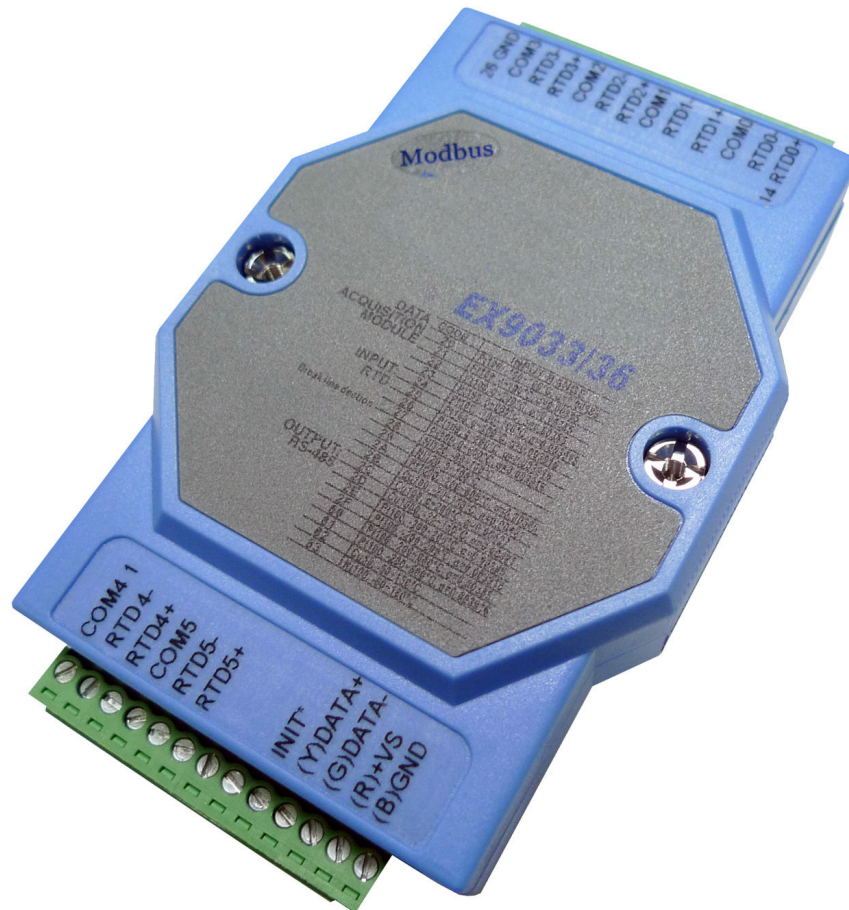# Technical Manual for
RT-EX-9036

Version 2.01

6 x Analog RTD Sensor Input (16 bit)

Introduction

The EX9036 MODBUS I/O Expansion module is a high-quality and low-cost add-on data acquisition device that allows expanding the on-board analog input capabilities on X32-based RTCU units almost indefinitely and completely transparent using MODBUS communication protocol.

The EX9036 uses the EIA RS-485 - the industry's most widely used bi-directional, balanced transmission line standard. It lets the module transmit and receive data at high data rates over long distances.

The EX9036 can be used to expand the RTCU with additional 6 high resolution analog inputs which are useful in a variety of applications saving your time, money and the risk of modifying legacy systems.

The EX9036 accepts different configurations of RTD sensors which can be useful for applications demanding high precision and wide-range temperature measurement

The EX9036 works in a variety of environments and applications, including:

