

MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Reference package for procurement and maintenance review

ROCKWELL AUTOMATION / ICS TRIPLEX

T8431CX

TRUSTED ANALOGUE INPUT MODULE

Used with the applicable Trusted TMR 24 Vdc analogue input modules configuration.

REFERENCE PACKAGE

OFFICIAL DOCUMENT

Selected official manufacturer pages follow this cover.

Source: Rockwell Automation Trusted TMR 24 Vdc Analog Input Module 40 Channel, ICSTT-RM273Q-EN-P

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.



WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

IMPORTANT Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.



SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.



BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.



ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

About this publication

This manual specifies the maintenance requirements and describes the procedures to assist troubleshooting and maintenance of a Trusted[®] system.

Who should use this manual

This manual is for plant maintenance personnel who are experienced in the operation and maintenance of electronic equipment and are trained to work with safety systems.

Disclaimer

It is not intended that the information in this publication covers every possible detail about the construction, operation, or maintenance of a control system installation. You should also refer to your own local (or supplied) system safety manual, installation, and operator/maintenance manuals.

Revision and updating policy

This document is based on information available at the time of its publication. The document contents are subject to change from time to time. The latest versions of the manuals are available at the Rockwell Automation Literature Library: rok.auto/literature.

Latest product information

For the latest information about this product, review the Product Notifications and Technical Notes issued by technical support. Product Notifications and product support are available at the Rockwell Automation Support Center: rok.auto/knowledgebase.

Some of the Answer IDs in the Knowledgebase require a TechConnectSM Support Contract. For more information about TechConnect Support Contract Access Level and Features, see Knowledgebase Document ID: [IP622 - TechConnect Support Contract - Access Level & Features](#).



Tip: Sign in to your Rockwell Automation account to view Knowledgebase articles.

Download firmware, AOP, EDS, and other files

Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes from the Product Compatibility and Download Center at rok.auto/pcdc.

Additional resources

These documents contain additional information concerning related Rockwell Automation products.

Product overview

The Trusted® TMR 24 Vdc Analog Input module interfaces to 40 sourcing field input devices, acting as a current sink for all these devices. Comprehensive diagnostic tests are performed on each input channel. Fault tolerance is achieved through a Triple Modular Redundant (TMR) architecture within the Module for each of the 40 input channels.

Using the built-in line-monitoring feature, the Module can detect open and shorted field cables. Line monitoring functions are independently configured for each input channel.

The Module provides onboard Sequence of Events (SOE) reporting with a resolution of 1 ms. A change of state triggers an SOE entry. States are determined by voltage thresholds that can be configured on a per channel basis. When the field voltage and field return are connected to the auxiliary input channels of the Module, thresholds can be specified as a ratio of the field supply voltage.

Features

- 40 Triple Modular Redundant (TMR) input channels per Module.
- Comprehensive, automatic diagnostics and self-test.
- Selectable line monitoring per channel to detect open circuit and short circuit field wiring faults.
- 2500V impulse withstand opto/galvanic isolation barrier.
- Onboard Sequence of Events (SOE) reporting with 1 ms resolution.
- Module can be hot-replaced online using dedicated Companion (adjacent) Slot or SmartSlot (one spare slot for many modules) configurations.
- Front panel input status Light Emitting Diodes (LEDs) for each channel indicate input status and field wiring faults.
- Front panel module status LEDs indicate module health and operational mode (Active, Standby, Educated).
- TÜV Certified IEC 61508 SIL 3.

Description

The Trusted® TMR 24 Vdc Analog Input Module is a member of the Trusted range of Input/Output (I/O) modules. All Trusted I/O Modules share common functionality and form. At the most general level, all I/O Modules interface to the Inter-Module Bus (IMB) which provides power and allows communication with the Trusted TMR Processor. In addition, all Modules have a field interface that is used to connect to module-specific signals in the field. All Modules are Triple Modular Redundant (TMR).

All High Integrity I/O Modules comprise four sections: Host Interface Unit (HIU), the Field Interface Unit (FIU), the Field Termination Unit (FTU) and the Front Panel Unit (or FPU).

Figure 2 shows a simplified functional block diagram of the Trusted 24 Vdc Analog Input Module.

