ICS Triplex T8431CX

01 / The measurement and its validity

ICS Triplex T8431CX acquires forty 4–20 mA field signals through a triple modular redundant input architecture. The conformally coated, non-RoHS module combines analog measurement with configurable line monitoring in a Trusted control system.

01	02	03	04
Sourcing transmitter	250 Ω termination	Triplicated acquisition	Value plus diagnostics

Follow the current-to-voltage path

A standard field termination assembly converts current into voltage across a 250 Ω resistor. Each input is measured within the three module slices, and the analog interface returns the median value. The module acts as a current sink for sourcing field devices; termination wiring and transmitter supply remain essential parts of the complete loop.

Apply the offset before scaling

The reported analog count includes an offset chosen for 4–20 mA scaling. One volt corresponds to zero counts and five volts to 4096 counts. State and line-fault variables must be interpreted alongside this measurement: a numerical zero can represent a valid live-zero signal, while a separate negative sentinel identifies an open circuit.

Separate events from analog trends

Each channel can have independently configured line monitoring and state thresholds. Separate rising and falling thresholds prevent a noisy value from repeatedly crossing one ideal boundary. Sequence-of-events logging records configured state transitions; it is not a substitute for continuous analog trending or proof that the entire process response occurs at the event-clock resolution.

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02 / Designing the field-signal path

Analog inputs	40
Nominal signal	4–20 mA
Architecture	Triple modular redundant
Construction variant	Conformally coated; non-RoHS
Backplane voltage	20–32 V DC
Module power	20 W
Acquisition current range	0–22 mA
Measurement voltage range	0–5.5 V DC
Standard FTA shunt	250 Ω
Module input impedance	16.967 kΩ
Paired-module impedance	Half the individual module impedance
Channel-to-channel isolation	None
Conversion method	Sigma-delta; converter per channel per slice
Analog result selection	Median of three measurements
Analog count gradient	1024 counts per volt

Separate input burden from input impedance

The 250 Ω FTA resistor converts field current into a measurable voltage. The 16.967 kΩ module input is a different circuit quantity, and a partner module changes the effective module impedance. Preserve the approved FTA and pairing arrangement when assessing the source circuit.

A count offset makes live zero meaningful

The transfer relationship is count = 1024 × (volts − 1). The standard current relationship is mA = counts/256 + 4. This produces a convenient zero at the 4 mA endpoint but requires explicit treatment of diagnostic sentinels before process conversion.

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03 / Scaling and diagnostic boundaries

Live-zero conversion	4 mA / 1 V = 0 counts
Full-scale conversion	20 mA / 5 V = 4096 counts
Open-circuit indication	−2048 analog counts
Current resolution	3.906 µA
Safety accuracy	±200 µA
Calibration accuracy	±0.15%
Threshold configuration	Four user thresholds with rising/falling hysteresis
Field channel numbering	1–40; 0 and 41 are internal references
Line-fault variable	Majority-voted Boolean
Discrepancy map	Three integer words: 1–16, 17–32, 33–40
SOE resolution	1 ms
Timestamp accuracy	±10 ms
Operating temperature	0 to +60 °C
Storage temperature	−25 to +70 °C
Relative humidity	10–95%, non-condensing

State bands do not define engineering units

Analog scaling expresses the process measurement; thresholds assign a discrete band. Changing an alarm threshold should not be confused with recalibrating the current-to-process conversion. Keep the two configuration records and acceptance tests separate.

Redundancy does not duplicate the field instrument

Triplicated electronics improve internal fault tolerance, but the external transmitter, cable and termination remain parts of one field signal path. Common field-circuit faults require line monitoring and the application response defined for the process.

04 / Interpreting abnormal measurements

How should 2048 analog counts from T8431CX be converted to loop current?

For the standard 250 Ω termination, voltage is counts/1024 + 1. Thus 2048 counts means 3 V and 12 mA. Apply this conversion to the analog rack, then check the corresponding state and line-fault variables before accepting the result.

Why does zero analog count on T8431CX not identify an open wire?

Zero counts represents the valid 4 mA live-zero point. The defined open-circuit analog indication is −2048. Use the channel state and line-fault input to distinguish a circuit failure from a valid low-end process measurement.

Can two tests at the same current produce different T8431CX threshold states?

Yes, within a hysteresis band the result depends on the previous state and whether the input approached from above or below. Test both directions and compare the configured rising and falling thresholds rather than changing scaling to force agreement.

What can state 7 on T8431CX mean when the field transmitter still produces a plausible current?

It is an unknown state. Causes include insufficient valid slice measurements, a detected two-out-of-three discrepancy, or a simulated/uncommunicative module. Check slice health and communication as well as the external loop; a plausible transmitter current alone does not validate the returned measurement.

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05 / Application integration and references

Triplicated transmitter acquisition

Acquire compatible sourcing 4–20 mA transmitters through a current-sinking input and the selected termination resistor.

Threshold-based event recording

Record transitions between configured input bands while retaining separate analog values for process analysis.

Field-circuit fault monitoring

Use channel line-fault and discrepancy variables to separate wiring defects from internal acquisition disagreement.

Configured module replacement

Use an approved Companion Slot or SmartSlot arrangement to coordinate an active and standby module during maintenance.

Technical scope

Rockwell Automation Trusted TMR 24 V DC Analog Input Module, ICSTT-RM273Q-EN-P. T8431CX is the conformally coated, non-RoHS T8431 input variant. The following measurement and diagnostic data describe the T8431 input architecture with its specified termination arrangement. Confirm the installed hardware and firmware revisions before applying configuration or replacement procedures.

Other automation product references

Emerson KJ2005X1-BK1 12P4688X052 SE3007

Foxboro P0922YU FPS400-24

Honeywell DCOM-232/485

Separate references; no replacement or compatibility is implied.