> ➢ Factory automation and control
> ➢ SCADA applications
> ➢ HVAC applications
> ➢ Remote measuring, monitoring and control
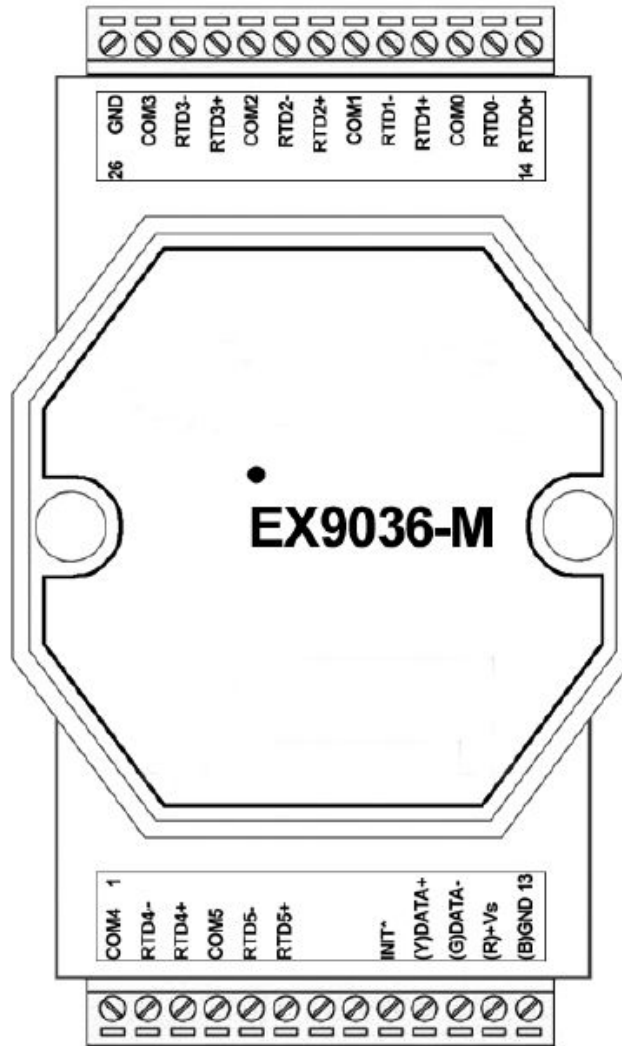> ➢ Security and alarm systems, etc.

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Graphical view

Pin Assignment

The 2 x 13-pins plug-terminals as seen in the following figure allow connecting supply, communication lines and analog inputs. The table below shows pin names and their functions.

Pin	Name	Description
1	COM4	Sensor 4 common
2	RTD4-	Sensor 4 input
3	RTD4+	Sensor 4 input
4	COM5	Sensor 5 common
5	RTD5-	Sensor 5 input
6	RTD5+	Sensor 5 input
7	NC	
8	NC	
9	INIT*	Pin for initialization of the configuration routine

Pin	Name	Description
10	(Y)DATA+	RS485+ data signal
11	(G)DATA-	RS485- data signal
12	(R)+VS	(+) Supply. Please refer to the specification for correct voltage level
13	(B)GND	Supply ground.
14	RTD0+	Sensor 0 input
15	RTD0-	Sensor 0 input
16	COM0	Sensor 0 common
17	RTD1+	Sensor 1 input
18	RTD1-	Sensor 1 input
19	COM1	Sensor 1 common
20	RTD2+	Sensor 2 input
21	RTD2-	Sensor 2 input
22	COM2	Sensor 2 common
23	RTD3+	Sensor 3 input
24	RTD3-	Sensor 3 input
25	COM3	Sensor 3 common
26	GND	Analog ground

Please refer to the section "Wire Connections" for correct wiring to the external device/sensor.

Default Settings

Name	Description
Baud rate	9600
Data bits	8
Parity	None
Stop bit	1
Device address	1
RTD Type	PT100, -100 to 100 ºC

These settings can easily be changed in RTCU IDE. Please refer to "Appendix A – Using the module as I/O extension in the RTCU IDE" for details.

LED Indicator

The EX9036 is provided with a system LED to indicate power status and communication. In the following table description of the different states of the LED can be found:

Name	Pattern	Description
	ON	Power on
System	OFF	Power off
	Blinking	Module is communicating with a RTCU unit

INIT* Pin Operation (Configuration mode)

The module has a build-in EEPROM to store configuration information such as address, type, baud rate and other information. Sometimes a user may forget the configuration of the module, or simply need to change it. Therefore, the module has a special mode named **"INIT mode"** to allow the system to change the configuration. To enable INIT mode, please follow these steps:

1. Power off the module.
2. Connect the INIT* pin to the GND pin.
3. Power on the module.

The module is now ready to be configured, afterward remove the power.

