

Honeywell MC-PAOX03

## Analog Output 8-Point Processor/FTA -Conformal Coated



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# **TPS Process Manager I/O Specification and Technical Data**



**IO03-684**

**TPN Release R684**

**December 2012**

**Revision 2**

## Revision History

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|----------|------------|-------------|
| 1        | 2012/08/30 | First Issue |
| 2        | 2012/12/02 | Updated     |

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## 1. Acronyms and Definitions

|       |                                                   |
|-------|---------------------------------------------------|
| AI    | Analog Input                                      |
| APM   | Advanced Process Manager                          |
| AO    | Analog Output                                     |
| CL    | Control Language                                  |
| DI    | Digital Input                                     |
| DISOE | Digital Input Sequence of Events                  |
| DO    | Digital Output                                    |
| EHPM  | Enhanced High Performance Process Manager         |
| FTA   | Field Termination Assemblies                      |
| HLAI  | High Level Analog Input                           |
| HPM   | High performance Process Manager                  |
| IEEE  | Institute of Electrical and Electronics Engineers |
| ISPA  | Intrinsically Safe Power Adapter                  |
| IOP   | Input/Output Processors                           |
| LCN   | Local Control Network                             |
| LLMUX | Low Level Multiplexer                             |
| NIM   | Network Interface Module                          |
| NIPA  | Non-Incendive Power Adapter                       |
| OTD   | Open-thermocouple detection                       |
| PM    | Process Manager                                   |
| PU    | Process Unit                                      |
| RHMUX | Remote Hardened Multiplexer                       |
| SDI   | Serial Device Interface                           |
| SI    | Serial Interface                                  |
| STI   | Smart Transmitters Interface                      |
| PI    | Pulse Input                                       |
| PV    | Process Variable                                  |
| TPN   | TPS Process Network                               |
| TPS   | TotalPlant Solution                               |
| UCN   | Universal Control Network                         |

## 2. Introduction

The Process Manager (PM), Advanced Process Manager (APM) and High Performance Process Manager (HPM) are Honeywell's leading **TotalPlant** Solution (TPS) system control and data acquisition devices for industrial process applications. They represent a powerful combination of cost-effective Honeywell controllers which can be applied to solve a broad range of industrial process control problems.

The PM, APM, HPM, and EHPM offer highly flexible I/O (input/output) functions for both data monitoring and control. One of the unique features of this family of controllers is its common set of Input/Output Processors (IOPs) and Field Termination Assemblies (FTAs). All IOPs and FTAs are usable by all three controllers (with only minor exceptions).

This specification and technical data sheet provides information on PM, APM, HPM, and EHPM IOPs and FTAs. Please refer to the following specification and technical data sheets for information about each controller:

- **PM03-400** - Process Manager Specification and Technical Data
- **AP03-500** - Advanced Process Manager Specification and Technical Data
- **HP03-500** - High Performance Process Manager Specification and Technical Data
- **EHPM03-600** - Enhanced High Performance Process Manager Specification

### 3. Functional Description

#### 3.1. Functional Overview

I/O Processors, along with Field Termination Assemblies (FTAs), perform input and output scanning and processing on all field PM/APM/HPM/EHPM I/O (Figure 2).

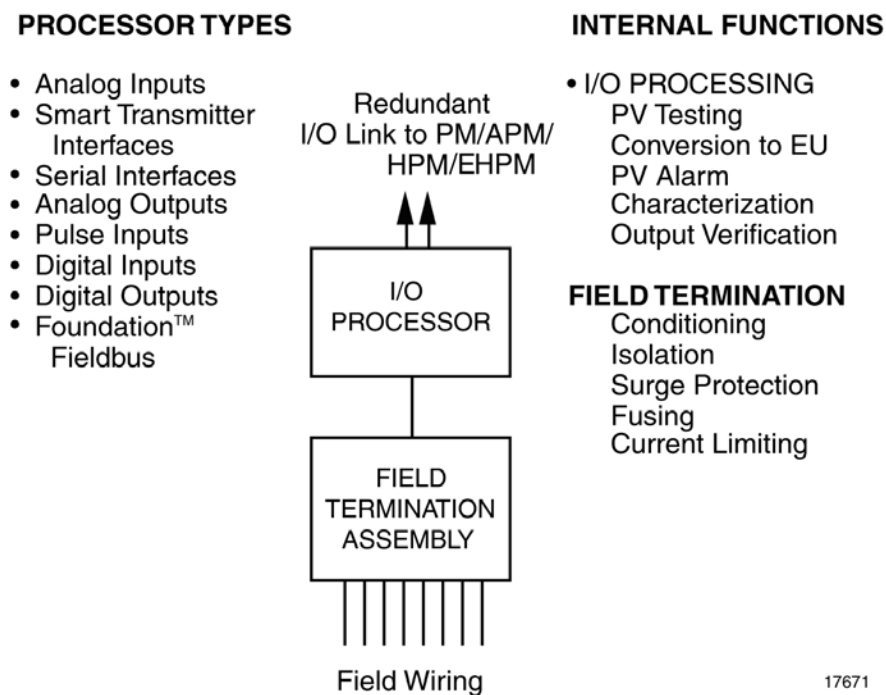


Figure 2 — PM/APM/HPM/EHPM I/O Functions

A redundant I/O Link is standard for maximum security. Optionally, High Level Analog Input, Smart Transmitter Interface, Analog Output, Digital Input and Digital Output processors can be redundant. I/O processing is performed separately from control processing functions so that I/O scan rates are completely independent of I/O quantity, controller loading, processing, and alarming. This partitioning of functions allows more efficient use of advanced Control Processor capability and provides for future I/O expansion.

A variety of I/O processors are available for the PM controllers:

- Analog Input—High Level (16 points)
- Analog Input—Low Level (8 points)
- Analog Input—Low Level Multiplexer (32 points)
- Smart Transmitter Multivariable Interface (16 points)
- Analog Output (8 points)
- Analog Output (16 points)
- Serial Device Interface (16 points—2 ports)
- Serial Interface (32 arrays, 2 ports)\*
- Pulse Input (8 points)
- Digital Input (32 points)
- Digital Input 24 Vdc (32 points)
- Digital Input Sequence of Events (DISOE) (32 points)\*

- Digital Output (16 points)
- Digital Output (32 points)
- Foundation Fieldbus (127 slots, 4 Fieldbus segments)\*\*

\* *APM, HPM, and EHPM only*

\*\* *HPM and EHPM only*

Any mix of the above I/O processors can be selected for a PM/APM/HPM/EHPM controller. This can be any combination of single and/or redundant (HLAI, STI, AO, DI and DO) pairs, up to a total of 40. Even with the maximum complement of 80 physical IOPs, there is no impact on control or communication performance. In a redundant IOP configuration, control automatically transfers to the backup I/O processor during board replacement or failure.

While a separate FTA of a given type is required to handle varying field wiring signal levels, identical I/O Processors can usually be used. This I/O approach simplifies system hardware selection and minimizes spare parts requirements. For example, one Digital Input Processor can handle 24 Vdc, 120 Vac, 125 Vdc or 240 Vac, depending on the FTA selected.

## Analog Input

**High and low level analog input** (HLAI + LLAI - 8) processors both perform signal conversion and conditioning functions:

- PV Source (Auto, Manual, Substituted)
- PV Clamping
- EU Conversion
- PV Value Status
- PV Filter (Single Lag)
- Bad PV
- PV Hi/Lo
- PV HiHi/LoLo
- PV Rate-of-Change +/-
- Software Calibration
- Low PV Cutoff

They perform engineering unit conversion, including fifth-order polynomial temperature input characterization, if the high level processor receives these inputs from mV/I converters. Through use of a dual processor design and custom integrated circuits, the low level analog input processor supports software configuration per channel for different thermocouples or RTD types with excellent resolution and accuracy. Open thermocouple detection is performed once per scan so that no bad data is propagated for control processing.

The **Low Level Multiplexer (LLMUX)** processor provides an economical way to bring in a large number of data acquisition signals. Each processor can handle 32 points, using two 16-point FTAs. Every point is scanned once per second with a one second scan delay for processing. Open thermocouple detection is performed every 30 seconds for all points. Options for either local or remote cold junction reference are available.

The **Remote Hardened Multiplexer (RHMUX)** processor provides functionality similar to that of the LLMUX, but the two 16-input FTAs may be mounted up to 2 km away from the xPM cabinet. Each FTA is mounted in its own NEMA-4 or -4X enclosure, providing protection against precipitation, hosedown, and windblown dust. The FTA itself is conformally coated, and is capable of operation in a GX "Severe" corrosive environment and in the presence of condensing humidity.

Power for the RHMUX's remote FTAs is provided by one of two power adapters, which provide power limiting, serial data interfaces, and galvanic isolation. The power adapter mounts in the FTA tray in the xPM cabinet, and provides the interface between the IOP and the two remote FTAs. The Intrinsically Safe Power Adapter (ISPA) allows the FTAs to be placed in Division 1 or Zone 0 environments. The Non-Incendive

Power Adapter (NIPA) provides an economical means to allow the remote FTAs to be placed in Division 2 or Zone 1 environments.

Every point is scanned once per 4 seconds. Data is made available at the end of each scan; there is no additional processing latency. Open-thermocouple detection (OTD) is optionally performed on every measurement. If enabled, the OTD test is performed immediately after the A/D conversion. If the test indicates an open thermocouple, data from the just-completed conversion will not be propagated.

To prevent spurious ground paths from affecting readings, ground-fault detection is performed. All RHMUX remote FTAs are equipped with a local cold junction reference. The RHMUX IOP is configured into the TPS PM system as a standard LLMUX. This permits using the RHMUX in Release 300 and greater systems.

## Smart Transmitter Multi-Variable Interface (STI-MV)

The Smart Transmitter Multivariable processor is the PM/APM/HPM/EHPM's digital interface to Honeywell's advanced series of smart transmitters.

Each STI-MV processor can communicate bi-directionally with up to 16 smart transmitters, including:

- ST3000 Pressure Transmitters
- STT3000 Temperature Transmitters
- MagneW 3000 Magnetic Flowmeters

These transmitters are used for pressure, temperature, and flow measurement

Each STI-MV processor also has the ability to accept up to four PVs each from the following multivariable transmitters:

- SCM 3000 Coriolis flowmeter
- Drexelbrook SLT level transmitter
- SMV3000 Multivariable Pressure Transmitter
- SGC3000 Gas Chromatograph

Multivariable transmitters provide the high accuracy of a digital interface while reducing wiring costs because multiple PVs are available over a single pair of wires.

Each IOP can accommodate DE inputs to a maximum of

- 16 single PV inputs from Smartline transmitters
- Four multivariable field devices with up to four PVs each, or
- A mix of single and multivariable field devices that equals up to 16 inputs per IOP (some restrictions apply)

The STI-MV Interface supports the functions for PV processing, EU conversion, and alarming supported by the other analog input processors (see above). It also provides Bad PV and Bad Database protection for added security.

All communications from the STI-MV processors to the Smart Transmitter are bit-serial, bi-directional, using the Honeywell DE (digital enhanced) protocol.

An individual at a Universal Station can perform any of the following functions

- Display primary and secondary Process Variables
- Display/Modify/Configure the transmitter database
- Re-range the transmitter
- Save/Restore the database
- Support calibration commands
- Display detailed transmitter status information
- Display the transmitter scratch pad, serial number, and revision level.



Enhanced digital accuracy is provided for all signals, resulting in accuracy that typically is three times better than that of analog.

### Serial Device Interface (SDI)

The Serial Device Interface processor provides connection to field devices that use serial communications (EIA-232 or EIA-485). Inputs from these devices are mapped into the I/O database and can be used directly for calculations and control. Since communication is bi-directional, information such as target value or damping factors can be written to or read from the field device. Specific serial devices are supported by custom programmable modules.

One such device is the UDC 6000 Process Controller, which provides single-loop remote display and control capability. Operating as a subsystem of the PM/APM/HPM/EHPM controller, the UDC 6000 displays PV, SP, and OP on front panel bar graphs. When digitally integrated with the PM/APM/HPM/EHPM, the UDC Controller can be configured for the following modes:

- Manual/Auto (M/A) Station where all control resides in the PM, APM, HPM, or EHPM.
- M/A Station with emergency backup control.
- Stand-alone control with the PM/APM/HPM/EHPM as supervisor.
- Stand-alone control with remote SP from the PM, APM, HPM, or EHPM.

Another device is the Toledo Weigh Cell (T8142), providing weight, setpoint control of feed (fast cutoff) and rate of change alarming.

### 3.2. Serial Interface (SI) (APM, HPM, and EHPM only)

The **Serial Interface** IOP provides a communications interface to Modbus or Allen-Bradley compatible subsystems (see Figure 3). Each serial interface IOP, by way of a Power Adapter, supports any combination of up to two FTAs. Note that the SI IOP is supported by the APM, HPM, and EHPM *only*. Each FTA supports one port and up to 16 array points.

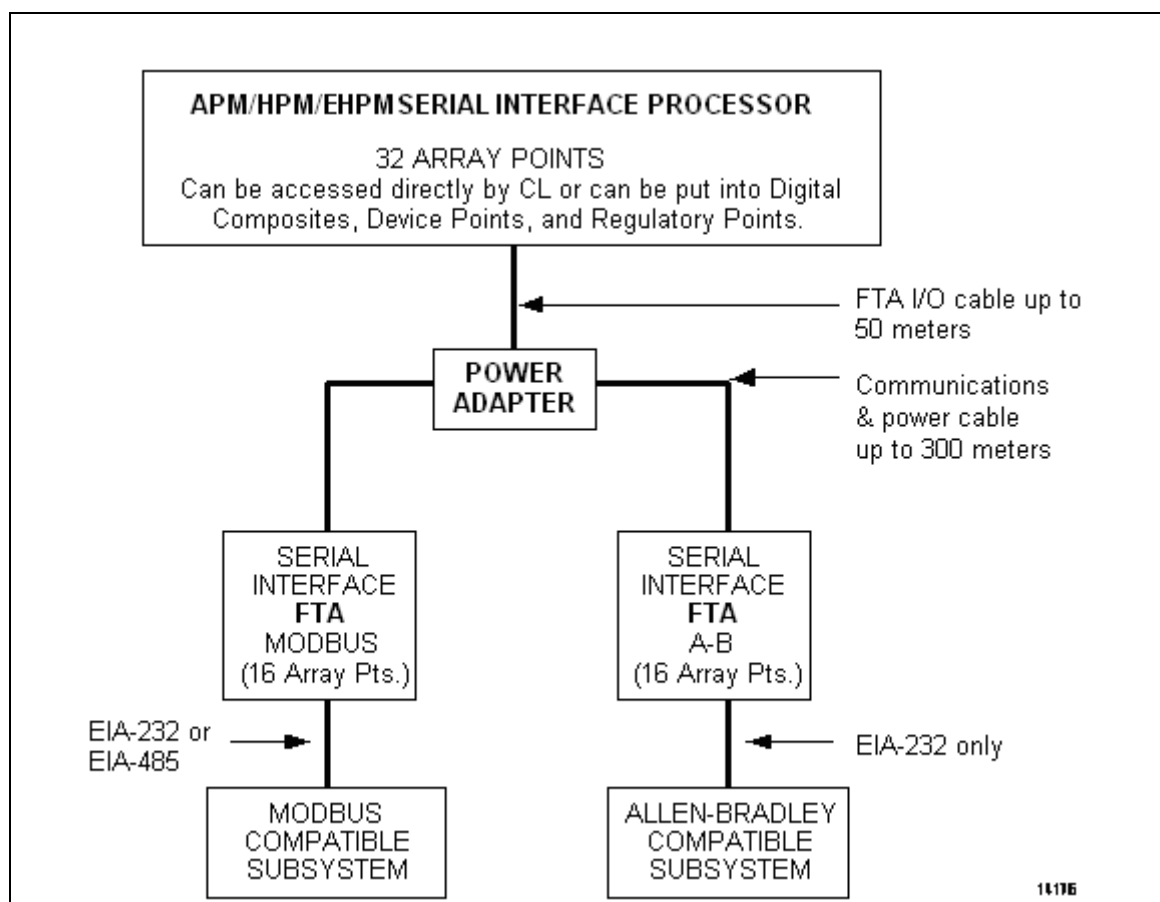


Figure 3 — PM/APM/HPM/EHPM I/O Functions

The Modbus SI FTA supports Modbus RTU protocol and uses either EIA-232 or EIA-422/485 communications, including multidrop configurations. The Allen-Bradley FTA supports DF-1 protocol and uses only EIA-232 communication.

The serial interface supports direct digital communications to any qualified, compatible subsystem. Using this scheme, serial data is then made available for all APM, HPM, and EHPM data acquisition and control strategies. Using the 16 available array points, an SI FTA has a nominal capacity of up to:

- 8192 Flags (Boolean) or
- 256 Reals (Floating Point) or
- 512 Integers or
- 1024 Characters.

The array point values can be displayed at the Universal Station or used as part of advanced control strategies. These values can be configured into APM, HPM, and EHPM control strategies using Digital Composites, Device Points, and Regulatory Points as well as CL programs. Both reads and writes of subsystem data are supported.

To assure smooth field integration of a variety of subsystems, subsystem devices with the serial interface are qualified as part of Honeywell's Multi-Vendor Interface Program.

In addition, custom interfaces can be designed to meet your specific interfacing requirements. Contact your account manager for more information.

### 3.3. Pulse Input (PI)

Precise control using high-accuracy pulsing-type sensing devices is possible with the Pulse Input processor. The result is improved product quality and reduced material waste. Pulse rates up to 20 kHz can be handled. Conversion to engineering units is performed, along with alarm checking, filtering, and data validity checking. 24 Vdc transmitter power is provided.

### 3.4. Analog Output

Two versions of the Analog Output IOP are available: one with 8 outputs and one with 16 outputs.

Both processors provide the following functions

- Readback check of actual output current
- Output characterization (5 segment)
- Output default action on failure (hold or unpowered)
- Modes and associated functions to support Manual loader and DDC control
- Software calibration

The 8-pt. analog output processor provides separate D/A converters and power regulator per channel for maximum output security. As an option, one-on-one Analog Output processor redundancy (available for both versions) provides even higher control strategy integrity.

The 16-pt analog output processor may be used with HART<sup>®</sup> field devices if the Model MU-THAO11 or MU-GHAO11 FTA is selected. These FTAs provide a connector for an external HART subsystem, and incorporate filters to prevent interference between the HART<sup>®</sup> signals and the TPS system.

### 3.5. Digital Input

Two Digital Input IOP models are available, both with 32 inputs. The Digital Input Processor provides the following functions:

- Event counting (accumulation) (maximum pulse rate = 15 Hz)
- Push-button and status type inputs (minimum on-time = 40 ms)
- Time deadband on alarms for status inputs

- Input direct/reverse
- PV source selection
- State or change of state alarming for status inputs
- Sequence of events resolution of 20 ms

Several voltage types are handled through a selection of FTAs. As an option, one-on-one Digital Input processor redundancy is available.

### 3.6. Digital Input Sequence of Events (APM, HPM, and EHPM only)

This specialized digital input processor (DISOE) provides all the functions of the conventional Digital Input except accumulation. Inputs from the board can be used for control strategies just like any other digital input. Note that the DISOE IOP is supported by the APM, HPM, and EHPM *only*.

In addition, this DISOE processor provides high-resolution sequence of events monitoring. Using the DISOE processor, SOE time stamp resolution within 1 ms is assured.

The DISOE processor provides optimum resolution when used with the standard 24 Vdc Digital Input FTA.

Optional one-on-one redundancy is available for higher availability

### 3.7. Digital Output

Two versions of the Digital Output IOP are available: one with 16 outputs and one with 32 outputs. Both processors provide the following functions:

- Output types (configurable per output)
  - Latched
  - Pulsed
  - Pulse-width modulated
- Output default action on failure (hold or unpowered)
- Output readback checking

The 16-point digital output processor provides separate output latches with redundant power regulators for added output security. As an option, one-on-one Digital Output processor redundancy is available for the 32-output IOP.

### 3.8. Fieldbus IOP (Obsolete Product)

The Fieldbus IOP and its associated Field Termination Assemblies (FTAs) as well as any power supplies or isolator modules used for Fieldbus applications have been discontinued. . For Full Fieldbus capability please refer to the Field Device Manager (FDM) product line.

