

Series 8 Controller and I/O Specification



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|----------|---------------|--|
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| 1.1 | March 2015 | TC/RTD update |
| 1.2 | December 2015 | Series 8 RAM Charger Module part number corrected (-100) |

Table of Contents

| | | |
|---------|---|----|
| 1. | Product Introduction..... | 1 |
| 1.1. | C300 Controller Overview..... | 1 |
| 1.2. | Series 8 I/O Overview..... | 3 |
| 2. | Specifications..... | 7 |
| 2.1. | C300 Controller Specifications..... | 7 |
| 2.1.1. | C300 Hardware..... | 7 |
| 2.1.2. | C300 Supported Function Blocks | 9 |
| 2.2. | Series 8 IO Specifications..... | 10 |
| 2.2.1. | TC/RTD..... | 10 |
| 2.2.2. | Analog Input – Single Ended | 12 |
| 2.2.3. | Analog Input with HART – Single Ended | 13 |
| 2.2.4. | Analog Input with HART – Differential | 14 |
| 2.2.5. | Analog Output..... | 15 |
| 2.2.6. | Analog Output with HART..... | 16 |
| 2.2.7. | Digital Input Sequence of Events..... | 17 |
| 2.2.8. | Digital Input 24VDC | 19 |
| 2.2.9. | Digital Input Pulse Accumulation | 20 |
| 2.2.10. | Digital Output 24VDC | 21 |
| 2.2.11. | DO Relay Extension Board..... | 23 |
| 2.2.12. | Series 8 IO Function Matrix | 24 |

1. Product Introduction

1.1. C300 Controller Overview

Honeywell's C300 Controller provides powerful and robust control for the distributed control system (DCS). The C300 is a node in operating Honeywell's field-proven deterministic Control Execution Environment (CEE) core software. The CEE software provides a superior control execution and scheduling environment. Control strategies for each controller node are configured and loaded through a common Control Builder, an easy and intuitive engineering tool.

In addition to a standard and robust library of pre-built function blocks and algorithms, the C300 Controller also supports Custom Algorithm Blocks (CABs). Custom Algorithm Blocks are similar in purpose and structure to the standard function blocks that are distributed with Control Builder. However, CABs have user-defined algorithms and data structures, allowing custom tailored strategies to be developed to specific requirements.

The C300 controller shares its hardware design with the Series 8 I/O, offering an innovative design that reduces footprint and installation and maintenance costs. The C300 controller module is mounted on the C300 Input Output Termination Assembly (IOTA). The C300 IOTA contains only passive devices such as FTE address switches. [Figure 1](#) below depicts the IOTA components.

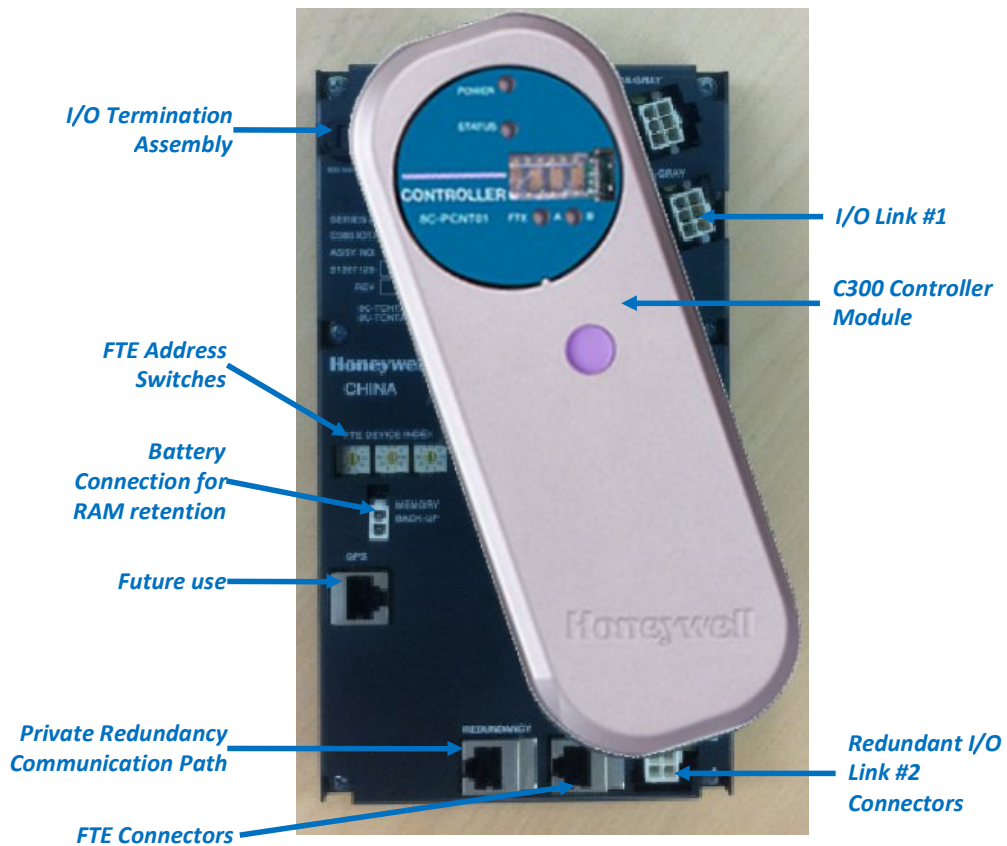


Figure 1 - C300 Controller

The Model Numbers of C300 controller are shown as below:

| Model Number | Description |
|--|--|
| 8C-PCNT02 | Series 8 C300 Controller, coated |
| 8U-PCNT02 | Series 8 C300 Controller, uncoated |
| 8C-TCNTA1 | Series 8 C300 Controller I/O Termination Assembly(IOTA),coated |
| 8U-TCNTA1 | Series 8 C300 Controller I/O Termination Assembly(IOTA),uncoated |
| 51305980-836 | Cable, Redundant C300 Controller |
| 51454475-100 | Series 8 RAM Charger Module (C300 Memory Backup) |
| 51202330-300 | Cable, Battery RAM Charger, 30 in |
| 51202330-200 | Cable, Battery RAM Charger, 84 in |
| Redundancy is implemented with two modules/IOTAs and a redundancy cable (51305980-836). C300 Memory Backup is optional. | |

1.2. Series 8 I/O Overview

This document provides technical information to configure the Series 8 I/O. The following Series 8 I/O items are included in this document.

- TC/RTD
- Analog Input – Single Ended
- Analog Input with HART – Single Ended
- Analog Input with HART – Differential
- Analog Output
- Analog Output with HART
- Digital Input Sequence of Events (SOE)
- Digital Input, 24 VDC
- Digital Input Pulse Accumulation
- Digital Output, 24 VDC
- DO Relay Extension Board

Definitions

- Input Output Termination Assembly (IOTA): An assembly that holds the IOM and the connections for field wiring;
- Input Output Module (IOM): A device that contains most of the electronics required to perform a specific I/O function. The IOM plugs onto the IOTA.

