

FEATURES

- Eight 3-wire RTD channels
- Each channel can have a different RTD type Pt100-385, Pt100-392, Ni120-672 or Cu10-427
- No multiplexing, 8 Independent channels
- 3000 Vrms Isolation Input, Power and Network
- 1000 Vrms Channel-to-Channel Isolation
- Resolution 0.01 Ohm
- Highly stable Apix technology A/D Conversion
- 140 db Common Mode Rejection 50/60 HZ
- 90 db Normal Mode Rejection 50/60 HZ
- 50 or 60 Conversions/Sec with all 8 channels converting synchronously
- Wide Range 9-36 VDC or 7-28 VAC Supply
- -40 to 85 °C Operating Temperature Range
- Synchronized Sampling & Hold of all channels throughout the Network

PRODUCT OVERVIEW

This Modbus Resistance Input Module features 8 independent RTD channels and an isolated RS-485 interface. Each channel is configured as a 3 wire connection. Sensor break and cable opens including most shorts are detected automatically.

The channels are fully isolated with 3000 Vrms between Input, Power, RS-485 link and 1000 Vrms Channel-to-Channel.

The module combines Signal Conditioning, robust Isolation, RTD linearization and an individual highly stable 16bit A/D converter per channel. The sampling rate of 50 or 60 Hz is user settable.

All 8 channels convert synchronously. A global Modbus command will result in synchronized sampling and hold of all Input Channels in the network. These samples are then stored in a second set of registers in each module for eventual readout.

Highly effective multipole digital low pass and notch filters automatically track the set sampling rate.



SPECIFICATIONS

Maximum Ratings

Power Supply Voltage	39VDC or 28VAC
RTD Input	±10V continuous
Storage Temperature	-55 to 125 Deg °C
Input Common Mode	3KVrms (1 min)
Channel to Channel Voltage	1KVrms (1 min)
RS-485 Common Mode	2.5KVrms (1 min)

Emissions & Immunity

Complies with the requirements of IEC61000-6-5 and IEC61326-1

In particular :

IEC61000-3-2	Class B emissions
IEC61000-4-2	8KV electrostatic discharge
IEC61000-4-4	4KV burst, 5/50 ns, 5 Khz
IEC61000-4-5	4KV surge 1.2/50 us, line to ground, 2KV line to line
IEC61000-4-6	Conducted RF
IEC61000-4-12	Damped oscillatory wave

Analog Inputs

RTD types	Pt100-385, Pt100-392, Ni120-672, Cu10-427
Resistance Range	0-640 Ohm
Bandwidth	5 Hz (-3db)
Cable Resistance (Three Wire)	< 50 Ohms/wire
Normal Mode Rejection	90 db at 50/60 Hz sample rate
Excitation Current	0.5 mA ±5 %

Common Mode

Rejection	140 db at 50/60 Hz sample rate
Leakage Current	2 µA rms at 1000 Vrms and 50/60 Hz, per channel

Capacitance	4 pF max per channel
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Performance

Initial Accuracy	±0.01 % of Span
Zero Drift	±10ppm of Span / °C
Span Drift	±20ppm / °C
Resolution	16bits, 0-64000 = 0-640.00 Ohms
Sample Rate	50 to 60 samples/sec (All 8 channels simultaneously)

RS-485 Interface

Protocol	Modbus RTU
Baud Rate	2400 to 921.6K standard baud rates, default = 19200
Duplex	Half duplex
Parity	None
Data bits	8
Stop bits	2
Response Delay	0 to 6553.5 msec in 0.1 msec increments
Module Address	1 to 247
Max nodes	1 to 31 without repeater
Max distance	4000 ft, 1230 meters (varies with baud rate)