### 3.9. I/O Simulation Option (APM/HPM/EHPM only)

The optional I/O Simulator package simulates the functions of the IOPs for the APM, HPM, and EHPM. It is a low cost, high fidelity simulation approach for control strategy checkout or for operator training support. A unique feature of this optional package is complete database transportability between the Simulation personality and the APM, HPM, or EHPM On-Process (normal operating) personality. This is especially useful for configuring the system before the physical I/O is available or connected. Features of the package include:

- “Bumpless” pause/resume interruption/restart
- Physical IOPs, FTAs and field wiring not required
- Simulation status indicated and journaled
- Database (checkpoint) transportable to target system
- Simulation rerun from saved data base using PV data

- Full peer-to-peer capability
- I/O functions simulated by Communications processor
- Almost any I/O configuration can be simulated
- Simulation load and status supported on system network
- Fault response testing and I/O redundancy simulation

The benefits of this package include

- The ability to perform high fidelity simulation
- Control strategy checkout
- Operator training
- Project cost savings

The HPM/EHPM I/O simulator package does not support the Fieldbus IOP

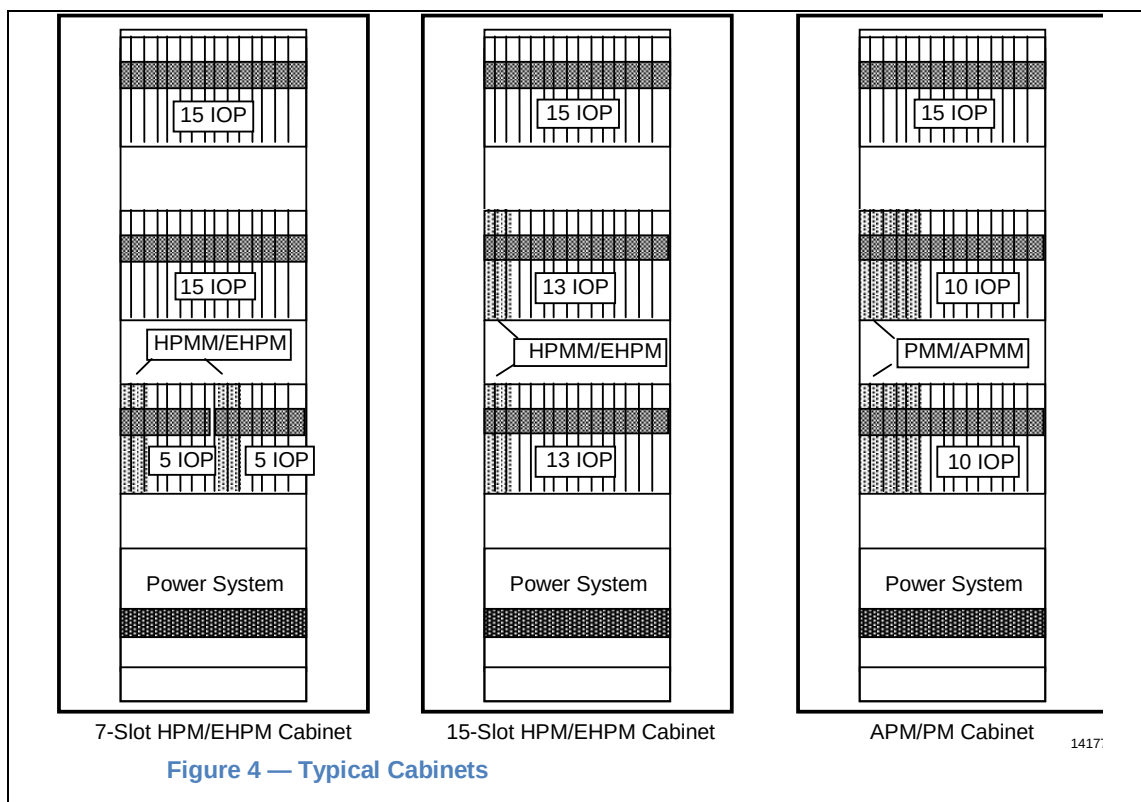
### 3.10. Card File Assemblies

A maximum of 40 logical IOPs can be configured per PM, APM, HPM, and EHPM. A "logical" IOP consists of either a single IOP or a redundant IOP pair). Typical PM, APM, HPM, and EHPM configurations may vary, but they generally consist of up to three cardfiles plus a power supply system. Each cardfile row may contain up to 15 module slots. (Refer to Figure 4.)

When options such as I/O redundancy and/or remote I/O are used, configurations with up to 8 "logical" card files can be provided.

One or two card files contain the PM, APM, HPM, or EPM Module(s). All remaining card file slots can be filled with any combination of I/O Processors. Note that 7-slot files which are used for the HPM/EHPM (i.e., not for PM or APM) can also be filled with IOPs. This "IOP only" configuration can be used to provide I/O for PMs and APMs as well.

With 7-slot HPM/EHPM files, a single cabinet side can hold up to 40 I/O Processors along with redundant High-Performance Process Manager Modules or redundant Ethernet High-Performance Process Manager Modules. Figure 4 shows typical cabinet layouts with redundant EHPMs/HPMs, APMs, and PMs.



### 3.11. Field Termination Assemblies

All connections to and from the process are made to Field Termination Assemblies (FTAs). Compression-type termination blocks (that can accept wire sizes as large as 14 AWG or ~1.6 mm) are available for all FTAs. Screw-type termination's can also be provided for most FTAs as shown in Table 1 in the "Specifications" section. The FTAs are connected to the I/O processors by cables that can be up to 50 meters in length. Three sizes of FTAs are used as shown in this table. Twenty-four Vdc transmitter and digital inputs sense power connections are provided through the standard FTA cable.

## 4. Options

### 4.1. I/O Redundancy

A one-on-one I/O redundancy option is also available for critical high level analog inputs, smart transmitter interface connections, analog outputs, digital inputs and digital outputs. This option offers significantly increased availability of automatic control by providing continuous operation through failure and replacement of I/O Processors, FTA cables, backplanes, and AO switching hardware. Up to 40 I/O Processors can be supported in a redundant or non-redundant PM, APM, HPM, or EHPM, and the user can selectively apply redundancy to some or all IOPs, for a maximum of 40 IOP pairs. The one-on-one design approach offers maximum coverage and fast switchover times. Integrity of the backup database and of the switching functions is provided through the extensive diagnostic coverage made possible by the processing capability of the smart I/O Processors.

### 4.2. Galvanically Isolated/ Intrinsically Safe FTAs

These FTAs are available for applications requiring a direct interface to either FM or CSA Class 1, Div 1, or CENELEC Zone 0 hazardous areas. Wiring and installation are simplified because integral galvanically isolated intrinsic safety isolators are part of the FTA. See GA03-100, Galvanic Isolation/ Intrinsic Safety Specification and Technical Data for further information.

### 4.3. Standby Manual

The 16-point digital output FTA and both analog output FTAs (8-point and 16-point) support connection to a standby manual unit. This option allows outputs to be maintained during I/O Processor replacement. Note that MU/MC-GHA011 does not include standby manual connectors.

### 4.4. Remote I/O

Remote I/O options are available to enable IOPs and FTAs to be distributed at up to six remote sites (see Figure 5). Using redundant fiber-optic cables to extend the I/O Link, remote I/O installation benefits from inherent immunity against ground potential differences and EMI/RFI. In addition, remote installation of IOPs and FTAs can significantly reduce signal wire runs.

Two options are available. The Remote I/O option supports remote sites up to 1 kilometer from the main PM/APM/HPM/EHPM electronics, while the Long Distance I/O option provides for separation of up to 8 kilometers. Either option requires an I/O link Extender pair (IOLE) at both ends. The 1-km option supports up to three remote sites for each IOLE, while the 8-km option requires one IOLE per remote site.

FTAs at the remote site may be located an additional 50 meters from the I/O Processors. LLAI Mux, Serial Device, or Serial Interface FTAs may be located an additional 300 meters away. The RHMUX FTA may be located an additional 2 km away.

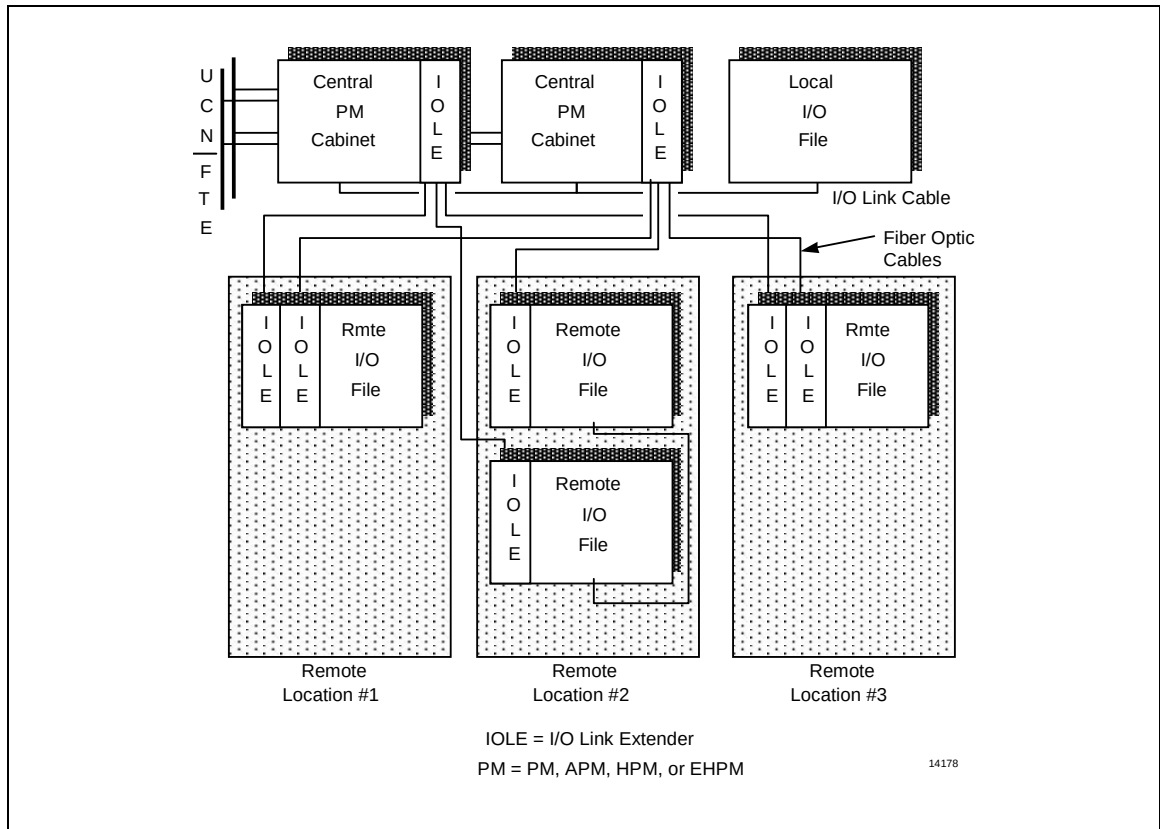


Figure 5 — Fiber Optic Remote I/O

#### 4.5. Corrosion Protection Option

As electronic board layouts have become more compact, sensitivity to corrosion has increased. In addition, a trend toward locating I/Os closer to the process to save installation costs has generated a requirement for environmentally hardened products. To provide extra corrosion protection when PM/APM/HPM/EHPM equipment cannot be located in a mild (G1) environment, board sets are conformally coated as a standard feature. These boards are completely covered with a thin plastic film resistant to the corrosive effects of humidity and certain gases, and are thus suitable for placement in a harsh (G3) atmosphere. Coating is optional for most PM/APM/HPM/EHPM system components, such as IOPs, FTAs, power supplies and backplanes. Many components are coated as a standard, such as the HLAI IOP, AO IOP, and HPM/EHPM controller board set.

All coated products are denoted by a "C" in the second character of their model number. Uncoated boards maintain the standard MU-xxxxxx style numbers; therefore, all products for which conformal coating is available have two model numbers. For example, the uncoated DI IOP model number is MU-PDIX02, and the coated version is MC-PDIX02. In order to easily identify coated IOPs in the field, they are labeled with a distinctive symbol located on their faceplate (see Figure 6). The "C" surrounded by a solid diamond (the universal symbol of hardness) represents the protection this conformal coating process provides.

**Note:** Boards installed and maintained in a G1 (mild) control room environment (defined by the ISA Environmental Severity Classification) do not need this added protection.

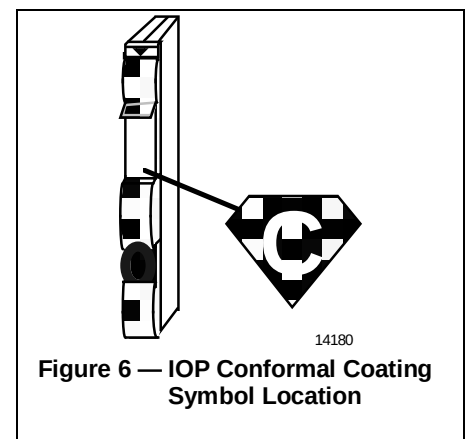


Figure 6 — IOP Conformal Coating Symbol Location

#### 4.6. Harsh Environment Option

To help reduce wiring and installation costs, as well as free up valuable control room space, a Remote Hardened I/O (RHIO) NEMA4X sealed cabinet option is available for remotely mounting PM/APM/HPM/EHPM I/O (see Figure 7). Backplanes and power supplies included with RHIO are conformally coated. When populated with conformally coated IOPs, FTAs, and Fiber Optic Extenders, the RHIO option provides a GX "Severe" environment product rating against corrosion due to humidity and corrosive gases in remote locations.

The IOP cabinet accommodates a 7-slot file and a redundant 8-amp power supply and is available as a standard product; the FTA cabinet must be custom ordered due to the many variations of FTA sizes and layouts.

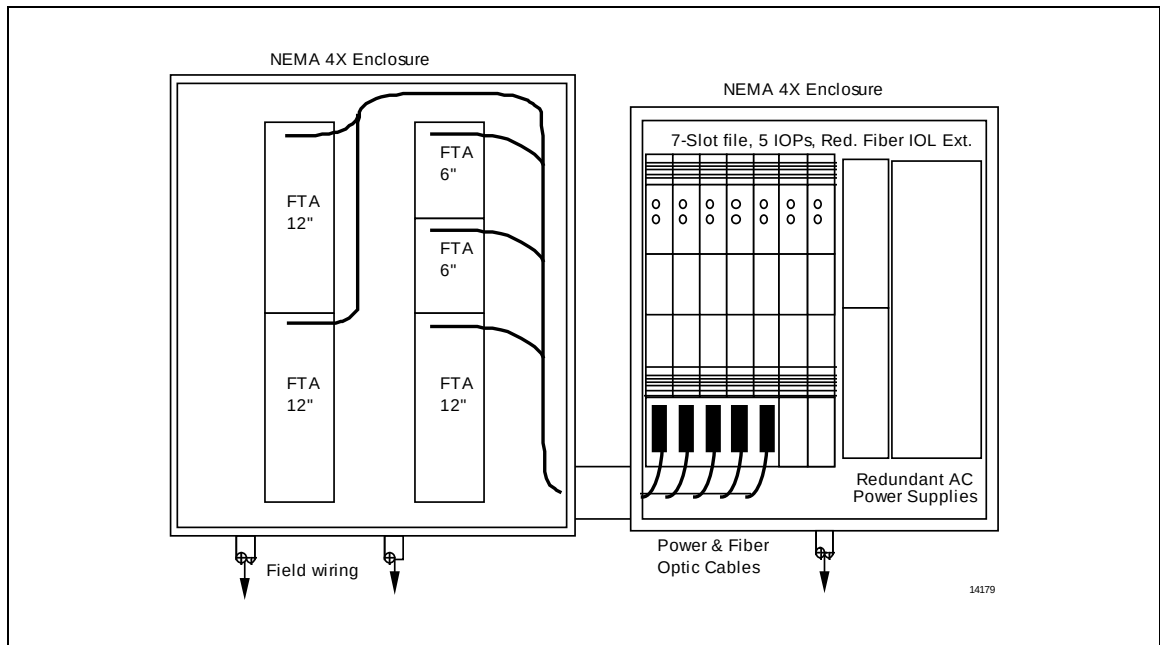


Figure 7 — Remote Hardened I/O Option

### 5. European Community (EC) Compliance

The APM, HPM, and EHPM are available in compliance with European Community (EC) directive requirements, denoted by the "CE mark" (Communauté Européenne). The PM is not covered. This compliance extends to the APMM/HPMM/EHPM, cardfiles, power supplies, IOPs and FTAs, as well as to Rittal cabinets. Since January 1, 1996, all goods imported into the European community or moving between member countries must be compliant with the new EC directives.

For APMM/HPMM/EHPM, customers must indicate whether or not CE compliance is required. APMMs, HPMMs, EHPMs, IOPs, and power supplies are only available CE-compliant. For cardfiles and some FTAs, both compliant and non-compliant versions are available. Only Rittal cabinets are CE-compliant. Please refer to Table 1 for IOP/FTA more information. Note that the system must be mounted in a standard Rittal cabinet per Honeywell specifications, use only standard Honeywell/Rittal mounting hardware, and be installed according to Honeywell instructions.

## 6. Specifications

Specifications apply to the PM/APM/HPM/EHPM I/O modules mounted in a standard cabinets. See PM/APM/HPM/EHPM Specification and Data Sheets for more information.

### 6.1. I/O Link Extender (Remote I/O)

| Parameter                                                                                                                                                                                                     | Specification            |                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------------|
|                                                                                                                                                                                                               | Remote I/O Link Extender | Long Distance I/O Link Extender |
| Fiber Link Length                                                                                                                                                                                             | 1.2 km                   | 8 km                            |
| Fiber Size                                                                                                                                                                                                    | 62.5/125 $\mu\text{m}$   | 62.5/125 $\mu\text{m}$          |
| Wave Length                                                                                                                                                                                                   | 820 nanometers           | 1300 nanometers                 |
| Fiber Power Budget Over-Temperature Range                                                                                                                                                                     | 5.5 dB                   | 10.0 dB                         |
| Note: Fiber optic cables are supplied by outside vendors in accordance with Honeywell specifications. For additional information, see the <i>PM/APM Process Manager Planning</i> manual, PM02-501, Section 9. |                          |                                 |

### 6.2. European Community Compliance (CE-Mark)

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CE Conformity (Europe)</b> | This product is in conformity with the protection requirements of the following European Council Directives: 73/23/EEC, the Low Voltage Directive, and 89/336/EEC, the EMC Directive. Conformity of this product with any other "CE Mark" Directive(s) shall not be assumed.<br><br><i>Deviation from the prescribed procedures and conditions specified in the installation manuals may invalidate this product's conformity with the Low Voltage and EMC Directives. See Table 1 for IOP and FTA model information.</i> |
| <b>Product Classification</b> | Class I: Permanently mounted, permanently connected Industrial Control Equipment with protective earthing (grounding). (EN 61010-1-1993)                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Installation Category</b>  | Category II: Energy-consuming equipment supplied from the fixed installation. Local Level Appliances and Industrial Control Equipment. (EN 61010-1-1993)                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Pollution Degree</b>       | Pollution Degree 2: Normally non-conductive pollution with occasional conductivity caused by condensation. (IEC 664-1-1992)                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>EMC Classification</b>     | Group 1, Class A, Industrial, Scientific and Medical (ISM) Equipment. (EN55011-1991; Emissions)                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Method of Assessment</b>   | EMC: Technical Construction File (TCF)<br>LVD: Technical File (TF)                                                                                                                                                                                                                                                                                                                                                                                                                                                        |



### 6.3. High Level Analog Input Processor - 16 Inputs

#### MC-PAIH03

| Parameter                                                                                                                                                                                 | Specification                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FTA Models                                                                                                                                                                                | MU-TAIH02, TAIH12, TAIH52, TAIH03, TAIH13, TAIH23, TAIH53, TAIH22, TAIH62                                                                                                                                           |
| Input Type                                                                                                                                                                                | Voltage, current (2-wire or self-powered transmitters)                                                                                                                                                              |
| Input Channels                                                                                                                                                                            | 16 differential input channels                                                                                                                                                                                      |
| Common Mode Rejection Ratio, dc to 60 Hz (500 $\Omega$ source imbalance)                                                                                                                  | 70 dB                                                                                                                                                                                                               |
| Common Mode Voltage, dc to 60 Hz <sup>(1)</sup>                                                                                                                                           | -6 to +5 V peak                                                                                                                                                                                                     |
| A/D Converter Resolution                                                                                                                                                                  | 16 bits (14 bits used)                                                                                                                                                                                              |
| Input Range                                                                                                                                                                               | 0 to 5 V<br>1 to 5 V<br>0.4 to 2 V<br>4-20 mA (through 250 $\Omega$ )                                                                                                                                               |
| Normal Mode Rejection Ratio, at 60 Hz                                                                                                                                                     | 32 dB                                                                                                                                                                                                               |
| Normal Mode Filter Response                                                                                                                                                               | Single-pole RC, -3 dB @ 1 Hz                                                                                                                                                                                        |
| Maximum Normal Mode Input (differential inputs, no damage)                                                                                                                                | $\square$ 30 Volts                                                                                                                                                                                                  |
| Crosstalk, dc to 60 Hz (channel-to-channel)                                                                                                                                               | 60 dB                                                                                                                                                                                                               |
| Input Impedance (Voltage Inputs)                                                                                                                                                          | > 10 M $\Omega$ powered                                                                                                                                                                                             |
| Maximum Input Voltage (any input referenced to common, no damage)                                                                                                                         | $\square$ 30 Volts                                                                                                                                                                                                  |
| Input Scan Rate                                                                                                                                                                           | 4 samples per second per channel.<br>All channels sampled within a 250 ms window.                                                                                                                                   |
| Hardware Accuracy (@ CMV = 0 V)                                                                                                                                                           | $\square$ 0.075% full-scale (23.5° $\square$ 2°C)<br>$\square$ 0.15% full-scale (0 to 50°C)                                                                                                                         |
| Transmitter Power Conditioning<br>MU-TAIH02, TAIH52, TAIH12, TAIH03, TAIH13, TAIH53<br>MU-TAIH22, TAIH23, & TAIH62                                                                        | Resistor Current Limited, 145 $\Omega$ (not fused) for Class 1, Div 2 interfacing<br>Individually Protected Current Limiting Circuits for Class 1, Div 2 interfacing<br>Maximum current: 30 ma Minimum voltage 23 V |
| Surge withstand capability (Common mode)                                                                                                                                                  | ANSI/IEEE C37.90.1-1978                                                                                                                                                                                             |
| (1) The low-side input connection is normally connected to system common by a wire jumper on the FTA. This can be removed by the user, subject to operating within the CMV specification. |                                                                                                                                                                                                                     |

