Analog Input Module

AIMS-4X / AIMS-8X

4 / 8 Channels
DIN-Rail Mount
MODBUS over Serial

Process Precision Instruments
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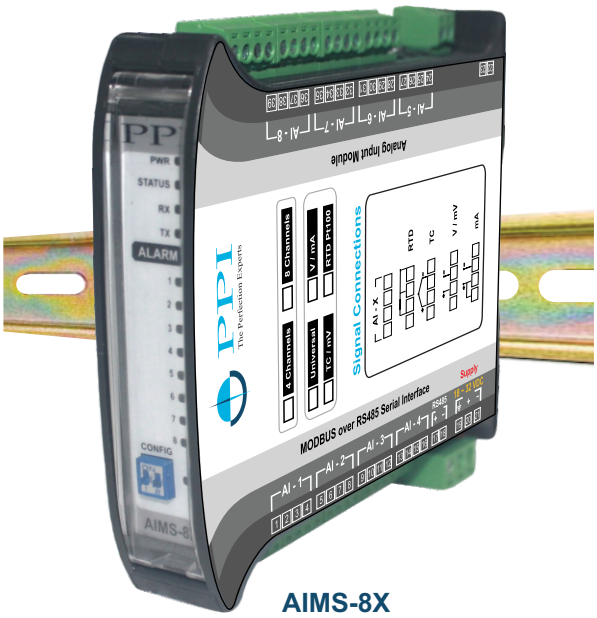
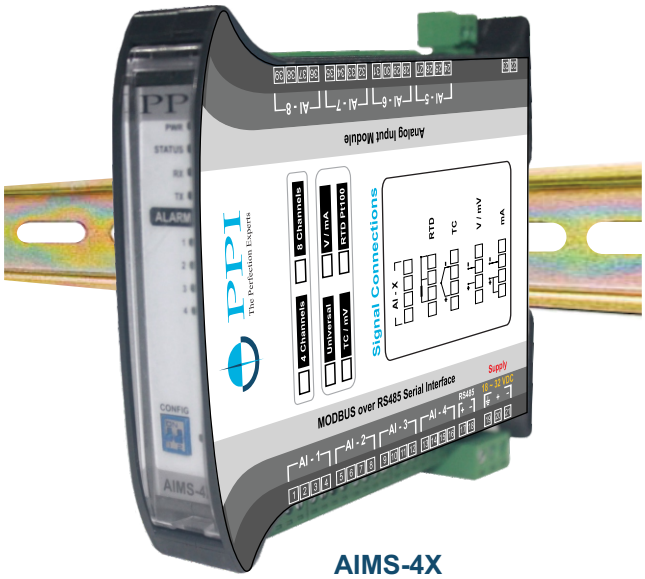
User Manual

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



AIMS-8X



AIMS-4X

Configuration Tool

CONTENTS

Section 1

PRODUCT OVERVIEW

The AIMS series is a compact, high-performance Analog Input Module engineered for seamless integration into industrial control, monitoring, and data acquisition systems via the RS485 serial interface, using the industry-standard MODBUS RTU protocol.

Available in 4-channel and 8-channel models, the AIMS series is designed to accommodate varied application needs through flexible input configurations. It ensures precise and stable measurements with features such as a 16-bit Sigma-Delta ADC, user-selectable channel update rates, built-in Cold Junction Compensation (CJC) for thermocouple inputs, Lead Resistance Compensation (LRC) for RTD inputs, and programmable scaling for DC voltage and current signals.

To support easy system integration, the module offers both 16-bit signed integer and 32-bit floating-point process value outputs. Three-way isolation between the power supply, input channels, and RS485 communication port ensures robust signal integrity and eliminates the risk of ground loop interference. Additionally, each channel supports four programmable soft alarms with dedicated LED indicators, enhancing process reliability and safety.

The AIMS is available in multiple input variants - Universal (U), DC V/mA (D), RTD Pt100 (P), and Thermocouple/mV (T) - and features a jumper-less design for fast and convenient software-based configuration.

The AIMS series is particularly well-suited for integration with SCADA, PLC, and HMI platforms, making it a reliable and flexible solution for system integrators working across diverse automation projects.

A free PC-based configuration tool is also provided, enabling quick and hassle-free setup.

Channel Specifications

Number of Channels	4 / 8
Input Types	Thermocouples : J, K, T, R, S, B, N RTD : Pt100, 3-Wire DC mV : 0 to 80 mV DC Volts : 0 to 1.25V, 0 to 5V, 1 to 5V, 0 to 10V DC mA : 0-20 mA, 4-20 mA
Accuracy	For Thermocouples & RTD : ± 0.25% of reading ± 1°C For DC Linear Volts / Current : ± 0.25% of reading ± 1 LSC
Resolution	For Thermocouples & RTD : 0.1 °C For DC Linear Volts / Current : 0.001 / 0.01 / 0.1 / 1 Counts
Corrections	• Cold-Junction Compensation for Thermocouples (Accuracy Better than ± 0.5°C) • Lead Resistance Compensation for RTD (Upto 22 Ohms in each lead)
Range	Thermocouple & RTD Pt100 : Refer Table-1 DC Volts / Current : -30000 to +30000 Counts
Zero Offset	User Adjustable over Full Range for Each Channel
ADC	16 Bit (± 32,768 Counts), Sigma-Delta (ΣΔ)
Sampling Time	Version U : 250mS Per Channel (4 Samples per Second) Version D : 100mS Per Channel (10 Samples per Second) Version P : 333mS Per Channel (3 Samples per Second) Version T : 100mS Per Channel (10 Samples per Second)

Input Resistance	> 10 MOhm
Common Mode Rejection	> 140dB at 50/60 Hz
Input Protection	ESD : 8KV EFT : 2KV Surge : 1KV
Input Conditioning	First Order Analog R-C Low-Pass Filter
Isolation	Three-way Isolation Eliminates Potential Ground Loops between Power, Inputs & RS485 Serial Port 1500VAC for 1 second or 250VAC continuous

Alarms

Numbers	4, Independent for Each Channel
Programmable Parameters	Type : Process Low, Process High Setpoint : Adjustable over Full Range Hysteresis : 1 to 3000 Unit Counts Inhibit : No, Yes

Serial Communication

Port	RS485, 2-wire, Half Duplex, Start-Stop Synchronized
Protocol	MODBUS RTU
Baud Rate	Settable : 2400, 4800, 9600, 19200, 38400, 57600
Parity	Settable : None, Even, Odd
Max. Units per Loop	31
Max. Distance	1200 Meters

Power Supply & Isolation

Type	Switch Mode (SMPS)
Power Requirement	18 ~ 32 VDC, nominal 24 VDC @ **60mA Max.** **Note** : In case of looping multiple modules on one power source, make sure that the power source is capable of supplying minimum 60mA current per module.
Isolation	1500VAC for 1 second or 250VAC continuous Three-way Isolation between Power, Inputs & Ethernet Port

Physical

Mounting	DIN-Rail
Overall Dimensions	22.5(W) X 101(H) X 119(D), mm
Terminals	Screw Type, Pluggable
Weight	400 gm, Appx.