Features

All Series 8 components feature an innovative design that supports enhanced heat management. This unique look provides significant reduction in overall size for the equivalent function.

The unique features of Series 8 I/O include:

- I/O Module and field terminations are combined in the same area. The I/O Module is plugged into the IOTA to eliminate the need for a separate chassis to hold the electronics assemblies
- Two level “detachable” terminals for landing the field wiring in the enclosure, providing easier plant installation and maintenance.
- Field power is supplied through the IOTA, with no need for extra power supplies to power the field devices and the associated craft wired marshalling
- Redundancy is accomplished directly on the IOTA without any external cabling or redundancy control devices, by simply adding a second IOM to an IOTA
- For both IOM and IOTA, coated (module numbers starting with 8C) and uncoated (module numbers starting with 8U) options are provided. Conformal coating material is applied to electronic circuitry to act as protection against moisture, dust, chemicals, and temperature extremes. Coated IOM and IOTA are recommended when electronics must withstand harsh environments and added protection is necessary.

The Series 8 inherits the innovative styling of Series C. This styling includes features to facilitate the effective use of control hardware in a systems environment. These features include:

- Vertical mounting allows for more effective wiring since most field wiring applications require entry from the top or bottom of the systems cabinet.
- An “information circle” allows for a quick visual cue to draw the Maintenance Technician’s eyes to important status information.
- “Tilted” design allows for effective heat management within the cabinet enclosure. Since Series 8 allows for a significant increase in cabinet density, an effective heat management system is critical for high system availability.
- Input and output circuits are protected from shorts to alleviate the need for in-line fusing, reducing installation and maintenance costs

Series 8 IOTAs combine multiple functions into a single piece of equipment:

- Single and redundant configurations
- On-board termination of process signals
- On-board signal conditioning
- On-board connection to appropriate networks (FTE, I/O LINK)
- Field power distribution without external marshalling
- IOM plugs into the IOTA and receives power from the IOTA
- The IOTA receives its power through cables from header board.

Series 8 I/O Sizing

In virtually all configurations, the C300 controller and Series 8 I/O provides useful, maintainable process equipment connections in a smaller footprint than traditional rack based systems. Installing Series 8 I/O modules contributes to overall total installed cost savings.

IOTA sizes vary based on the application. In general, an analog module has 16 points and resides on a 6-inch (152mm) IOTA for non-redundant applications and a 12-inch (304mm) IOTA for redundant applications. A discrete module has 32 points and resides on a 9-inch (228mm) IOTA for non-redundant applications and a 12-inch (304mm) IOTA for redundant applications. Specific information on the size of a particular module can be found in the Model Number Table.

I/O Module Functions

- **TC/RTD (16pt)** – Provides thermocouple (TC) and resistance temperature device (RTD) inputs.
- **Analog Input – Single Ended (16pt)** - The Analog Input Module supports analog inputs which are typically 4-20mA DC inputs for traditional devices, such as transmitters.
- **Analog Input with HART – Single Ended (16pt)** – The Analog Input Module supports both analog and HART inputs. Analog inputs are typically 4-20mA DC for both traditional and HART devices. HART data can be used for status and configuration. HART data, such as the secondary and tertiary variables, can also be used as process control variables.
- **Analog Input with HART – Differential (16pt)** – The Analog Input Module supports Single Ended or Differential analog inputs, and HART inputs.
- **Analog Output (16pt)** – The Analog Output Module supports standard 4-20mA DC outputs.
- **Analog Output with HART (16pt)** – The Analog Output Module supports both standard 4-20mA DC outputs and HART outputs.



- **Digital Input Sequence of Events (32pt)** - Accepts 24VDC discrete signals as discrete inputs. The inputs can be time tagged to support 1ms resolution Sequence of Events.
- **Digital Input 24 VDC (32pt)** – Digital input sensing for 24V signals
- **Digital Input Pulse Accumulation (32pt)** – Accepts 24VDC discrete signals as discrete inputs. The first 16 channels can be configured as Pulse accumulation to support Pulse Accumulation and frequency measurement on per channel basis. Channels 17 – 32 can be configured as DI.
- **Digital Output 24 VDC (32 pt)** – Current sinking digital outputs. Outputs are electronically short-circuited protected.
- **DO Relay Extension Board (32 pt)** – Digital output with NO or NC dry contacts. It can be used for low power or high power applications.

Series 8 Field Connections

Series 8 Field connections use a standard modular connector. The connector modularity allows for removal and insertion of the field wiring. This significantly reduces installation and maintenance procedures and can assist in field check out. Series 8 field connectors accept up to 12 AWG / 2.5 mm² stranded wire.

IOTA Sizes

IOTA Sizing is nominal (6in = 152mm, 9in =228mm, 12in =304mm). I/O modules are associated with their respective IOTAs in the table below. The I/O Module is supported by one or more IOTAs.

| Model Number | Description | Channels | Size | Red. | |
|---------------|---|----------|------|------|---|
| TC/RTD | | | | | |
| 8C-TAIMA1 | TC/RTD IOTA, Coated | 16 | 9" | | |
| 8U-TAIMA1 | TC/RTD IOTA, Uncoated | | | | |
| Analog Input | | | | | |
| 8C-TAIXA1 | ANALOG INPUT IOTA Single Ended, Coated | 16 | 6" | | |
| 8U-TAIXA1 | ANALOG INPUT IOTA Single Ended, Uncoated | | | | |
| 8C-TAIDA1 | ANALOG INPUT IOTA Differential, Coated | | 9" | | |
| 8U-TAIDA1 | ANALOG INPUT IOTA Differential, Uncoated | | | | |
| 8C-TAIXB1 | ANALOG INPUT IOTA Single Ended, Red, Coated | | 12" | | √ |
| 8U-TAIXB1 | ANALOG INPUT IOTA Single Ended, Red, Uncoated | | | | √ |
| 8C-TAIDB1 | ANALOG INPUT IOTA Differential, Red, Coated | | | | √ |
| 8U-TAIDB1 | ANALOG INPUT IOTA Differential, Red, Uncoated | | | | √ |
| Analog Output | | | | | |
| 8C-TAOXA1 | ANALOG OUTPUT IOTA, Coated | 16 | 6" | | |
| 8U-TAOXA1 | ANALOG OUTPUT IOTA, Uncoated | | | | |
| 8C-TAOXB1 | ANALOG OUTPUT IOTA Red, Coated | | 12" | | √ |
| 8U-TAOXB1 | ANALOG OUTPUT IOTA Red, Uncoated | | | | √ |




| Digital Input | | | | |
|----------------|--------------------------------------|----|-----|---|
| 8C-TDILA1 | DIGITAL INPUT 24V IOTA, Coated | 32 | 9" | |
| 8U-TDILA1 | DIGITAL INPUT 24V IOTA, Uncoated | | | |
| 8C-TDILB1 | DIGITAL INPUT 24V IOTA Red. Coated | | 12" | √ |
| 8C-TDILB1 | DIGITAL INPUT 24V IOTA Red. Uncoated | | | √ |
| Digital Output | | | | |
| 8C-TDODA1 | DIGITAL OUTPUT IOTA, Coated | 32 | 9" | |
| 8U-TDODA1 | DIGITAL OUTPUT IOTA, Uncoated | | | |
| 8C-TDODB1 | DIGITAL OUTPUT IOTA Red, Coated | | 12" | √ |
| 8U-TDODB1 | DIGITAL OUTPUT IOTA Red, Uncoated | | | √ |