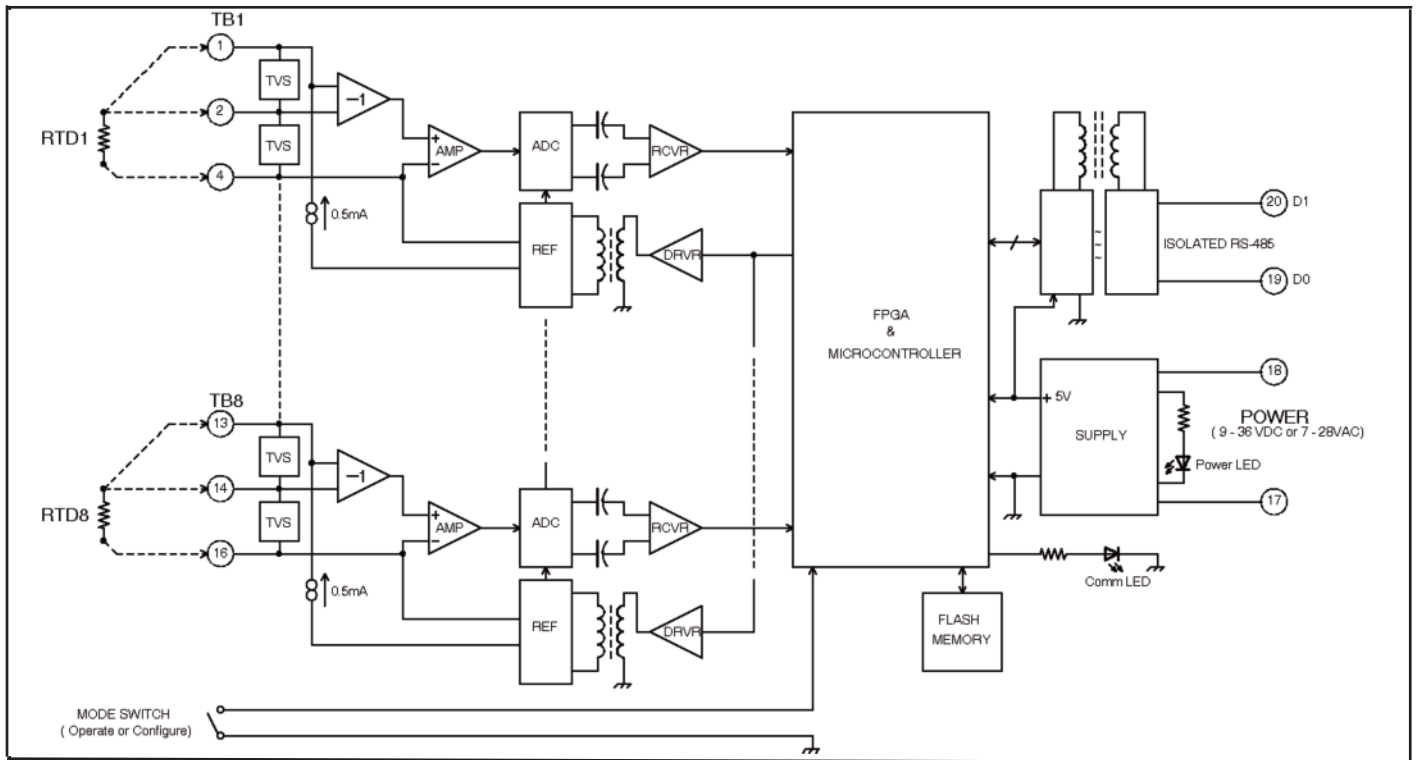
Power Requirements

Supply Voltage	9 to 36 VDC or 7 to 28 VAC
Max Power	1.8 W, Non Polarized

Environmental & Mechanical

Operating Temperature	-40 to 85 °C
Relative Humidity	< 95 % Non Condensing
Overall Dimensions	113.6 x 117.2 x 45 (mm), 4.47 x 4.62 x 1.78 (in)
Enclosure material	PA 66 GF 30
PC Board material	FR4
Protection Class	IP20
Conductor Size	AWG26 min, AWG14 max

Functional Block Diagram



OPERATION

The Functional Block Diagram shows how the external RTD inputs are connected to the eight identical isolated processing channels.

Each channel has a Transient Voltage Suppressor Network across the input terminals, followed by signal conditioning, AD conversion and isolation. The RTD channel excitation current is 0.5 mA. The circuit will detect all open wires and all short circuits except the short between the wires which connect to the common RTD Terminal. (Example: between terminals 1 & 2 of Channel one)

Four different RTD types are supported. Each channel may have a different RTD of the following types:

RTD Type	Temp. Range (°C)
Pt100-385	-196 to 651
Pt100-392	-193 to 638
Ni120-672	-74 to 259
Cu10-427	-189 to 257

Any channel may be set to measure Ohms directly, instead of temperature, with a resolution of 0.01 Ohms.