Environmental

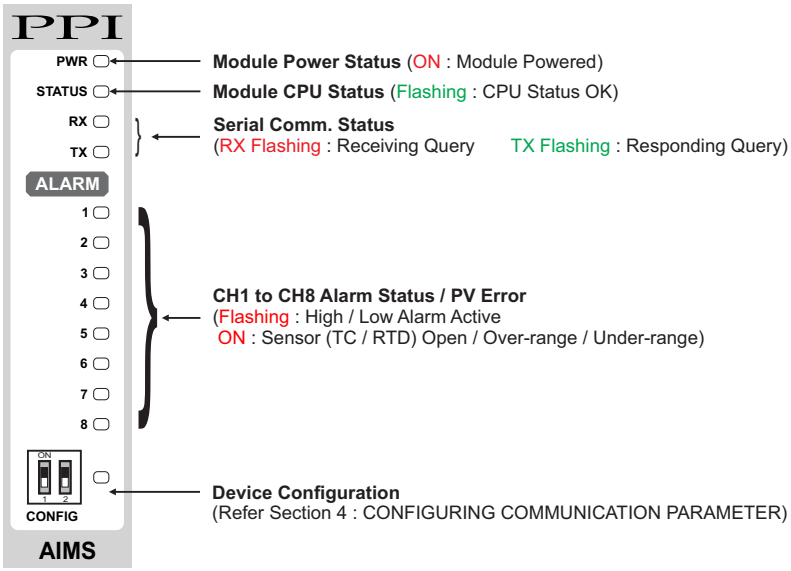
Operating Ambient	0 to 55°C & 5 to 90%RH Non-condensing
Storage Temperature	-10 to +70°C
Atmospheres	Not Suitable for use in Corrosive or Explosive Atmospheres. The Panel in which the Instrument is Mounted must be free of Electrically Conductive Pollution.

TABLE 1	
Input Type	**Range (Min. to Max.)**
2 / 3-wire, RTD Pt100	-199.9 to +600.0 °C / -328.0 to +1112.0 °F
Type J Thermocouple (Fe-K)	0.0 to +960.0°C / +32.0 to +1760.0°F
Type K Thermocouple (Cr-Al)	-200.0 to +1376.0°C / -328.0 to +2508.0°F
Type T Thermocouple (Cu-Con)	-200.0 to +387.0°C / -328.0 to +728.0°F
Type R Thermocouple (Pt / Pt-Rh13%)	0.0 to +1771.0°C / +32.0 to +3219.0°F
Type S Thermocouple (Pt / Pt-Rh10%)	0.0 to +1768.0°C / +32.0 to +3214.0°F
Type B Thermocouple (Pt-Rh6% / Pt-Rh30%)	0.0 to +1826.0°C / +32.0 to +3318.0°F
Type N Thermocouple (NiCrSi / NiSi)	0.0 to +1314.0°C / +32.0 to +2397.0°F

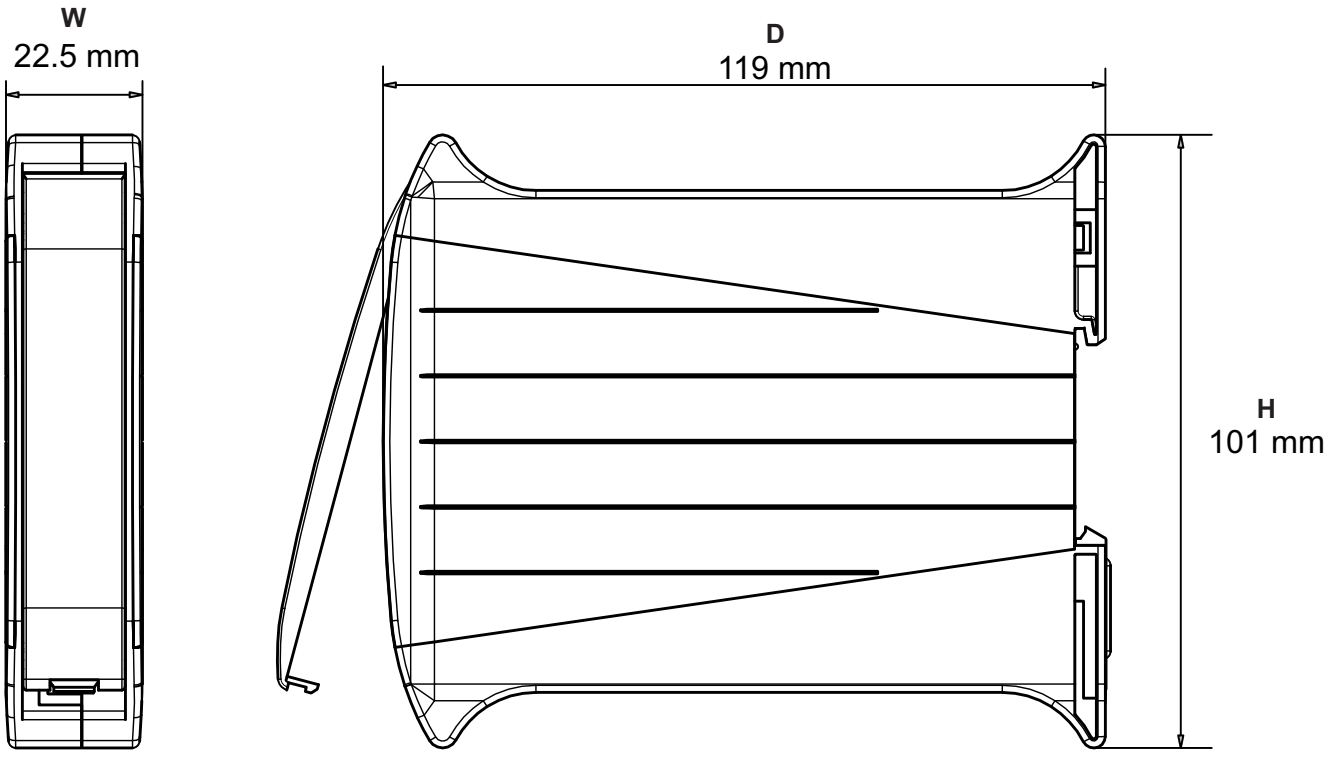
Section 2

HARDWARE OVERVIEW

FRONT PANEL



MECHANICAL DIMENSIONS

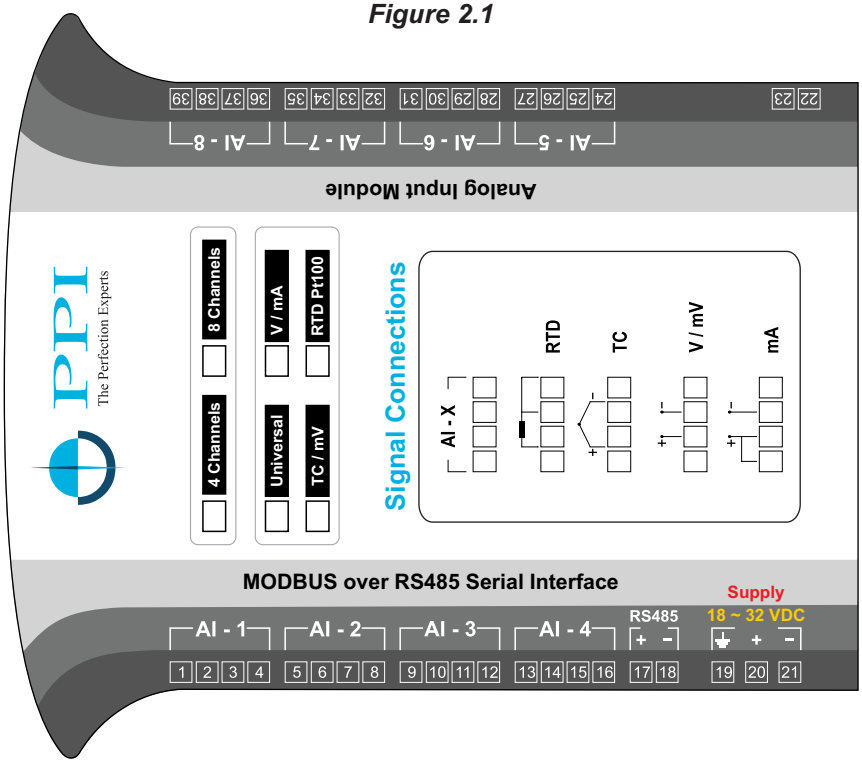


Overall Size (mm) : Width = 22.5, Height = 101.0, Depth = 119.0

CONNECTION DIAGRAM

The Figure 2.1 illustrates Electrical Connection Diagrams.