#### 6.4. High Level Analog Input Processor Redundancy Option

**MU-TAIH12, TAIH52, TAIH13, TAIH53, TAIH22, TAIH23, TAIH62**

| Parameter                                                   | Specification                                                                         |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Input Scan Cycles Missed or Delayed During Swap or Failover | No cycles missed or delayed                                                           |
| Hardware Accuracy Effect of Failure                         | No effect nominally<br><input type="checkbox"/> 2% of FS maximum (at 0 V Common Mode) |

## 6.5. Low Level Analog Input Processor - 8 Inputs

MU-PAIL02

| Data Conversion Performance                                                                                                                                                                                                                                                                         |                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameter                                                                                                                                                                                                                                                                                           | Specification                                                                                                                                                            |
| FTA Model                                                                                                                                                                                                                                                                                           | MU-TAIL02, TAIL03                                                                                                                                                        |
| Input Type                                                                                                                                                                                                                                                                                          | Thermocouple, RTD, Voltage, & Current (2-wire transmitters require separate power source)                                                                                |
| Input Channels                                                                                                                                                                                                                                                                                      | 8 galvanically isolated                                                                                                                                                  |
| A/D Converter Resolution                                                                                                                                                                                                                                                                            | 15 bits                                                                                                                                                                  |
| Input Range                                                                                                                                                                                                                                                                                         | See table on following page                                                                                                                                              |
| CMV, dc to 60 Hz                                                                                                                                                                                                                                                                                    | 250 Vac rms or $\pm 250$ Vdc                                                                                                                                             |
| Dielectric Strength                                                                                                                                                                                                                                                                                 | 1500 Vac rms or $\pm 1500$ Vdc<br>Channel-to-channel, and channel-to-PM/APM/HPM/EHPM common                                                                              |
| CMRR, dc to 60 Hz                                                                                                                                                                                                                                                                                   | 120 dB min. w/1k lead imbalance                                                                                                                                          |
| NMRR, at line frequency                                                                                                                                                                                                                                                                             | 60 dB min.                                                                                                                                                               |
| Normal Mode Filter Response                                                                                                                                                                                                                                                                         | -3 dB point: Typical 10.6 Hz; min. 9.6 Hz; max. 11.9 Hz                                                                                                                  |
| Crosstalk, dc to 60 Hz                                                                                                                                                                                                                                                                              | 120 dB                                                                                                                                                                   |
| Input Impedance                                                                                                                                                                                                                                                                                     | 5 k $\Omega$ min. @ 0-5 Vdc (unpowered)                                                                                                                                  |
| Input Impedance                                                                                                                                                                                                                                                                                     | 10 M $\Omega$ min. @ 0-5 Vdc (powered)                                                                                                                                   |
| Maximum Normal Mode Input (no damage)                                                                                                                                                                                                                                                               | -20 mV to 5.5 Volt                                                                                                                                                       |
| Input Scan Rate                                                                                                                                                                                                                                                                                     | 8 samples per second per channel. All channels sample simultaneously.<br>4 samples per second per channel for thermocouple input if open thermocouple detection enabled. |
| Line Frequency Synchronization<br>Type<br>Frequency Range                                                                                                                                                                                                                                           | Running Average<br>50/60 Hz +3%, -6%                                                                                                                                     |
| Hardware (only) Accuracy (0-100 mV, 0-5 V)                                                                                                                                                                                                                                                          | $\pm 0.05\%$ of full scale, or $\pm 0.075\%$ of reading at 23.5 $\pm 2^\circ\text{C}$ (whichever is larger)                                                              |
| Software (only) Accuracy <sup>(1)</sup>                                                                                                                                                                                                                                                             | $\pm 0.1^\circ\text{C}$ typical, $\pm 0.5^\circ\text{C}$ maximum at 23.5 $\pm 2^\circ\text{C}$                                                                           |
| Hardware Reference Junction Accuracy                                                                                                                                                                                                                                                                | $\pm 0.9^\circ\text{C}$ maximum at 23.5 $\pm 2^\circ\text{C}$ (in cabinet)                                                                                               |
| Temperature Stability<br>Voltage Input, current input, thermocouple input (except reference junction)<br>RTD Input                                                                                                                                                                                  | 45 ppm/ $^\circ\text{C}$ RSS<br>70 ppm/ $^\circ\text{C}$ maximum<br>50 ppm/ $^\circ\text{C}$ RSS<br>85 ppm/ $^\circ\text{C}$ maximum                                     |
| Surge withstand capability (common mode)                                                                                                                                                                                                                                                            | ANSI/IEEE C37.90.1-1978                                                                                                                                                  |
| (1) Software EU conversion error including software reference junction compensation. The temperature conversion by software meets or exceeds the accuracy tolerances for fifth order polynomials as specified in the National Institute of Standards and Technology (NIST) Monograph 125 (IPTS-68). |                                                                                                                                                                          |

| Signal Types and Ranges                                                                       |                                                                                                                                                |                                                                                                                                            |
|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Signal Type                                                                                   | Normal Signal Range                                                                                                                            | Extended Signal Range                                                                                                                      |
| ANSI J<br>ANSI K<br>ANSI E<br>ANSI T<br>ANSI B<br>ANSI S<br>ANSI R<br>JAPAN Type R            | -100 to 750 °C<br>0 to 1100 °C<br>-150 to 500 °C<br>-200 to 300 °C<br>+600 to 1650 °C<br>+550 to 1500 °C<br>+550 to 1500 °C<br>+550 to 1500 °C | -200 to 1200 °C<br>-200 to 1370 °C<br>-200 to 1000 °C<br>-230 to 400 °C<br>+100 to 1820 °C<br>0 to 1700 °C<br>0 to 1700 °C<br>0 to 1700 °C |
| RTD (3 Wire)<br>Pt: 100 ° DIN (4376)<br>Pt: 100 ° JIS (C-1604)<br>Ni: 120 ° Ed #7<br>Cu: 10 ° | -200 to 850 °C<br>-200 to 650 °C<br>-45 to 315 °C<br>-20 to 250 °C                                                                             | N/A<br>N/A<br>N/A<br>N/A                                                                                                                   |
| Voltage Input                                                                                 | 0-100 mV<br>0-5 V                                                                                                                              | N/A<br>N/A                                                                                                                                 |

## 6.6. Low Level Analog Input Multiplexer Processor - 32 Inputs

## MU-PLAM02

| Data Conversion Performance (General Specifications)                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameter                                                                                                                                                                                                                                                                                                                     | Specification                                                                                                                                                                                                       |
| <b>FTA Models</b>                                                                                                                                                                                                                                                                                                             | <b>MU-TAMR03, TAMT03, TAMT13</b>                                                                                                                                                                                    |
| Input Type                                                                                                                                                                                                                                                                                                                    | Thermocouple, RTD, and linear millivolts                                                                                                                                                                            |
| Input Channels                                                                                                                                                                                                                                                                                                                | 32 galvanically isolated                                                                                                                                                                                            |
| A/D Converter Resolution                                                                                                                                                                                                                                                                                                      | 14 bits<br>TC types J, K, E, T, B, S, R, RP: 10 $\mu$ V per bit<br>100 $\square$ and 120 $\square$ RTDs: 64 m $\square$ per bit<br>10 $\square$ RTD: 8 m $\square$ per bit<br>Linear mV sensors: 20 $\mu$ V per bit |
| CMV, dc to 60 Hz                                                                                                                                                                                                                                                                                                              | 250 Vac Peak or $\pm$ 250 Vdc                                                                                                                                                                                       |
| Dielectric Strength                                                                                                                                                                                                                                                                                                           | 1500 Vac rms or $\pm$ 1500 Vdc channel-to-channel (operating), and channel-to-PM/APM/HPM/EHPM common (not operating)                                                                                                |
| Crosstalk, dc to 60 Hz                                                                                                                                                                                                                                                                                                        | 120 dB                                                                                                                                                                                                              |
| Input Impedance                                                                                                                                                                                                                                                                                                               | 2 M $\square$ min. @ 100 mV                                                                                                                                                                                         |
| Maximum Normal Mode Continuous Input (No damage)                                                                                                                                                                                                                                                                              | -1 V to 10 V                                                                                                                                                                                                        |
| Input Scan Rate                                                                                                                                                                                                                                                                                                               | 32 samples per second (each channel once per second)                                                                                                                                                                |
| Line Frequency Synchronization                                                                                                                                                                                                                                                                                                | Configurable to 50 or 60 Hz                                                                                                                                                                                         |
| Hardware (only) Accuracy                                                                                                                                                                                                                                                                                                      | $\pm$ 40 $\mu$ V, or $\pm$ 160 m $\square$<br>23.5 $\square$ $\pm$ 2 $\square$ C                                                                                                                                    |
| Software (only) Accuracy <sup>(1)</sup>                                                                                                                                                                                                                                                                                       | $\pm$ 0.1 $\square$ C typical, $\pm$ 0.5 $\square$ C maximum at 23.5 $\square$ $\pm$ 2 $\square$ C                                                                                                                  |
| Surge withstand capability (common mode)                                                                                                                                                                                                                                                                                      | ANSI/IEEE C37.90.1-1978                                                                                                                                                                                             |
| (1) Software EU conversion error including software reference junction compensation, at reference temperature. The temperature conversion by software meets or exceeds the accuracy tolerances for fifth order polynomials as specified in the National Institute of Standards and Technology (NIST) Monograph 125 (IPTS-68). |                                                                                                                                                                                                                     |
| <b>NOTE:</b> Mercury-Wetted Relays are used in this product.                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                     |

(Continued)

**Low Level Analog Input Multiplexer Processor - 32 Inputs (continued)****MU-PLAM02**

| Data Conversion Performance --Thermocouple (TC) and Voltage Input                                     |                                                                                                                                                                                                                                                                                                                                        |          |                       |
|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------|
| Parameter                                                                                             | Specification                                                                                                                                                                                                                                                                                                                          |          |                       |
| Thermocouple Device Range                                                                             | Normal Signal Range                                                                                                                                                                                                                                                                                                                    |          | Extended Signal Range |
| ANSI J                                                                                                | -100 to                                                                                                                                                                                                                                                                                                                                | 750 ° C  | -200 to 1200 ° C      |
| ANSI K                                                                                                | 0 to                                                                                                                                                                                                                                                                                                                                   | 1100 ° C | -200 to 1370 ° C      |
| ANSI E                                                                                                | -150 to                                                                                                                                                                                                                                                                                                                                | 500 ° C  | -200 to 1000 ° C      |
| ANSI T                                                                                                | -200 to                                                                                                                                                                                                                                                                                                                                | 300 ° C  | -230 to 400 ° C       |
| ANSI B                                                                                                | +600 to                                                                                                                                                                                                                                                                                                                                | 1650 ° C | +100 to 1820 ° C      |
| ANSI S                                                                                                | +550 to                                                                                                                                                                                                                                                                                                                                | 1500 ° C | 0 to 1700 ° C         |
| ANSI R                                                                                                | +550 to                                                                                                                                                                                                                                                                                                                                | 1500 ° C | 0 to 1700 ° C         |
| JAPAN Type R                                                                                          | +550 to                                                                                                                                                                                                                                                                                                                                | 1500 ° C | 0 to 1700 ° C         |
| Voltage Input Signal Range                                                                            | 0 to 100 mV                                                                                                                                                                                                                                                                                                                            |          |                       |
| CMRR, dc to 60 Hz (0-100 mV)                                                                          | 120 dB min. with 500 Ω lead imbalance                                                                                                                                                                                                                                                                                                  |          |                       |
| NMRR, at line frequency (50 or 60 Hz)                                                                 | 60 dB min.                                                                                                                                                                                                                                                                                                                             |          |                       |
| NMRR, at other than line frequency (1-15 mV)                                                          | <div><math display="block">\text{NMRR} = -20 \log_{10} \left( \frac{\sin(\pi^x f^x t)}{(\pi^x f^x t)} \right) - 20 \log_{10} \left( \frac{1}{K^x f} \right)</math></div> <div>Where:<br/>    Ω = 3.14159<br/>    f= Noise Frequency<br/>    t= Integration Time (20 ms @ 50 Hz, 16.66ms @ 60 Hz)<br/>    K= 0.20878 (a constant)</div> |          |                       |
| Normal Mode Filter Response (TC & mV)                                                                 | -3 dB point: Typical 5.1 Hz; min. 4.3 Hz; max. 6.4 Hz                                                                                                                                                                                                                                                                                  |          |                       |
| Hardware Reference Junction Accuracy                                                                  | ±1.0 °C maximum at 23.5 ° ±2 °C (in cabinet)                                                                                                                                                                                                                                                                                           |          |                       |
| Temperature Stability<br>Voltage Input, current input, thermocouple input (except reference junction) | 20 ppm/ °C RSS<br>30 ppm/ °C maximum                                                                                                                                                                                                                                                                                                   |          |                       |
| TC Max Length, 250 V Peak/dc Common Mode<br>16 Gauge TC Wire<br>18 Gauge TC Wire<br>20 Gauge TC Wire  | 3,500 ft.<br>2,250 ft.<br>1,250 ft.                                                                                                                                                                                                                                                                                                    |          |                       |
| CMRR = Common Mode Rejection Ratio.<br>NMRR = Normal Mode Rejection Ratio.                            |                                                                                                                                                                                                                                                                                                                                        |          |                       |

(Continued)

**Low Level Analog Input Multiplexer Processor - 32 Inputs (continued)****MU-PLAM02**

| <b>Data Conversion Performance--Resistive Temperature Device (RTD)</b>                                                                           |                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameter</b>                                                                                                                                 | <b>Specification</b>                                                                                                                                                                                             |
| RTD (3 Wire) Input Signal Range<br>Pt: 100 $\square$ DIN (4376)<br>Pt: 100 $\square$ JIS (C-1604)<br>Ni: 120 $\square$ Ed #7<br>Cu: 10 $\square$ | -200 to 850°C<br>-200 to 650°C<br>-45 to 315°C<br>-20 to 250°C                                                                                                                                                   |
| CMRR, dc to 60 Hz (0-100 mV)                                                                                                                     | 10 $\square$ RTD: 120 dB min.<br>100 $\square$ RTD: 110 dB min.                                                                                                                                                  |
| NMRR, at line frequency (50 or 60 Hz)                                                                                                            | 10 $\square$ RTD: 60 dB min. (for 50/60 Hz noise of 0-15 mV)<br>100 $\square$ RTD: 60 dB min. (for 50/60 Hz noise of 0-75 mV)                                                                                    |
| NMRR, at other than line frequency<br>10 $\square$ RTD: (0-15 mV)<br>100 $\square$ RTD: (0-75 mV)                                                | $\text{NMRR} = -20 \square \log_{10} \left( \frac{\sin(\pi^x f^x t)}{(\pi^x f^x t)} \right) \text{ Where:}$<br>$\square = 3.14159$<br>f= Noise Frequency<br>t= Integration Time (20 ms @ 50 Hz, 16.66ms @ 60 Hz) |
| Hardware Reference Junction Accuracy                                                                                                             | $\pm 1.0 \square$ C maximum at 23.5 $\square$ $\pm 2 \square$ C (in cabinet)                                                                                                                                     |
| Temperature Stability<br>RTD Input                                                                                                               | 30 ppm/ $\square$ C RSS<br>40 ppm/ $\square$ C maximum                                                                                                                                                           |
| RTD Max Lead Resistance                                                                                                                          | 15 $\square$                                                                                                                                                                                                     |
| CMRR = Common Mode Rejection Ratio.<br>NMRR = Normal Mode Rejection Ratio.                                                                       |                                                                                                                                                                                                                  |

## 6.7. Remote Hardened Multiplexer Processor - 32 Inputs

MU-PRHM01

| Data Conversion Performance (General Specifications)         |                                                                                                                                                     |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameter                                                    | Specification                                                                                                                                       |
| FTA Model                                                    | MC-GRMT01                                                                                                                                           |
| Input Type                                                   | Thermocouple and linear millivolts                                                                                                                  |
| Input Channels                                               | 32 galvanically isolated (16 per remote FTA)                                                                                                        |
| A/D Converter resolution                                     | 15 bits<br>100 mV range: LSB = 8 $\mu$ V<br>Type J, K, or E thermocouples: LSB = 8 $\mu$ V<br>Type T, B, S, R, or R' thermocouples: LSB = 2 $\mu$ V |
| Common Mode Voltage, dc to 60 Hz                             | $\pm$ 30 VRMS Continuous (max, no damage)<br>$\pm$ 200 V Intermittent (max, no damage)                                                              |
| Crosstalk, dc to 60 Hz                                       | 120 dB min                                                                                                                                          |
| Input Impedance                                              | 10 Megohms Min                                                                                                                                      |
| Maximum Normal Mode Continuous Input (no damage)             | $\pm$ 30 VRMS Continuous, one channel at a time                                                                                                     |
| Input Scan Rate                                              | Each channel once per 4 seconds                                                                                                                     |
| Line Frequency Noise Cancellation                            | Configurable to 50 or 60 Hz                                                                                                                         |
| Hardware (only) accuracy                                     | 0.075% of Full Scale (mV or T/C range)                                                                                                              |
| Software (only) accuracy <sup>(1)</sup>                      | 0.1°C typical, 0.5°C maximum at 20°C                                                                                                                |
| Surge withstand capability                                   | ANSI/IEEE C37.90.1-1978                                                                                                                             |
| Data Conversion Performance (Thermocouple and Voltage Input) |                                                                                                                                                     |
| Parameter                                                    | Specification                                                                                                                                       |
| Thermocouple Device Range                                    |                                                                                                                                                     |
| ANSI J                                                       | -200 to + 1200°C                                                                                                                                    |
| ANSI K                                                       | -100 to + 1370°C                                                                                                                                    |
| ANSI E                                                       | -200 to + 1000°C                                                                                                                                    |
| ANSI T                                                       | -230 to + 400°C                                                                                                                                     |
| ANSI B                                                       | +100 to + 1820°C                                                                                                                                    |
| ANSI S                                                       | 0 to + 1700°C                                                                                                                                       |
| ANSI R                                                       | 0 to + 1700°C                                                                                                                                       |
| Japan Type R                                                 | 0 to + 1700°C                                                                                                                                       |

(Continued)



**Remote Hardened Multiplexer Processor - 32 Inputs (continued)****MU-PRHM01**

| <b>Data Conversion Performance (Thermocouple and Voltage Input)</b>                                                                                                                                                                                                                                                                                                               |                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Parameter</b>                                                                                                                                                                                                                                                                                                                                                                  | <b>Specification</b>                                                                                           |
| Voltage Input Signal Range                                                                                                                                                                                                                                                                                                                                                        | 0 to 100 mV                                                                                                    |
| CMRR <sup>(2)</sup> , dc to 60 Hz                                                                                                                                                                                                                                                                                                                                                 | 90 dB min, 1000Ω lead resistance, DC or line frequency<br>120 dB min, 0Ω lead resistance, DC or line frequency |
| Hardware Reference Junction Accuracy                                                                                                                                                                                                                                                                                                                                              | ±1°C max error in 20 to 25°C static environment                                                                |
| Calibration Stability: Voltage input or thermocouple input (except reference junction)                                                                                                                                                                                                                                                                                            | ±50 ppm per °C max                                                                                             |
| Open Thermocouple Detection                                                                                                                                                                                                                                                                                                                                                       | Performed on every conversion<br>≤1000Ω good, ≥1200Ω PV = NAN                                                  |
| T/C Max loop resistance                                                                                                                                                                                                                                                                                                                                                           | 1000Ω total loop resistance                                                                                    |
| <b>Environmental Specifications</b>                                                                                                                                                                                                                                                                                                                                               |                                                                                                                |
| <b>Parameter</b>                                                                                                                                                                                                                                                                                                                                                                  | <b>Specification</b>                                                                                           |
| Operating Temperature                                                                                                                                                                                                                                                                                                                                                             | -40 to +85°C at Remote FTA<br>0 to +50°C cabinet ambient for IOP and power adapters                            |
| Operating Humidity                                                                                                                                                                                                                                                                                                                                                                | 10 to 100% condensing, Remote FTA<br>10 to 90% non-condensing, IOP and power adapters                          |
| Corrosives                                                                                                                                                                                                                                                                                                                                                                        | Gx, Remote FTA<br>G1 or G3 for IOP and power adapters, depending on corrosion option                           |
| Notes:<br>(1) Software EU conversion error including software reference junction compensation, at reference temperature. The temperature conversion by software meets or exceeds the accuracy tolerances for fifth-order polynomials as specified in the National Institute of Standards and Technology (NIST) monograph 125 (IPTS-68).<br>(2) CMRR = Common Mode Rejection Ratio |                                                                                                                |

## 6.8. Smart Transmitter Interface Processor\*

## MU-PSTX03

| Parameter                                                                                                                          | Specification                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FTA Models                                                                                                                         | MU-TAIH02, TAIH12, TAIH22, TAIH52, TAIH62, TSTX03, TSTX13, TSTX53                                                                                                                                                         |
| Input Type                                                                                                                         | Honeywell DE (digital enhanced) protocol (bidirectional)                                                                                                                                                                  |
| Input Channels                                                                                                                     | 16 digital input channel PVs                                                                                                                                                                                              |
| Resolution                                                                                                                         | The resolution of the connected field instrument is passed through without degradation.                                                                                                                                   |
| Maximum Input Voltage (any input referenced to common, no damage)                                                                  | -10 V to +30 V                                                                                                                                                                                                            |
| Transmitter broadcast frequency (PV)                                                                                               | 2.4-3.6 PVs per second per channel (configuration dependent).                                                                                                                                                             |
| Accuracy                                                                                                                           | The accuracy of the connected field instrument is passed through without degradation.                                                                                                                                     |
| Surge withstand capability (Common mode)                                                                                           | ANSI/IEEE C37.90.1-1978                                                                                                                                                                                                   |
| Transmitter Power Conditioning<br>MU-TAIH02, MU-TAIH52,<br>MU-TAIH12, MU-TSTX03,<br><br>MU-TSTX13, MU-TSTX53<br>MU-TAIH22 & TAIH62 | Resistor Current Limited, 145 $\Omega$ (not fused) for Class 1, Div 2 interfacing<br><br>Individual Protected Current Limiting Circuits for Class 1, Div 2 interfacing<br><br>Maximum current: 30 ma Minimum voltage 23 V |

## 6.9. Smart Transmitter Interface Processor\* Redundancy Option

### MU-TAIH12, TAIH52, TSTX13, TSTX53

| Parameter                                                   | Specification                                                                                                |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Input Scan Cycles Missed or Delayed During Swap or Failover | No cycles missed or delayed                                                                                  |
| Hardware Accuracy Effect of Failure                         | No effect nominally. The resolution of the connected field instrument is passed through without degradation. |

\* Smart Transmitter Interface Processor (MU-PSTX03) supports both single and multivariable transmitter types.