When using the RTCU IDE to change the setting, select "setup module" from the right-click menu of the node in "I/O – Extension" tree, and a guide will go through each step of the configuration process. Please refer to the RTCU IDE on-line help for further information.

RTD Input

RTD sensors are high temperature measurements devices which come in many variations and for demanding applications. The EX9036 module accepts the following types of RTD sensors:

Type	Temperature Range [ºC]
Platinum 100 α=0.00385	-100 to 100
Platinum 100 α=0.00385	0 – 100
Platinum 100 α=0.00385	0 – 200
Platinum 100 α=0.00385	0 – 600
Platinum 100 α=0.003916	- 100 – 100
Platinum 100 α=0.003916	0 – 100
Platinum 100 α=0.003916	0 – 200
Platinum 100 α=0.003916	0 – 600

For sensitivity of the RTD sensor see the appropriate datasheet for the RTD sensor used.

Implementation

The high resolution analog-to-digital converter returns a 16 bit value to the RTCU. A RTD sensor is an accuracy device (0,385 Ω/ºC - 0,392 Ω/ºC), therefore the resistance and installation of the lead wire has influence on the measurement, and must be taken in consideration for an accurate measurement.

The minimum and maximum ranges in different configurations are shown in the table below.

Range	Min.(DINT)	Max. (DINT)
-100 to 100 ºC	0	65535
0 to 100 ºC	0	65535
0 to 200 ºC	0	65535
0 to 600 ºC	0	65535

As INT supports values up to 32767, DINT must be used as data type in order to cover the whole value range.

The analog input module has the same 16 bit resolution in all of the configurations, so for increased accuracy select the range which fits the application best.

In the table below are the values when -10 ºC, 10 ºC and 50 ºC are applied to the inputs for each of the configurations.

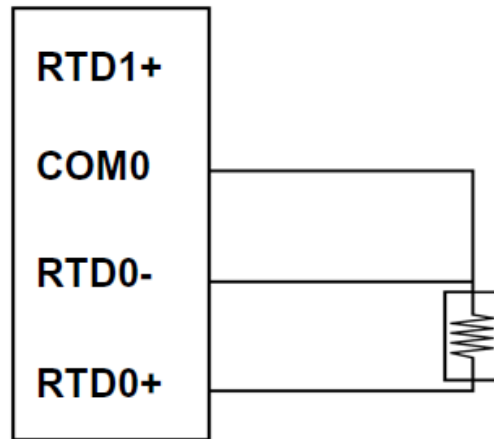| Range	-10 ºC (DINT)	10 ºC (DINT)	50 ºC (DINT)
-100 to 100 ºC	29491	36045	49152
0 to 100 ºC	NA	6554	32768
0 to 200 ºC	NA	3277	16384
0 to 600 ºC	NA	1092	5461

Wire Connections

When connecting sensors to the input channels please follow the wiring schemes below:

**2-wire RTD connection:**
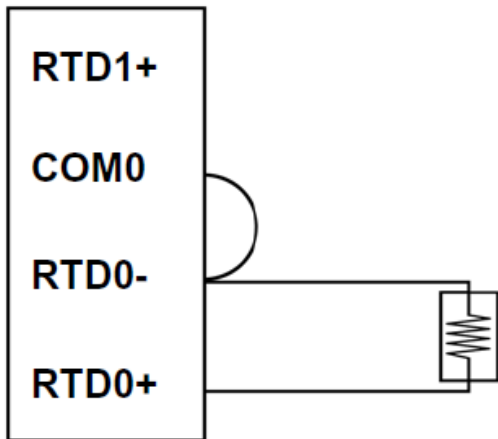
4-wire RTD connection:

Technical Specifications

Resolution	16 bit
Input Channel	6 diff.
Sampling Rate	15 Hz
RTD sensor types supported	Pt100
Isolation	3000 V
Power Input	+10 V to + 30 V
Power Consumption	2,5 W
Operating Temperature	-25 ~ 75°C
Dual Watchdog Timer	√

Appendix A – Using the module as I/O extension in the RTCU IDE

To be able to use the MODBUS I/O Expansion module as an I/O extension, the RTCU IDE project needs to be configured correctly, by entering the correct parameters for the expansion module into the "I/O Extension device" dialog[1].

