501 to 508 (8 Channels)</p>	<p>Conditional Parameter ^(Note2)</p> <table border="1" data-bbox="938 405 1358 651"> <thead> <tr> <th>Input Type</th> <th>Settings</th> <th>Default</th> </tr> </thead> <tbody> <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> </tbody> </table>	Input Type	Settings	Default	0 to 20 mA	0.00 to Signal High	0.00	4 to 20 mA	4.00 to Signal High	4.00	0 to 80 mV	0.00 to Signal High	0.00	0 to 1.25 V	0.000 to Signal High	0.000	0 to 5 V	0.000 to Signal High	0.000	0 to 10 V	0.00 to Signal High	0.00	1 to 5 V	1.000 to Signal High	1.000
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<p>Signal High</p> <p><i>(Applicable only for Versions supporting mV / V / mA Inputs)</i></p> <p>The transmitter output signal value corresponding to Range High process value.</p> <p>Refer <i>Appendix-A : DC Linear Signal Interface</i> for details.</p> <p>Note : The value should be set as integer counts ignoring decimal value. For e.g. 80.00 mV should be set as 8000 counts.</p>	<p>517 to 520 (4 Channels)</p> <p>517 to 524 (8 Channels)</p>	<p>Conditional Parameter ^(Note2)</p> <table border="1" data-bbox="938 837 1358 1084"> <thead> <tr> <th>Input Type</th> <th>Settings</th> <th>Default</th> </tr> </thead> <tbody> <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> </tbody> </table>	Input Type	Settings	Default	0 to 20 mA	Signal Low to 20.00	20.00	4 to 20 mA	Signal Low to 20.00	20.00	0 to 80 mV	Signal Low to 80.00	80.00	0 to 1.25 V	Signal Low to 1.250	1.250	0 to 5 V	Signal Low to 5.000	5.000	0 to 10 V	Signal Low to 10.00	10.00	1 to 5 V	Signal Low to 5.000	5.000
Input Type	Settings	Default																								
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0 to 10 V	Signal Low to 10.00	10.00																								
1 to 5 V	Signal Low to 5.000	5.000																								
<p>Range Low</p> <p><i>(Applicable only for Versions supporting mV / V / mA Inputs)</i></p> <p>The process value corresponding to the Signal Low value from the transmitter.</p> <p>Refer <i>Appendix-A : DC Linear Signal Interface</i> for details.</p>	<p>131 to 134 (4 Channels)</p> <p>131 to 138 (8 Channels)</p>	<p>Conditional Parameter ^(Note2)</p> <p>-30000 to 30000 (Default : 0)</p>																								
<p>Range High</p> <p><i>(Applicable only for Versions supporting mV / V / mA Inputs)</i></p> <p>The process value corresponding to the Signal High value from the transmitter.</p> <p>Refer <i>Appendix-A : DC Linear Signal Interface</i> for details.</p>	<p>147 to 150 (4 Channels)</p> <p>147 to 154 (8 Channels)</p>	<p>Conditional Parameter ^(Note2)</p> <p>-30000 to 30000 (Default : 1000)</p>																								
<p>Offset for PV ^(Note1)</p> <p>This value is algebraically added to the measured PV to derive the final PV.</p> <p>Final PV = Measured PV + Offset</p>	<p>163 to 166 (4 Channels)</p> <p>163 to 170 (8 Channels)</p>	<p>-30000 to 30000 (Default : 0)</p>																								