The temperature values are presented with a resolution of 1/16 °C, so for example:

16000 = 1000 °C (Divide value by 16 to get temperature reading)

The maximum possible value is 32767 which corresponds to 2048 °C.

A watchdog timer will restart the module if any unusual event disrupts normal operation.

A transformer and associated driver (DRVR) supply power for each channel. Output values from the ADCs are isolated by high voltage capacitors and differential receivers (RCVR) and are passed on to the FPGA—32 Bit Processor for digital filtering, calibration, linearization and transmission to the Modbus network.

External power at the POWER terminals is indicated by the “Power” LED.

An isolated RS-485 interface drives the network cable. The “Comm” LED turns ON when the module is transmitting.

INSTALLATION

Enclosure

All ISODIN modules offer IP20 level protection to withstand typical industrial environments. The thermoplastic package is non-flammable per UL94 V-0 with high impact resistance.

They feature surge protection on each input and have low radiated emissions and high immunity tolerance

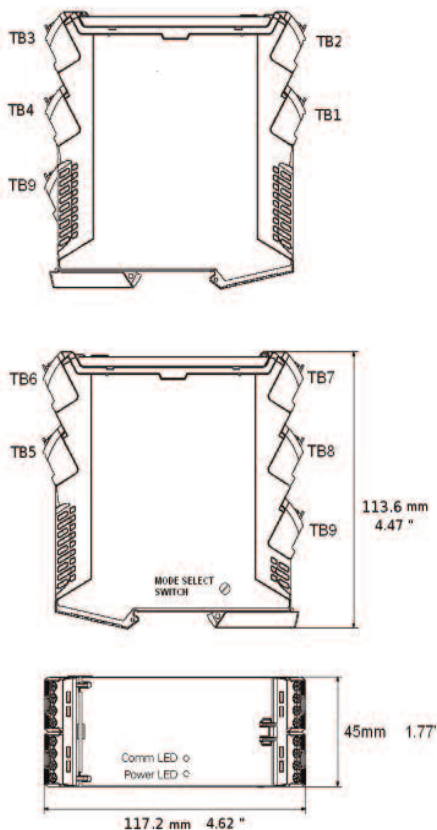
The Outline drawing details the mechanical dimensions, plug-in terminal block identification and LED locations.

Mounting

This module must be mounted vertically on a 35mm “T” type DIN rail as per EN50022.

Module attachment is done by locating the top groove of the adapter over the upper lip of the rail then pushing the unit downwards until it snaps into place.

Removal is accomplished by inserting a screwdriver into the groove of the bottom side latch and using it as a lever to open the latch until the module disconnects from the rail.



CONNECTIONS

There are 9 plug-in terminal blocks, TB1—TB8 for RTD sensor input wiring and one 4 pin terminal, TB9 for power and RS-485 connections.

These terminal blocks and RTD wire connections are clearly indicated on the module side labels. TB1-TB9 have a convenient lever mechanism for easy ejection.

All terminals will accept from AWG26 up to AWD14 wire and are rated 10A/400V at ambient temperature and II/2 pollution severity.

RTD inputs should preferably use twisted wire cables, with or without shields, to minimize external magnetic field pickup, thus preserving the excellent 16bit resolution and signal to noise ratio.

The power input can be from 9 to 36VDC or 7 to 24VAC and connects to the POWER terminals. A Green LED, labeled "Power" on the front panel is fed directly by the power input.

A twisted pair cable should be used for the RS-485 signal and daisy chained from module to module, without branching.