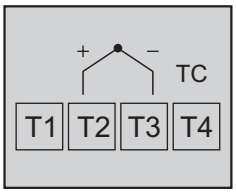
Figure 2.1



Input Channel Connections

Each of the 4 / 8 input channels follows an identical wiring configuration. For clarity in wiring description, the four terminals associated with each channel are labeled T1, T2, T3 & T4.

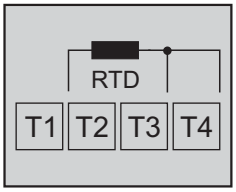
Figure 2.2(a)



Thermocouple (TC) Connections

- Connect the Thermocouple Positive (+) to T2 and Negative (-) to T3.
- Use the correct type of extension wires or compensating cables, ensuring polarity consistency.
- Avoid splicing or joining cables to prevent signal degradation.

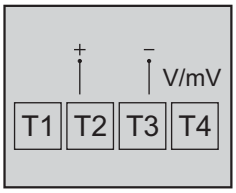
Figure 2.2(b)



RTD (Pt100 / Pt1000, 3-Wire) Connections

- Connect the single leaded end of the RTD sensor to T2.
- Connect the double leaded ends to T3 and T4 (interchangeable).
- Use copper conductors of low resistance, ensuring that all three leads are of the same gauge and length.

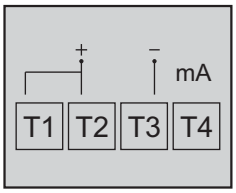
Figure 2.2(c)



DC Voltage (mV / V) Input

- Use shielded twisted-pair cables, with the shield grounded at the signal source.
- Connect common (-) to T3 and signal (+) to T2.

Figure 2.2(d)

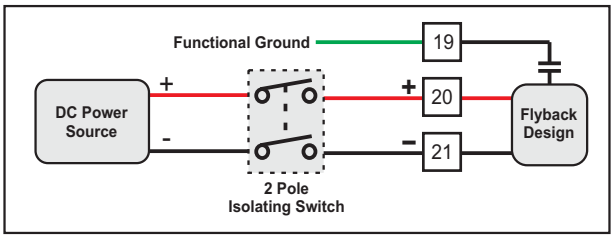


DC Current (mA) Input

- Use shielded twisted-pair cables, with the shield grounded at the signal source.
- Connect common (-) to T3 and signal (+) to T2. Short T1 & T2.

POWER SUPPLY (Terminals 20, 21)

Figure 2.3



As standard, the Module is supplied with power connections suited for 18 to 32 VDC power source. The accuracy / performance of the Module is not affected by the variations in the supply within specified limits of 18 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 2.3. 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.

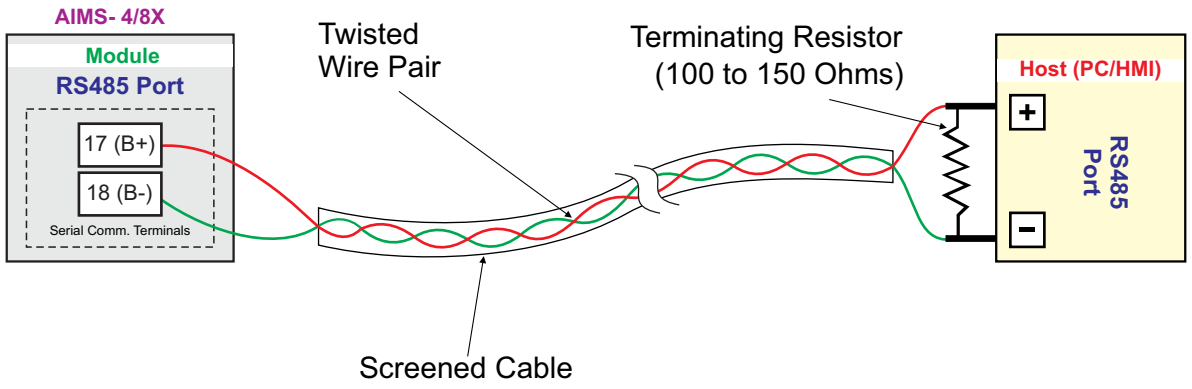
For safety and enhanced electrical noise immunity, it is highly recommended to connect Main Power Supply 'Earth' to terminal 19.

SERIAL COMMUNICATION PORT

The wiring connections for interfacing the Host (PC/HMI) with AIMS is shown in the figure 2.4.

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 2.4



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 3

CONFIGURING COMMUNICATION PARAMETERS

Overview

The AIMS Analog Input Module communicates with host devices (SCADA, PLC, or HMI) over a 2-wire RS485 interface using the industry-standard MODBUS RTU protocol. This section provides a structured explanation of the module's communication specifications and the procedure to configure its communication parameters.

Serial Communication Specifications

Port	RS485, 2-wire, Half-duplex, Start-stop synchronized
Protocol	MODBUS RTU
Maximum Units per Network Loop	31 units
Maximum Communication Distance	1200 meters

Configuration and Normal Operation Modes

Table 3.1

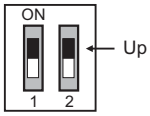
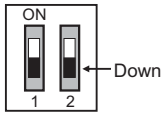
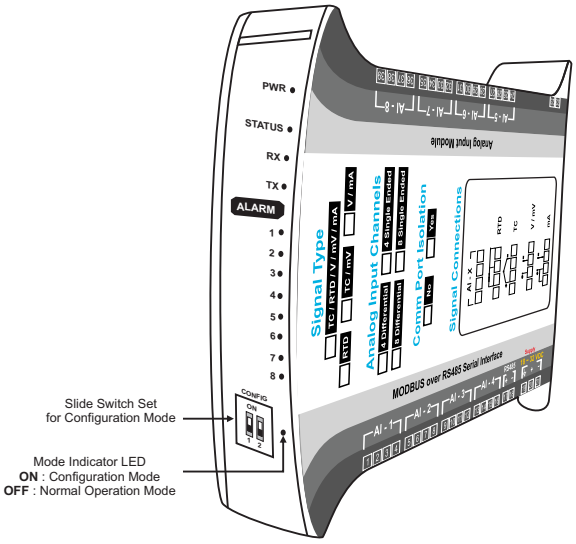
Operation Mode	Configuration	Normal
Switch Position		
Mode Indicator	ON	OFF
Communication Parameter Values	Fixed Values Slave ID : 1 Baud Rate : 9600 bps Parity : None	User Set Values

Figure 3.1



The module allows communication parameter settings through Configuration Mode and regular functioning via Normal Operation Mode.

- **Configuration Mode**
  - ➢ The module communicates at fixed settings (Slave ID = 1, Baud Rate = 9600 bps, Parity = None), regardless of user-set values.
  - ➢ Used for modifying communication parameters to match host settings.

- **Normal Operation Mode**
  - ➢ The module communicates using user-set parameters values.