Parameter Description	MODBUS Address	Settings (Default Value)								
Alarm-1 Type Refer Alarm-4 Type	179 to 182 (4 Channels) 179 to 186 (8 Channels)	<table border="1" data-bbox="927 331 1307 483"> <thead> <tr> <th>Value</th> <th>Type</th> </tr> </thead> <tbody> <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> </tbody> </table> <p data-bbox="1023 506 1214 539">(Default : None)</p>	Value	Type	0	None	1	Process Low	2	Process High
Value	Type									
0	None									
1	Process Low									
2	Process High									
Alarm-2 Type Refer Alarm-4 Type	243 to 246 (4 Channels) 243 to 250 (8 Channels)									
Alarm-3 Type Refer Alarm-4 Type	307 to 310 (4 Channels) 307 to 314 (8 Channels)									
Alarm-4 Type <i>None</i> The Alarm function is disabled. <i>Process Low</i> The Alarm is activated upon the PV equaling or falling below the 'Alarm Set-point' value. <i>Process High</i> The Alarm is activated upon the PV equaling or rising above the 'Alarm Set-point' value.	371 to 374 (4 Channels) 371 to 378 (8 Channels)									
Alarm-1 Set-point <i>(Note1)</i> Refer Alarm-4 Set-point	195 to 198 (4 Channels) 195 to 202 (8 Channels)	<p data-bbox="810 1357 1485 1413">Min. to Max. Range specified for the selected Input Type Refer Table 2.3</p> <p data-bbox="799 1447 1497 1480">(Default : Min or Max Range depending on the Alarm type)</p>								
Alarm-2 Set-point <i>(Note1)</i> Refer Alarm-4 Set-point	259 to 262 (4 Channels) 259 to 266 (8 Channels)									
Alarm-3 Set-point <i>(Note1)</i> Refer Alarm-4 Set-point	323 to 326 (4 Channels) 323 to 330 (8 Channels)									
Alarm-4 Set-point <i>(Note1)</i> Sets limit for Process-High or Process-Low Alarm.	387 to 390 (4 Channels) 387 to 394 (8 Channels)									

Parameter Description	MODBUS Address	Settings (Default Value)						
Alarm-1 Hysteresis <i>(Note 1)</i> Refer Alarm-4 Hysteresis	211 to 214 (4 Channels) 211 to 218 (8 Channels)	1 to 30000 (Default : 20)						
Alarm-2 Hysteresis <i>(Note 1)</i> Refer Alarm-4 Hysteresis	275 to 278 (4 Channels) 275 to 282 (8 Channels)							
Alarm-3 Hysteresis <i>(Note 1)</i> Refer Alarm-4 Hysteresis	339 to 342 (4 Channels) 339 to 346 (8 Channels)							
Alarm-4 Hysteresis <i>(Note 1)</i> Sets differential (dead) band between Alarm switching ON and OFF states.	403 to 406 (4 Channels) 403 to 410 (8 Channels)							
Alarm-1 Inhibit Refer Alarm-4 Inhibit	227 to 230 (4 Channels) 227 to 234 (8 Channels)	<table border="1" data-bbox="954 972 1337 1084"> <thead> <tr> <th>Value</th> <th>Inhibit</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Disable</td> </tr> <tr> <td>1</td> <td>Enable</td> </tr> </tbody> </table> (Default : Disable)	Value	Inhibit	0	Disable	1	Enable
Value	Inhibit							
0	Disable							
1	Enable							
Alarm-2 Inhibit Refer Alarm-4 Inhibit	291 to 294 (4 Channels) 291 to 298 (8 Channels)							
Alarm-3 Inhibit Refer Alarm-4 Inhibit	355 to 358 (4 Channels) 355 to 362 (8 Channels)							
Alarm-4 Inhibit <i>Enable</i> 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. <i>Disable</i> The Alarm is not suppressed during the start-up Alarm conditions.	419 to 422 (4 Channels) 419 to 426 (8 Channels)							

Parameter Description	MODBUS Address	Settings (Default Value)						
Enable Bottom Clipping <i>(Applicable only for Versions supporting mV / V / mA Inputs)</i> Refer Appendix-B.	435 to 438 (4 Channels) 435 to 442 (8 Channels)	<table border="1"> <thead> <tr> <th>Value</th> <th>Enable</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>No</td> </tr> <tr> <td>1</td> <td>Yes</td> </tr> </tbody> </table> (Default : No)	Value	Enable	0	No	1	Yes
Value	Enable							
0	No							
1	Yes							
Bottom Clip Value <i>(Applicable only for Versions supporting mV / V / mA Inputs)</i> Refer Appendix-B.	451 to 454 (4 Channels) 451 to 458 (8 Channels)	-30000 to 30000 (Default : 0)						
Enable Top Clipping <i>(Applicable only for Versions supporting mV / V / mA Inputs)</i> Refer Appendix-B.	467 to 470 (4 Channels) 467 to 474 (8 Channels)	<table border="1"> <thead> <tr> <th>Value</th> <th>Enable</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>No</td> </tr> <tr> <td>1</td> <td>Yes</td> </tr> </tbody> </table> (Default : No)	Value	Enable	0	No	1	Yes
Value	Enable							
0	No							
1	Yes							
Top Clip Value <i>(Applicable only for Versions supporting mV / V / mA Inputs)</i> Refer Appendix-B.	483 to 486 (4 Channels) 483 to 490 (8 Channels)	-30000 to 30000 (Default : 1000)						