2. Specifications

2.1. C300 Controller Specifications

2.1.1. C300 Hardware

| Specification | | Limit |
|--|-----------------------|--|
| Processor | | PowerPC 8270 |
| Power requirement | | 24 VDC (provided through cables by the Series 8 power system) |
| Module current rating | | 320mA |
| IOTA Dimension | | 220 mm (9 ") height, 120 mm (4,75 ") width |
| | | |
| Module Removal and Insertion Under Power | | Supported |
| Supported I/O Types | | Series 8 |
| Supported I/O Links | | 2 I/O Links, each I/O Link configurable for Series 8. |
| Maximum Number of IO Modules per Controller | | 80 I/O Units (Redundant or Non-Redundant IOMs) |
| Maximum Number of IO Modules on each I/O link | | 40 I/O Units (Redundant or Non-Redundant IOMs) |
| | | |
| | | |
| Temperature | Operating Temperature | 0 to 60 °C |
| | Storage temperature | -40 to 85 °C |
| Relative Humidity | | 5 to 95 % (non condensing) |
| Harsh Environment (ANSI/ISA- S71.04-1985 corrosion standard) | | 8C- model number designation support the harsh environment or G3 level |
| | | |
| | | |
| | | |
| Control Capacity | | |
| Execution Units | | 5500 Execution Units (single or redundant) |
| Tagged Objects | | 4095 objects |
| Memory Units | | 16000 Memory Units |
| Execution Period | | 50 msec – 2000 msec (adjustable per control strategy) |
| RAM Retention | | 50 hour through optional rechargeable battery pack (Optional) |

| Controller Communication | |
|---------------------------------|--|
| Series 8 C300 | Native peer to peer with other Series 8 C300s |
| Supervisory Control Network | Fault Tolerant Ethernet |
| Third party devices | Modbus Master |
| Agency certifications |  |
| |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2 AEx/ Ex nA II C T4 |
| |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2, Ex nA II C T4 |

2.1.2. C300 Supported Function Blocks

| Function Block | Function Block | Function Block | Function Block |
|--|---|------------------------------------|-------------------------------------|
| General Purpose (Utility) | Profit Loop | GE (Compare Greater than or Equal) | SOLENOID |
| Alarm Window | Positional Proportional | GT (Compare Greater Than) | VALVEDAMPER |
| Annpanel | Pulse Count | LE (Compare Less than or Equal) | Sequential Control Functions |
| Dig Acq | Pulse Length | LIMIT | Step |
| EXECTIMER | Ramp / Soak | LT | Transition |
| First Out | Ratio Bias | MAX | Synchronize |
| Flag | Ratio Control | MAXPULSE | Handler |
| Flag Array | Remote Cascade Support | MIN | Phase |
| Operator Message | Switch (8 input single pole) | MINPULSE | Container Block Types |
| Numeric | Device Control | MUX | Control Module |
| Numeric Array | Device Control (multi input, multi output, multi state) | MUXREAL | Sequential Control Module |
| Push | Custom Block Types | MVOTE | Recipe Control Module |
| Text Array | Custom Data Block | NAND | Unit Control Module |
| Timer | Custom Algorithm Block | NE | IO Related |
| Type Convert | Math | nOON | Series 8 I/O |
| PV Algorithms (Auxiliary) | Absolute Value | NOR | Interface Block Types |
| PV Calculator | Addition | NOT | PCDI |
| Summer | Divide | OFFDELAY | Profibus Gateway Module |
| Counter | Exponent | ONDELAY | |
| Dead Time | LN | OR | |
| Enhanced PV Calculator | LOG | PULSE | |
| Enhanced General Linearization | Modulo | QOR | |
| Flow Compensation | Multiply | ROL | |
| General Linearization | Negate | ROR | |
| Lead / Lag | Power | RS | |
| Rate of Change | Rolling Average | RTRIG | |
| Signal Selector | Round | SEL | |
| Totalizer | Square Root | SELREAL | |
| PV Handling | Subtract | SHL | |
| Data Acquisition | Truncate | SHR | |
| Auto Manual | Discrete Logic | SR | |
| Regulatory Control | 2oo3 (2 out of 3 voting) | STARTSIGNAL | |
| Regulatory Calculator | AND | TRIG | |
| Enhanced Regulatory Calculator | CHECKBAD | WATCHDOG | |
| Fan Out (1 input / up to 8 outputs) | CHECKBOOL | XOR | |
| Override Selector (4 inputs) | CHGEXEC | Power Related | |
| PID (Proportional, Integral, Derivative) | CONTACTMON | GRPCAPRBK | |
| PID with External Reset | DELAY | HTMOTOR | |
| PID with Feed Forward | EQ (Compare Equal) | LEVELCOMP | |
| | FTRIG (Falling Edge Trigger) | LTMOTOR | |
| | | MAINIBV | |

2.2. Series 8 IO Specifications

Specifications for Series-8 I/O modules are shown below.

2.2.1. TC/RTD

Function

The TC/RTD IOM module supports up to 16 channels of temperature inputs.

Notable Features

- TC and RTD operation
- Remote cold junction compensation capability
- 1 Second PV scanning with OTD protection
- Configurable OTD protection (See below)
- Temperature points can be added in 16 point increments

Temperature Support




The Temperature variable is collected from all points at a 1 second rate. The 1 second update includes a configurable check for Open Thermocouple Detection (OTD) (see below) before propagation of the temperature variable. All TC inputs include integral Cold Junction Compensation (CJC).

Sampling and Open Sensor Detect

The TC/RTD IOM supports a configuration parameter for Open Sensor Detect before PV delivery. With the OTD configuration active, the PV is sampled and held while an OTD cycle is performed within the same measurement window. If the OTD is negative, the PV is propagated up through the system. If the OTD is positive, the PV is set to NAN and the input channel soft failure is set. In this way, no inappropriate control action occurs for PV values that are invalid due to an open thermocouple. PV sampling/reporting incurs no added delays from OTD processing.