Changing Communication Parameters

To alter communication parameters:

1. Set the DIP switches to Configuration Mode (both ON).
2. Power on the module.
3. Set the host (Master) communication parameters to Baud Rate: 9600 bps and Parity: None.
4. Using MODBUS RTU commands, write new values to the parameters (Slave ID, Baud Rate, and Parity) described below.
5. After writing the parameters, power off the module.
6. Set the DIP switches back to Normal Operation Mode (both OFF).
7. Power on the module; it will now operate with the newly set parameters.

Slave ID

MODBUS

- Data Type : Holding Register, Read / Write, 16-bit Unsigned Integer
  Address : 1
  Remark : Settable Range : 1 to 127 (Default : 1)

Description

A unique address assigned to each device on the MODBUS network. The master uses this ID to communicate with the specific module.

Baud Rate

MODBUS

- Data Type : Holding Register, Read / Write, 16-bit Unsigned Integer (ENUM)
  Address : 2
  Remark : 2400 bps = 0, 4800 bps = 1, 9600 bps = 2, 19200 bps = 3, 38400 bps = 4, 57600 bps = 5 (Default : 9600)

Description

The speed at which data is transmitted over the RS485 interface, measured in bits per second (bps). The module supports multiple baud rates for compatibility with various systems.

Parity

MODBUS

- Data Type : Holding Register, Read / Write, 16-bit Unsigned Integer (ENUM)
  Address : 3
  Remark : None = 0, Even = 1, Odd = 2 (Default : Even)

Description

A data integrity check method used in serial communication.

Section 4

MODBUS MAPPING

Overview

This section provides a comprehensive description of the MODBUS register mappings & parameter descriptions for the analog input channels. It explains data types, address allocations, and parameter handling for seamless integration into SCADA or PLC systems.

1. MODBUS DATA TYPES

Type	Description	Range	Remark
INT16	16-bit signed integer (1 word)	-32768 to 32767	MSB first
UINT16	16-bit unsigned integer (1 word)	0 to 65535	MSB first
FLOAT32	32-bit value (2 words)	-3.4028E+38 to 3.4028E+38	FLOAT32 is a 32-bit data type that represents a single-precision floating-point number. It is a binary representation of a decimal number, consisting of: • 1 sign bit (indicating positive or negative) • 8 exponent bits (representing the power of 2) • 23 fraction bits (representing the fractional part) FLOAT32 is commonly used to represent real numbers. It is compliant with the IEEE 754 floating-point standard.
BIT	Boolean value	0 or 1	Used for coil or discrete input status monitoring
BITMAP16	16-bit field (1 word)	Each bit value : 0 or 1	Represents a collection of 16 individual bits, with bit positions ranging from 0 (LSB) to 15 (MSB). Each bit can have a value of 0 or 1, allowing for a compact representation of binary data.
ENUM16	16-bit field (1 word)	0 to predefined numeric integer	ENUM (Enumeration) represents a predefined set of named values, typically stored in a 16-bit unsigned Modbus register. This register can hold a value between 0 and 65535, but in the context of ENUM, it is restricted to a specific set of discrete values. **For example**: ENUM (None = 0, Process Low Alarm = 1, Process High Alarm = 2) In this example, the ENUM data type is represented as an unsigned 16-bit integer (UINT16), with a predefined set of named values: None, Process Low Alarm, Process High Alarm.

2. RESOLUTION BASED PARAMETERS

MODBUS protocol utilizes 16-bit signed integer registers (Input and Holding Registers) to store data. These registers accommodate values within the range -32,767 to 32,768. However, many process parameters require values with decimal precision. Since MODBUS registers inherently do not support floating-point values, decimal handling is achieved through scaling techniques.

This section describes how **Fixed** and **Programmable** decimal point parameters are stored and retrieved using MODBUS registers.

Handling Fixed Decimal Point Values

For parameters with a fixed decimal resolution, the integer values written to the MODBUS register are automatically converted by the device. However, when reading values, users must convert the retrieved integer values back to their corresponding decimal representations by dividing them by the appropriate power of 10.

Example: Fixed Decimal Resolution of 0.01

- Parameter Range: -12.34 to 20.00
- Scaling Factor: 100 (since 0.01 = 10^(-2))
- Writing a Value: To set a parameter to 34.82, write 34.82 × 100 = 3482 into the register.
- Reading a Value: If the register contains 3482, the actual value is 3482 ÷ 100 = 34.82.

This method ensures consistency in handling values with fixed decimal precision across MODBUS communication.

Handling Programmable Decimal Point Values

For parameters with a programmable decimal resolution, the number of decimal places is stored in a separate parameter named Resolution (or PV Resolution). The resolution value determines the scaling factor applied when storing and retrieving values in MODBUS registers.

Resolution Parameter Definition

The resolution parameter is stored as an integer value corresponding to the decimal precision:

Resolution Value	Decimal Precision	Scaling Factor
0	1 (No Decimals)	10^0=1
1	0.1	10^1=10
2	0.01	10^2=100
3	0.001	10^3=1000
4	0.0001	10^4=10000

Example: Programmable Decimal Resolution

- Resolution Parameter Value: 3 (corresponding to 0.001 resolution)
- Writing a Value: To set the parameter to 27.651, use Scaling Factor 1000 (corresponding to Resolution value 3) to convert the decimal value to integer value : 27.651 × 1000 = 27651 and write to the MODBUS register.
- Reading a Value: If the register contains 27651, divide by 1000 (10^3) to get 27.651.

Using this method, MODBUS allows flexible handling of parameters where decimal precision may need to be adjusted dynamically.

3. PROCESS VALUE (PV) AS FLOAT32 DATA TYPE

The module supports reading process values for all channels in 32-bit Single Precision Floating-Point (FLOAT32) format via MODBUS communication. This allows direct access to real-time measured values with decimal precision for easy integration into SCADA, PLC, and monitoring systems.

Data Representation

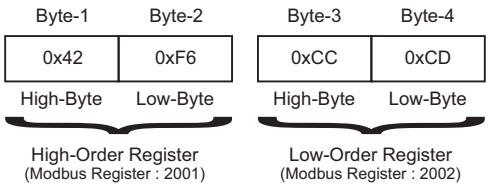
- The process values are represented in IEEE 754 single precision floating-point format.
- The FLOAT32 data occupies two consecutive 16-bit MODBUS registers, with the high-order register at an odd address.
  Example :
  The MODBUS address for Channel-1 float value is 2001and it occupies two registers; 2001(high register) & 2002 (low register).
- The byte order follows standard MODBUS RTU convention:
  - High-order byte first, followed by low-order byte within each 16-bit register.

Byte and Register Sequence Example

Let's consider an example of a process value reading for Channel 1:

- Process Value: 123.4
- Hexadecimal FLOAT32 Representation: 0x42F6CCCD

Register allocation and byte order:



The MODBUS frame will transmit these bytes in sequence:

Byte-1 → Byte-2 → Byte-3 → Byte-4 (0x42, 0xF6, 0xCC, 0xCD)

Resolution Details

- For Thermocouple and RTD Pt100 inputs, the FLOAT32 process values are communicated with a fixed 0.1 resolution.
- For DC Linear inputs (mV / V / mA), the resolution depends on the DC Resolution parameter, which can be set from 0 to 4.
  Example : If DC Resolution = 2 (0.01 resolution) and the measured integer count is 12345, the FLOAT32 value will be transmitted as 123.45 (i.e., 12345 ÷ 100).

PV Errors

The following constant counts indicate PV Errors.