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

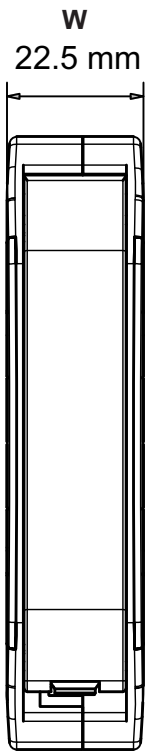
Conditional Parameters are those whose usage depend upon the values set for some other parameters. For example; the parameters 'Signal Low' & 'Signal High' for a selected channel are used only if the input type for the selected channel is DC Input (mV / V / mA). The access to the conditional parameters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

Table 2.3

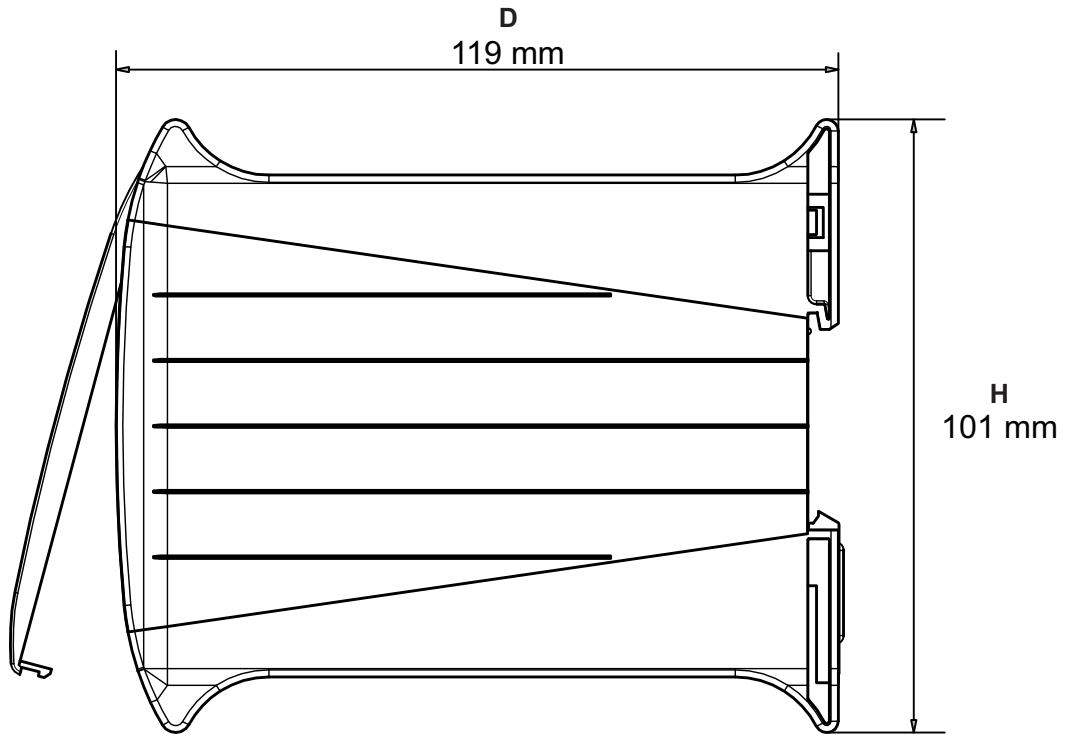
Input Type	Range (Min. to Max.)	Resolution
Type J Thermocouple	0 to +960.0°C / +32.0 to +1760.0°F	0.1 °C / °F
Type K Thermocouple	-200.0 to +1376.0°C / -328.0 to +2508.0°F	
Type T Thermocouple	-200.0 to +387.0°C / -328.0 to +728.0°F	
Type R Thermocouple	0 to +1771.0°C / +32.0 to +3219.0°F	
Type S Thermocouple	0 to +1768.0°C / +32.0 to +3214.0°F	
Type B Thermocouple	0 to +1826.0°C / +32.0 to +3218.0°F	
Type N Thermocouple	0 to +1314.0°C / +32.0 to +2397.0°F	
3-wire, RTD Pt100	-199.0 to +600.0°C / -328.0 to +1112.0°F	
0 to 20mA DC current	-30000 to 30000 units	1
4 to 20mA DC current		0.1
0 to 80mV DC voltage		0.01
0 to 1.25V DC voltage		0.001
0 to 5.0V DC voltage		0.0001
0 to 10.0V DC voltage		Units
1 to 5.0V DC voltage		