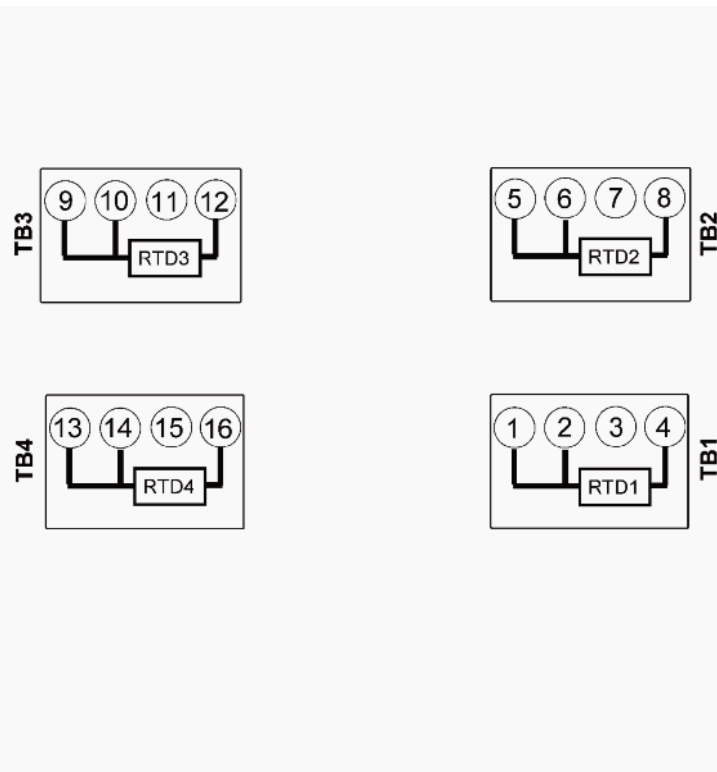
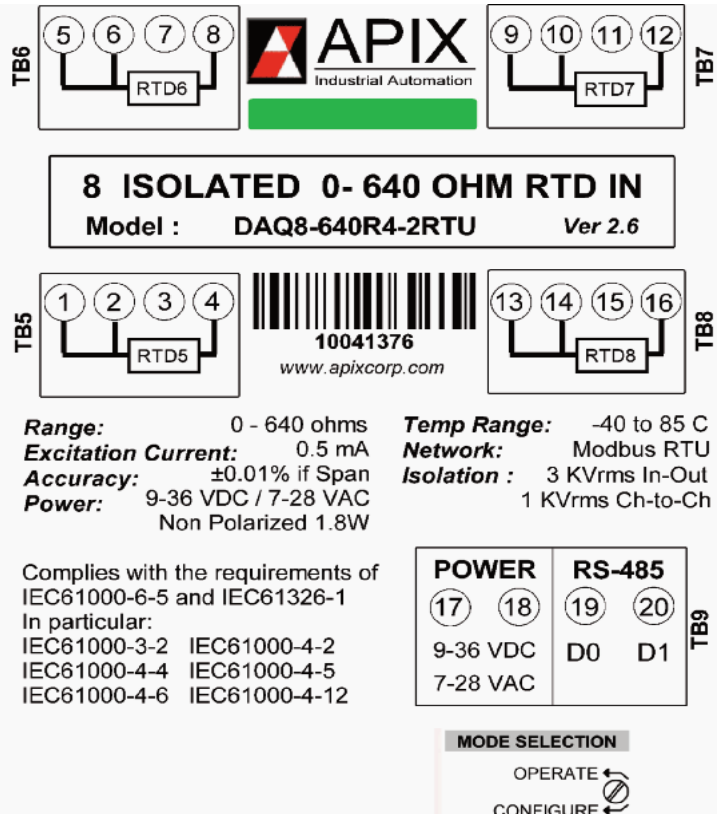
Terminals labeled D0 and D1, as per the Modbus specification, carry the differential half duplex RS-485 signal.

A cable shield is not normally required but if available should be connected to chassis (DIN rail) ground. Since this RS-485 link is isolated, there is no current flow along the shield drain wire.

RS-485 line polarization is required for proper operation of this module. This is usually provided by the Modbus Master node via pullup and pulldown resistors.

The Master node should also provide a 120 or 150 ohm line termination resistor across the D0 & D1 pins.

If the cable is very long and reflections are a problem, then a second termination resistor, at the far end of the cable, may be required.