## 6.10. Serial Device Interface (General Specifications)

### MU-PSDX02

| Parameter                                       | Specification                                                  |
|-------------------------------------------------|----------------------------------------------------------------|
| FTA Models                                      | MU-TSDM02, TSDT02, TSDU02                                      |
| Input Channels                                  | 1 galvanically isolated serial channel per FTA                 |
| Interface Type                                  | EIA-232, EIA-422 or EIA-485                                    |
| Points per FTA<br>(Maximum of two FTAs per IOP) | 1-8                                                            |
| Points per IOP                                  | 1-16                                                           |
| Common Mode Voltage, dc to 60 Hz                | 250 Vac rms or $\pm 250$ Vdc                                   |
| Dielectric Strength                             | 1500 Vac rms or $\pm 1500$ Vdc<br>(channel to PM/APM/HPM/EHPM) |
| Surge withstand capability                      | ANSI/IEEE C37.90.1-1978                                        |

## 6.11. Serial Device Interface - Toledo Weigh Cell

MU -TSDT02

| Parameter                           | Specification                                                                                                                                          |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Physical Interface                  | EIA-232 using DB-25 female connector                                                                                                                   |
| Device Supported                    | Toledo Weigh Cell Model Number 8142-2089                                                                                                               |
| Lines Supported (EIA-232)           | Transmit Data, Receive Data, Request To Send, Clear To Send, Data Set Ready, Data Terminal Ready, Data Carrier Detect, Logic Ground, Protective Ground |
| Full Modem Support                  | No                                                                                                                                                     |
| Distance, Power Adapter to FTA      | <input type="checkbox"/> Internal cable within PM/APM/HPM/EHPM cabinet or<br><input type="checkbox"/> External cable 300 m (1000 ft.) maximum          |
| EIA-232 Cable Length, FTA to Device | 15 m (2500 pF cable capacity maximum)*                                                                                                                 |
| Surge withstand capability          | ANSI/IEEE C37.90.1-1978                                                                                                                                |
| ESD Protection                      | IEC 801.2                                                                                                                                              |
| Number of Toledo Weigh Cells        | <input type="checkbox"/> 2 FTAs per SDI IOP<br><input type="checkbox"/> 1 Toledo Weigh Cell per FTA                                                    |
| Baud Rate                           | 9600 bps fixed rate                                                                                                                                    |
| Data Transfer                       | Bidirectional, Half-Duplex                                                                                                                             |
| Message Validity                    | <input type="checkbox"/> Single-bit character parity<br><input type="checkbox"/> Message block checksum                                                |

\* Consult factory for longer lengths.

## 6.12. Serial Device Interface - Manual/Auto Station

MU-TSDM02

| Parameter                           | Specification                                                                                                                                 |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Physical Interface                  | EIA-485 Multidrop using 5-terminal compression connector                                                                                      |
| Device Supported                    | Honeywell Manual/Auto Station                                                                                                                 |
| Lines Supported (EIA-485)           | R (Data+), Data+, Shield, Data-, R (Data-)                                                                                                    |
| Full Modem Support                  | No, Multidrop is not a modem interface                                                                                                        |
| Distance, Power Adapter to FTA      | <input type="checkbox"/> Internal cable within PM/APM/HPM/EHPM cabinet or<br><input type="checkbox"/> External cable 300 m (1000 ft.) maximum |
| EIA-485 Cable Length, FTA to Device | 1.2 km (4000 ft.) with appropriate cable*                                                                                                     |
| Surge withstand capability          | ANSI/IEEE C37.90.1-1978                                                                                                                       |
| ESD Protection                      | IEC 801.2                                                                                                                                     |
| Number of Manual/Auto Stations      | <input type="checkbox"/> 2 FTAs per SDI IOP<br><input type="checkbox"/> 4 Manual/Auto Stations per FTA                                        |
| Baud Rate                           | 19.2 Kbps                                                                                                                                     |
| Transmission Mode                   | Asynchronous, Bit Serial                                                                                                                      |
| Data Transfer                       | Bidirectional, Half-Duplex                                                                                                                    |
| Message Validity                    | <input type="checkbox"/> Single-bit character parity<br><input type="checkbox"/> Message block checksum                                       |
| Tag ID Downloaded                   | 8 Characters                                                                                                                                  |
| PV Range                            | EUHI and EULO downloaded                                                                                                                      |
| Input Scan Rate                     | Four updates per second per point                                                                                                             |

\* Refer to PM I/O Installation manual (PM20-520).

## 6.13. Serial Device Interface - UDC 6000 Process Controller

MU-TSDU02

| Parameter                           | Specification                                                                                                                     |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Physical Interface                  | EIA-485 Multidrop using 5-terminal compression connector                                                                          |
| Device Supported                    | Honeywell UDC 6000 with Modbus Communication Option                                                                               |
| Lines Supported (EIA-485)           | R (Data+), Data+, Shield, Data-, R (Data-)                                                                                        |
| Full Modem Support                  | No—Multidrop is not a modem interface                                                                                             |
| Distance, Power Adapter to FTA      | <input type="checkbox"/> Internal cable within APM cabinet or<br><input type="checkbox"/> External cable 300 m (1000 ft.) maximum |
| EIA-485 Cable Length, FTA to Device | 1.2 km (4000 ft.) with appropriate cable*                                                                                         |
| Surge withstand capability          | ANSI/IEEE C37.90.1-1978                                                                                                           |
| ESD Protection                      | IEC 801.2                                                                                                                         |
| Number of UDC 6000s                 | <input type="checkbox"/> 2 FTAs per SDI IOP<br><input type="checkbox"/> 4 UDC 6000s per FTA                                       |
| Baud Rate                           | 19.2 Kbps                                                                                                                         |
| Transmission Mode                   | Asynchronous, Bit Serial                                                                                                          |
| Data Transfer                       | Bidirectional, Half-Duplex                                                                                                        |
| Communication Protocol              | Modbus Remote Terminal Unit (RTU) protocol                                                                                        |
| Message Validity                    | <input type="checkbox"/> Single-bit character parity<br><input type="checkbox"/> Message block checksum                           |

\* Refer to PM I/O Installation manual (PM20-520).

## 6.14. Serial Interface I/O Processor/FTA - Modbus

MU-TSIM12

| Parameters                                                                                                                                                                                                                                                                                                                                 | Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Physical Interface                                                                                                                                                                                                                                                                                                                         | EIA-232 or EIA-485                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Devices Supported                                                                                                                                                                                                                                                                                                                          | Multivendor Qualified Modbus Compatible Devices                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Distance, Power Adapter to FTA                                                                                                                                                                                                                                                                                                             | <input type="checkbox"/> Internal cable within APM/HPM/EHPM cabinet or<br><input type="checkbox"/> External cable 300 m (1000 ft.) maximum                                                                                                                                                                                                                                                                                                                                           |
| Surge withstand capability                                                                                                                                                                                                                                                                                                                 | ANSI/IEEE C37.90.1-1978                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| ESD Protection                                                                                                                                                                                                                                                                                                                             | IEC 801.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Number of Devices per SI                                                                                                                                                                                                                                                                                                                   | <input type="checkbox"/> 2 FTAs per SI<br><input type="checkbox"/> Up to 15 devices per FTA                                                                                                                                                                                                                                                                                                                                                                                          |
| Data Quantity per IOP                                                                                                                                                                                                                                                                                                                      | 16 Points per serial channel (organized as Arrays in the APM/HPM/EHPM)<br>Each point can access <i>one</i> of the following:<br>512 Booleans into FLAGS<br>16 Reals or 32 Integers into NUMERICS<br>64 NUMERICS (Diagnostic Counter Data Only)<br>1 STRING of 64 Characters<br>2 STRINGS of 32 Characters<br>4 STRINGS of 16 Characters<br>8 STRINGS of 8 Characters                                                                                                                 |
| Serial Data Format                                                                                                                                                                                                                                                                                                                         | 8 data bits with programmable 9th bit                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| EIA RS232 Support<br>Transmission Mode:<br>Lines Supported:<br>Distance, FTA to Device:                                                                                                                                                                                                                                                    | Serial asynchronous, bidirectional<br>TXD, RXD, RTS, CTS, DSR, DTR, DCD, Logic GND, Protective GND<br>15 m (2500 pf cable capacity maximum)                                                                                                                                                                                                                                                                                                                                          |
| EIA-RS485 Support<br>Transmission Mode:<br>Lines Supported:<br>Common Mode Operation:<br>Number of drops:<br>Distance, FTA to Device:                                                                                                                                                                                                      | Serial asynchronous, bidirectional, half duplex only<br>Two wire, differential pair: Data+(B), Data-(A), Protective GND (shield)<br>250 Vac rms (continuous)<br>15 drops maximum<br>1.2 Km (4000 ft.) maximum                                                                                                                                                                                                                                                                        |
| Modbus Interface Specification<br>Protocol:<br>Serial Line Mode:<br>Selectable Baud Rates:<br>Selectable Parity:<br>Number of Stop Bits:<br>Modem Control Support:<br>Keep Alive Cell Write<br>Message Response Timeout:<br>Exception Errors Reported:<br>Data Formats Supported:<br>Intermessage stall time:<br>Function Codes Supported: | (Default parameters are shown in <b><u>bold</u></b> .)<br>Modbus, Remote Terminal Unit (RTU)<br><b><u>RS232</u></b> or RS485<br>1200, 2400, 4800, 9600, <b><u>19200</u></b> bps<br>None, <b><u>odd</u></b> , or even<br>1<br>Selectable ON/ <b><u>OFF</u></b><br>Configurable address/ <b><u>NONE</u></b><br>Configurable timeout/ <b><u>1.5 seconds</u></b><br>All<br>Boolean, Real, ASCII Strings, Signed Integers<br>3.5 character time minimum<br>01, 02, 03, 04, 05, 06, 08, 16 |



## 6.15. Serial Interface I/O Processor/FTA - Allen-Bradley

MU-TSIA12

| Parameters                                                                                                                                                                                                                                                               | Specification                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General</b><br>Interface Type:<br>Number of Channels per IOP:<br>Distance, Power Adapter to FTA:<br>Baud Rate:<br>Serial Data Format with parity bit:<br>Common Mode Operation:                                                                                       | EIA-RS232<br>2<br>300 m (1000 ft.)<br>19.2 k bps<br>8 data bits<br>250 V rms (continuous)                                                                                                                                                                              |
| <b>EIA-RS232 Support</b><br>Interface Type:<br>Lines Supported:<br>Distance, FTA to Device:                                                                                                                                                                              | Serial asynchronous<br>TXD, RXD, Logic GND, Protective GND<br>15 meters (cable cap. = 2500 pF max.)                                                                                                                                                                    |
| <b>SI A-B Specific Interface Specifications</b><br>Protocol:<br>Transmission Mode:<br>Serial Line Mode:<br>Parity:<br>No. Stop Bits:<br>Modem Control Support:<br>ACK Timeout:<br>FTA Message Response Timeout:<br>Data Formats Supported:<br>CIM Communication Options: | Full Duplex Allen-Bradley DF1 with embedded responses<br>Character oriented<br>RS232<br>even<br>1<br>Off<br>3.2 sec.<br>4.0 sec.<br>Booleans, Reals, Signed/Unsigned Integers, ASCII Strings<br>Pass-through diagnostic<br>Accept duplicate message<br>BCC error check |
| <b>Allen-Bradley Family Types Supported:</b>                                                                                                                                                                                                                             | PLC-2<br>PLC-3 (Native Mode and PLC-2 Mode)<br>PLC-5, except PLC-5/250 (Native Mode and PLC-2 Mode)                                                                                                                                                                    |

## 6.16. Allen-Bradley File Types

| <b>APM/HPM Array Point Types</b>     | <b>PLC-5 File Types</b>               | <b>PLC-3 Files Types</b>             |
|--------------------------------------|---------------------------------------|--------------------------------------|
| Flag                                 | Output (O), Input (I),<br>Status (S)  | Output (O), Input (I),<br>Status (S) |
| Flag                                 | Bit (B)                               | Binary (B)                           |
| Numeric (16-bit Signed Integer)      | Integer (N)                           | Integer (N)                          |
| Numeric (IEEE Single Precision)      | Float (F)<br>(IEEE Format)            | Float (F)<br>(VAX F Format)          |
| Numeric<br>(16-bit Unsigned Integer) | Timer (T), Counter (C)<br>(READ ONLY) |                                      |
| String                               | ASCII (A)                             | ASCII (A)                            |

## 6.17. Pulse Input Processor/FTA

## MU-PPIX02

| Parameters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Specification                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>FTA Models</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>MU-TPIX12, TPIX52</b>                                                                                                                                                                                                |
| Sensor Inputs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Self-powered 2-wire<br>PM/APM/HPM/EHPM-powered (with automatic current limiting) 3-wire<br>Pulse voltage or contact input                                                                                               |
| Input Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Rectangular or sine waves                                                                                                                                                                                               |
| Input Channels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 8                                                                                                                                                                                                                       |
| Input Impedance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10 k $\Omega$ minimum                                                                                                                                                                                                   |
| Input Frequency <sup>(1)</sup><br>50% Duty Cycle Square Wave<br>Sine Waves                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1 Hz to 20 kHz (all channels same amplitude)<br>1 Hz to 20 kHz                                                                                                                                                          |
| Pulse Levels<br>Low<br>High                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | -0.5 V to +1.9 V<br>+3.5 V to +24 V (Hysteresis prevents change between 1.9 V and 3.5 V)                                                                                                                                |
| Pulse Width (On/Off Dwell)<br>High and Low                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 25 $\mu$ s minimum at 20 kHz (with IOP filter jumper in storage position)<br>50 $\mu$ s minimum at 10 kHz (with IOP filter jumper in H position)<br>500 $\mu$ s minimum at 1 kHz (with IOP filter jumper in L position) |
| Contact Current<br>Low (0, Field contact closed)<br>High (1, Field contact open)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 23 mA maximum (with FTA Pullup) <sup>(2)</sup><br>20 mA maximum (with FTA Pullup) <sup>(2)</sup>                                                                                                                        |
| Contact Resistance<br>Low (0, Field contact closed)<br>High (1, Field contact open)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 82 $\Omega$ maximum (with FTA Pullup) <sup>(2)</sup><br>175 $\Omega$ minimum (with FTA Pullup) <sup>(2)</sup>                                                                                                           |
| Field Input Scan Rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20 ms                                                                                                                                                                                                                   |
| AV Update Rate (Used for Totalizer Algorithm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 20 ms                                                                                                                                                                                                                   |
| PV Update Rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 500 ms for 8 channels                                                                                                                                                                                                   |
| Rate Accuracy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $\pm 0.01\%$ of input frequency, $\pm 0.4$ Hz (whichever is larger)                                                                                                                                                     |
| Rate Resolution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $\pm 0.4$ Hz                                                                                                                                                                                                            |
| Input Range (No Damage)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | $\pm 30$ V maximum                                                                                                                                                                                                      |
| Transmitter Power Conditioning (for 3-wire connection)<br>Open Circuit Voltage<br>Full Load<br>Short Circuit Current                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 23-25 Vdc<br>21 V @ 115 mA<br>150 mA maximum                                                                                                                                                                            |
| <p>(1) Sine waves must not be intermixed with square waves or contacts on the same FTA.<br/> 50 M FTA cables with mixed signal amplitudes: frequency is 9 kHz maximum (55 <math>\mu</math>s minimum pulse width)<br/> 30 M FTA cables: frequency is 13 kHz maximum (38 <math>\mu</math>s minimum pulse width)<br/> 20 M FTA cables: frequency is 15 kHz maximum (33 <math>\mu</math>s minimum pulse width)<br/> 10 M FTA cables: frequency is 18 kHz maximum (28 <math>\mu</math>s minimum pulse width)<br/> 5 M FTA cables: frequency is 20 kHz maximum (25 <math>\mu</math>s minimum pulse width)</p> <p>(2) 1 k<math>\Omega</math> to 24 Vdc.</p> |                                                                                                                                                                                                                         |

## 6.18. Analog Output 8-Point Processor/FTA

## MC-PAOX03

| Parameter                                                              | Specification                                                         |
|------------------------------------------------------------------------|-----------------------------------------------------------------------|
| FTA Models                                                             | <b>MU-TAOX02, TAOX12, TAOX52</b>                                      |
| Output Type                                                            | 4-20 mA                                                               |
| Output Channels                                                        | 8                                                                     |
| Output Ripple                                                          | 100 mV peak-to-peak at power line frequency, across 250 $\Omega$ load |
| Output Temperature Stability                                           | 0.02% Full Scale/ $^{\circ}$ C                                        |
| Resolution                                                             | $\pm 0.05\%$                                                          |
| Calibrated Accuracy                                                    | $\pm 0.35\%$ (25 $^{\circ}$ C) including linearity                    |
| Output Readback Checking Accuracy                                      | $\pm 4\%$                                                             |
| Humidity                                                               | 10 - 90% non-condensing                                               |
| Directly Accessible Output Current Range                               | 0.1-21.4 mA                                                           |
| Maximum Current Output                                                 | 26 mA                                                                 |
| Maximum Resistive Load                                                 | 750 $\Omega$ @ 22 mA                                                  |
| Output Settling Time (digital input code to 98% of final output value) | 4 ms                                                                  |
| Surge withstand capability                                             | ANSI/IEEE C37.90.1-1978                                               |

## 6.19. Analog Output 8-Point Processor Redundancy Option

### MU-TAOX12, TAOX52

| Parameter                                   | Specification                   |
|---------------------------------------------|---------------------------------|
| Output Signal Perturbation During Swap      | 1 ms nominal<br>4 ms maximum    |
| Output Signal Perturbation During Failover  | 30 ms nominal<br>125 ms maximum |
| FTA Switching Hardware Diagnostic Frequency | Once per minute                 |