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

4. MODBUS FUNCTIONS SUPPORTED

Description	Function Code
Read Input Registers	04
Read Holding Registers	03
Write Single Holding Register	06
Write Multiple Holding Registers	16

Description	Function Code
Read Discrete Inputs	02
Read Coils	01
Write Single Coil	05
Write Multiple Coils	15

5. PARAMETER DESCRIPTIONS

Note :
In the following parameter descriptions, the MODBUS addresses are mentioned for 8 channels. For 4 channel module, only the first four addresses are valid. Similarly for BITMAP16 data type, ignore bit positions 4 to 7 for 4 channel module.

Process Value (PV)

MODBUS
The process values for all channels can be monitored as both INT16 and FLOAT32 data types.

- Data Type : Input Register, Read-only, INT16
  Address : 1561 (CH1) to 1568 (CH8)
  Remark : Values require scaling as per resolution settings.
  PV errors are indicated as the following constant integer values.

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

- Data Type : 2x Input Register, Read-only, FLOAT32
  Address : 2001 (CH1) to 2015 (CH8)
  Remark : Direct representation of measured PV (°C / °F for TC/RTD or scaled counts for mV/mA inputs).

Description
The PV represents the measured temperature or scaled counts for each channel based on the input type. Refer below tables.

Thermocouples & RTDs	
Input Type	**Range (Min. to Max.)**
Type J	0 to +960.0°C / +32.0 to +1760.0°F
Type K	-200.0 to +1376.0°C / -328.0 to +2508.0°F
Type T	-200.0 to +387.0°C / -328.0 to +728.0°F
Type R	0 to +1771.0°C / +32.0 to +3219.0°F
Type S	0 to +1768.0°C / +32.0 to +3214.0°F
Type B	0 to +1826.0°C / +32.0 to +3318.0°F
Type N	0 to +1314.0°C / +32.0 to +2397.0°F
RTD Pt100	-199.0 to +850.0°C / -328.0 to +1562.0°F

DC Signals	
Input Type	**Range (Min. to Max.)**
0 to 20 mA	-30000 to 30000 units Settable Resolution: 1 0.1 0.01 0.001 0.0001 Units
4 to 20 mA	
0 to 80 mV	
0 to 1.25 V	
0 to 5.0 V	
0 to 10.0 V	
1 to 5.0 V	

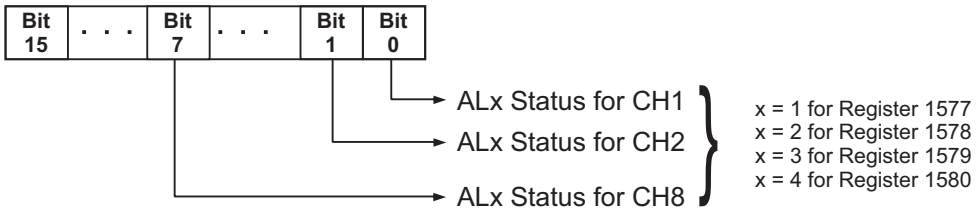
Alarm Status

MODBUS

The status for each of the 4 alarms (AL1 to AL4) across 8 channels (CH1 to CH8) can be monitored as both BIT and BITMAP16 data types.

- Data Type : Discrete Input, Read-only, BIT
  Address : 1 to 8 (AL1 Status for CH1 to CH8)
  17 to 24 (AL2 Status for CH1 to CH8)
  33 to 40 (AL3 Status for CH1 to CH8)
  49 to 56 (AL4 Status for CH1 to CH8)
  Remark : 0 = Alarm Off, 1 = Alarm On

- Data Type : Input Register, Read-only, BITMAP16
  Address : 1577 (AL1 Status for CH1 to CH8), 1578 (AL2 Status for CH1 to CH8)
  1579 (AL3 Status for CH1 to CH8),1580 (AL4 Status for CH1 to CH8)
  Remark : Each bit : 0 = Alarm Off, 1 = Alarm On



- **Description**

Alarm status for each of the 4 alarms (AL1 to AL4) across 8 channels (CH1 to CH8).

Ambient Temperature

MODBUS

- Data Type : Input Register, Read-only, INT16
  Address : 82
  Remark : Resolution based parameter

Description

- Represents the ambience temperature surrounding the module.
- Measured in °C with 0.1°C resolution.
- Used for cold junction compensation for thermocouple inputs.
- Applicable for versions supporting thermocouples inputs.

Digital Filter

MODBUS

- Data Type : Holding Register, Read / Write, INT16
  Address : 1612 (CH1) to 1619 (CH8)
  Remark : —

Description

- Applies an IIR (Infinite Impulse Response) filter to the measured Process Value (PV) to minimize signal noise and fluctuations.
- Adjustable filter strength from 0% to 90%.
- Setting 0% disables the filter.
- Higher values provide greater noise reduction but result in a slower response time.
- Lower values allow faster response but with less noise suppression.

Input Type

MODBUS

- Data Type : Holding Register, Read / Write, ENUM16
  Address : 83 (CH1) to 90 (CH8)
  Remark : **Version : AIMS 4U / 8U**
  Type J = 0, Type K = 1, Type T = 2, Type R = 3, Type S = 4, Type B = 5, Type N = 6
  RTD Pt100 = 8
  0 to 20 mA = 9, 4 to 20 mA = 10
  0 to 80 mV = 11, 0 to 1.25 V = 13, 0 to 5 V = 14, 0 to 10 V = 15, 1 to 5 V = 16 (**Default : 0 to 10 V**)

  Version : AIMS 4D / 8D
  0 to 20 mA = 0, 4 to 20 mA = 1, 0 to 1.25 V = 2, 0 to 5 V = 3, 0 to 10 V = 4, 1 to 5 V = 5 (**Default : 0 to 10 V**)

  Version : AIMS 4T / 8T
  Type J = 0, Type K = 1, Type T = 2, Type R = 3, Type S = 4, Type B = 5, Type N = 6
  0 to 80 mV = 8 (**Default : Type K**)

  Version : AIMS 4P / 8P
  RTD Pt100 = 0 (Read only)

Description

- Defines the type of input signal the addressed channel will process.

Temperature Units

MODBUS

- Data Type : Holding Register, Read / Write, ENUM16
  Address : 99 (CH1) to 106 (CH8)
  Remark : °C = 0, °F = 1 (Default : °C)

Description

- Defines the units for converting the measured temperature.
- Applicable for Thermocouples & RTDs only.

PV Resolution

MODBUS

- Data Type : Holding Register, Read / Write, ENUM16
  Address : 115 (CH1) to 122 (CH8)
  Remark : 1 count = 0, 0.1 count = 1, 0.01 count = 2, 0.001 count = 3, 0.0001 count = 4
  (Default : 1 Unit for DC Linear input & 0.1 for Thermocouple & RTD)

Description

- Determines the decimal point position for the measured PV.
- Thermocouples & RTDs always follow fixed 0.1 °C / °F resolution. This parameter value is ignored.
- Parameters such as alarm limits, hysteresis, etc. follow the set resolution setting.

Signal Low

MODBUS

- Data Type : Holding Register, Read / Write, INT16
  Address : 501 (CH1) to 508 (CH8)
  Remark : Resolution based parameter. Refer table below for input type v/s settable range.

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

Description

- Applicable to mV / V / mA input signals.
- Helps in scaling transmitter signals to match the desired measured PV range.
- Defines the input signal value corresponding to the **low end** of the PV range.
- Refer *Appendix-A : DC Linear Signal Interface* for details.

Signal High

MODBUS

- Data Type : Holding Register, Read / Write, INT16
  Address : 517 (CH1) to 524 (CH8)
  Remark : Resolution based parameter. Refer table below for input type v/s settable range.

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

Description

- Applicable to mV / V / mA input signals.
- Helps in scaling transmitter signals to match the desired measured PV range.
- Defines the input signal value corresponding to the **high end** of the PV range.
- Refer *Appendix-A : DC Linear Signal Interface* for details.