CONFIGURATION

An external MODE Rotary switch must be set to the "CONFIGURE" position (fully clockwise) in order to permit changes to all internal parameters. The procedure is as follows:

- 1) Power must be OFF
- 2) Turn MODE switch fully clockwise
- 3) Power ON
- 4) Change any parameters as necessary
- 5) Power OFF
- 6) Turn MODE switch fully counterclockwise (OPERATE position , default)
- 7) Power ON to operate normally

NOTE that the MODE switch state will be recognized only when power is applied.
In the CONFIGURE position , default communication parameters are set as follows:

Module address = 1
Baud rate = 19200
Sample rate = 50

All user accessible parameters are stored in Flash memory and can be read and written to as "Holding Registers", via the Modbus RTU protocol (function codes 3 and 6), in the following locations:

Register Address	Name	Value Range
0	Module ID	5 (DAQ8-640R4-2RTU Module)
1	Module Address	1 to 247
2	Sample Rate	50 or 60
3	Baud Rate	24 to 9216 (Actual rate divided by 100)
4	Parity	0=none
5	Reserved	
6	Reserved	
7	Reserved	
8	Offset channel 1	-32768 to 32767
9	Offset channel 2	-32768 to 32767
10	Offset channel 3	-32768 to 32767
11	Offset channel 4	-32768 to 32767
12	Offset channel 5	-32768 to 32767
13	Offset channel 6	-32768 to 32767
14	Offset channel 7	-32768 to 32767
15	Offset channel 8	-32768 to 32767
16	Gain channel 1	0 to 65535
17	Gain channel 2	0 to 65535
18	Gain channel 3	0 to 65535
19	Gain channel 4	0 to 65535
20	Gain channel 5	0 to 65535
21	Gain channel 6	0 to 65535
22	Gain channel 7	0 to 65535
23	Gain channel 8	0 to 65535
24	Channel 1 type	0 to 4
25	Channel 2 type	0 to 4
26	Channel 3 type	0 to 4
27	Channel 4 type	0 to 4
28	Channel 5 type	0 to 4
29	Channel 6 type	0 to 4
30	Channel 7 type	0 to 4
31	Channel 8 type	0 to 4

The Channel type numbers in the above list represent the following inputs:

Channel type

0	Ohms
1	Pt100-385
2	Pt100-392
3	Ni120-672
4	Cu10-427

Due to the nature of Flash memory, it can be read very quickly but when writing to a single location it actually writes a complete block of 65536 locations. This can take several seconds to complete.

Please note that the offset and gain values are set very precisely at the factory and should not need to be modified.

MODBUS FUNCTIONS

All data values and Flash memory parameters are accessed via the Modbus RTU protocol as per the "Modbus Application Protocol Specification V1.1b". Available at www.Modbus-IDA.org

For reading data values of the 8 input channels, use function code 04 (read input registers). You must specify the starting address 0 to 7 (for channel 1 to 8) and the number of registers to read (1 to 8). Example.....

04 Function code - (Read input registers)
0000 Starting address – (begin at channel 1)
0008 Number of registers – (all 8 channels)

In a similar manner, to read the Flash memory parameters, use function code 03 (read holding registers). Example...

03 Function code
0002 Read address 2 = Sample rate
0001 One register

To write parameters into the Flash memory, use function code 06 (write single register). Example...

06 Function code
0002 Write address 2 = Sample rate
003C Sample rate value = 3C hex = 60 Hz decimal

SYNC COMMAND

A Modbus global broadcast command has been implemented to take a synchronized sample of all Input Channels in the network. When this command is received by the module, it immediately starts a new sample (discarding any ongoing AD conversions) on all 8 channels simultaneously. This broadcast command is 2 bytes ...

00 Broadcast address
01 Take sample

These samples are then stored in a second set of 8 registers for eventual readout. This second set of registers begins at address 8 and ends at address 15 and can be accessed as " Input registers" in the normal manner, for example...

04 Function code - (Read input registers)
0008 Starting address – (begin at channel 1 of second register set)
0008 Number of registers – (all 8 channels)

ERROR CODES

If any error occurs in these message transactions, the appropriate exception code will be returned to the Master node. The supported codes are as follows:

Code	Meaning
01	Illegal function, not supported by this module
02	Illegal data address, not valid for this module
03	Illegal data value, indicates a fault in the structure of the message.