The following figure shows the correct setting for an EX9036 connected to the RS485_1 port on a RTCU DX4 with default settings:
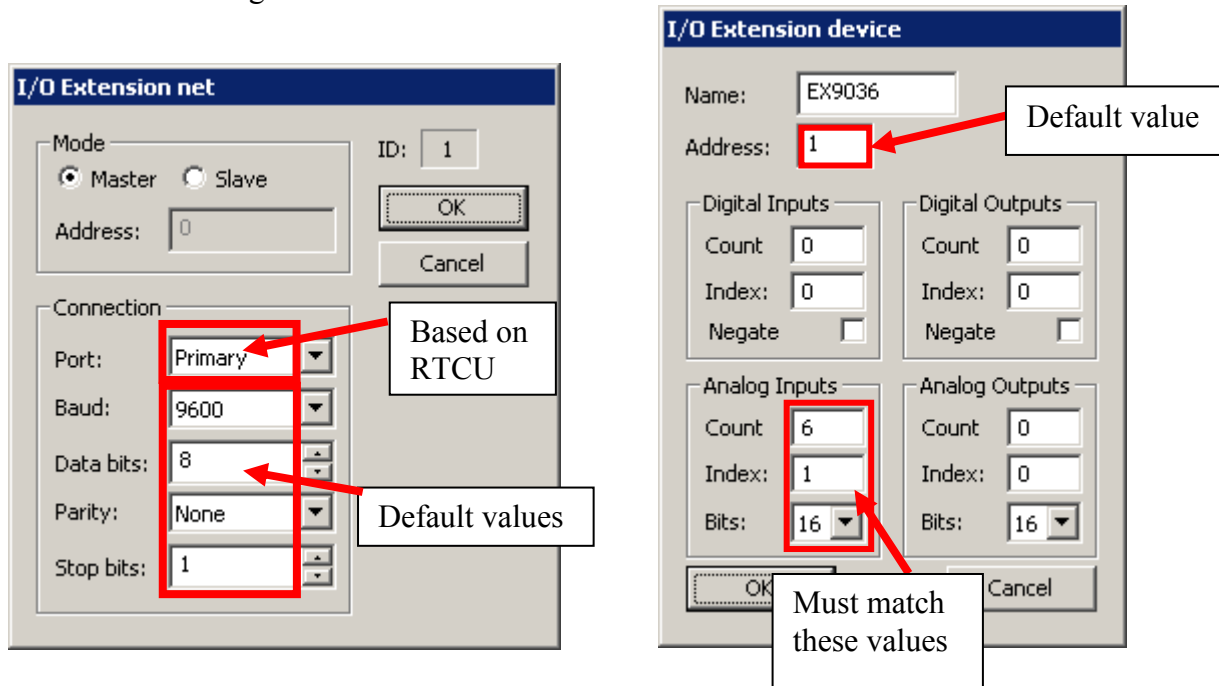
To change the above mentioned default values, new values must be entered and transferred to the module[2].

Values in the "I/O Extension net" must be set according to communication between the module and the RTCU unit, the port numeration follows the principles of the serOpen function, which is described in the IDE online help. When changing baud, data bit(s), parity or stop bit(s) all units on the net must be reconfigured[3].

The address field is per default "1"; if more modules are connected to same net each must have a unique address. Changing the address of a module is done, by selecting the new value and then reconfigure the module.

A close attention must be paid to the Count, Index and Bits fields in the Analog Inputs section, which must be 6, 1 and 16 respectively, else will communication with the module fail.

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[1] Please refer to the RTCU IDE online help for creating and editing I/O extension
[2] Please see "Project Control - I/O Extension" in the IDE online help.
[3] To reconfigure: right click the device in the IDE and select "setup module", and then follow the guide.