PV Range Low

MODBUS

- Data Type : Holding Register, Read / Write, INT16
  Address : 131 (CH1) to 138 (CH8)
  Remark : Resolution based parameter.
  Settable Range : -30000 to 30000 (Default : 0)

Description

- Applicable to mV / V / mA input signals.
- Helps in signal-to-value mapping for transmitter signal inputs.
- Defines the process value that corresponds to the **Signal Low** input.
- Refer *Appendix-A : DC Linear Signal Interface* for details.

PV Range High

MODBUS

- Data Type : Holding Register, Read / Write, INT16
  Address : 147 (CH1) to 154 (CH8)
  Remark : Resolution based parameter.
  Settable Range : -30000 to 30000 (Default : 1000)

Description

- Applicable to mV / V / mA input signals.
- Helps in signal-to-value mapping for transmitter signal inputs.
- Defines the process value that corresponds to the **Signal High** input.
- Refer *Appendix-A : DC Linear Signal Interface* for details.

PV Zero-offset

MODBUS

- Data Type : Holding Register, Read / Write, INT16
  Address : 163 (CH1) to 170 (CH8)
  Remark : Resolution based parameter.
  Settable Range : -30000 to 30000 (Default : 0)

Description

- Compensates for sensor zero-offset or thermal gradient errors.
- The set value is algebraically added to the measured Process Value (PV) to correct deviations.
- Final PV = Measured PV + Zero-offset.

Alarm Type

MODBUS

- Data Type : Holding Register, Read / Write, ENUM16
  Address : 179 to 186 (AL1 Type for CH1 to CH8), 243 to 250 (AL2 Type for CH1 to CH8)
  307 to 314 (AL3 Type for CH1 to CH8), 371 to 378 (AL4 Type for CH1 to CH8)
  Remark : None = 0, Process Low = 1, Process High = 2 (Default : None).

Description

Defines the alarm condition for the addressed alarm number.

- *None* : Disables the alarm.
- *Process Low* : Triggers an alarm when PV drops below the set low limit.
- *Process High* : Triggers an alarm when PV exceeds the set high limit.

Alarm Setpoint

MODBUS

- Data Type : Holding Register, Read / Write, INT16
  Address : 195 to 202 (AL1 SP for CH1 to CH8), 259 to 266 (AL2 SP for CH1 to CH8)
  323 to 330 (AL3 SP for CH1 to CH8), 387 to 394 (AL4 SP for CH1 to CH8)
  Remark : Resolution based parameter.
  Min. to Max. Range specified for the selected Input Type.
  Default : Min Range for Alarm Low type & Max Range for Alarm High type.

Description

- Defines the alarm limit for the addressed alarm number and channel number.
- Sets the low limit if the alarm type is Process Low.
- Sets the high limit if the alarm type is Process High.

Alarm Hysteresis

MODBUS

- Data Type : Holding Register, Read / Write, INT16
  Address : 211 to 218 (AL1 Hyst for CH1 to CH8), 275 to 282 (AL2 Hyst for CH1 to CH8)
  339 to 346 (AL3 Hyst for CH1 to CH8), 403 to 410 (AL4 Hyst for CH1 to CH8)
  Remark : Resolution based parameter. 1 to 30000 (Default : 20)

Description

- Specifies the hysteresis value for the addressed alarm number and channel number.
- Introduces a dead band between the ON and OFF states to prevent rapid switching.

Alarm Inhibit

MODBUS

The alarm inhibit for each of the 4 alarms (AL1 to AL4) across 8 channels (CH1 to CH8) can be accessed as both BIT and UINT16 data types.

- Data Type : Coil, Read / Write, BIT
  Address : 65 to 72 (AL1 Inhibit for CH1 to CH8), 81 to 88 (AL2 Inhibit for CH1 to CH8)
  97 to 104 (AL3 Inhibit for CH1 to CH8), 113 to 120 (AL4 Inhibit for CH1 to CH8)
  Remark : 0 = Disable, 1 = Enable (Default : Disable)

- Data Type : Holding Register, Read / Write, UINT16
  Address : 227 to 234 (AL1 Inhibit for CH1 to CH8), 291 to 298 (AL2 Inhibit for CH1 to CH8)
  355 to 362 (AL3 Inhibit for CH1 to CH8), 419 to 426 (AL4 Inhibit for CH1 to CH8)
  Remark : 0 = Disable, 1 = Enable (Default : Disable)

- **Description**

Decides whether alarm monitoring starts immediately after power-up.

Yes

Alarm monitoring begins only after the PV crosses the limit once:

- Above the low limit for Process Low alarms.
- Below the high limit for Process High alarms.

No

The alarm monitors PV immediately after power-up.

Enable Bottom Clipping

MODBUS

- Data Type : Holding Register, Read / Write, UINT16
  Address : 435 (CH1) to 442 (CH8)
  Remark : 0 = Disable, 1 = Enable (Default : Disable)

Description

- Applicable for mV / V / mA inputs.
- Refer Appendix-B.

Bottom Clip Value

MODBUS

- Data Type : Holding Register, Read / Write, INT16
  Address : 451 (CH1) to 458 (CH8)
  Remark : Resolution based parameter. Settable Range : -30000 to 30000 (Default : 0)

Description

- Applicable for mV / V / mA inputs.
- Refer Appendix-B.

Enable Top Clipping

MODBUS

- Data Type : Holding Register, Read / Write, UINT16
  Address : 467 (CH1) to 474 (CH8)
  Remark : 0 = Disable, 1 = Enable (Default : Disable)

Description

- Applicable for mV / V / mA inputs.
- Refer Appendix-B.

Top Clip Value

MODBUS

- Data Type : Holding Register, Read / Write, INT16
  Address : 483 (CH1) to 490 (CH8)
  Remark : Resolution based parameter. Settable Range : -30000 to 30000 (Default : 1000)

Description

- Applicable for mV / V / mA inputs.
- Refer Appendix-B.

Section 5

PC BASED DEVICE SETUP UTILITY

OVERVIEW

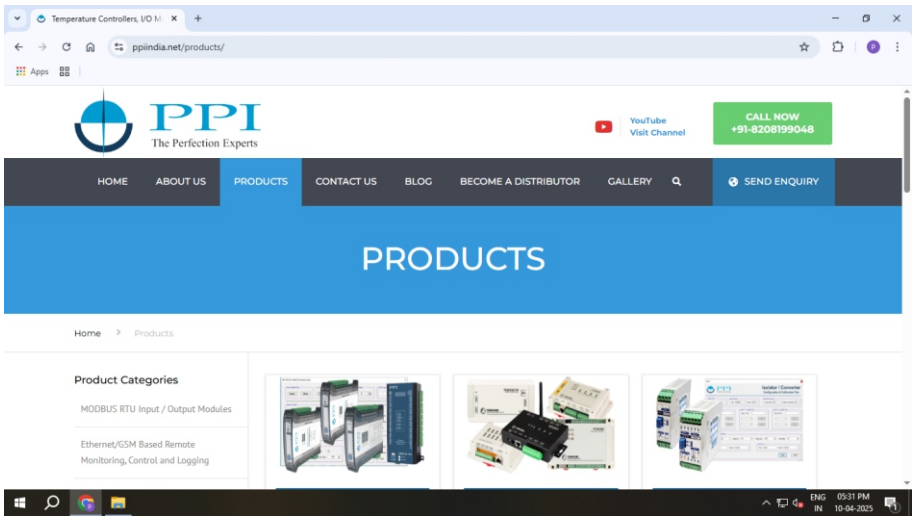
UniSet is a free Windows-based configuration utility developed by PPI to simplify the setup, parameter configuration, and monitoring of its MODBUS-compatible product range. It eliminates the need for manual MODBUS commands and streamlines device commissioning and testing.