## 6.20. Analog Output 16-Point Processor/FTA

## MU-PAOY22

| Parameter                                                              | Specification                                                                                                                                             |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| FTA Models                                                             | <b>MU-TAOY22, TAOY52, THAO11, GHAO11</b>                                                                                                                  |
| Output Type                                                            | 4-20 mA                                                                                                                                                   |
| Output Channels                                                        | 16                                                                                                                                                        |
| Output Ripple                                                          | 100 mV peak-to-peak at power line frequency, across 250 $\Omega$ load                                                                                     |
| Output Temperature Stability                                           | $\pm 0.02\%$ Full Scale/ $^{\circ}\text{C}$ (all except MU-GHAO11)<br>$\pm 0.025\%$ Full Scale/ $^{\circ}\text{C}$ (MU-GHAO11)                            |
| Output Readback Accuracy                                               | $\pm 4\%$                                                                                                                                                 |
| Humidity                                                               | $\pm 0.1\%$ full scale (50% RH $\pm$ 40% RH)                                                                                                              |
| Output Current Linearity                                               | $\pm 0.05\%$ nominal                                                                                                                                      |
| Resolution                                                             | $\pm 0.05\%$                                                                                                                                              |
| Calibrated Accuracy                                                    | $\pm 0.35\%$ (25 $^{\circ}\text{C}$ ) including linearity (all except MU-GHAO11)<br>$\pm 0.45\%$ (25 $^{\circ}\text{C}$ ) including linearity (MU-GHAO11) |
| Directly Settable Output Current Range                                 | 0 mA, 2.9 mA to 21.1 mA                                                                                                                                   |
| Absolute Max Current Output for AO Value Digital Input Code            | 24 mA                                                                                                                                                     |
| Maximum Resistive Load<br>(24 V supply = 20 V)                         | 750 $\Omega$ @ 20 mA (MU-TAOY22, TAOY52)<br>720 $\Omega$ @ 20 mA (MU-THAO11)<br>870 $\Omega$ @ 20 mA (MU-GHAO11)                                          |
| Maximum Output Compliant Voltage<br>(24 V supply = 20 V)               | 15 V (MU-TAOY22, TAOY52)<br>14.4 V (MU-THAO11)<br>17.4 V (MU-GHAO11)                                                                                      |
| Output Settling Time (digital input code to 98% of final output value) | 4 ms                                                                                                                                                      |
| Surge Withstand Capability                                             | ANSI/IEEE C37.90.1-1978                                                                                                                                   |

## 6.21. Analog Output 16-Point Processor Redundancy Option

**MU-TAOY22, TAOY52, THAO11, GHAO11**

| <b>Parameter</b>                          | <b>Specification</b> |
|-------------------------------------------|----------------------|
| Gap (0 mA) of Output to Field on Failover | 20 ms maximum        |
| Switching Hardware Diagnostic Frequency   | Once per minute      |

## 6.22. Digital Input Processor and Digital Input Sequence of Events Processor

## MU-PDIX02/MU-PDIS12

| FTAs with Removable Plug-In Isolators                                                                                                                                                                                                                                                           |                                               |                                   |                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------|------------------------------------|
| Parameter                                                                                                                                                                                                                                                                                       | Specification                                 |                                   |                                    |
|                                                                                                                                                                                                                                                                                                 | 24 Vdc FTA                                    | 120 Vac FTA<br>125 Vdc FTA        | 240 Vac FTA                        |
| FTA Models                                                                                                                                                                                                                                                                                      | MU-TDID12, TDID52                             | MU-TDIA12, TDIA52                 | MU-TDIA22, TDIA62                  |
| Input Channels                                                                                                                                                                                                                                                                                  | 32                                            | 32                                | 32                                 |
| Accumulated Input Frequency                                                                                                                                                                                                                                                                     | dc - 15 Hz                                    | NA                                | NA                                 |
| Galvanic Isolation<br>(field to PM/APM/HPM/EHPM)                                                                                                                                                                                                                                                | 1500 Vac rms or $\pm 1500$ Vdc <sup>(2)</sup> | 1500 Vac rms or $\pm 1500$ Vdc    | 1500 Vac rms or $\pm 1500$ Vdc     |
| Isolation Technique                                                                                                                                                                                                                                                                             | Optical                                       | Optical                           | Optical                            |
| Digital Input<br>Pwr. Range <sup>(1)</sup>                                                                                                                                                                                                                                                      | 20-30 Vdc                                     | 90-132 Vac rms                    | 180-264 Vac rms                    |
| Sense Current<br>(ON condition)                                                                                                                                                                                                                                                                 | 4.5 mA minimum                                | 3.5 mA minimum                    | 2.2 mA minimum                     |
| Sense Current<br>(OFF condition)                                                                                                                                                                                                                                                                | 2.8 mA maximum                                | 1.5 mA maximum                    | 1.0 mA maximum                     |
| Pick Up Voltage<br>(ON condition)                                                                                                                                                                                                                                                               | 20 Vdc minimum <sup>(3)</sup>                 | 90 Vac rms minimum <sup>(4)</sup> | 180 Vac rms minimum <sup>(4)</sup> |
| Drop Out Voltage<br>(OFF condition)                                                                                                                                                                                                                                                             | 10 Vdc maximum <sup>(3)</sup>                 | 25 Vac rms maximum <sup>(4)</sup> | 50 Vac rms maximum <sup>(4)</sup>  |
| Absolute Delay Across<br>Input Filter and Isolation<br>(Bounceless Input to PM/APM/HPM/EHPM logic level change)                                                                                                                                                                                 | 2.0 ms maximum                                | 25 ms maximum                     | 25 ms maximum                      |
| Frequency Range                                                                                                                                                                                                                                                                                 | dc                                            | 47-63 Hz                          | 47-63 Hz                           |
| Surge withstand capability                                                                                                                                                                                                                                                                      | ANSI/IEEE C37.90.1-1978                       | ANSI/IEEE C37.90.1-1978           | ANSI/IEEE C37.90.1-1978            |
| (1) These dc voltage limits include an ac component that has a peak value of 5% of the nominal dc range value.<br>(2) Not applicable if system power is used to power field inputs.<br>(3) This voltage present from '-' terminal to ground.<br>(4) The voltage present across input terminals. |                                               |                                   |                                    |

(Continued)



**Digital Input Processor and Digital Input SOE Processor (continued)****MU-PDIX02/ MU-PDIS12**

| <b>Packaged FTAs without Plug-In Isolators</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                               |                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------|
| <b>Parameter</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Specification</b>                          |                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>24 Vdc FTA</b>                             | <b>120 Vac FTA</b>             |
| FTA Model Numbers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>MU-TDID72</b>                              | <b>MU-TDIA72</b>               |
| Input Channels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 32                                            | 32                             |
| Accumulated Input Frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | dc - 15 Hz                                    | NA                             |
| Galvanic Isolation<br>(field to APM)                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1500 Vac rms or $\pm 1500$ Vdc <sup>(5)</sup> | 1500 Vac rms or $\pm 1500$ Vdc |
| Isolation Technique                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Optical                                       | Optical                        |
| Digital Input<br>Pwr. Range <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 18-30 Vdc                                     | 90-132 Vac rms                 |
| Sense Current<br>(ON condition)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 12 mA minimum                                 | 5.2 mA minimum                 |
| Sense Current<br>(OFF condition)                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4.3 mA maximum                                | 1.47 mA maximum                |
| Absolute Delay Across Input Filter and<br>Isolation (Bounceless Input to<br>PM/APM/HPM/EHPM logic level<br>change)                                                                                                                                                                                                                                                                                                                                                                               | 3.6 ms maximum                                | 25 ms maximum                  |
| Field Resistance for Guaranteed ON<br>condition <sup>(2, 3)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                | 100 $\square$ maximum                         | 100 $\square$ maximum          |
| Field Resistance for Guaranteed OFF<br>condition <sup>(2, 3)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                               | 45 k $\square$ minimum <sup>(4)</sup>         | 71 k $\square$ minimum         |
| Frequency Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | dc                                            | 47-63 Hz                       |
| Surge withstand capability                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ANSI/IEEE C37.90.1-1978                       | ANSI/IEEE C37.90.1-1978        |
| <p>(1) These dc voltage limits include an ac component that has a peak value of 5% of the nominal dc range value.</p> <p>(2) This resistance is present between the two legs of a DI current sense circuit.</p> <p>(3) For field wiring distance guidelines, see the appropriate <i>Site Planning</i> manual.</p> <p>(4) Reduce to 37.4 k<math>\square</math> if digital input power range is limited to 18-25 Vdc.</p> <p>(5) Not applicable if system power is used to power field inputs.</p> |                                               |                                |

## 6.23. Digital Input Processor Redundancy Option

(MU-PDIS12 Only)

| Parameter                                                   | Specification                               |
|-------------------------------------------------------------|---------------------------------------------|
| Input Scan Cycles Missed or Delayed During Swap or Failover | No cycles missed or delayed (all FTA types) |

## 6.24. Digital Input 24 Vdc Processor

**MU-PDIY22**

| Parameter                                                            | Specification                                             |
|----------------------------------------------------------------------|-----------------------------------------------------------|
| FTA Models                                                           | <b>MU-TDIY22, MU-TDIY62</b>                               |
| No. Points per IOP/FTA                                               | 32                                                        |
| Galvanic Isolation (any input terminal voltage referenced to common) | 30 Vac, □42.4 Vdc (max)                                   |
| Isolation Technique                                                  | Optical (in IOP)                                          |
| DI Power Voltage Range                                               | 15 to 30 Vdc                                              |
| Input Signal Direction                                               | Source/Sink                                               |
| ON Sense Voltage/Current<br>OFF Sense Voltage/Current                | 13 Vdc (min) or 3 mA (min)<br>5 Vdc (max) or 1.2 mA (max) |
| Input Impedance                                                      | 4.2 K□                                                    |
| Absolute Delay Across Input Filter and Isolation                     | 5 ms □ 20%                                                |
| Field Resistance for Guaranteed ON Condition                         | 300 Ω max @ 15 Vdc                                        |
| Field Resistance for Guaranteed OFF Condition                        | 30 KΩ min @ 30 Vdc                                        |
| Surge Withstand Capability                                           | ANSI/IEEE C37.90.1-1978                                   |

## 6.25. Digital Output 16-Point Processor

## MU-PDOX02

| Solid State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                    |                                                                                           |                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Specification                                                                                                      |                                                                                           |                                                                                                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3-30 Vdc FTA                                                                                                       | 120/240 Vac FTA                                                                           | 31-200 Vdc FTA                                                                                                     |
| FTA Model Numbers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | MU-TDOD13, 53, 14, 54                                                                                              | MU-TDOA13, MU-TDOA53                                                                      | MU-TDOD23, MU-TDOD63                                                                                               |
| Output Channels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 16 (Outputs are independent from each other and can use independent load power supplies.)                          | 16 (Outputs are independent from each other and can use independent load power supplies.) | 16 (Outputs are independent from each other and can use independent load power supplies.)                          |
| Output Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Normally open power transistor switch per output (emitter and collector terminals are both available to the user.) | Normally open triac switch per output (both triac terminals are available to the user)    | Normally open power transistor switch per output (emitter and collector terminals are both available to the user.) |
| Load Voltage Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 13, 53 3-30 Vdc<br>14, 54 5-30 Vdc                                                                                 | 120/240 Vac                                                                               | 31-200 Vdc                                                                                                         |
| FTA Max Continuous Load Current                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1.25 Adc per output <sup>(2)</sup>                                                                                 | 1.25 Adc per output <sup>(2)</sup>                                                        | 0.5 Adc per output <sup>(2)</sup>                                                                                  |
| Load Fuse Rating <sup>(5)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2.5 A 125 V slow blow (5x20 mm) fuse per output (readily replaceable in fuseholders)                               | 2.5 A 125 V slow blow (5x20 mm) fuse per output (readily replaceable in fuseholders)      | 1 A 125 V slow blow (5x20 mm) fuse per output (readily replaceable in fuseholders)                                 |
| Fuse Type (BUSS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | GDC-2.5 A                                                                                                          | GDC-2.5 A                                                                                 | GDC-1 A                                                                                                            |
| Load Power Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | N/A                                                                                                                | Must be 0.5 or greater <sup>(1)</sup>                                                     | N/A                                                                                                                |
| Min. Load Current <sup>(3)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10 mAdc                                                                                                            | 50 mA (rms)                                                                               | 10 mAdc                                                                                                            |
| Isolation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1500 V (rms) (field terminals to system power supply common)                                                       | 1500 V (rms) (field terminals to system power supply common)                              | 1500 V (rms) (field terminals to system power supply common)                                                       |
| On-State Voltage Drop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (@ max. load current)<br>13, 53 1.6 V max.<br>14, 54 3.0 V max.                                                    | 1.6 V max. (@ max. load current)                                                          | 3.0 V max. (@ max. load current)                                                                                   |
| Off-State Leakage Max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 13, 53 10 µAdc max.<br>14, 54 100 µAdc max.                                                                        | 5 mA rms                                                                                  | 100 µAdc max.                                                                                                      |
| Turn-on/Turn-off Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1 ms max.                                                                                                          | Next zero voltage/next zero current <sup>(4)</sup>                                        | 1 ms max.                                                                                                          |
| Contact Suppression (Shunt)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Diode clamp                                                                                                        | Resistor/capacitor snubber plus varistor per output                                       | Diode clamp                                                                                                        |
| Surge withstand capability                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ANSI/IEEE C37.90.1-1978                                                                                            | ANSI/IEEE C37.90.1-1978                                                                   | ANSI/IEEE C37.90.1-1978                                                                                            |
| <p>(1) Load power factors less than 0.5 can damage the triac switches. Additional resistor/capacitor snubbing must be added across the triac as discussed in the appropriate <i>Installation</i> manual for load power factors less than 0.5; otherwise a load with power factor 0.5, or greater, must be used.</p> <p>(2) Individual output rated at maximum 2 Adc, provided that total current for two adjacent channels does not exceed 2.5 amps.</p> <p>(3) Surge current rating of solid-state switch at 20 °C non-repeating.</p> <p>(4) As much as 0.5 line cycle (8.33 ms for 60 Hz line) for power factor &lt;1.0.</p> <p>(5) Actual fuse rating is slightly greater than the maximum FTA output allowed. "Use the FTA Max Continuous Load Current" section for maximum FTA output rating.</p> |                                                                                                                    |                                                                                           |                                                                                                                    |

(Continued)

**Digital Output 16-Point Processor (continued)****MU-PDOX02**

| <b>Solid State (continued)</b>                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>Parameter</b>                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Specification</b>                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>24 Vdc Nonisolated FTA</b>                                                       |
| FTA Models                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>MU-TDON12, MU-TDON52</b>                                                         |
| Output Channels                                                                                                                                                                                                                                                                                                                                                                                                                                            | 16 (outputs referenced to power supply common)                                      |
| Output Type                                                                                                                                                                                                                                                                                                                                                                                                                                                | Open-collector (current-sinking) NPN transistors                                    |
| Output Volt. States <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                         | ON-state: 0-2 Vdc (maximum)<br>OFF-state: "Ref +" terminal voltage (24 Vdc nominal) |
| Maximum Load Current                                                                                                                                                                                                                                                                                                                                                                                                                                       | 100 mA per output <sup>(2)</sup>                                                    |
| Minimum Load Current                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1 mA per output                                                                     |
| Output Isolation                                                                                                                                                                                                                                                                                                                                                                                                                                           | None (any screw terminal to common)                                                 |
| On-State Voltage Drop                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2 V max. @ max. load current                                                        |
| Off-State Leak. Current                                                                                                                                                                                                                                                                                                                                                                                                                                    | 100 $\mu$ A max. @ max. output voltage                                              |
| Turn-on/Turn-off Time                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10 $\mu$ s                                                                          |
| Contact Suppression (Shunt)                                                                                                                                                                                                                                                                                                                                                                                                                                | Diode per output to "Ref +" terminal <sup>(3)</sup>                                 |
| Output Transient Protection                                                                                                                                                                                                                                                                                                                                                                                                                                | (See Contact Suppression)                                                           |
| <p>(1) Because of the open-collector transistor configuration of the outputs, the nominal off-state output voltage is the load power supply ("Ref +") voltage, nominally +24 Vdc, minus any voltage across the load caused by off-state leakage current.</p> <p>(2) All outputs ON (100% duty cycle) at maximum operating temperature.</p> <p>(3) User must diode-suppress any inductive loads (such as relay coils) as close as possible to the load.</p> |                                                                                     |

(Continued)

**Digital Output 16-Point Processor (continued)****MU-PDOX02**

| <b>Electro-Mechanical Relay--120 Vac FTA, 125 Vdc FTA</b>                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                  |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------|---------|-----|---------|----|---------|----|-----------|----|-----------|----|------------|---------------------|
| <b>Parameter</b>                                                                                                                                                                                                                                                                                                                                                          | <b>Specification</b>                                                                                                                                                                                                                                                                                                                             |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| FTA Models                                                                                                                                                                                                                                                                                                                                                                | <b>MU-TDOR12, MU-TDOR52</b>                                                                                                                                                                                                                                                                                                                      |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Outputs                                                                                                                                                                                                                                                                                                                                                                   | 16 isolated Form A (SPST/NO) or Form B (SPST/NC) contacts (jumper selectable per output)                                                                                                                                                                                                                                                         |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Contact Type                                                                                                                                                                                                                                                                                                                                                              | Silver alloy                                                                                                                                                                                                                                                                                                                                     |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Maximum Load Voltage                                                                                                                                                                                                                                                                                                                                                      | 140 Vac (rms)/140 Vdc                                                                                                                                                                                                                                                                                                                            |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Maximum Steady-State Load Current                                                                                                                                                                                                                                                                                                                                         | 5 A rms @ 120 Vac (resistive) per output<br>2 A @ 30 Vdc (resistive) per output<br>0.5 A @ 125 Vdc (resistive) per output<br>1/8 horsepower per output                                                                                                                                                                                           |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Minimum Load Current <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                       | 100 mA                                                                                                                                                                                                                                                                                                                                           |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Load Surge Current <sup>(2)</sup>                                                                                                                                                                                                                                                                                                                                         | Overload and Endurance per UL 508                                                                                                                                                                                                                                                                                                                |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Isolation                                                                                                                                                                                                                                                                                                                                                                 | 1500 Vac rms or $\pm 1500$ Vdc<br>Channel-to-channel, and channel-to-PM/APM/HPM common                                                                                                                                                                                                                                                           |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Turn-on Time                                                                                                                                                                                                                                                                                                                                                              | 10 ms typical, 15 ms maximum                                                                                                                                                                                                                                                                                                                     |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Turn-off Time                                                                                                                                                                                                                                                                                                                                                             | 10 ms typical, 15 ms maximum                                                                                                                                                                                                                                                                                                                     |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Maximum Repetition Rate                                                                                                                                                                                                                                                                                                                                                   | 360 cycles per hour at rated load                                                                                                                                                                                                                                                                                                                |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Contact Life <sup>(3)</sup>                                                                                                                                                                                                                                                                                                                                               | <table> <tr> <th><u>Operations</u></th><th><u>% of Max. Load</u></th></tr> <tr> <td>350,000</td><td>100</td></tr> <tr> <td>450,000</td><td>80</td></tr> <tr> <td>750,000</td><td>60</td></tr> <tr> <td>1,000,000</td><td>40</td></tr> <tr> <td>1,300,000</td><td>20</td></tr> <tr> <td>20,000,000</td><td>0 (Mechanical Life)</td></tr> </table> | <u>Operations</u> | <u>% of Max. Load</u> | 350,000 | 100 | 450,000 | 80 | 750,000 | 60 | 1,000,000 | 40 | 1,300,000 | 20 | 20,000,000 | 0 (Mechanical Life) |
| <u>Operations</u>                                                                                                                                                                                                                                                                                                                                                         | <u>% of Max. Load</u>                                                                                                                                                                                                                                                                                                                            |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| 350,000                                                                                                                                                                                                                                                                                                                                                                   | 100                                                                                                                                                                                                                                                                                                                                              |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| 450,000                                                                                                                                                                                                                                                                                                                                                                   | 80                                                                                                                                                                                                                                                                                                                                               |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| 750,000                                                                                                                                                                                                                                                                                                                                                                   | 60                                                                                                                                                                                                                                                                                                                                               |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| 1,000,000                                                                                                                                                                                                                                                                                                                                                                 | 40                                                                                                                                                                                                                                                                                                                                               |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| 1,300,000                                                                                                                                                                                                                                                                                                                                                                 | 20                                                                                                                                                                                                                                                                                                                                               |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| 20,000,000                                                                                                                                                                                                                                                                                                                                                                | 0 (Mechanical Life)                                                                                                                                                                                                                                                                                                                              |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Contact Suppression (Shunt)                                                                                                                                                                                                                                                                                                                                               | 22 $\Omega$ /0.1 $\mu$ F resistor/capacitor snubber across each contact                                                                                                                                                                                                                                                                          |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Load Fusing on Termination Assembly                                                                                                                                                                                                                                                                                                                                       | 6 A 125 V slow-blow (5x20 mm) fuse per output                                                                                                                                                                                                                                                                                                    |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| Surge withstand capability                                                                                                                                                                                                                                                                                                                                                | ANSI/IEEE C37.90.1-1978                                                                                                                                                                                                                                                                                                                          |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |
| <p>(1) The power contacts in these relays are not suitable for load currents less than 100 mA.</p> <p>(2) Contact surge rating is limited by fuse opening time. Fuse opening time is 0.5 sec @ 18 A, 1 sec. @ 15 A, 5 sec @ 10 A</p> <p>(3) For resistive loads (power factor = 1.0); derate linearly by 5% at 0.9 load power factor to 50% at 0.1 load power factor.</p> |                                                                                                                                                                                                                                                                                                                                                  |                   |                       |         |     |         |    |         |    |           |    |           |    |            |                     |