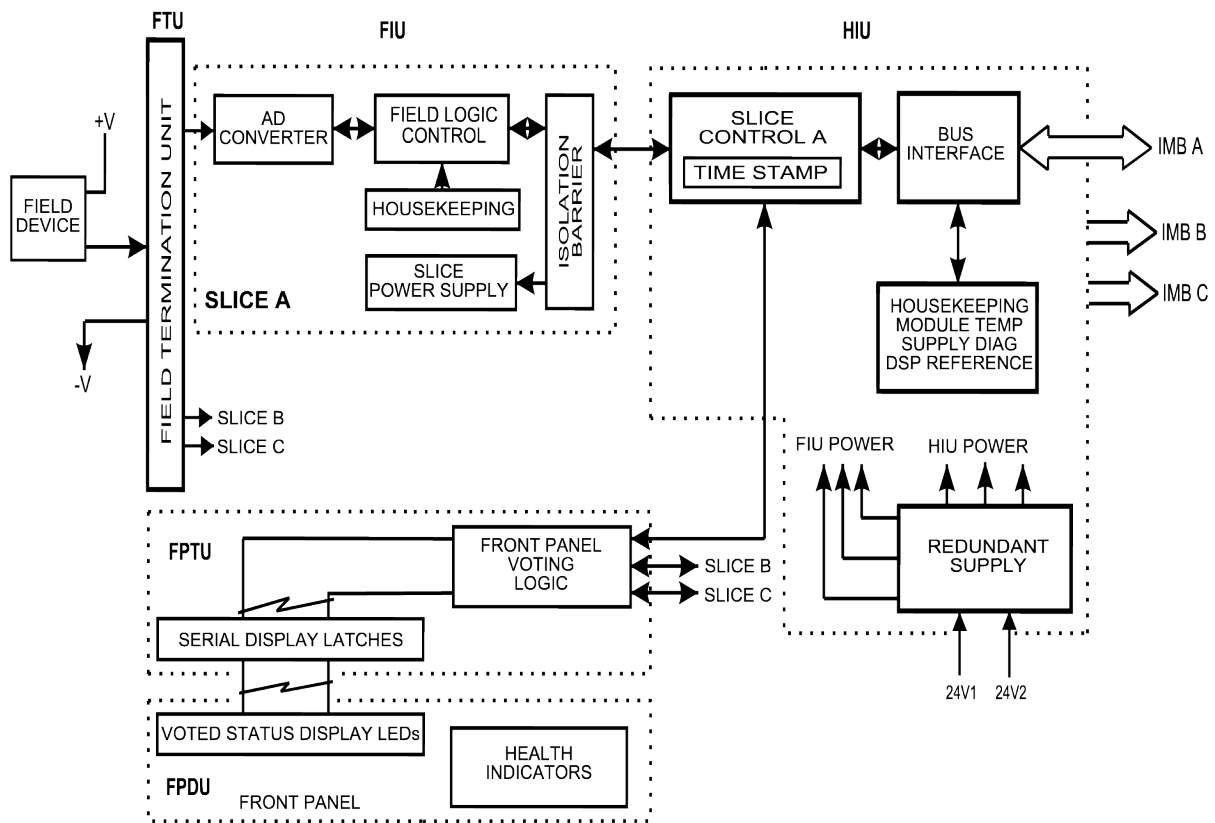


Figure 2: Functional Block Diagram

Field Termination Unit (FTU) The Field Termination Unit (FTU) is the I/O Module assembly that connects all three FIUs to a field connector. The FTU primarily contains passive components necessary for front-end signal conditioning. When installed in a Trusted Controller or Expander Chassis, the FTU field connector mates to the Field I/O Cable Assembly attached at the rear of the Chassis.

The SmartSlot link is passed from the HIU to the field connections via the FTU. These signals go directly to the I/O cable assembly and maintain isolation from the I/O signals on the FTU. The SmartSlot link is the intelligent connection between Active and Standby Modules for coordination during Module replacement.

Field Interface Unit (FIU)

The Field Interface Unit (FIU) is the section of the Module that contains the specific circuits necessary to interface to the particular types of field I/O signals. Each Module has three FIUs, one per slice. For the TMR 24 Vdc Analog Input Module, the FIU contains an analog to digital converter (ADC) for each of the 40 field inputs.

The FIU receives isolated power from the HIU for logic. The FIU provides additional power conditioning for the operational voltages required by the

Installation

Module insertion and removal

Before installation, visually inspect the module for damage. Ensure that the module housing appears undamaged and inspect the I/O connector at the back of the module for bent pins. If the module appears damaged or any pins are bent, do not install the module. Do not try to straighten bent pins. Return the module for replacement.

Ensure that the module is of the correct type.

Record the module type, revision and serial number of the module before installation.



WARNING: The module contains static sensitive parts. Static handling precautions must be observed. Specifically ensure that exposed connector pins are not touched. Under no circumstances should the module housing be removed.

To install the module:

1. Ensure that the field cable assembly is installed and correctly located.
2. Release the ejector tabs on the module using the release key. Ensure that the ejector tabs are fully open.
3. Holding the ejectors, carefully insert the module into the intended slot.
4. Push the module fully home by pressing on the top and bottom of the module fascia.
5. Close the module ejectors, ensuring that they click into their locked position.