Section 3
MECHANICAL DIMENSIONS



Front View



Side View

Width (W)	22.5 mm
Height (H)	101.0 mm
Depth (D)	119.0 mm



Section 4 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 4.1 below.

Table 4.1

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 Set is provided on the Module, as shown in the Figure 4.1, to select between the Configuration and Normal Operation modes. The Table 4.2 shows the Switch Positions 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 4.1

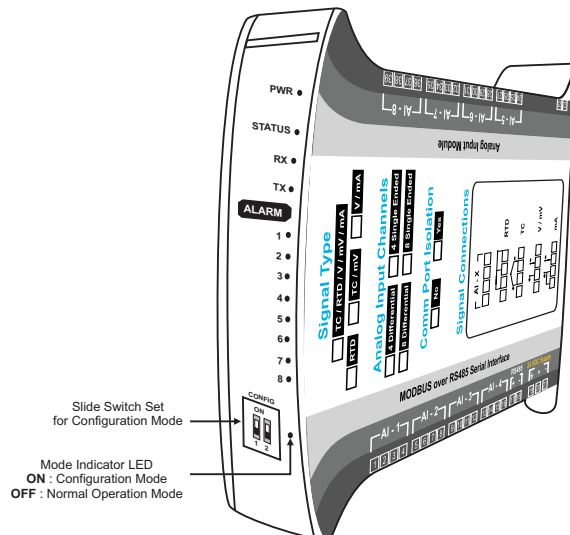
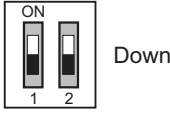
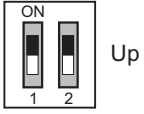


Table 4.2

Switch Position	 Down	 Up
Mode Indicator	OFF	ON
Operation Mode	Normal	Configuration
Communication Parameter Values	User Set values for <i>Module Slave ID,</i> <i>Baud Rate & Parity</i>	<i>Module Slave ID : 1</i> <i>Baud Rate : 9600</i> <i>Parity : None</i>

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 4.3 below.

Table 4.3

Parameter Description	MODBUS Address	Settings (Default Value)																
<p>Module Slave ID</p> <p>Unique numeric value assigned to the indicator for identification by the host.</p> <p>Set the value as required by the host.</p>	1	1 to 247 (Default : 1)																
<p>Baud Rate</p> <p>Communication speed in ‘Bits per Second’.</p> <p>Set the value to match with the host baud rate.</p>	2	<table border="1"> <thead> <tr> <th>Value</th> <th>Baud Rate</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>(Default : 9600 bps)</p>	Value	Baud Rate	0	2400 bps	1	4800 bps	2	9600 bps	3	19200 bps	4	38400 bps	5	57600 bps	6	115200 bps
Value	Baud Rate																	
0	2400 bps																	
1	4800 bps																	
2	9600 bps																	
3	19200 bps																	
4	38400 bps																	
5	57600 bps																	
6	115200 bps																	
<p>Parity</p> <p>One of the communication error trapping features.</p> <p>Set the data packet parity as implemented by the host protocol.</p>	3	<table border="1"> <thead> <tr> <th>Value</th> <th>Parity</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>None</td> </tr> <tr> <td>1</td> <td>Even</td> </tr> <tr> <td>2</td> <td>Odd</td> </tr> </tbody> </table> <p>(Default : Even)</p>	Value	Parity	0	None	1	Even	2	Odd								
Value	Parity																	
0	None																	
1	Even																	
2	Odd																	