Detailed Specs – TC/RTD

| Parameter | | Specification |
|--|-----------------------|--|
| Input / Output Module | | 8C-PAIMA1, TC/RTD, Coated |
| | | 8U-PAIMA1, TC/RTD, Uncoated |
| IOTA (16pt) PWA | | 8C-TAIMA1, Coated 9" |
| | | 8U-TAIMA1, Uncoated 9" |
| Input Type | | Thermocouple and / or RTD |
| Voltage Rating | | 24 VDC |
| Module current rating | | 120m A |
| Temperature | Operating Temperature | 0 to 60 °C |
| | Storage Temperature | -40 to 85 °C |
| Module Removal and Insertion Under Power | | Supported |
| Input channels | | 16 fully-isolated channel-to-channel, channel-to-IOL, and channel-to-power supply common in 16 channel increments. |
| Input scan rate | | 1 Second fixed by IOM (up to 16 channels/sec max.) |
| Channel bandwidth | | 0 to 4.7 Hz (-3 dB) |
| Nominal input range (TC only) | | -20 to +100 millivolts |

| Parameter | | Specification |
|--|------------------------|---|
| Maximum normal mode continuous input non-damaging (any thermocouple type configured) | | -10 to +10 volts (TC) -1 to +2 Volts @ 100 milliamps (RTD) |
| Gain error (-20 to +100 millivolt range) | | 0.050% full scale max |
| Temperature stability | TC, Millivolt inputs | +/-20 ppm per °C max |
| | RTD inputs | +/-20 ppm per °C max |
| Long term drift | | 500 ppm |
| Input impedance | | 1 megohm at dc (TC only) |
| CMV with respect to Power System common, dc to 60 Hz | | Channel to Shield :+/-250 VDC or VAC RMS Channel to Channel: +/-33 VDC or VAC RMS |
| CMRR, 50 or 60 Hz (with 1000 ohms source impedance max.) | | 120 dB min |
| Voltage, channel-to-channel, dc to 60 Hz | | +/-250 VDC or VAC RMS |
| Crosstalk, dc to 60 Hz | | 80 dB (120 dB at 50 and 60 Hz) |
| NMRR at 50/ 60 Hz | | 60 dB min |
| Line frequency integration | | Fixed selection of 50 Hz or 60 Hz |
| RTD sensor excitation current | | 1 milliamp |
| Cold junction compensation range | | -20 to +60 °C (+/-0.5 °C typical) |
| TC Linearization Accuracy (2) | | ± 0.05 Ω / °C |
| Open Thermocouple Detection | | Each conversion qualified, ≤ 1000 Ω = guaranteed no-trip ≥ 1500 Ω guaranteed trip. |
| RTD Max Lead Resistance | | 15 Ω |
| Surge protection (sensor terminals) | | EN 61000-4-5 (for Industrial locations, 1kV line to line, 2kV line to gnd.) |
| Surge protection (power/serial link with cable adapter option) | | EN 61000-4-5 (for Industrial locations, 1kV line to line, 2kV line to gnd.) |
| Supported types (RTD) | Pt: 100 ohm DIN 4376 | -180 to +800 °C |
| | Pt: 100 ohm JIS C-1604 | -180 to +650 °C |
| | Ni: 120 ohm ED #7 | -45 to +315 °C |
| | Cu: 10 ohm SEER | -20 to +250 °C |
| | Cu: 50 ohm SEER | -50 to +150 °C |
| Supported thermocouple types | ANSI specification J | -200 to +1200 °C |
| | ANSI specification K | -100 to +1370 °C |
| | ANSI specification E | -200 to +1000 °C |
| | ANSI specification T | -230 to +400 °C |
| | ANSI specification B | +100 to +1820 °C |
| | ANSI specification S | 0 to +1700 °C |
| | ANSI specification R | 0 to +1700 °C |
| Supported millivolt types | | -20 to +100 millivolts |
| Agency certifications | |  |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2 AEx/ Ex nA II C T4 |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2, Ex nA II C T4 |
| (1): Linearization polynomials are 4th order and based on NIST Monograph 175, ITS90 and JIS C-1602-1995. | | |

2.2.2. Analog Input – Single Ended




Function

The Analog Input Module accepts current inputs from transmitters and sensing devices.

Notable Features

- Extensive self diagnostics
- Optional redundancy
- Fast loop scan
- Internal or external field power selection
- On board excitation power (no need for marshalling power)
- Galvanic Isolation

Detail Specifications – Analog Input

| Parameter | | Specification | |
|--|-----------------------|---|----------------------------|
| Input / Output Module | | 8C-PAINA1 - Analog Input – Single Ended, Coated | |
| | | 8U-PAINA1 - Analog Input – Single Ended, Uncoated | |
| IOTA Modules | | 8C-TAIXA1 | Non Redundant, Coated 6" |
| | | 8U-TAIXA1 | Non Redundant, Uncoated 6" |
| | | 8C-TAIXB1 | Redundant, Coated 12" |
| | | 8U-TAIXB1 | Redundant, Uncoated 12" |
| Input Type | | current (2-wire or self-powered transmitters) | |
| Input Channels | | 16 Channels (All 16 Single Ended) | |
| Voltage Rating | | 24 VDC | |
| Module current rating | | 105m A | |
| Temperature | Operating Temperature | 0 to 60 °C | |
| | Storage temperature | -40 to 85 °C | |
| A/D Converter Resolution | | 16 bits | |
| Module Removal and Insertion Under Power | | Supported | |
| Input Range | | 4-20 mA (through 250 Ω) | |
| Normal Mode Rejection Ratio, at 60 Hz | | 19 dB | |
| Normal Mode Filter Response | | Single-pole RC, -3 dB @ 6.5 Hz | |
| Crosstalk, dc to 60 Hz (channel-to-channel) | | -60 dB | |
| Maximum Input Voltage (any input referenced to common, no damage) | | ± 30 Volts | |
| Input Scan Rate | | 50 ms | |
| Hardware Accuracy (@ CMV = 0 V) | | ± 0.075% of full-scale (23.5± 2°C) ± 0.15% of full-scale (0 to 60°C) | |
| Galvanic Isolation (any input terminal voltage referenced to common) | | 1000 VAC RMS or ±1000 VDC | |
| Isolation Technique | | Icoupler (in IOM) | |
| Agency certifications | |  | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2 AEx/ Ex nA II C T4 | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2, Ex nA II C T4 | |

2.2.3. Analog Input with HART – Single Ended




Function

The Analog Input Module accepts current inputs from transmitters and sensing devices.