The module should mount into the chassis with a minimum of resistance. If the module does not mount easily, do not force it. Remove the module and check it for bent or damaged pins. If the pins have not been damaged, try reinstalling the module.

Field cable selection

I/O cables suitable for use with the Trusted® TMR 24 Vdc Analog Input Module are detailed in these publications:

- Trusted I/O Companion Slot Cables Product Description, publication [ICSTT-RM311](#) (PD-TC200)
- Trusted I/O SmartSlot Cables Product Description, publication [ICSTT-RM313](#) (PD-TC500)

The publications listed above also detail the types of Field Termination Assembly (FTA) or Versatile Field Termination Assembly (VFTA) that may be used with this type of module.

Module pin-out connections

This table describes the module pin-out connections:

Table 2 Field Connector Pin-out

	C	B	A
1	SmartSlot Link C	SmartSlot Link B	SmartSlot Link A
2			
3	Chan 28 (+)	Chan 14 (+)	Chan 0 (+)
4	Chan 28 (+)	Chan 14 (+)	Chan 0 (+)
5	Chan 29 (+)	Chan 15 (+)	Chan 1 (+)
6	Chan 29 (+)	Chan 15 (+)	Chan 1 (+)
7	Chan 30 (+)	Chan 16 (+)	Chan 2 (+)
8	Chan 30 (+)	Chan 16 (+)	Chan 2 (+)
9	Return	Return	Return
10	Chan 31 (+)	Chan 17 (+)	Chan 3 (+)
11	Chan 31 (+)	Chan 17 (+)	Chan 3 (+)
12	Chan 32 (+)	Chan 18 (+)	Chan 4 (+)
13	Chan 32 (+)	Chan 18 (+)	Chan 4 (+)
14	Chan 33 (+)	Chan 19 (+)	Chan 5 (+)
15	Chan 33 (+)	Chan 19 (+)	Chan 5 (+)
16	Chan 34 (+)	Chan 20 (+)	Chan 6 (+)
17	Chan 34 (+)	Chan 20 (+)	Chan 6 (+)
18	Chan 35 (+)	Chan 21 (+)	Chan 7 (+)
19	Chan 35 (+)	Chan 21 (+)	Chan 7 (+)
20	Return	Return	Return
21	Chan 36 (+)	Chan 22 (+)	Chan 8 (+)
22	Chan 36 (+)	Chan 22 (+)	Chan 8 (+)
23	Chan 37 (+)	Chan 23 (+)	Chan 9 (+)
24	Chan 37 (+)	Chan 23 (+)	Chan 9 (+)
25	Chan 38 (+)	Chan 24 (+)	Chan 10 (+)
26	Chan 38 (+)	Chan 24 (+)	Chan 10 (+)
27	Chan 39 (+)	Chan 25 (+)	Chan 11 (+)
28	Chan 39 (+)	Chan 25 (+)	Chan 11 (+)
29	Chan 40 (+)	Chan 26 (+)	Chan 12 (+)
30	Chan 40 (+)	Chan 26 (+)	Chan 12 (+)
32	Chan 41 (+)	Chan 27 (+)	Chan 13 (+)
32	Chan 41 (+)	Chan 27 (+)	Chan 13 (+)

Trusted module polarization and keying

All Trusted modules have been Keyed to prevent insertion into the wrong position within a chassis. The polarization comprises two parts: the module and the associated field cable.

Each module type has been Keyed during manufacture. The organization responsible for the integration of the Trusted System must key the cable by

removing the keying pieces from the cable so that they correspond with the bungs fitted to the associated module before fitting.

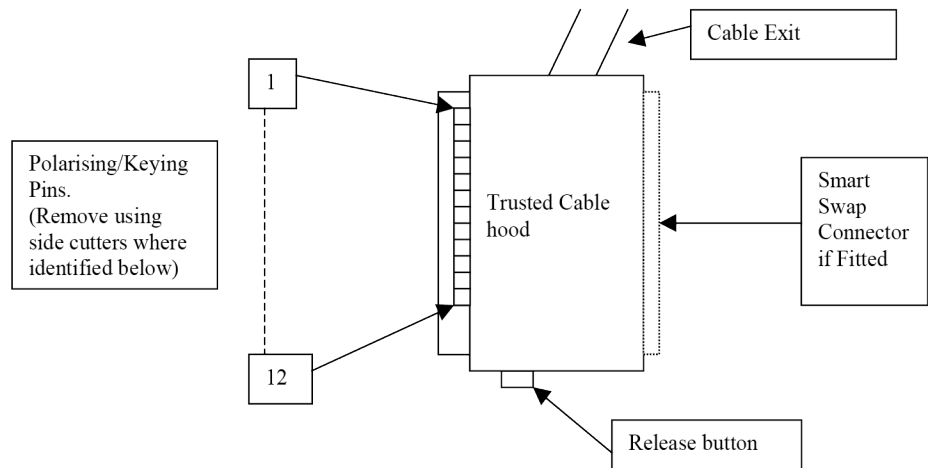


Figure 3: Module Polarization

For Cables with Companion Slot installations both keying strips must be polarized.