This utility offers a quick, reliable, and user-friendly interface for configuring and validating this device during initial setup and field deployment.

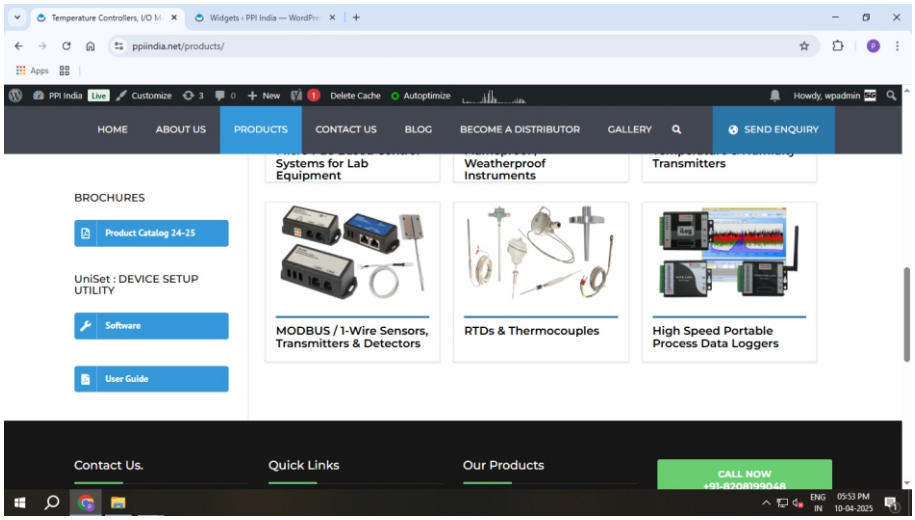
5.1 DOWNLOADING THE SETUP TOOL

The tool is available for **free download** from the **PPI website** and can be accessed from the **PRODUCTS** section. To download and launch the tool:

1. **Visit** www.ppiindia.net and click on the **PRODUCTS** tab in the main navigation menu.



2. In the **left-hand panel**, scroll to **UniSet : Device Setup Utility**.



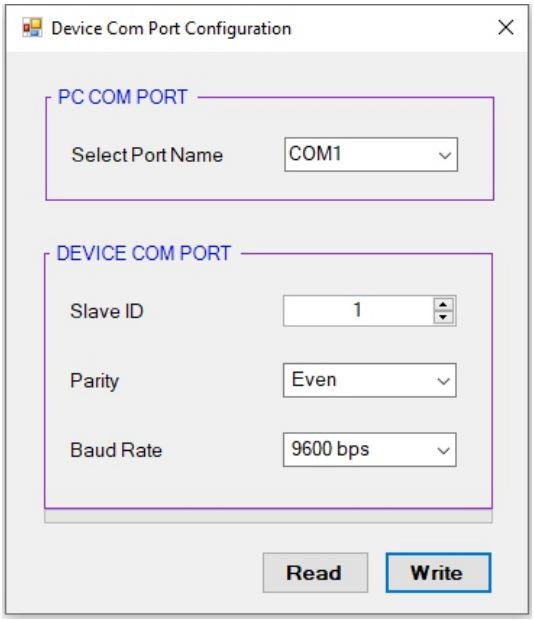
3. Two buttons will be visible under this section:
   - **Software** – Click to download the configuration utility archive (IO-Module-Configuration-Tool.rar).
   - **User Guide** – Click to download the PDF manual for reference.

4. After downloading the archive file:
   - Extract the contents into a folder (e.g., IO-Module-Configuration-Tool).
   - Open the folder and double-click on IO Module Configuration Tool.exe to launch the application.

The **UniSet** interface for this device includes the following key task panels:

5.2 DEVICE COM PORT SETTING

Used to select the appropriate COM port and configure baud rate, parity, and slave ID to match the connected device.

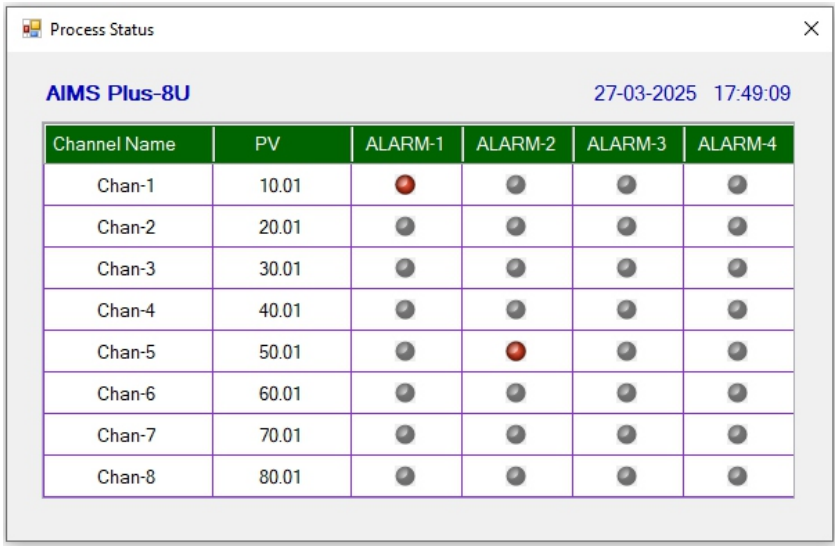


5.3 PARAMETER SETTINGS

Used to configure device-specific channel parameters. Users can load/save configuration files or write/read directly to/from the connected device.

5.4 ON-LINE MONITORING

Displays real-time process values, alarms, and I/O statuses (as applicable). Useful for system diagnostics and validation.



Channel Name	PV	ALARM-1	ALARM-2	ALARM-3	ALARM-4
Chan-1	10.01				
Chan-2	20.01				
Chan-3	30.01				
Chan-4	40.01				
Chan-5	50.01				
Chan-6	60.01				
Chan-7	70.01				
Chan-8	80.01				

APPENDIX A

DC LINEAR SIGNAL INTERFACE

Overview

Various transmitters generate different signal types, such as mV, V, or mA, with distinct signal ranges. To ensure compatibility with a wide range of transmitters, PPI products offer configurable Signal Type and Range settings.

Common industry-standard signal ranges include:

- 0 to 80 mV, 0 to 160 mV
- 0 to 5 V, 1 to 5 V, 0 to 10 V
- 0 to 20 mA, 4 to 20 mA

Additionally, since transmitters output different signal ranges corresponding to specific process values (e.g., a 1 to 4.5 V signal may represent 5% to 95% RH), PPI products allow users to configure the process value range and resolution.