Notable Features

- Extensive self diagnostics
- Optional redundancy
- HART-capable
- Fast loop scan
- Internal or external field power selection
- On board excitation power (no need for marshalling power)
- Galvanic Isolation

Detail Specifications – Analog Input with HART – Single Ended

| Parameter | | Specification | | |
|--|-----------------------|---|-------------------------|-----|
| Input / Output Module | | 8C-PAIHA1 - Analog Input with HART, Coated | | |
| | | 8U-PAIHA1 - Analog Input with HART, Uncoated | | |
| IOTA Modules | | 8C-TAIXA1 | Non Redundant, Coated | 6" |
| | | 8U-TAIXA1 | Non Redundant, Uncoated | 6" |
| | | 8C-TAIXB1 | Redundant, Coated | 12" |
| | | 8U-TAIXB1 | Redundant, Uncoated | 12" |
| Input Type | | current (2-wire or self-powered transmitters) | | |
| Input Channels | | 16 Channels (All 16 Single Ended) | | |
| A/D Converter Resolution | | 16 bits | | |
| Voltage Rating | | 24 VDC | | |
| Module current rating | | 110 mA | | |
| Temperature | Operating Temperature | 0 to 60 °C | | |
| | Storage temperature | -40 to 85 °C | | |
| Input Range | | 4-20 mA (through 250 Ω) | | |
| Module Removal and Insertion Under Power | | Supported | | |
| Normal Mode Rejection Ratio, at 60 Hz | | 19 dB | | |
| Normal Mode Filter Response | | Single-pole RC, -3 dB @ 6.5 Hz | | |
| Crosstalk, dc to 60 Hz (channel-to-channel) | | -60 dB | | |
| Maximum Input Voltage (any input referenced to common, no damage) | | ± 30 Volts | | |
| Input Scan Rate | | 50 ms | | |
| Hardware Accuracy (@ CMV = 0 V) | | ± 0.075% of full-scale (23.5±2°C) ± 0.15% of full-scale (0 to 60°C) | | |
| Galvanic Isolation (any input terminal voltage referenced to common) | | 1000VAC RMS or ±1000 VDC | | |
| Isolation Technique | | Icoupler (in IOM) | | |
| Agency certifications | |  | | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2 AEx/ Ex nA II C T4 | | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2, Ex nA II C T4 | | |

2.2.4. Analog Input with HART – Differential




Function

The Analog Input Module accepts current inputs from transmitters and sensing devices.

Notable Features

- Extensive self diagnostics
- Optional redundancy
- No Open Wire Detection
- Supports either Single Ended / Differential Inputs
- HART-capable
- Fast loop scan

Detail Specifications – Analog Input with HART – Differential

| Parameter | | Specification | |
|--|-----------------------|--|----------------------------|
| Input / Output Module | | 8C-PAIH54 - Analog Input with HART- Differential (16), Coated | |
| | | 8U-PAIH54- Analog Input with HART- Differential (16), Uncoated | |
| IOTA Modules | | 8C-TAIDA1 | Non Redundant, Coated 9" |
| | | 8U-TAIDA1 | Non Redundant, Uncoated 9" |
| | | 8C-TAIDB1 | Redundant, Coated 12" |
| | | 8C-TAIDB1 | Redundant, Uncoated 12" |
| Input Type | | Supports either single ended or Differential current / voltage inputs with one type of IOTA | |
| Input Channels(1) | | 16 Channels (All 16 Single Ended / Differential) | |
| A/D Converter Resolution | | 16 bits | |
| Input Range | | 1 to 5 V, 4-20 mA (through 250 Ω) | |
| Voltage Rating | | 24 VDC | |
| Module current rating | | 310 mA | |
| Normal Mode Rejection Ratio, at 60 Hz | | 19 dB | |
| Module Removal and Insertion Under Power | | Supported | |
| Temperature | Operating Temperature | 0 to 60 °C | |
| | Storage temperature | -40 to 85 °C | |
| Normal Mode Filter Response | | Single-pole RC, -3 dB @ 6.5 Hz | |
| Crosstalk, dc to 60 Hz (channel-to-channel) | | -60 dB | |
| Maximum Input Voltage (any input referenced to common, no damage) | | \pm 30 Volts | |
| Input Scan Rate | | 50 ms | |
| Hardware Accuracy (@ CMV = 0 V) | | \pm 0.075% of full-scale (23.5 \pm 2 °C) \pm 0.15% of full-scale (0 to 60 °C) | |
| Agency certifications | |  | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2 AEx/ Ex nA II C T4 | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2, Ex nA II C T4 | |
| Each channel's 250-Ohm load resistor is connected to the input terminal through a wire jumper on the IOTA. This jumper should be cut by the user on channels to be used with voltage transmitters. | | | |

2.2.5. Analog Output

Function

The Analog Output (AO) Module delivers high-level constant current to actuators and recording/indicating devices.

Notable Features

- Extensive self diagnostics
- Optional redundancy
- Safe-state (FAILOPT) behaviors configurable on a per channel basis




FAILOPT

Series 8 AO module supports the FAILOPT parameter on a per channel basis. The user can configure each channel to either HOLD LAST VALUE, or SHED to a SAFE VALUE. The Output will always go to zero, the safe state, if the IOM device electronics fails.

Open-wire Detection

This Series 8 IO function can detect and annunciate open field wire with a Channel Soft Failure indication.

Detail Specifications – Analog Output

| Parameter | | Specification | |
|---|-----------------------|--|----------------------------|
| Input / Output Module | | 8C-PAONA1 - Analog Output, Coated | |
| | | 8U-PAONA1 - Analog Output, Uncoated | |
| IOTA Modules | | 8C-TAOXA1 | Non-Redundant, Coated 6" |
| | | 8U-TAOXA1 | Non-Redundant, Uncoated 6" |
| | | 8C-TAOXB1 | Redundant, Coated 12" |
| | | 8U-TAOXB1 | Redundant, Uncoated 12" |
| Output Type | | 4-20 mA | |
| Output Channels | | 16 | |
| Output Ripple | | 100 mV peak-to-peak at power line frequency, across 250 Ω load | |
| Load Resistance | | 50-800 Ω | |
| Voltage Rating | | 24 VDC | |
| Module current rating | | 190 mA | |
| Temperature | Operating Temperature | 0 to 60 °C | |
| | Storage temperature | -40 to 85 °C | |
| Resolution | | $\pm 0.05\%$ of Full Scale | |
| Module Removal and Insertion Under Power | | Supported | |
| Calibrated Accuracy | | $\pm 0.2\%$ of Full Scale (25°C) including linearity | |
| Directly Settable Output Current Range | | 2.9 mA to 21.1 mA | |
| Maximum Open Circuit Voltage | | 22 V | |
| Response Time (DAC input code to output) | | settles to within 1% of final value within 80 ms | |
| Gap (0 mA) of Output to Field on Switchover | | 10 ms maximum (applies to Redundancy only) | |
| Agency certifications | |  | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2 AEx/ Ex nA II C T4 | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2, Ex nA II C T4 | |

2.2.6. Analog Output with HART

The Analog Output (AO) Module delivers high-level constant current to actuators and recording/indicating devices.