For this module (T8431) remove keying pins 1, 4, and 5.

Table 17 Module Status Indicators

LED	State	Description
Healthy	Off	No power applied to the module.
	Amber	Slice is in the startup state (momentary after installation or power-up).
	Green	Slice is healthy.
	Red - flashing	Fault present on the associated slice but the slice is still operational, or one 24V feed to the chassis has failed.
	Red (momentary)	On installation - power applied to the associated slice.
	Red	The associated slice is in the fatal state. A critical fault has been detected and the slice disabled.
Active	Off	Module is not in the Active state.
	Green	Module is in the Active (or Maintain) state.
	Red - flashing	Module is in the shutdown state if the Standby LED is off.
	Red - flashing	Module is in the fatal state if the Standby LED is also flashing.
Standby	Off	Module is not in the Standby state.
	Green	Module is in the Standby state.
	Red - flashing	Module is in the fatal state. The Active LED will also be flashing red.
Educated	Off	Module is not educated.
	Green	Module is educated.
	Green - flashing	Module is recognized by the Processor but education is not complete.
	Amber - flashing	Active/Standby changeover in progress.

I/O status LEDs

There are 40 input channel status LEDs on the Module Front Panel, one for each field input. These indicators are controlled by the FPU. The FPU receives data from each of the module slices. The FPU performs a 2003 vote on each data bit from the slices and sets the indicators accordingly.

The input status LED mode is dependent upon the voltage level of the field I/O signal. Each field input voltage is measured and compared to six threshold levels (four configurable and two fixed) which produce seven threshold bands. Each threshold band can be defined to have a particular indicator mode: off, green, red, flashing green, or flashing red.

The configurable voltage thresholds and LED modes allow users to customize the input measurement and status indications to suit individual application requirements. Without customization, the default indicator modes are suitable for analog inputs as described below:

Table 18 Default I/O Status Indicators

Channel	Description
Off	'Normal' (states 1,2,3)
Green - steady	'High alarm' (states 4,5)
Green - flashing	Over-range (state 6)
Red-flashing	Under-range (state 0) or Channel Fault (8 to 15)

Specifications

This table lists the module specifications:

Item	Description
Backplane (IMB) Supply	
Voltage	20 Vdc to 32 Vdc
Power	20 W
Field Supply	N/A
Maximum Power Dissipation	20 W
Module Location	T8100, T8300 I/O Module Slot
Isolation	
Field Common	50 V Reinforced (continuous) ¹ 250 V Basic (fault) ² [Type tested at 2436 Vdc for 60 s].
Channel to Channel	None
Fusing	None
Number of Inputs	40
Input	
Impedance (FTA)	250 Ohm
Impedance (module) ³	16.967 K Ohm
Current	0 mA – 22 mA
Voltage	0 Vdc – 5.5 Vdc
Thresholds	Configurable
Resolution (LSB)	3.906 μ A
Safety Accuracy	$\pm 200 \mu$ A
Calibration Accuracy ⁴	± 0.15 %
Intrinsic Safety	None - External barrier required
Sequence of Events	
Event Resolution (LSB)	1 ms
Time stamp Accuracy	± 10 ms
Operating Temperature	0 °C to +60 °C (+32 °F to +140 °F)
Storage Temperature	-25 °C to +70 °C (-13 °F to +158 °F)
Relative Humidity – Operating and Storage	10% – 95%, noncondensing
Environmental Specifications	Refer to Trusted 8000 Series International Safety and Environmental Approvals, publication ICSTI-ID003
Dimensions	
Height	266 mm (10.5 in)

¹ 50 Vrms Secondary circuit derived from Mains, OVC II up to 300V.

² 250 Vrms Mains circuit, OVC II up to 300V. Exposure to voltages at these levels shall be temporally constrained consistent with the system MTTR.

³ In the case where partner modules are fitted then the effective Module input impedance is halved.

⁴ Refer to T8094 Trusted Safety Manual for guidance on calibration maintenance.

Item	Description
Width	31 mm (1.2 in)
Depth	303 mm (12.0 in)
Weight	1.149 kg (2.5 lb)