(Continued)

**Digital Output 16-Point Processor (continued)****MU-PDOX02**

| <b>Electro-Mechanical Relay--240 Vac FTA, 125 Vdc FTA</b>                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                    |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------|---------|-----|---------|----|---------|----|-----------|----|-----------|----|------------|---------------------|
| <b>Parameter</b>                                                                                                                                                                                                                                                                                                                                                         | <b>Specification</b>                                                                                                                                                                                                                                                                                                               |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| FTA Models                                                                                                                                                                                                                                                                                                                                                               | <b>MU-TDOR22, MU-TDOR62</b>                                                                                                                                                                                                                                                                                                        |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Outputs                                                                                                                                                                                                                                                                                                                                                                  | 16 isolated Form A (SPST/NO) or Form B (SPST/NC) contacts (jumper selectable per output)                                                                                                                                                                                                                                           |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Contact Type                                                                                                                                                                                                                                                                                                                                                             | Silver alloy                                                                                                                                                                                                                                                                                                                       |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Maximum Load Voltage                                                                                                                                                                                                                                                                                                                                                     | 265 Vac (rms)/140 Vdc                                                                                                                                                                                                                                                                                                              |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Maximum Steady-State Load Current                                                                                                                                                                                                                                                                                                                                        | 2.5 A (rms) @ 240 Vac (resistive) per output<br>2 A @ 30 Vdc (resistive) per output<br>0.5 A @ 125 Vdc (resistive) per output<br>1/8 horsepower per output                                                                                                                                                                         |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Minimum Load Current <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                      | 100 mA                                                                                                                                                                                                                                                                                                                             |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Load Surge Current <sup>(2)</sup>                                                                                                                                                                                                                                                                                                                                        | Overload and Endurance per UL 508                                                                                                                                                                                                                                                                                                  |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Isolation                                                                                                                                                                                                                                                                                                                                                                | 1500 Vac rms or $\pm 1500$ Vdc<br>Channel-to-channel, and channel-to-PM/APM/HPM common                                                                                                                                                                                                                                             |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Turn-on Time                                                                                                                                                                                                                                                                                                                                                             | 10 ms typical, 15 ms maximum                                                                                                                                                                                                                                                                                                       |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Turn-off Time                                                                                                                                                                                                                                                                                                                                                            | 10 ms typical, 15 ms maximum                                                                                                                                                                                                                                                                                                       |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Maximum Repetition Rate                                                                                                                                                                                                                                                                                                                                                  | 360 cycles per hour at rated load                                                                                                                                                                                                                                                                                                  |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Contact Life <sup>(3)</sup>                                                                                                                                                                                                                                                                                                                                              | <table> <tr> <th>Operations</th><th>% of Max. Load</th></tr> <tr> <td>350,000</td><td>100</td></tr> <tr> <td>450,000</td><td>80</td></tr> <tr> <td>750,000</td><td>60</td></tr> <tr> <td>1,000,000</td><td>40</td></tr> <tr> <td>1,300,000</td><td>20</td></tr> <tr> <td>20,000,000</td><td>0 (Mechanical Life)</td></tr> </table> | Operations | % of Max. Load | 350,000 | 100 | 450,000 | 80 | 750,000 | 60 | 1,000,000 | 40 | 1,300,000 | 20 | 20,000,000 | 0 (Mechanical Life) |
| Operations                                                                                                                                                                                                                                                                                                                                                               | % of Max. Load                                                                                                                                                                                                                                                                                                                     |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| 350,000                                                                                                                                                                                                                                                                                                                                                                  | 100                                                                                                                                                                                                                                                                                                                                |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| 450,000                                                                                                                                                                                                                                                                                                                                                                  | 80                                                                                                                                                                                                                                                                                                                                 |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| 750,000                                                                                                                                                                                                                                                                                                                                                                  | 60                                                                                                                                                                                                                                                                                                                                 |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| 1,000,000                                                                                                                                                                                                                                                                                                                                                                | 40                                                                                                                                                                                                                                                                                                                                 |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| 1,300,000                                                                                                                                                                                                                                                                                                                                                                | 20                                                                                                                                                                                                                                                                                                                                 |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| 20,000,000                                                                                                                                                                                                                                                                                                                                                               | 0 (Mechanical Life)                                                                                                                                                                                                                                                                                                                |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Contact Suppression (Shunt)                                                                                                                                                                                                                                                                                                                                              | 51 $\Omega$ /0.022 $\mu$ F resistor/capacitor snubber across each contact                                                                                                                                                                                                                                                          |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Load Fusing on Termination Assembly                                                                                                                                                                                                                                                                                                                                      | 3 A 250 V slow-blow (5x20 mm) fuse per output                                                                                                                                                                                                                                                                                      |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| Surge withstand capability                                                                                                                                                                                                                                                                                                                                               | ANSI/IEEE C37.90.1-1978                                                                                                                                                                                                                                                                                                            |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |
| <p>(1) The power contacts in these relays are not suitable for load currents less than 100 mA.</p> <p>(2) Contact surge rating is limited by fuse opening time. Fuse opening time is 0.5 sec @ 10 A, 1 sec. @ 8 A, 5 sec @ 6 A.</p> <p>(3) For resistive loads (power factor = 1.0); derate linearly by 5% at 0.9 load power factor to 50% at 0.1 load power factor.</p> |                                                                                                                                                                                                                                                                                                                                    |            |                |         |     |         |    |         |    |           |    |           |    |            |                     |

## 6.26. Digital Output 32-Point Processor

**MU-PDOY22**

| <b>24 Vdc FTA</b>          |                                                                                                                                                                              |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameter</b>           | <b>Specification</b>                                                                                                                                                         |
| FTA Model Numbers          | <b>MU-TDOY22, MU-TDOY62</b>                                                                                                                                                  |
| Output Channels            | 32                                                                                                                                                                           |
| Output Type                | Open-collector (current sinking) NPN transistors                                                                                                                             |
| Load Voltage Range         | 15-30 Vdc                                                                                                                                                                    |
| Load Current               | MU-TDOY22<br>0.5 A (max) per pts.<br>1.0 A (max) per 2 pts.<br>5 A (max) per 32 pts.<br>MU-TDOY62<br>0.5 A (max) per pts.<br>1.2 A (max) per 8 pts.<br>5 A (max) per 32 pts. |
| Isolation                  | Galvanic Isolation (photo coupler)<br>30 Vac, □42.4 Vdc max.<br>(Any output voltage referenced to common)                                                                    |
| On-State Voltage           | 0.5 V (max), load current @ 0.5A                                                                                                                                             |
| Off-State Voltage          | 30 Vdc (max)                                                                                                                                                                 |
| Off-State Leak Current     | 0.5 □A (max)                                                                                                                                                                 |
| Turn-On/Turn-Off Time      | 200 msec (max)                                                                                                                                                               |
| Surge withstand capability | ANSI/IEEE C37.90.1-1978                                                                                                                                                      |
| Load Fuse Rating           | MU-TDOY22 -- 1 fuse/2 pts. (compression)*<br>MU-TDOY62 -- 1 fuse/8 pts. (screw terminal)*<br>* Fuse - 1.6 A 125 V (5.5 x 17.2 MM)                                            |

(Continued)



**Digital Output 32-Point Processor** (continued)**MU-PDOY22**

| <b>120/240 Vac Relay FTA</b>                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------------|------------|---------------------|---------------|---------------------|-----|--------------------|-----|--------------------|-------|---------------------|-----|----------------------------------------|-----|----------------------------------------|-----|---------------------------------|-------|---------------------------------|-------|----------------------------------|
| <b>Parameter</b>                                                                                                                                                      | <b>Specification</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| FTA Model Numbers                                                                                                                                                     | <b>MU-TDOY23, MU-TDOY63</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Output Channels                                                                                                                                                       | 32 (16 per FTA)<br>16 isolated Form A (SPST/NO) or Form B (SPST/NC) contacts<br>(jumper selectable per output)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Contact Type                                                                                                                                                          | Gold-clad silver nickel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Maximum Load Voltage                                                                                                                                                  | 250 Vac (RMS)/125 Vdc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Maximum Steady State Load Current per Output                                                                                                                          | <table> <tr> <th>Current</th><th>Voltage</th></tr> <tr> <td>3 A</td><td>250 Vac(resistive)</td></tr> <tr> <td>3 A</td><td>125 Vac (resistive)</td></tr> <tr> <td>3 A</td><td>30 Vdc (resistive)</td></tr> <tr> <td>1 A</td><td>48 Vdc (resistive)</td></tr> <tr> <td>0.4 A</td><td>125 Vdc (resistive)</td></tr> <tr> <td>2 A</td><td>250 Vac (inductive = 0.4 power factor)</td></tr> <tr> <td>2 A</td><td>125 Vac (inductive = 0.4 power factor)</td></tr> <tr> <td>1 A</td><td>30 Vac (inductive L/R = 100 ms)</td></tr> <tr> <td>0.3 A</td><td>48 Vac (inductive L/R = 100 ms)</td></tr> <tr> <td>0.1 A</td><td>125 Vac (inductive L/R = 100 ms)</td></tr> </table> | Current    | Voltage       | 3 A        | 250 Vac(resistive)  | 3 A           | 125 Vac (resistive) | 3 A | 30 Vdc (resistive) | 1 A | 48 Vdc (resistive) | 0.4 A | 125 Vdc (resistive) | 2 A | 250 Vac (inductive = 0.4 power factor) | 2 A | 125 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) |
| Current                                                                                                                                                               | Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| 3 A                                                                                                                                                                   | 250 Vac(resistive)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| 3 A                                                                                                                                                                   | 125 Vac (resistive)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| 3 A                                                                                                                                                                   | 30 Vdc (resistive)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| 1 A                                                                                                                                                                   | 48 Vdc (resistive)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| 0.4 A                                                                                                                                                                 | 125 Vdc (resistive)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| 2 A                                                                                                                                                                   | 250 Vac (inductive = 0.4 power factor)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| 2 A                                                                                                                                                                   | 125 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Minimum Load Current                                                                                                                                                  | 10 mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Isolation                                                                                                                                                             | 1500 Vac rms or $\pm 1500$ Vdc<br>Channel-to-channel, and channel-to-PM/APM/HPM common                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Turn-On Time                                                                                                                                                          | 10 ms maximum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Turn-Off Time                                                                                                                                                         | 10 ms maximum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Maximum Repetition Rate                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Contact Life                                                                                                                                                          | <table> <tr> <th>Operations</th><th>% of Max Load</th></tr> <tr> <td>10,000,000</td><td>0 (Mechanical Life)</td></tr> <tr> <td>200,000 @ 3 A</td><td>(100%)</td></tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Operations | % of Max Load | 10,000,000 | 0 (Mechanical Life) | 200,000 @ 3 A | (100%)              |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Operations                                                                                                                                                            | % of Max Load                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| 10,000,000                                                                                                                                                            | 0 (Mechanical Life)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| 200,000 @ 3 A                                                                                                                                                         | (100%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| FTA +24 Vdc Current                                                                                                                                                   | 12.5 mA for each energized relay (coil resistance = $2\text{ K}\Omega$ )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Surge Absorber for Coil                                                                                                                                               | $120\Omega + 0.03\text{ }\mu\text{F}$ for each channel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Serviceability                                                                                                                                                        | No fuse for FTA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| Surge withstand capability                                                                                                                                            | ANSI/IEEE C37.90.1-1978                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |
| NOTE: One FTA supports up to 16 circuits. When 17-32 circuits are used, 2 FTAs are required. Bridge cable MU-KBFT01 or MU-KBFT02 is required to connect the two FTAs. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |               |            |                     |               |                     |     |                    |     |                    |       |                     |     |                                        |     |                                        |     |                                 |       |                                 |       |                                  |

### 6.27. FOUNDATION Fieldbus I/O Processor/FTA (Obsolete Product)

The EHPM/HPM based Fieldbus products (MU-PFBS01, MC-PFBS01, MU-TFBS01, MC-TFBS01, MU-TFBS11, MC-TFBS11, MU-GFBS01, MC-GFBS01, MU-GFBS71 and MC-GFBS71) have been discontinued. For Full Fieldbus capability please refer to the Field Device Manager (FDM) product line.

## 6.28. Analog Input IOP Comparison

| Product                                                                                                                                                                                                                                                                                                                                                                                           | LLAI 8                          | LLMUX                                   | RHMUX                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-----------------------------------------|---------------------------------|
| IOP Configuration <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                  | LLAI                            | LLMUX                                   | LLMUX                           |
| Channels                                                                                                                                                                                                                                                                                                                                                                                          | 8                               | 32                                      | 32                              |
| T/C inputs                                                                                                                                                                                                                                                                                                                                                                                        | Yes                             | Yes (MU-TAMT03/13)                      | Yes                             |
| RTD inputs                                                                                                                                                                                                                                                                                                                                                                                        | Yes                             | Yes (MU-TAMR03)                         | No                              |
| Linear Voltage                                                                                                                                                                                                                                                                                                                                                                                    | 0 - 100 mV<br>0 - 5 V           | 0 - 100 mV                              | 0 - 100 mV                      |
| CJR                                                                                                                                                                                                                                                                                                                                                                                               | Local                           | Local (MU-TAMT03)<br>Remote (MU-TAMT13) | Local (on mux FTA)              |
| A/D Converter Resolution                                                                                                                                                                                                                                                                                                                                                                          | 15 bits                         | 14 bits                                 | 15 bits                         |
| Max distance                                                                                                                                                                                                                                                                                                                                                                                      | 50 meters                       | 300 meters                              | 2000 meters                     |
| Scans/Second                                                                                                                                                                                                                                                                                                                                                                                      | 8 (without OTD)<br>4 (with OTD) | 1                                       | 0.25 <sup>(2)</sup>             |
| OTD Detection                                                                                                                                                                                                                                                                                                                                                                                     | Every Sample                    | Every 30 Seconds                        | Every Sample                    |
| Ground Fault Detect                                                                                                                                                                                                                                                                                                                                                                               | No                              | No                                      | Yes                             |
| Multiplexer Switch Type                                                                                                                                                                                                                                                                                                                                                                           | N/A                             | Mercury-Wetted Relays                   | Solid-State Relays              |
| Temperature Range                                                                                                                                                                                                                                                                                                                                                                                 | 0 to 50°C                       | 0 to 50°C                               | -40 to +85°C (FTA only)         |
| Humidity Range                                                                                                                                                                                                                                                                                                                                                                                    | 10-90% noncondensing            | 10-90% noncondensing                    | 10-100% condensing (FTA only)   |
| Mounting                                                                                                                                                                                                                                                                                                                                                                                          | FTA Tray                        | FTA Tray                                | Remote Enclosure <sup>(3)</sup> |
| Corrosion Resistance                                                                                                                                                                                                                                                                                                                                                                              | G1 or G3 <sup>(4)</sup>         | G1 or G3 <sup>(4)</sup>                 | GX                              |
| <p>(1) The RHMUX is configured into the TPS PM system as a standard LLMUX, and may be used in systems with Release 300 or greater.</p> <p>(2) The IOP scans one or both remote FTAs every 4 seconds.</p> <p>(3) The RHMUX remote multiplexer FTA is designed to mount in a NEMA-4 or NEMA-4X enclosure to withstand harsh environmental conditions.</p> <p>(4) Depending on corrosion option.</p> |                                 |                                         |                                 |

## 6.29. Analog Output IOP Comparison

| Function<br>IOP Models                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | AO (8 points)<br>MC-PAOX03                                                     | AO (16 points)<br>MU-PAOY22                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------------|
| IOP Configuration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | AO                                                                             | AO_16                                          |
| Number of Channels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 8                                                                              | 16                                             |
| Smallest ORU <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | IOP                                                                            | IOP                                            |
| Redundancy <sup>(2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Yes                                                                            | Yes                                            |
| Redundancy Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Outputs Electrically Isolated via Field Replaceable Relay Switch Module on FTA | Parallel Outputs -- Solid-State Switch in IOPs |
| Redundancy Bias <sup>(3)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Yes                                                                            | No                                             |
| Output Condition on IOP failure <sup>(4)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Configurable                                                                   | Unpowered                                      |
| Output Condition on PMM failure <sup>(5)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Configurable                                                                   | Configurable                                   |
| Single Channel Failure Robustness <sup>(6)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | High                                                                           | Medium                                         |
| External Connection Check <sup>(7)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Yes                                                                            | Yes                                            |
| Standby Manual <sup>(8)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Yes                                                                            | Yes                                            |
| Supports Direct Landing of HART Signals                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | No                                                                             | Yes                                            |
| <p>(1) The Optimal Replaceable Unit (ORU) is the object that can be replaced on a failure that minimally impacts the operation of the system. The ORU is generally an item that can be replaced in the field using a minimum number of tools. In many cases the item is plug replaceable such as the IOP.</p> <p>(2) Failure detection coverage for the redundancy option is equivalent.</p> <p>(3) In a redundant configuration, the primary is a "preferred" primary. System availability is slightly increased when the primary IOP is the "preferred" Primary. Servicing of the FTA switching module can be performed without disturbing the process when the IOP is the "preferred" primary.</p> <p>(4) The output state upon failure of the AO8 IOP is configurable to either <b>Hold</b> or <b>Unpower</b> the output. AO16 outputs are always set to <b>Unpowered</b> upon failure of the IOP.</p> <p>(5) The output state upon failure of the PMM for both AO8 and AO16 IOPs is configurable to either <b>Hold</b> or <b>Unpower</b> the output.</p> <p>(6) Channel robustness is different in the two module types. The AO8 provides individual channel output circuitry including individual output power systems and individual DAC output circuits. The AO16 provides one power supply and one DAC per IOP. Individual AO16 outputs are controlled using sample and hold circuitry.</p> <p>(7) Point level failures are detected by both AO8 and AO16 IOPs. Both IOPs can detect if the output is being correctly propagated to the field (i.e., wires are connected).</p> <p>(8) The Standby Manual is an optional unit which handles 8 outputs. The AO16 provides a Standby manual function by using two AO8 standby manual units connected into the AO16 FTA.</p> |                                                                                |                                                |

### 6.30. Digital Input IOP Comparison

| Function<br>IOP Models                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DI (32 points)<br>MU-PDIX02 | DI (32 points)<br>MU-PDIY22 | DI SOE (32 points)<br>MU-PDIS12 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|---------------------------------|
| Number of Channels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 32                          | 32                          | 32                              |
| IOP Configuration <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | DI                          | DI                          | DISOE                           |
| Maximum Input Voltage @ FTA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 250 V ac/dc                 | 30 Vdc                      | 250 V ac/dc                     |
| Smallest ORU <sup>(2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2 Channels                  | IOP                         | 2 Channels                      |
| Redundancy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | No                          | Yes                         | Yes                             |
| <p>(1) The DI24V is configured into the TPS PM system as a standard DI IOP. This permits using the DI24 V IOP in systems on releases prior to R500. Any PM system requiring only 24 Volt Digital Inputs can use the DI24 V IOP.</p> <p>(2) The Optimal Replaceable Unit (ORU) is the object that can be replaced on a failure that minimally impacts the operation of the system. The ORU is generally an item that can be replaced in the field using a minimum number of tools. In many cases the item is plug replaceable such as the IOP.</p> |                             |                             |                                 |