Notable Features

- Extensive self diagnostics
- Optional redundancy
- HART-capable, multivariable devices
- Safe-state (FAILOPT) behaviors configurable on a per channel basis




Safe-state Behavior (FAILOPT)

Series 8 AO module supports the FAILOPT parameter on a per channel basis. The user can configure each channel to either HOLD LAST VALUE, or SHED to a SAFE VALUE. The Output will always go to zero, the safe state, if the IOM device electronics fails.

Open-wire Detection

This Series 8 IO function can detect and annunciate open field wire with a Channel Soft Failure indication.

Detail Specifications – Analog Output with HART

| Parameter | | Specification | |
|---|-----------------------|--|-----|
| Input / Output Module | | 8C-PAOHA1 - Analog Output with HART, Coated 8U-PAOHA1 - Analog Output with HART, Uncoated | |
| IOTA Modules | 8C-TAOXA1 | Non-Redundant, Coated | 6" |
| | 8U-TAOXA1 | Non-Redundant, Uncoated | 6" |
| | 8C-TAOXB1 | Redundant, Coated | 12" |
| | 8U-TAOXB1 | Redundant, Uncoated | 12" |
| Output Type | | 4-20 mA | |
| Output Channels | | 16 | |
| Output Ripple | | < 100 mV peak-to-peak at power line freq, across 250 Ω load | |
| Load Resistance | | 50-800 Ω | |
| Voltage Rating | | 24 VDC | |
| Module current rating | | 205 mA | |
| Temperature | Operating Temperature | 0 to 60 $^{\circ}\text{C}$ | |
| | Storage temperature | -40 to 85 $^{\circ}\text{C}$ | |
| Resolution | | $\pm 0.05\%$ of Full Scale | |
| Module Removal and Insertion Under Power | | Supported | |
| Calibrated Accuracy | | $\pm 0.2\%$ of Full Scale (25 $^{\circ}\text{C}$) including linearity | |
| Directly Settable Output Current Range | | 2.9 mA to 21.1 mA | |
| Maximum Open Circuit Voltage | | 22 V | |
| Response Time(DAC input code to output) | | settles to within 1% of final value within 80 ms | |
| Gap (0 mA) of Output to Field on Switchover | | 10 ms maximum (applies to Redundancy only) | |
| Agency certifications | |  | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2 AEx/ Ex nA II C T4 | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2, Ex nA II C T4 | |

2.2.7. Digital Input Sequence of Events

Function




The Digital Input Sequence of Events (DISOE) accepts 24VDC discrete signals as discrete inputs. The inputs can be time tagged to support 1ms resolution Sequence of Events

Notable Features

- Three modes of operation:
 - Normal (20ms PV scan)
 - Sequence of Events (1ms resolution SOE,20ms PV scan)
 - Low Latency (5ms PV scan)
- Extensive internal diagnostics for data integrity
- Optional redundancy
- Internal or external field power selection
- On board excitation power (no need for marshalling power)
- Direct / Reverse Input Indication
- Galvanic Isolation

Detail Specifications – Digital Input Sequence of Events

| Parameter | | Specification | | |
|--|-----------------------|--|-------------------------|-----|
| Input / Output Module | | 8C-PDISA1 - Digital Input Sequence of Events, Coated | | |
| | | 8U-PDISA1 - Digital Input Sequence of Events, Uncoated | | |
| IOTA Modules | | 8C-TDILA1 | Non Redundant, Coated | 9" |
| | | 8U-TDILA1 | Non Redundant, Uncoated | 9" |
| | | 8C-TDILB1 | Redundant, Coated. | 12" |
| | | 8U-TDILB1 | Redundant, Uncoated | 12" |
| Input Channels | | 32 | | |
| Input Channel Scanning (PV) | | Normal = 20ms ; Fast = 5ms | | |
| Digital Input Resolution for Sequence of Events (SOE) | | 1ms | | |
| Voltage Rating | | 24 VDC | | |
| Module current rating | | 95 mA | | |
| Temperature | Operating Temperature | 0 to 60 °C | | |
| | Storage temperature | -40 to 85 °C | | |
| Galvanic Isolation (any input terminal voltage referenced to common) | | 1000 VAC RMS or ±1000 VDC | | |
| Module Removal and Insertion Under Power | | Supported | | |
| Isolation Technique | | Optical (in IOM) | | |
| DI Power Voltage Range | | 18 to 30 VDC | | |
| ON Sense Voltage/Current | | 13 VDC (min) or 3 mA (min) | | |

| | |
|--|--|
| OFF Sense Voltage/Current | 5 VDC (max) or 1.2 mA (max) |
| Input Impedance | 4.2 K Ω |
| Absolute Delay Across Input Filter and Isolation | 5 ms \pm 20% |
| Field Resistance for Guaranteed ON Condition | 300 Ω max @ 15 VDC |
| Field Resistance for Guaranteed OFF Condition | 30 K Ω min @ 30 VDC |
| Agency certifications |  |
| |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2 AEx/ Ex nA II C T4 |
| |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2, Ex nA II C T4 |

2.2.8. Digital Input 24VDC




Function

The Digital Input 24VDC accepts 24VDC signals as discrete inputs.

Notable Features

- Extensive internal diagnostics for data integrity
- Optional redundancy
- Internal / External field power selection
- Galvanic isolation (System to Field only with external user supplied power)

Detail Specifications – Digital Input 24VDC

| Parameter | | Specification | | |
|--|-----------------------|---|-------------------------|-----|
| Input / Output Module | | 8C-PDILA1 - Digital Input 24VDC, Coated | | |
| | | 8U-PDILA1 - Digital Input 24VDC, Uncoated | | |
| IOTA Modules | | 8C-TDILA1 | Non Redundant, Coated | 9" |
| | | 8U-TDILA1 | Non Redundant, Uncoated | 9" |
| | | 8C-TDILB1 | Redundant, Coated | 12" |
| | | 8U-TDILB1 | Redundant, Uncoated | 12" |
| Input Channels | | 32 | | |
| Galvanic Isolation (any input terminal voltage referenced to common) | | 1000 VAC RMS for System – to – Field isolation for user supplied field Power | | |
| Isolation Technique | | Optical (In IOM) | | |
| Voltage Rating | | 24 VDC | | |
| Module current rating | | 95 mA | | |
| Temperature | Operating Temperature | 0 to 60 °C | | |
| | Storage temperature | -40 to 85 °C | | |
| DI Power Voltage Range | | 18 to 30 VDC (For user supplied field power) | | |
| Module Removal and Insertion Under Power | | Supported | | |
| ON Sense Voltage/Current | | 13 VDC (min) or 3 mA (min) | | |
| OFF Sense Voltage/Current | | 5 VDC (max) or 1.2 mA (max) | | |
| Input Impedance | | 4.2 K Ω | | |
| Absolute Delay Across Input Filter and Isolation | | 5 ms \pm 20% | | |
| Agency certifications | |  | | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2 AEx/ Ex nA II C T4 | | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2, Ex nA II C T4 | | |

2.2.9. Digital Input Pulse Accumulation




Function

The Digital Input Pulse Accumulation accepts 24VDC signals as discrete inputs. The first 16 channels can be configured either as Digital Input or Pulse accumulation to support Pulse Accumulation and frequency measurement on per channel basis.