Required Parameters for Linear Transmitter Interface

For interfacing linear transmitters, the following six parameters must be configured:

Parameter	Definition	Example
Input Type	Defines the standard DC signal type in which the transmitter signal range falls.	4 to 20 mA
Signal Low	The minimum signal value corresponding to the lowest process value.	4.00 mA
Signal High	The maximum signal value corresponding to the highest process value.	20.00 mA
PV Resolution	Defines the smallest measurable unit for the process value.	0.01 psi
Range Low	The process value corresponding to Signal Low.	0.00 psi
Range High	The process value corresponding to Signal High.	5.00 psi

Mathematical Representation

The relationship between transmitter signal values and the corresponding process values follows a straight-line equation:

$$Y = mX + C$$

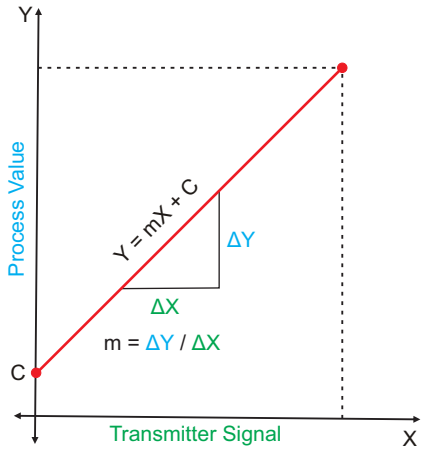
Where;

X : Signal Value from Transmitter

Y : Process Value Corresponding to X

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

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

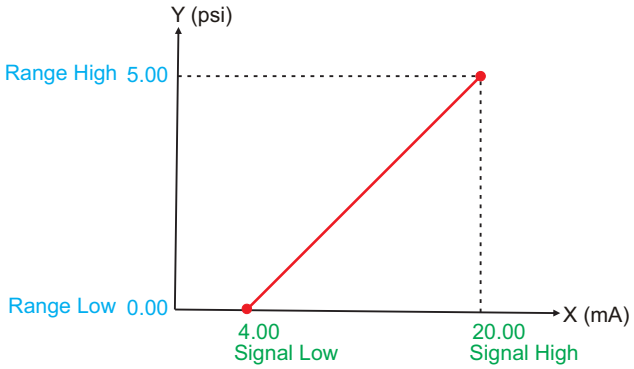


Examples of Transmitter Configurations

Example 1:

Pressure Transmitter (**4 to 20 mA** corresponding to **0 to 5 psi**)

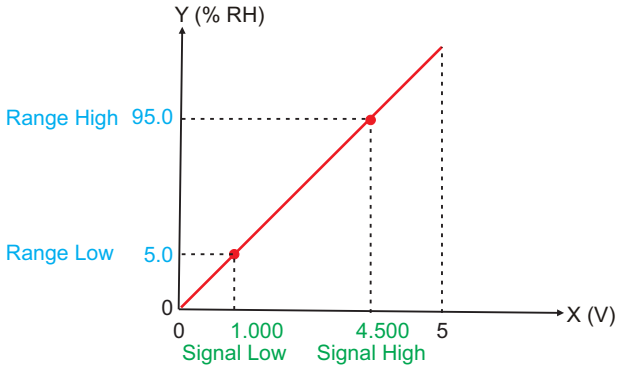
Input Type	:	4-20 mA
Signal Low	:	4.00 mA
Signal High	:	20.00 mA
PV Resolution	:	0.01
Range Low	:	0.00
Range High	:	5.00



Example 2

Humidity Transmitter (**1 to 4.5 V** corresponding to **5 to 95 %RH**)

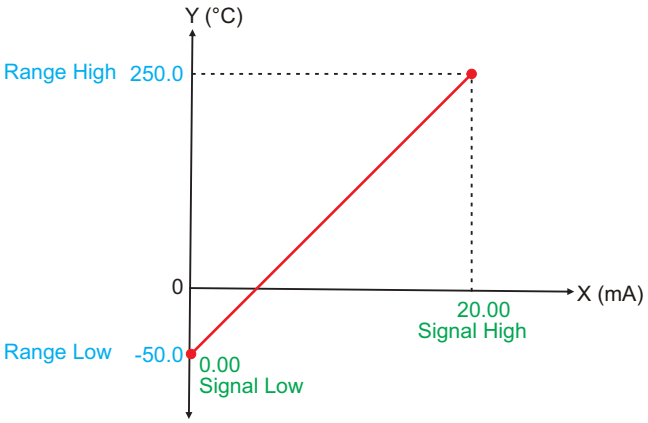
Input Type	:	0-5 V
Signal Low	:	1.000 V
Signal High	:	4.500 V
PV Resolution	:	0.1
Range Low	:	5.0
Range High	:	95.0



Example 3

Temperature Transmitter (**0 to 20 mA** corresponding to **-50 to 250 °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



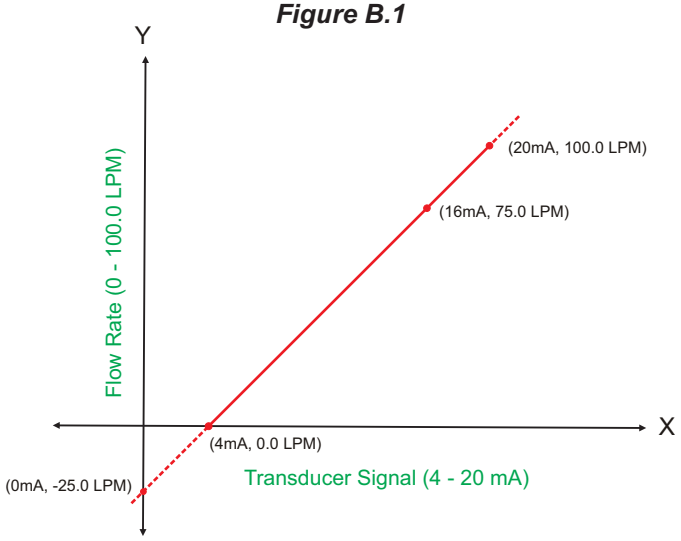
APPENDIX B

LOW / HIGH CLIPPINGS

Overview

For mA, mV, or V inputs, the measured process value (PV) is calculated based on the configured Signal Low and Signal High values, which correspond to the PV Range Low and PV Range High settings. Low and High Clippings allow users to restrict PV values within a specific operational range to suppress unwanted out-of-range values.

Figure B.1



Example: Flow Rate Measurement

A flow transmitter outputs a signal between 4 to 20 mA, corresponding to a flow rate of 0.0 to 100.0 LPM (Liters per Minute). However, if the system is designed for a maximum flow rate of 75.0 LPM, then only the signal range 4 to 16 mA is relevant. Without clipping, any signal value outside this range would result in incorrect process values.

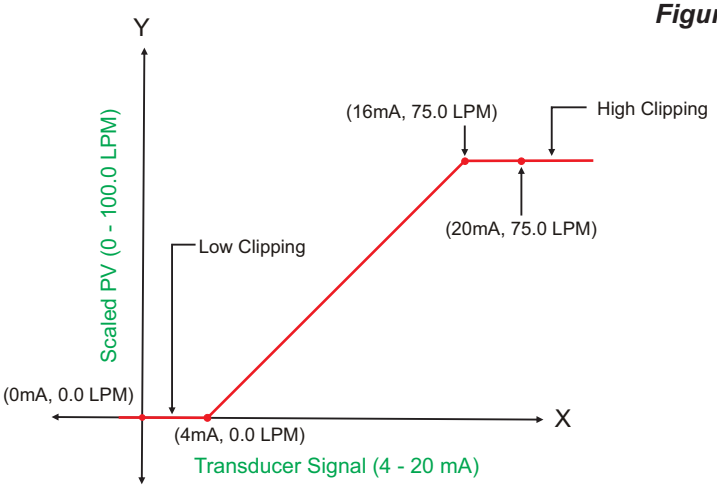
Low & High Clippings Implementation

To prevent out-of-range readings:

- Enable Low Clipping: Suppresses PV values below the Signal Low threshold.
- Enable High Clipping: Restricts PV values exceeding the Signal High threshold.

Example Parameter Configuration for Clipping

Figure B.2



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

Summary

- Low Clipping ensures that the PV does not drop below the defined minimum.
- High Clipping ensures that the PV does not exceed the defined maximum.
- This feature is useful for applications where operating limits are predefined and must be strictly followed.

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