## 6.31. Digital Output IOP Comparison

| Function<br>IOP Models                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | DO (16 points)<br>MU-PDOX02 | DO (32 points)<br>MU-PDOY22                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------------------------------------------------------------------------------------------|
| IOP Configuration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | DO                          | DO_32                                                                                                   |
| Number of Channels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 16                          | 32                                                                                                      |
| Smallest ORU <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1 Channel                   | IOP                                                                                                     |
| Redundancy <sup>(2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | No                          | Yes                                                                                                     |
| Redundancy Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Solid-state switch in IOP   | Solid-state switch in IOP                                                                               |
| Relay Minimum Load current Relay FTA)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 100 ma                      | 10 ma                                                                                                   |
| Standby Manual Supported                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Yes                         | No                                                                                                      |
| Output Overload Protection <sup>(3)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Fuses on FTA per channel    | <ul style="list-style-type: none"> <li>• Fuses on 24 Vdc FTA</li> <li>• No fuse on relay FTA</li> </ul> |
| Contact Bounce Suppression-Relay FTA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Always Installed            | Configurable via Jumper                                                                                 |
| Galvanic Output Isolation - Relay FTA <sup>(4)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | per Channel                 | per Channel                                                                                             |
| Galvanic Output Isolation - SS FTA <sup>(4)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | per Channel                 | no per channel isolation                                                                                |
| Galvanic Output Isolation <sup>(4)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | per Channel                 | per 16 Channels                                                                                         |
| Output Condition on IOP Failure <sup>(5)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Configurable                | Unpowered                                                                                               |
| Output Condition on PMM Failure <sup>(6)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Configurable                | Configurable                                                                                            |
| Output Readback Check <sup>(7)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Yes                         | Yes                                                                                                     |
| Number of FTAs Supported <sup>(8)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 5 (See Below)               | 2 (Direct & Relay)                                                                                      |
| <p>(1) The Optimal Replaceable Unit (ORU) is the object that can be replaced on a failure that minimally impacts the operation of the system. The ORU is generally an item that can be replaced in the field using a minimum number of tools. In many cases the item is plug replaceable such as the IOP.</p> <p>(2) Readback check coverage for the redundancy option is not equivalent. See Output Readback Check.</p> <p>(3) Compression-type relay FTA for DO-32 has 1 fuse per 2 points. Screw-type relay FTA for DO-32 has 1 fuse per 8 points. Current overload protection for the DO16 is provided on a per channel basis based on the particular FTA used.</p> <p>(4) All Outputs are galvanically isolated from system common.</p> <p>(5) The output state upon failure of both the DO16 and DO32 IOP is configurable to either <b>Hold</b> or <b>Unpower</b> the output. The DO32 outputs are set to <b>Unpowered</b> when the on-board power regulator (5 V) has failed.</p> <p>(6) The output state upon failure of the PMM (or APMM or HPMM or EHPPM) for both DO16 and DO32 IOPs is configurable to either <b>Hold</b> or <b>Unpower</b> the output.</p> <p>(7) The DO32 performs register readback check on the IOP. The DO16 performs actual output readback check including the FTA and FTA cable.</p> <p>(8) DO16 FTA types are: 120 Vac Electro-Mechanical Relay; 240 Vac Electro-Mechanical Relay; 24 Vdc @100 ma Non-Isolated; 20-200 Vdc Solid State; 3-30 Vdc Solid State; 120/240 Vac Solid State; 31-200 Vdc Solid State.</p> |                             |                                                                                                         |

## 6.32. IOP/FTA Compatibility Matrix

| IOP Model Number | FTA Model Number | Description                         | Red | CE Mark | Term Type <sup>(6)</sup> | Circuits | Size <sup>(1)</sup> |
|------------------|------------------|-------------------------------------|-----|---------|--------------------------|----------|---------------------|
| <b>MC-PAIH03</b> |                  | <b>High Level Analog Input</b>      | √   | □       |                          | 16       |                     |
|                  | MU-TAIH02        | HLAI/STI                            |     |         | C                        | 16       | A                   |
|                  | MU-TAIH12        | HLAI /STI Redundant                 | □   |         | C                        | 16       | B                   |
|                  | MU-TAIH52        | HLAI/STI Redundant                  | □   |         | S                        | 16       | B                   |
|                  | MU-TAIH03        | HLAI                                |     | □       | C                        | 16       | A                   |
|                  | MU-TAIH13        | HLAI Redundant                      | □   | □       | C                        | 16       | B                   |
|                  | MU-TAIH53        | HLAI Redundant                      | □   | □       | S                        | 16       | B                   |
|                  | MU-TAIH22        | Enhanced Power HLA I /STI           | □   |         | C                        | 16       | B                   |
|                  | MU-TAIH23        | Enhanced Power HLA I                | □   | □       | C                        | 16       | B                   |
|                  | MU-TAIH62        | Enhanced Power HLA I /STI           | □   |         | S                        | 16       | B                   |
|                  | MU-GAIH13        | GI/IS - Aux. Out (4041B)            | □   | □       | C <sup>(3)</sup>         | 16       | B                   |
|                  | MU-GAIH83        | GI/IS - Aux. Out (4041B)            | □   | □       | CP <sup>(3)</sup>        | 16       | B                   |
|                  | MU-GAIH14        | GI/IS - Aux. & Hi V Out (4041P)     | □   | □       | C <sup>(3)</sup>         | 16       | B                   |
|                  | MU-GAIH84        | GI/IS - Aux. & Hi V Out (4041P)     | □   | □       | CP <sup>(3)</sup>        | 16       | B                   |
|                  | MU-GAIH22        | GI/IS - Aux. Current Out (4041B)    | □   | □       | C <sup>(3)</sup>         | 16       | B                   |
|                  | MU-GAIH92        | GI/IS - Aux. Current Out (4041B)    | □   | □       | CP <sup>(3)</sup>        | 16       | B                   |
| <b>MU-PSTX03</b> |                  | <b>Smart Xmtr Int. - Multi-Var.</b> | □   | □       |                          | 16       |                     |
|                  | MU-TAIH02        | HLAI /STI                           |     |         | C                        | 16       | A                   |
|                  | MU-TAIH12        | HLAI/STI Redundant                  | □   |         | C                        | 16       | B                   |
|                  | MU-TAIH52        | HLAI/STI Redundant                  | □   |         | S                        | 16       | B                   |
|                  | MU-TAIH22        | Enhanced Power HLA I/STI            | □   |         | C                        | 16       | B                   |
|                  | MU-TAIH62        | Enhanced Power HLA I/STI            | □   |         | S                        | 16       | B                   |
|                  | MU-TSTX03        | STI                                 |     | □       | C                        | 16       | A                   |
|                  | MU-TSTX13        | STI Redundant                       | □   | □       | C                        | 16       | B                   |
|                  | MU-TSTX53        | STI Redundant                       | □   | □       | S                        | 16       | B                   |
|                  | MU-GAIH13        | GI/IS - Aux. Out (4041B)            | □   | □       | C <sup>(3)</sup>         | 16       | B                   |

**NOTE:** The footnotes are located at the end of the table.

(Continued)

**IOP / FTA Compatibility Matrix (continued)**

| IOP Model Number          | FTA Model Number | Description                                     | Red | CE Mark | Term Type <sup>(6)</sup> | Circuits          | Size <sup>(1)</sup> |
|---------------------------|------------------|-------------------------------------------------|-----|---------|--------------------------|-------------------|---------------------|
| <b>MU-PSTX03 (cont'd)</b> | MU-GAIH83        | GI/IS - Aux. Out (4041B)                        | ☐   | ☐       | CP <sup>(3)</sup>        | 16                | B                   |
|                           | MU-GAIH14        | GI/IS - Aux. & Hi V Out (4041P)                 | ☐   | ☐       | C <sup>(3)</sup>         | 16                | B                   |
|                           | MU-GAIH84        | GI/IS - Aux. & Hi V Out (4041P)                 | ☐   | ☐       | CP <sup>(3)</sup>        | 16                | B                   |
|                           | MU-GAIH22        | GI/IS - Aux. Current Out (4041B)                | ☐   | ☐       | C <sup>(3)</sup>         | 16                | B                   |
|                           | MU-GAIH92        | GI/IS - Aux. Current Out (4041B)                | ☐   | ☐       | CP <sup>(3)</sup>        | 16                | B                   |
| <b>MU-PAIL02</b>          |                  | <b>Low Level Analog Input</b>                   |     | ☐       |                          | 8                 |                     |
|                           | MU-TAIL02        | Low Level Analog Input                          |     |         | C                        | 8                 | B                   |
|                           | MU-TAIL03        | Low Level Analog Input                          |     | ☐       | C                        | 8                 | B                   |
| <b>MU-PLAM02</b>          |                  | <b>Low Level Analog Input Mux.</b>              |     | ☐       |                          | 32                |                     |
|                           | MU-TAMR03        | LLMUX FTA RTD <sup>(2)</sup>                    |     | ☐       | C                        | 16                | B                   |
|                           | MU-TAMT03        | LLMUX FTA RTD <sup>(2)</sup>                    |     | ☐       | C                        | 16                | B                   |
|                           | MU-TAMT13        | LLMUX FTA TC w/ Remote CJR <sup>(2)</sup>       |     | ☐       | C                        | 16                | B                   |
| <b>MU-PRHM01</b>          |                  | <b>Remote Hardened Mux.</b>                     |     | ☐       |                          | 32                |                     |
|                           | MU-GRPA01        | Intrinsically Safe Power Adapter <sup>(7)</sup> |     | ☐       | C <sup>(3)</sup>         | 16                | A                   |
|                           | MU-TRPA01        | Non-Incendive Power Adapter <sup>(7)</sup>      |     | ☐       | C                        | 16                | B                   |
|                           | MC-GRMT01        | Remote FTA <sup>(7)</sup>                       |     | ☐       | C                        | 16                | 12.5 x 12.5 in.     |
| <b>MU-PSDX02</b>          |                  | <b>Serial Device Interface</b>                  |     | ☐       |                          | 16 <sup>(5)</sup> |                     |
|                           | MU-TSDM02        | SDI - Manual / Auto Station IF <sup>(2)</sup>   |     | ☐       | C                        | 1                 | A                   |
|                           | MU-TSDT02        | SDI - Toledo Weigh Cell IF <sup>(2)</sup>       |     | ☐       | DB25                     | 1                 | A                   |
|                           | MU-TSDU02        | SDI - UDC6000 IF <sup>(2)</sup>                 |     | ☐       | C                        | 1                 | A                   |

(Continued)



**IOP / FTA Compatibility Matrix (continued)**

| <b>IOP Model Number</b> | <b>FTA Model Number</b> | <b>Description</b>                                                  | <b>Red</b> | <b>CE Mark</b> | <b>Term Type<sup>(6)</sup></b> | <b>Circuits</b>   | <b>Size<sup>(1)</sup></b> |
|-------------------------|-------------------------|---------------------------------------------------------------------|------------|----------------|--------------------------------|-------------------|---------------------------|
| <b>MU-PSIM11</b>        |                         | <b>Serial Interface</b>                                             |            | ☐              |                                | 32 <sup>(5)</sup> |                           |
|                         | MU-TSIA12               | SI - Allen Bradley PLC-2/3/5 IF <sup>(2)</sup>                      |            | ☐              | DB25                           | 1                 | A                         |
|                         | MU-TSIM12               | SI - Modbus IF <sup>(2)</sup>                                       |            | ☐              | DB25 or C                      | 1                 | A                         |
| <b>MC-PAOX03</b>        |                         | <b>Analog Output (8 Outputs)</b>                                    | ☐          | ☐              |                                | 8                 |                           |
|                         | MU-TAOX02               | AO                                                                  |            | ☐              | C                              | 8                 | A                         |
|                         | MU-TAOX12               | AO Redundant                                                        | ☐          | ☐              | C                              | 8                 | B                         |
|                         | MU-TAOX52               | AO Redundant                                                        | ☐          | ☐              | S                              | 8                 | B                         |
|                         | MU-GAOX02               | GI/IS - AO (4045C)                                                  |            | ☐              | C <sup>(3)</sup>               | 8                 | B                         |
|                         | MU-GAOX72               | GI/IS - AO (4045C)                                                  |            | ☐              | CP <sup>(3)</sup>              | 8                 | B                         |
|                         | MU-GAOX12               | GI/IS - AO Redundant (4045C)                                        | ☐          | ☐              | C <sup>(3)</sup>               | 8                 | B                         |
|                         | MU-GAOX82               | GI/IS - AO Redundant (4045C)                                        | ☐          | ☐              | CP <sup>(3)</sup>              | 8                 | B                         |
| <b>MU-PAOY22</b>        |                         | <b>Analog Output (16 Outputs)</b>                                   | ☐          | ☐              |                                | 16                |                           |
|                         | MU-TAOY22               | AO16 Redundant w/ Stby Man.                                         | ☐          | ☐              | C                              | 16                | B                         |
|                         | MU-TAOY52               | AO16 Redundant w/ Stby Man.                                         | ☐          | ☐              | S                              | 16                | B                         |
|                         |                         |                                                                     |            |                |                                |                   |                           |
|                         |                         |                                                                     |            |                |                                |                   |                           |
|                         | MU-THAO11               | AO16 Redundant w/ Stby Man. and HART <sup>®</sup>                   | ☐          | ☐              | C                              | 16                | B                         |
|                         | MU-GHAO11               | GI/IS – AO16 Redundant (4046P) w/ HART <sup>®</sup> , w/o Stby Man. | ☐          | ☐              | C                              | 16                | B                         |

(Continued)

**IOP / FTA Compatibility Matrix (continued)**

| IOP Model Number          | FTA Model Number | Description                          | Red                      | CE Mark                  | Term Type <sup>(6)</sup> | Circuits | Size <sup>(1)</sup> |
|---------------------------|------------------|--------------------------------------|--------------------------|--------------------------|--------------------------|----------|---------------------|
| <b>MU-PDIX02</b>          |                  | <b>Digital Input</b>                 |                          | <input type="checkbox"/> |                          | 32       |                     |
| <b>MU-PDIS12</b>          |                  | <b>Digital Input SOE</b>             | <input type="checkbox"/> | <input type="checkbox"/> |                          | 32       |                     |
|                           | MU-TDID12        | DI 24 Vdc                            | <input type="checkbox"/> | <input type="checkbox"/> | C                        | 32       | C                   |
|                           | MU-TDID52        | DI 24 Vdc                            | <input type="checkbox"/> | <input type="checkbox"/> | S                        | 32       | C                   |
|                           | MU-TDID72        | DI Packaged 24 Vdc                   |                          |                          | RS                       | 32       | C                   |
|                           | MU-TDIA12        | DI Isolated 120 Vac                  | <input type="checkbox"/> | <input type="checkbox"/> | C                        | 32       | C                   |
|                           | MU-TDIA52        | DI Isolated 120 Vac                  | <input type="checkbox"/> | <input type="checkbox"/> | S                        | 32       | C                   |
|                           | MU-TDIA72        | DI Pckgd. Isolated 120 Vac           |                          |                          | RS                       | 32       | C                   |
|                           | MU-TDIA22        | DI 240 Vac                           | <input type="checkbox"/> | <input type="checkbox"/> | C                        | 32       | C                   |
|                           | MU-TDIA62        | DI 240 Vac                           | <input type="checkbox"/> | <input type="checkbox"/> | S                        | 32       | C                   |
| <b>MU-PDIS12 (cont'd)</b> | MU-GDID12        | GI/IS - DI (4016)                    | <input type="checkbox"/> | <input type="checkbox"/> | C <sup>(3)</sup>         | 32       | B                   |
|                           | MU-GDID82        | GI/IS - DI (4016)                    | <input type="checkbox"/> | <input type="checkbox"/> | CP <sup>(3)</sup>        | 32       | B                   |
|                           | MU-GDID13        | GI/IS - DI Solid-State Relays (4013) | <input type="checkbox"/> | <input type="checkbox"/> | C <sup>(3)</sup>         | 32       | B                   |
|                           | MU-GDID83        | GI/IS - DI Solid-State Relays (4013) | <input type="checkbox"/> | <input type="checkbox"/> | CP <sup>(3)</sup>        | 32       | B                   |

(Continued)

**IOP / FTA Compatibility Matrix (continued)**

| IOP Model Number | FTA Model Number | Description                        | Red                      | CE Mark                  | Term Type <sup>(6)</sup> | Circuits | Size <sup>(1)</sup> |
|------------------|------------------|------------------------------------|--------------------------|--------------------------|--------------------------|----------|---------------------|
| <b>MU-PDIY22</b> |                  | <b>Digital Input 24 V Only</b>     | <input type="checkbox"/> | <input type="checkbox"/> |                          | 32       |                     |
|                  | MU-TDIY22        | DI 24 Vdc Only                     | <input type="checkbox"/> | <input type="checkbox"/> | C                        | 32       | B                   |
|                  | MU-TDIY62        | DI 24 Vdc Only                     | <input type="checkbox"/> | <input type="checkbox"/> | S                        | 32       | B                   |
| <b>MU-PPIX02</b> |                  | <b>Pulse Input</b>                 |                          | <input type="checkbox"/> |                          | 8        |                     |
|                  | MU-TPIX12        | Pulse Input                        |                          | <input type="checkbox"/> | C                        | 8        | B                   |
|                  | MU-TPIX52        | Pulse Input                        |                          | <input type="checkbox"/> | S                        | 8        | B                   |
| <b>MU-PDOX02</b> |                  | <b>Digital Output (16 Outputs)</b> |                          | <input type="checkbox"/> |                          | 16       |                     |
|                  | MU-TDON12        | DO 24 Vdc, Nonisolated             |                          |                          | C                        | 16       | B                   |
|                  | MU-TDON52        | DO 24 Vdc, Nonisolated             |                          |                          | S                        | 16       | B                   |
|                  | MU-TDOD13        | DO 3-30 Vdc, Solid State           |                          |                          | C                        | 16       | B                   |
|                  | MU-TDOD53        | DO 3-30 Vdc, Solid State           |                          | <input type="checkbox"/> | S                        | 16       | B                   |
|                  | MU-TDOD14        | DO 3-30 Vdc, Solid State           |                          | <input type="checkbox"/> | C                        | 16       | B                   |
|                  | MU-TDOD54        | DO 3-30 Vdc, Solid State           |                          | <input type="checkbox"/> | S                        | 16       | B                   |
|                  | MU-TDOD23        | DO 31-200 Vdc, Solid State         |                          | <input type="checkbox"/> | C                        | 16       | B                   |
|                  | MU-TDOD63        | DO 31-200 Vdc, Solid State         |                          | <input type="checkbox"/> | S                        | 16       | B                   |
|                  | MU-TDOA13        | DO 120/240 Vac, Solid State        |                          | <input type="checkbox"/> | C                        | 16       | B                   |
|                  | MU-TDOA53        | DO 120/240 Vac, Solid State        |                          | <input type="checkbox"/> | S                        | 16       | B                   |
|                  | MU-TDOR12        | DO120 Vac/125 Vdc Relay            |                          | <input type="checkbox"/> | C                        | 16       | B                   |
|                  | MU-TDOR52        | DO120 Vac/125 Vdc Relay            |                          | <input type="checkbox"/> | S                        | 16       | B                   |
|                  | MU-TDOR22        | DO 240 Vac/125 Vdc Relay           |                          | <input type="checkbox"/> | C                        | 16       | B                   |
|                  | MU-TDOR62        | DO 240 Vac/125 Vdc Relay           |                          | <input type="checkbox"/> | S                        | 16       | B                   |

(Continued)

**IOP / FTA Compatibility Matrix (continued)**

| IOP Model Number          | FTA Model Number | Description                             | Red | CE Mark | Term Type <sup>(6)</sup> | Circuits | Size <sup>(1)</sup> |
|---------------------------|------------------|-----------------------------------------|-----|---------|--------------------------|----------|---------------------|
| <b>MU-PDOX02 (cont'd)</b> | MU-GDOL12        | GI/IS - DO w/ line fault dect.(4023)    |     | ☐       | C <sup>(3)</sup>         | 16       | B                   |
|                           | MU-GDOL82        | GI/IS - DO w/ line fault dect.(4023)    |     | ☐       | CP <sup>(3)</sup>        | 16       | B                   |
|                           | MU-GDOD12        | GI/IS - DO (4021)                       |     | ☐       | C <sup>(3)</sup>         | 16       | B                   |
|                           | MU-GDOD82        | GI/IS - DO (4021)                       |     | ☐       | CP <sup>(3)</sup>        | 16       | B                   |
|                           | MU-GLFD02        | GI/IS DO Combiner Panel                 |     | ☐       | N/A                      | 32       | A                   |
| <b>MU-PDOY22</b>          |                  | <b>Digital Output (32 Outputs)</b>      | ☐   | ☐       |                          | 32       |                     |
|                           | MU-TDOY22        | Digital Output 32, 24 Vdc               | ☐   | ☐       | C                        | 32       | B                   |
|                           | MU-TDOY62        | Digital Output 32, 24 Vdc               | ☐   | ☐       | S                        | 32       | B                   |
|                           | MU-TDOY23        | Digital Output 32, Relay <sup>(4)</sup> | ☐   | ☐       | C                        | 16       | B                   |
|                           | MU-TDOY63        | Digital Output 32, Relay <sup>(4)</sup> | ☐   | ☐       | S                        | 16       | B                   |
|                           |                  | <b>Misc. / Multiple Use FTAs</b>        |     |         |                          |          |                     |
|                           | MU-TLPA02        | LLMUX, SI, SDI Power Adapter            |     | ☐       | C                        | 2        | A                   |
|                           | MU-TDPR02        | DI Power Distribution FTA               |     | ☐       | S                        | 12       | A                   |
|                           | MU-GPRD02        | GI/IS Power Distribution FTA            |     | ☐       | N/A                      | 12       | A                   |
|                           | MU-GMAR52        | GI/IS — Marshalling Panel               |     | ☐       | S                        | 16       | B                   |

- (1) Length: A = 15.24 cm/6.0 in.  
B = 30.73 cm/12.1 in.  
C = 46.228 cm/18.2 in.
- (1) Width: All FTAs except GI/IS FTAs = 12.065 cm/4.75 in.  
All GI/IS FTAs = 12.446 cm/4.90 in.  
MU/MC-TAIL03 = 13.335 cm/5.25 in.
- (2) Requires Power Adapter FTA.
- (3) Terminals are on top of the GI/IS modules.
- (4) One FTA supports up to 16 circuits. When 17-32 circuits are used, 2 FTAs are required. Bridge cable MU-KBFT01 or MU-KBFT02 is required to connect the two FTAs.
- (5) Number of Circuits denotes number of logical connections.
- (6) For nongalvanically isolated FTAs, the terminal connector types are compression (C), nonremovable screw (S), and removable screw (RS). For galvanic isolation type FTAs, the terminal connector types are compression (C), and crimp pin (CP). The Marshalling Panel has nonremovable screw (S) terminals.
- (7) The MC-GRMT01 is a remotely mountable Field Termination for Thermocouple inputs. Two of these FTAs can be connected to a single Power Adapter (MU-GRPA01 or MU-TRPA01) depending on the hazardous environment. The Power Adapter is, in turn, connected to the IOP (MU-PRHM01).