Notable Features

- Extensive internal diagnostics for data integrity
- Optional redundancy
- Internal / External field power selection
- Galvanic isolation (System to Field only with external user supplied power)
- Support Pulse Accumulation & frequency measurement
- Channels 1-16 can support Pulse accumulation on per channel basis
- Channels 17-32 can be configured as DI

Detail Specifications – Digital Input Pulse Accumulation

| Parameter | | Specification | | |
|--|-----------------------|---|-------------------------|-----|
| Input / Output Module | | 8C-PDIPA1 - 24VDC Digital Input Pulse Accumulation, Coated | | |
| | | 8U-PDIPA1 - 24VDC Digital Input Pulse Accumulation, Uncoated | | |
| IOTA Modules | | 8C-TDILA1 | Non Redundant, Coated | 9" |
| | | 8U-TDILA1 | Non Redundant, Uncoated | 9" |
| | | 8C-TDILB1 | Redundant, Coated | 12" |
| | | 8U-TDILB1 | Redundant, Uncoated | 12" |
| Input Channels | | 32 | | |
| Galvanic Isolation (any input terminal voltage referenced to common) | | 1000 VAC RMS for System – to – Field isolation for user supplied field Power | | |
| Isolation Technique | | Optical (In IOM) | | |
| Voltage Rating | | 24 VDC | | |
| Module current rating | | 105 mA | | |
| Temperature | Operating Temperature | 0 to 60 °C | | |
| | Storage temperature | -40 to 85 °C | | |
| DI Power Voltage Range | | 18 to 30 VDC (For user supplied field power) | | |
| Module Removal and Insertion Under Power | | Supported | | |
| Signal Type (Pulse Accumulation) | | Accumulation Type (0-1KHz, for minimum 30% DUTY CYCLE devices) | | |
| Minimum Pulse Width | | 300 uSec | | |
| Individual Channel SCAN Time | | 300 uSec | | |
| ON Sense Voltage/Current | | 13 VDC (min) or 3 mA (min) | | |
| OFF Sense Voltage/Current | | 5 VDC (max) or 1.2 mA (max) | | |
| Input Impedance | | 4.2 KΩ | | |
| Absolute Delay Across Input Filter and Isolation | | 5 ms ± 20% | | |
| Agency certifications | |  | | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2 AEx/ Ex nA II C T4 | | |
| | |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2, Ex nA II C T4 | | |

2.2.10. Digital Output 24VDC

Function

The Digital Output bussed 24VDC (DO24V) module can switch reliable 24V digital output signals to control other process equipment as well as solenoid valves and interposing relays.

Notable Features

- Extensive internal diagnostics to ensure data integrity
- Optional redundancy
- Safe-state (FAILOPT) behaviors
- Latched, pulsed or pulse-width modulated output (per channel)
- Galvanic Isolation (System to Field only with external user supplied power)

Bussed 24VDC DO




The Digital Output Bussed 24VDC has provisions for both internal and external field power excitation. As a bussed output device, all of the outputs share a common return (ground). All outputs get their power from the same source, which can be either the system power supply or an externally connected 24V power supply. When selection is from an external source, outputs can be galvanically isolated from the Series 8 power system. A wiring option on the IOTA determines if outputs are referenced to the Series 8 system power or an external field power source.

Safe-state Behavior (FAILOPT)

Series 8 DO module will support FAILOPT parameter on a per channel basis. The output can be directed by configuration to either HOLD THE LAST VALUE, or SHED to a SAFE VALUE. The safe value can be configured by the user.

Detail Specifications – Digital Output 24VDC

| Parameter | | Specification | | |
|--|-----------------------|--|-------------------------|-----|
| Input / Output Module | | 8C-PDODA1 - Digital Output 24 VDC, Field Isolated, Bussed output, Coated | | |
| | | 8U-PDODA1 - Digital Output 24 VDC, Field Isolated, Bussed output, Uncoated | | |
| IOTA Module Numbers | | 8C-TDODA1 | Non Redundant, Coated | 9" |
| | | 8U-TDODA1 | Non Redundant, Uncoated | 9" |
| | | 8C-TDODB1 | Redundant, Coated | 12" |
| | | 8U-TDODB1 | Redundant, Uncoated | 12" |
| Output Channels | | 32 | | |
| Output Type | | Source | | |
| Voltage Rating | | 24 VDC | | |
| Module current rating | | 105mA | | |
| Temperature | Operating Temperature | 0 to 60 °C | | |
| | Storage temperature | -40 to 85 °C | | |
| Load Voltage | | 30 VDC Maximum | | |
| Module Removal and Insertion Under Power | | Supported | | |

| | |
|---|---|
| <p>Load Current Short circuit protection for DO channel would be using series FUSES in the output channel. One FUSE per Eight channels. Total FOUR (4) fuses for 32 channels on DO IOTA</p> | <p>100mA per channel (Max)</p> |
| <p>Galvanic Isolation</p> | <p>1000 VAC RMS for System – to – Field isolation for user supplied field Power only No System- to-Field isolation for internal system power used for field sensing</p> |
| <p>On-State Voltage</p> | <p>24 VDC (typ) (load current @ 0.1A max)</p> |
| <p>Off-State Voltage</p> | <p>0v VDC</p> |
| <p>Off-State Leak Current</p> | <p>5 μA (max)</p> |
| <p>Turn-On/Turn-Off Time</p> | <p>10 ms (max)</p> |
| <p>Gap (0 current) of Output to Field on Switchover</p> | <p>None (0ms) (applies to Redundancy only)</p> |
| <p>Agency certifications</p> |  |
| |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2 AEx/ Ex nA II C T4 |
| |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2, Ex nA II C T4 |

2.2.11. DO Relay Extension Board




Function

The Digital Output Relay provides a dry contact for isolated low voltage / low current or high voltage / high current discrete output applications. Each relay supports a Form-A or Form-B output based on jumper configuration. The Relay IOTA uses the Digital Output 24V (DO24V) IOM with a special IOTA to support the Relay IOTA. All characteristics of the DO24V IOM are incorporated here.