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;

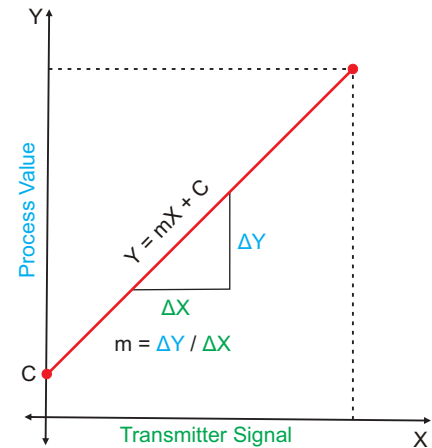
1. Pressure Transmitter producing **4 to 20 mA** for **0 to 5 psi**
2. Relative Humidity Transmitter producing **1 to 4.5 V** for **5 to 95 %RH**
3. Temperature Transmitter producing **0 to 20 mA** for **-50 to 250 °C**

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: $\pm 80\text{mV}$, $\pm 5\text{V}$, ± 1 to $\pm 5\text{V}$, $0\text{-}20\text{ mA}$, $4\text{-}20\text{ mA}$, 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.

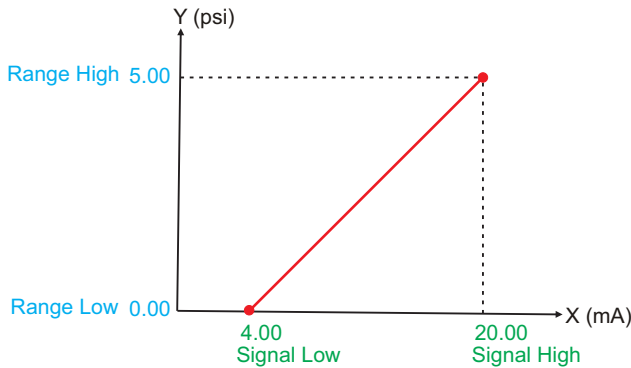
The linear transmitters usually specify two signal values (Signal Low and Signal High) and the corresponding Process Values (Range Low and Range High). In the example Pressure Transmitter above; the Signal Low, Signal High, Range Low & Range High values specified are: 4 mA, 20 mA, 0 psi & 5 psi, respectively.

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.

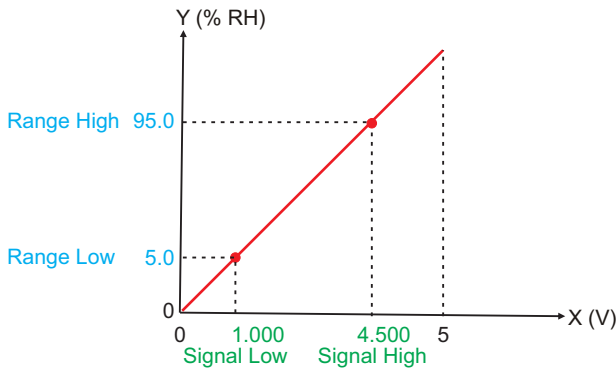
Example 1: Pressure Transmitter producing **4 to 20 mA** for **0 to 5 psi**



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

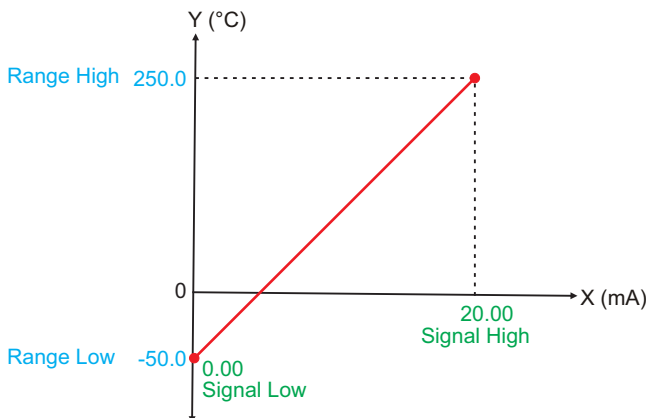
Example 2: Relative Humidity Transmitter producing **1 to 4.5 V** for **5 to 95 %RH**



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.