## 7. Model Numbers

| Description                                                                                                              | Uncoated Model Number | Coated Model Number (see note) |
|--------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------------|
| <b>I/O Processors</b>                                                                                                    |                       |                                |
| High Level Analog Input Processor (16 Inputs)                                                                            | n/a                   | MC-PAIH03                      |
| Smart Transmitter Interface (Multivariable) Processor (16 Inputs)                                                        | MU-PSTX03             | MC-PSTX03                      |
| Serial Device Interface Processor (16 Points/Port)                                                                       | MU-PSDX02             | MC-PSDX02                      |
| Serial Interface Processor (16 Points/Port)                                                                              | MU-PSIM11             | MC-PSIM11                      |
| Low Level Analog Input Processor (8 Inputs)                                                                              | MU-PAIL02             | MC-PAIL02                      |
| Low Level Analog Input Multiplexer Processor (32 Inputs)                                                                 | MU-PLAM02             | MC-PLAM02                      |
| Remote Hardened Multiplexer IOP (32-Points)                                                                              | MU-PRHM01             | MC-PRHM01                      |
| Pulse Input Processor (8 Inputs)                                                                                         | MU-PPIX02             | MC-PPIX02                      |
| Analog Output Processor (8 Outputs)                                                                                      | n/a                   | MC-PAOX03                      |
| Analog Output 16 Processor (16 Outputs)                                                                                  | n/a                   | MC-PAOY22                      |
| Digital Input Processor (32 Inputs)                                                                                      | MU-PDIX02             | MC-PDIX02                      |
| Digital Input Processor for Sequence of Events (32 Inputs)                                                               | MU-PDIS12             | MC-PDIS12                      |
| Digital Input 24 Vdc Processor (32 Inputs)                                                                               | MU-PDIY22             | MC-PDIY22                      |
| Digital Output Processor (16 Outputs)                                                                                    | MU-PDOX02             | MC-PDOX02                      |
| Digital Output 32 Processor (32 Outputs)                                                                                 | MU-PDOY22             | MC-PDOY22                      |
| Blank Filler Plate for I/O Slot                                                                                          | MU-PFPX01             | n/a                            |
| I/O Link Extender Pair Main Location                                                                                     | MU-IOLM02             | MC-IOLM02                      |
| I/O Link Extender Pair Remote Location                                                                                   | MU-IOLX02             | MC-IOLX02                      |
| Long Distance I/O Link Extender Pair                                                                                     | MU-ILDX03             | MC-ILDX03                      |
| I/O Link Extender Shroud (EC)                                                                                            | MU-ILES01             | n/a                            |
| <b>NOTE:</b> MC model numbers indicate conformally coated boards. All IOPs are available conformally coated (MC models). |                       |                                |

(Continued)

**Model Numbers (continued)**

|                                                                                      |                                       |           |
|--------------------------------------------------------------------------------------|---------------------------------------|-----------|
| <b>FTA I/O Cables (Telephone Connector* Version)</b>                                 |                                       |           |
| FTA I/O Cable (5 m)                                                                  |                                       | MU-KFTA05 |
| FTA I/O Cable (10 m)                                                                 |                                       | MU-KFTA10 |
| FTA I/O Cable (15 m)                                                                 |                                       | MU-KFTA15 |
| FTA I/O Cable (20 m)                                                                 |                                       | MU-KFTA20 |
| FTA I/O Cable (25 m)                                                                 |                                       | MU-KFTA25 |
| FTA I/O Cable (30 m)                                                                 |                                       | MU-KFTA30 |
| FTA I/O Cable (35 m)                                                                 |                                       | MU-KFTA35 |
| FTA I/O Cable (40 m)                                                                 |                                       | MU-KFTA40 |
| FTA I/O Cable (45 m)                                                                 |                                       | MU-KFTA45 |
| FTA I/O Cable (50 m)                                                                 |                                       | MU-KFTA50 |
| Shielded FTA I/O Cables (lengths, xx, same as MU-KFTAxx)                             |                                       | MU-KFTSxx |
| FTA I/O Bridge Cable, 0.5 meter                                                      | To combine two 16 pt. MU-TDOY63 relay | MU-KBFT01 |
| FTA I/O Bridge Cable, 2.0 meter                                                      | FTAs for 32-pt. MU-PDOY22 DO IOP      | MU-KBFT02 |
| <b>LLAI MUX, Serial Device Interface, or Serial I/F Twisted Pair Cables</b>          |                                       |           |
| Twisted Pair Cable with Shield (Local Cabinet Use)                                   |                                       | MU-KLAM00 |
| Four-Conductor Cable with Shield - 18 gauge (76 m/250 ft.)                           |                                       | MU-KLX076 |
| Four-Conductor Cable with Shield- 18 gauge (152 m/500 ft.)                           |                                       | MU-KLX152 |
| Four-Conductor Cable with Shield - 18 gauge (305 m/1000 ft.)                         |                                       | MU-KLX305 |
| Four-Conductor Outdoor Cable with Armor and Shield - 12 gauge (305 m/1000 ft.)       |                                       | MU-KLO305 |
| LLMUX (TC) Remote CJR Cable (45 m/150 ft.)                                           |                                       | MU-KRCJ00 |
| * For DIN-style FTAs, Cables, and File Options, see the <i>Site Planning</i> manual. |                                       |           |

**Model Numbers (continued)**

| Description                                                                                                                                                                                                                     | Uncoated Model Number | Coated Model Number |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------|
| <b>Field Termination Assemblies<br/>(Phone Connector Style* - Compression Terminals)</b>                                                                                                                                        |                       |                     |
| High Level Analog Input/STI FTA (16 Inputs)                                                                                                                                                                                     | MU-TAIH02             | MC-TAIH02           |
| High Level Analog Input/STI FTA for Redundancy (16 Inputs) **                                                                                                                                                                   | MU-TAIH12             | MC-TAIH12           |
| High Level Analog Input FTA (16 Inputs) (CE Mark)                                                                                                                                                                               | MU-TAIH03             | MC-TAIH03           |
| High Level Analog Input FTA for Redundancy (16 Inputs) (CE Mark) **                                                                                                                                                             | MU-TAIH13             | MC-TAIH13           |
| Smart Transmitter Interface FTA (16 Inputs) (CE Mark)                                                                                                                                                                           | MU-TSTX03             | MC-TSTX03           |
| Smart Transmitter Interface FTA for Redundancy (16 Inputs) (CE Mark) **                                                                                                                                                         | MU-TSTX13             | MC-TSTX13           |
| Enhanced Power High Level /STI Analog Input FTA (16 Inputs) **                                                                                                                                                                  | MU-TAIH22             | MC-TAIH22           |
| Enhanced Power High Level Analog Input FTA (16 Inputs) (CE Mark)**                                                                                                                                                              | MU-TAIH23             | MC-TAIH23           |
| Low Level Analog Input FTA (8 Inputs)                                                                                                                                                                                           | MU-TAIL02             | MC-TAIL02           |
| Low Level Analog Input FTA (8 Inputs) (CE Mark)                                                                                                                                                                                 | MU-TAIL03             | MC-TAIL03           |
| Low Level Analog Input Multiplexer RTD FTA (16 Inputs)                                                                                                                                                                          | MU-TAMR03             | MC-TAMR03           |
| Low Level Analog Input Multiplexer TC FTA (16 Inputs)                                                                                                                                                                           | MU-TAMT03             | MC-TAMT03           |
| Low Level Analog Input Multiplexer TC FTA with Remote CJR (16 Inputs)                                                                                                                                                           | MU-TAMT13             | MC-TAMT13           |
| RHMUX Remote FTA                                                                                                                                                                                                                |                       | MC-GRMT01           |
| RHMUX GI/IS Power Adapter                                                                                                                                                                                                       | MU-GRPA01             | MC-GRPA01           |
| RHMUX GI/NI Power Adapter                                                                                                                                                                                                       | MU-TRPA01             | MC-TRPA01           |
| RHMUX NEMA 4 Enclosure (Painted Carbon Steel)                                                                                                                                                                                   | MU-CMSC03             |                     |
| RHMUX NEMA 4X Enclosure (Stainless Steel)                                                                                                                                                                                       | MU-CMSS03             |                     |
| LLMUX, SDI, SI Power Adapter                                                                                                                                                                                                    | MU-TLPA02             | MC-TLPA02           |
| Pulse Input FTA (8 Inputs)                                                                                                                                                                                                      | MU-TPIX12             | MC-TPIX12           |
| Analog Output FTA (8 Outputs)                                                                                                                                                                                                   | MU-TAOX02             | MC-TAOX02           |
| Analog Output FTA for Redundancy (8 Outputs) **                                                                                                                                                                                 | MU-TAOX12             | MC-TAOX12           |
| Analog Output 16 FTA (16 Outputs), w/StbyMan<br>(use ONLY w/ MU-PAOY22)**                                                                                                                                                       | MU-TAOY22             | MC-TAOY22           |
| Analog Output 16 FTA (16 Outputs), w/StbyMan and HART® connector<br>(use ONLY w/ MU-PAOY22)**                                                                                                                                   | MU-THAO11             | MC-THAO11           |
| GI/IS Analog Output 16 FTA (16 Outputs), w/o StbyMan, w/HART®<br>connector<br>(use ONLY w/ MU-PAOY22)**                                                                                                                         | MU-GHAO11             | MC-GHAO11           |
| Digital Input Isolated 120 Vac FTA (32 Inputs)                                                                                                                                                                                  | MU-TDIA12             | MC-TDIA12           |
| Digital Input Isolated 240 Vac FTA (32 Inputs)                                                                                                                                                                                  | MU-TDIA22             | MC-TDIA22           |
| Digital Input 24 Vdc FTA (32 Inputs)                                                                                                                                                                                            | MU-TDID12             | MC-TDID12           |
| Digital Input 24 Vdc FTA (32 Inputs) (use ONLY w/ MU-PDIY22)**                                                                                                                                                                  | MU-TDIY22             | MC-TDIY22           |
| Digital Output 120/240 Vac Solid-State FTA (16 Outputs)                                                                                                                                                                         | MU-TDOA13             | MC-TDOA13           |
| Digital Output 3-30 Vdc Solid-State FTA (16 Outputs)                                                                                                                                                                            | MU-TDOD13             | MC-TDOD13           |
| Digital Output 3-30 Vdc Solid-State FTA (16 Outputs) (CE Mark)                                                                                                                                                                  | MU-TDOD14             | MC-TDOD14           |
| Digital Output 31-200 Vdc Solid-State (16 Outputs)                                                                                                                                                                              | MU-TDOD23             | MC-TDOD23           |
| Digital Output 24 Vdc, 100 ma Nonisolated FTA (16 Outputs)                                                                                                                                                                      | MU-TDON12             | MC-TDON12           |
| Digital Output 120 Vac/125 Vdc Relay FTA (16 Outputs)                                                                                                                                                                           | MU-TDOR12             | MC-TDOR12           |
| Digital Output 240 Vac/125 Vdc Relay FTA (16 Outputs)                                                                                                                                                                           | MU-TDOR22             | MC-TDOR22           |
| Digital Output 24 Vdc FTA (32 Outputs) (use ONLY w/ MU-PDOY22)**                                                                                                                                                                | MU-TDOY22             | MC-TDOY22           |
| Digital Output Relay FTA (16 Outputs) (use two w/ MU-PDOY22)**                                                                                                                                                                  | MU-TDOY23             | MC-TDOY23           |
| <p>* For DIN-style FTAs, Cables and File Options, See the <i>Site Planning</i> manual.</p> <p>** These FTAs can be used for single or redundant applications.</p> <p>All FTAs are available conformally coated (MC-models).</p> |                       |                     |

**Model Numbers (continued)**

| Description                                                                                                                                                                                                                      | Uncoated Model Number | Coated Model Number |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------|
| <b>Field Termination Assemblies<br/>(Phone Connector* Style with Screw Terminals)</b>                                                                                                                                            |                       |                     |
| High Level Analog Input/STI FTA (16 Inputs)**                                                                                                                                                                                    | MU-TAIH52             | MC-TAIH52           |
| High Level Analog Input FTA (16 Inputs) (CE Mark)**                                                                                                                                                                              | MU-TAIH53             | MC-TAIH53           |
| Smart Transmitter Interface FTA for Redundancy (16 Inputs) (CE Mark)**                                                                                                                                                           | MU-TSTX53             | MC-TSTX53           |
| Enhanced Power High Level Analog Input/STI FTA (16 Inputs)**                                                                                                                                                                     | MU-TAIH62             | MC-TAIH62           |
| Pulse Input FTA (8 Inputs)                                                                                                                                                                                                       | MU-TPIX52             | MC-TPIX52           |
| Analog Output FTA (8 Outputs)**                                                                                                                                                                                                  | MU-TAOX52             | MC-TAOX52           |
| Analog Output 16 FTA (16 Outputs), w/StbyMan<br>(use ONLY w/ MU-PAOY22)**                                                                                                                                                        | MU-TAOY52             | MC-TAOY52           |
| Digital Input Isolated 120 Vac FTA (32 Inputs)                                                                                                                                                                                   | MU-TDIA52             | MC-TDIA52           |
| Digital Input Isolated 120 Vac FTA -Packaged (32 Inputs)                                                                                                                                                                         | MU-TDIA72             | MC-TDIA72           |
| Digital Input Isolated 240 Vac FTA (32 Inputs)                                                                                                                                                                                   | MU-TDIA62             | MC-TDIA62           |
| Digital Input 24 Vdc FTA (32 Inputs)                                                                                                                                                                                             | MU-TDID52             | MC-TDID52           |
| Digital Input 24 Vdc FTA -Packaged, without plug-in isolators (32 Inputs)                                                                                                                                                        | MU-TDID72             | MC-TDID72           |
| Digital Input 24 Vdc FTA (32 Inputs) (use ONLY w/ MU-PDIY22)**                                                                                                                                                                   | MU-TDIY62             | MC-TDIY62           |
| Digital Output 120/240 Vac Solid-State FTA (16 Outputs)                                                                                                                                                                          | MU-TDOA53             | MC-TDOA53           |
| Digital Output 3-30 Vdc Solid-State FTA (16 Outputs)                                                                                                                                                                             | MU-TDOD53             | MC-TDOD53           |
| Digital Output 3-30 Vdc Solid-State FTA (16 Outputs) (CE Mark)                                                                                                                                                                   | MU-TDOD54             | MC-TDOD54           |
| Digital Output 31-200 Vdc Solid-State (16 Outputs)                                                                                                                                                                               | MU-TDOD63             | MC-TDOD63           |
| Digital Output 5-200 Vdc Solid State (16 Outputs)                                                                                                                                                                                | MU-TDOD62             | MC-TDOD62           |
| Digital Output 24 Vdc, 100 ma Nonisolated FTA (16 Outputs)                                                                                                                                                                       | MU-TDON52             | MC-TDON52           |
| Digital Output 120 Vac/125 Vdc Relay FTA (16 Outputs)                                                                                                                                                                            | MU-TDOR52             | MC-TDOR52           |
| Digital Output 240 Vac/125 Vdc Relay FTA (16 Outputs)                                                                                                                                                                            | MU-TDOR62             | MC-TDOR62           |
| Digital Output 24 Vdc FTA (32 Outputs) (use ONLY w/ MU-PDOY22)**                                                                                                                                                                 | MU-TDOY62             | MC-TDOY62           |
| Digital Output Relay FTA (16 Outputs) (use two w/ MU-PDOY22)**                                                                                                                                                                   | MU-TDOY63             | MC-TDOY63           |
| <b>Field Termination Assemblies for Serial Device Interface and Serial Interface</b>                                                                                                                                             |                       |                     |
| Serial Device Interface FTA for Toledo Scale (8142)                                                                                                                                                                              | MU-TSDT02             | MC-TSDT02           |
| Serial Device Interface FTA for Manual/Auto Station                                                                                                                                                                              | MU-TSDM02             | MC-TSDM02           |
| <p>* For DIN-style FTAs, Cables and File Options, See the <i>Site Planning</i> manual.</p> <p>** These FTAs can be used for single or redundant applications.</p> <p>All FTAs are available conformally coated (MC- models).</p> |                       |                     |





**Model Numbers (continued)**

| Description                                                                                     | Uncoated Model Numbers | Coated Model Number |
|-------------------------------------------------------------------------------------------------|------------------------|---------------------|
| <b>Power Systems Including, or Upgradeable to, System Battery Backup</b>                        |                        |                     |
| Redundant Power System with Mounting (20 A)                                                     | MU-PSRX04              | MC-PSRX04           |
| Single Power System with Mounting (20 A)                                                        | MU-PSSX04              | MC-PSSX04           |
| Redundant Power System with System Battery Backup Mounting (20 A)                               | MU-PSRB04              | MC-PSRB04           |
| HPM Power System (20 A) Upgrade Kit (upgrade from MU/MC-PSxx03 only)                            | MU-ZPSR04              | MC-ZPSR04           |
| <b>Harsh Environment Option</b>                                                                 |                        |                     |
| Remote Hardened I/O Encl, 110 Vac, Left (1-7) <sup>(1)</sup>                                    | MU-CBSS01              |                     |
| Remote Hardened I/O Encl, 110 Vac, Right (9-15) <sup>(1)</sup>                                  | MU-CBSS02              |                     |
| Remote Hardened I/O Encl, Left (1-7), No Power Supply                                           | MU-CBSS11              |                     |
| Remote Hardened I/O Encl, Right (9-15), No Power Supply                                         | MU-CBSS12              |                     |
| Remote Hardened I/O Encl, 220 Vac, Left (1-7) <sup>(1)</sup>                                    | MU-CBSS21              |                     |
| Remote Hardened I/O Encl, 220 Vac, Right (9-15) <sup>(1)</sup>                                  | MU-CBSS22              |                     |
| <b>AC-Only Power Systems</b>                                                                    |                        |                     |
| AC-Only Redundant Power Supply 120 Vac (8 A)                                                    | MU-PAR111              |                     |
| AC-Only Redundant Power Supply 240 Vac (8 A)                                                    | MU-PAR211              |                     |
| AC-Only Single Power Supply 120 Vac (8 A)                                                       | MU-PAS111              |                     |
| AC-Only Single Power Supply 240 Vac (8 A)                                                       | MU-PAS211              |                     |
| AC-Only Redundant Power Supply 120 Vac (16 A)                                                   | MU-PAR121              |                     |
| AC-Only Redundant Power Supply 240 Vac (16 A)                                                   | MU-PAR221              |                     |
| AC-Only Single Power Supply 120 Vac (16 A)                                                      | MU-PAS121              |                     |
| AC-Only Single Power Supply 240 Vac (16 A)                                                      | MU-PAS221              |                     |
| AC-Only Power System Cover Plate                                                                | MU-PACP01              |                     |
| <b>24 Vdc Power Distribution</b>                                                                |                        |                     |
| Power Distribution FTA (24 Vdc)                                                                 | MU-TDPR02              | MC-TDPR02           |
| (1) Includes enclosure, power distribution panel, backplane, and 8 A, redundant power supplies. |                        |                     |

| Digital Sense Power Cables                                           | Model Number |
|----------------------------------------------------------------------|--------------|
| Power Distribution (24 Vdc) (5 m)                                    | MU-KDPR05    |
| Power Distribution (24 Vdc) (10 m)                                   | MU-KDPR10    |
| Power Distribution (24 Vdc) (15 m)                                   | MU-KDPR15    |
| Power Distribution (24 Vdc) (20 m)                                   | MU-KDPR20    |
| Power Distribution (24 Vdc) (25 m)                                   | MU-KDPR25    |
| Power Distribution (24 Vdc) (30 m)                                   | MU-KDPR30    |
| Power Distribution (24 Vdc) (35 m)                                   | MU-KDPR35    |
| Power Distribution (24 Vdc) (40 m)                                   | MU-KDPR40    |
| Power Distribution (24 Vdc) (50 m)                                   | MU-KDPR50    |
| CE-Mark Power Distribution (24 Vdc) (lengths, xx, same as MU-KDPRxx) | MU-KSPRxx    |

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