Notable Features

- Galvanic isolation
- Isolated Dry Contact
- Counter EMF Snubbing Circuit
- LED indication for each channel ON condition

Detail Specifications – DO Relay Extension Board

| Parameter | | Specification |
|--|---|--|
| IOTA Module Numbers | 8C-SDOX01 | Relay Extension, Coated |
| | 8U-SDOX01 | Relay Extension, Uncoated |
| Output Channels | 32 isolated Form C (SPDT) or Form B (SPST/NC) contacts (jumper selectable per output) | |
| Contact Type | Au over AgSnO ₂ | |
| Maximum Load Voltage | 250 VAC (RMS)/125 VDC | |
| Maximum Steady State Load Current per Output | Current | Voltage |
| | 5A | 125 / 250 VAC (resistive) |
| | 3 A | 30 VDC (resistive) |
| | 1 A | 48 VDC (resistive) |
| | 0.2 A | 125 VDC (resistive) |
| | 2 A | 125 / 250 VAC (inductive = 0.4 power factor) |
| | 1 A | 30 VAC (inductive L/R = 100 ms) |
| | 0.3 A | 48 VAC (inductive L/R = 100 ms) |
| 0.1 A | 125 VAC (inductive L/R = 100 ms) | |
| Minimum Load Voltage | 5 VDC (1) | |
| Minimum Load Current | 10 mA or 100mA (1) | |
| Voltage Rating | 24 VDC | |
| Module current rating | 1010 mA | |
| Module Removal and Insertion Under Power | Supported | |
| Temperature | Operating Temperature | 0 to 60 °C |
| | Storage temperature | -40 to 85 °C |
| Isolation (Channel-to-channel, and channel-to-logic common) | 1500 VAC RMS or ±1500 VDC | |
| Turn On Time | 20 ms maximum | |
| Turn Off Time | 20 ms maximum | |
| Contact Life | Operations % of Max Load 10,000,0000 (Mechanical Life) 200,000 @ 3 A (100%) | |
| Agency certifications |  | |
| |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2 AEx/ Ex nA nC II C T4 | |
| |  Class I, Division 2, Group A, B, C, D; T4 Class I, Zone 2, Ex nA nC II C T4 | |
| Note 1: The minimum 10mA load current and 5 VDC load voltage specified are only valid if the contact has not been previously used in high current / high voltage applications. Once a relay contact is used in a high current / high voltage application, the minimum load current is 100mA. | | |

2.2.12. Series 8 IO Function Matrix

The following tables assist in selecting I/O Modules and IOTAs with similar functional characteristics:

AI Function Matrix

| IOM | NR IOTA | Red IOTA | Function | |
|------------------------|------------------------|------------------------|---------------|--------|
| | | | AI 4-20 mA | HART |
| 8C-PAIHA1 8U-PAIHA1 | 8C-TAIXA1 8U-TAIXA1 | 8C-TAIXB1 8U-TAIXB1 | ◆ ◆ | ◆ ◆ |
| 8C-PAINA1 8U-PAINA1 | 8C-TAIXA1 8U-TAIXA1 | 8C-TAIXB1 8U-TAIXB1 | ◆ ◆ | |
| 8C-PAIH54 8U-PAIH54 | 8C-TAIDA1 8U-TAIDA1 | 8C-TAIDB1 8U-TAIDB1 | ◆ ◆ | ◆ ◆ |

TC/RTD Function Matrix

| IOM | NR IOTA | Red IOTA | Function | |
|------------------------|------------------------|----------|----------|--------|
| | | | TC | RTD |
| 8C-PAIMA1 8U-PAIMA1 | 8C-TAIMA1 8U-TAIMA1 | NA NA | ◆ ◆ | ◆ ◆ |

AO Function Matrix

| IOM | NR IOTA | Red IOTA | Function | |
|------------------------|------------------------|------------------------|----------------|--------|
| | | | AIO 4-20 mA | HART |
| 8C-PAOHA1 8U-PAOHA1 | 8C-TAOXA1 8U-TAOXA1 | 8C-TAOXB1 8U-TAOXB1 | ◆ ◆ | ◆ ◆ |
| 8C-PAONA1 8U-PAONA1 | 8C-TAOXA1 8U-TAOXA1 | 8C-TAOXB1 8U-TAOXB1 | ◆ ◆ | |

DI Function Matrix

| IOM | NR IOTA | Red IOTA | Function | | |
|------------------------|------------------------|------------------------|----------|--------|--------|
| | | | DI | SOE | PA |
| 8C-PDILA1 8U-PDILA1 | 8C-TDILA1 8U-TDILA1 | 8C-TDILB1 8U-TDILB1 | ◆ ◆ | | |
| 8C-PDISA1 8U-PDISA1 | 8C-TDILA1 8U-TDILA1 | 8C-TDILB1 8U-TDILB1 | | ◆ ◆ | |
| 8C-PDIPA1 8U-PDIPA1 | 8C-TDILA1 8U-TDILA1 | 8C-TDILB1 8U-TDILB1 | | | ◆ ◆ |

DO Function Matrix

| IOM | NR IOTA | Red IOTA | Relay Extension | Source |
|------------------------|------------------------|--------------------------|------------------------|--------|
| 8C-PDODA1 8U-PDODA1 | 8C-TDODA1 8U-TDODA1 | 8C-TDODDB1 8U-TDODDB1 | 8C-SDOX01 8U-SDOX01 | ◆ ◆ |

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ASIA PACIFIC

Honeywell Process Solutions,
(TAC) hfs-tac-support@honeywell.com

Australia

Honeywell Limited
Phone: +(61) 7-3846 1255
FAX: +(61) 7-3840 6481
Toll Free 1300-36-39-36
Toll Free Fax:
1300-36-04-70

China – PRC - Shanghai

Honeywell China Inc.
Phone: (86-21) 5257-4568
Fax: (86-21) 6237-2826

Singapore

Honeywell Pte Ltd.
Phone: +(65) 6580 3278
Fax: +(65) 6445-3033

South Korea

Honeywell Korea Co Ltd
Phone: +(822) 799 6114
Fax: +(822) 792 9015

EMEA

Honeywell Process Solutions,
Phone: + 80012026455 or
+44 (0)1344 656000

Email: (Sales)

FP-Sales-Apps@Honeywell.com

or

(TAC)

hfs-tac-support@honeywell.com

AMERICA'S

Honeywell Process Solutions,
Phone: (TAC) 1-800-423-9883 or
215/641-3610
(Sales) 1-800-343-0228

Email: (Sales)

FP-Sales-Apps@Honeywell.com

or

(TAC)

hfs-tac-support@honeywell.com

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Process Solutions

Honeywell
1250 W Sam Houston Pkwy S
Houston, TX 77042

Honeywell Control Systems Ltd
Honeywell House, Skimped Hill Lane
Bracknell, England, RG12 1EB

Shanghai City Centre, 100 Jungi Road
Shanghai, China 20061

www.honeywellprocess.com



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