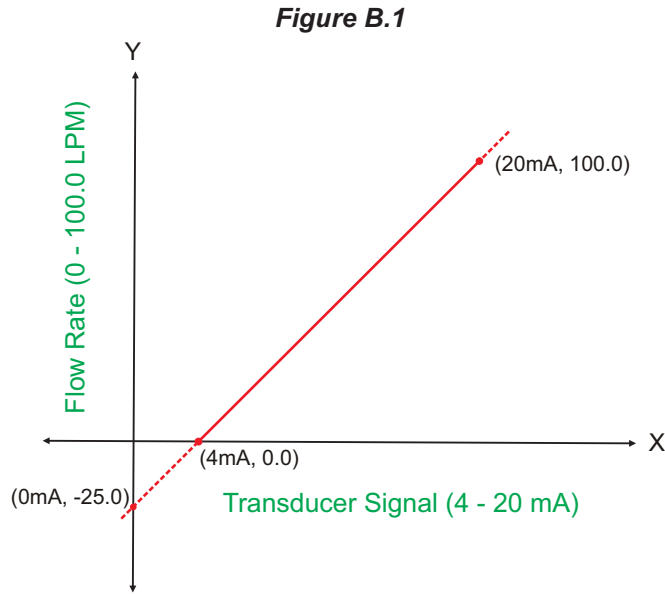
Input Type	: 0-20 mA
Signal Low	: 0.00 mA
Signal High	: 20.00 mA
PV Resolution	: 0.1
Range Low	: -50.0
Range High	: 250.0



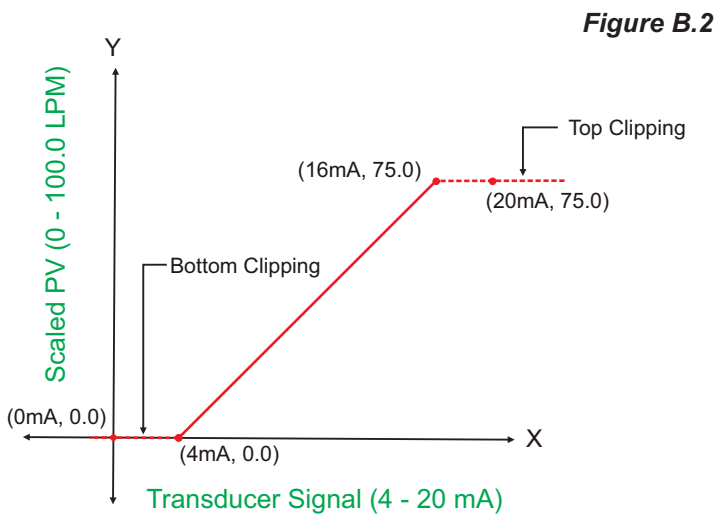
APPENDIX B BOTTOM / TOP CLIPPING

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).



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.



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.

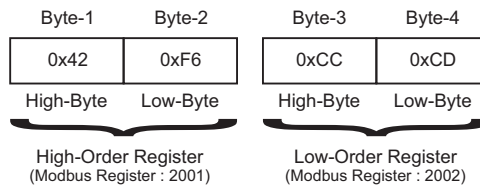
Read-Only Parameter

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 2008 (4 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. <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Value</th> <th style="width: 15%;">PV Error Type</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">-32768</td> <td style="text-align: center;">Under Range</td> </tr> <tr> <td style="text-align: center;">+32752</td> <td style="text-align: center;">Over Range</td> </tr> <tr> <td style="text-align: center;">+32767</td> <td style="text-align: center;">Sensor Open</td> </tr> </tbody> </table>	Value	PV Error Type	-32768	Under Range	+32752	Over Range	+32767	Sensor Open
	Value		PV Error Type							
-32768	Under Range									
+32752	Over Range									
+32767	Sensor Open									
	2001 to 2016 (8 Channels)									

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 118 for 4 Channels & 115 to 122 for 8 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.





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