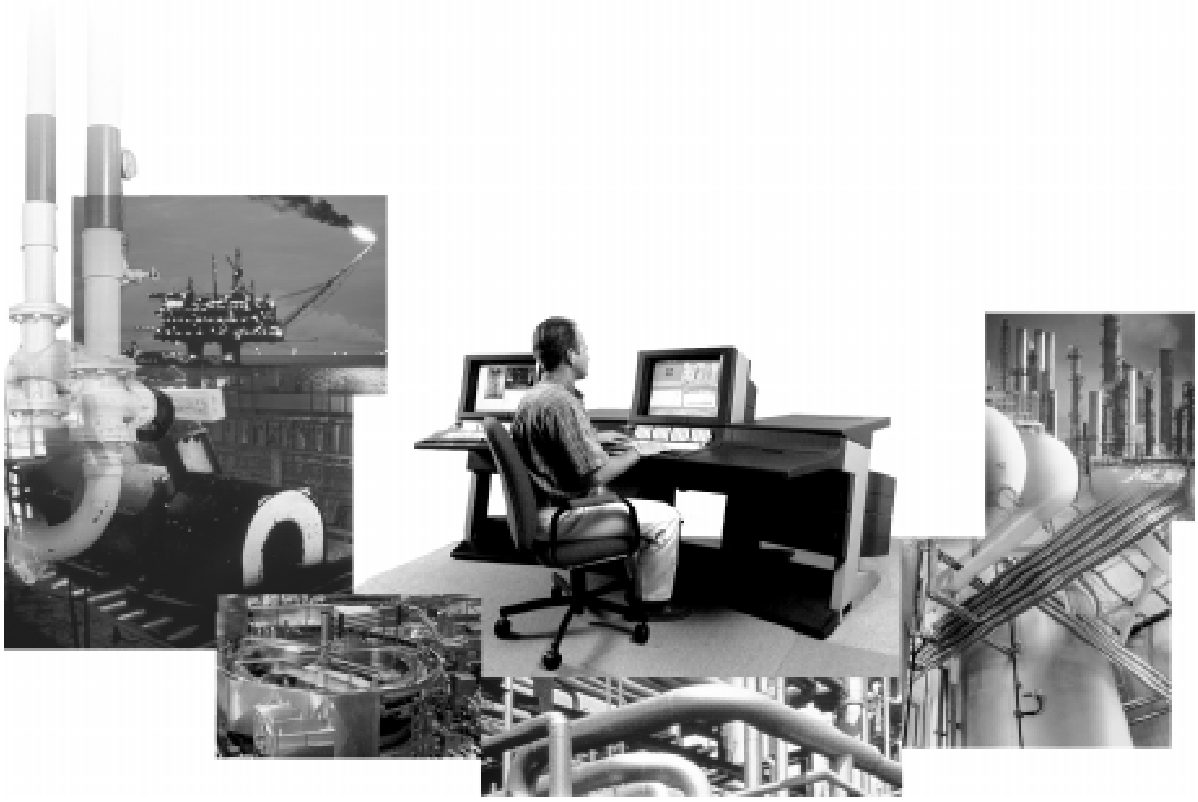
Honeywell

TPS Process Manager I/O

Specification and Technical Data

IO03-500
Release 500
11/97



Total Plant

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, and HPM 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, and HPM 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

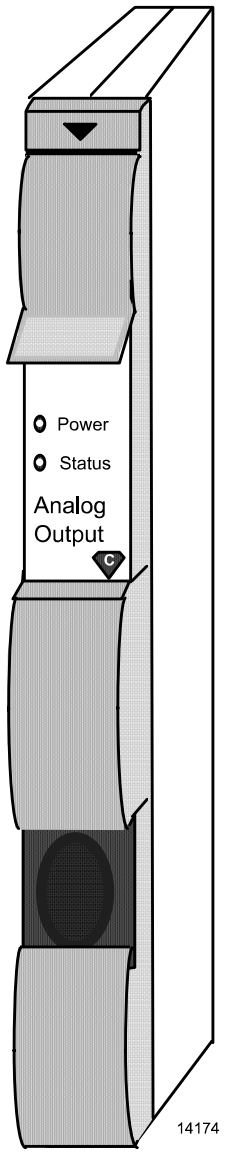


Figure 1 — PM/APM/HPM Input Output Processor

Functional Description

Functional Overview

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

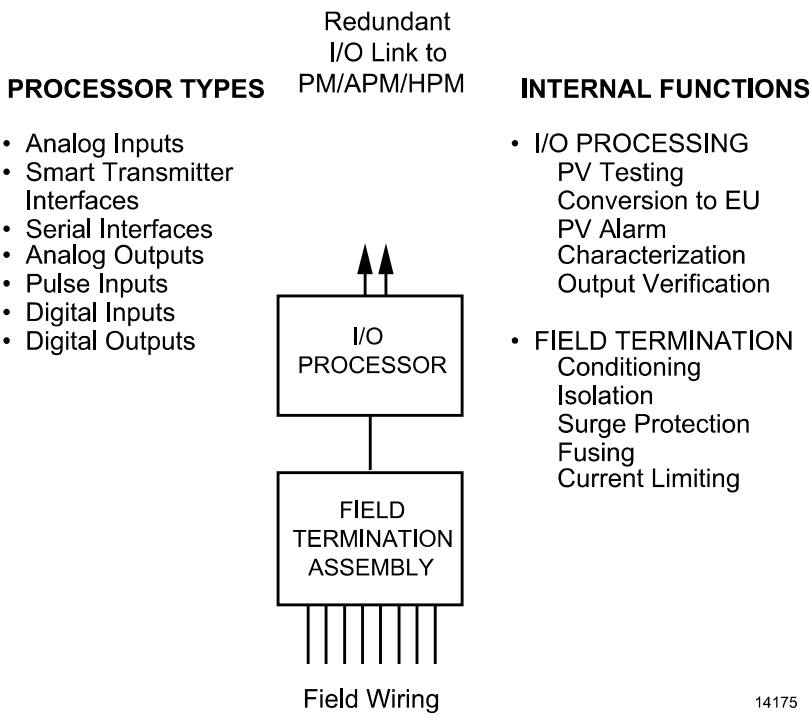


Figure 2 — PM/APM/HPM I/O Functions

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)

* *APM and HPM only*

Any mix of the above I/O processors can be selected for a PM/APM/HPM 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, two levels of ground-fault detection are performed: a low-sensitivity check on every measurement, and a high-sensitivity check once per 4-second scan cycle.

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.

FM, CSA, KEMA, and EC approvals are pending for the RHMUX.

Smart Transmitter Multi-Variable Interface (STI-MV)

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

Each STI-MV processor can communicate bidirectionally 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 controller, the UDC 6000 displays PV, SP, and OP on front panel bar graphs. When digitally integrated with the PM/APM/HPM, the UDC Controller can be configured for the following modes:

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

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

Serial Interface (SI) (APM and HPM 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 and HPM *only*. Each FTA supports one port and up to 16 array points.

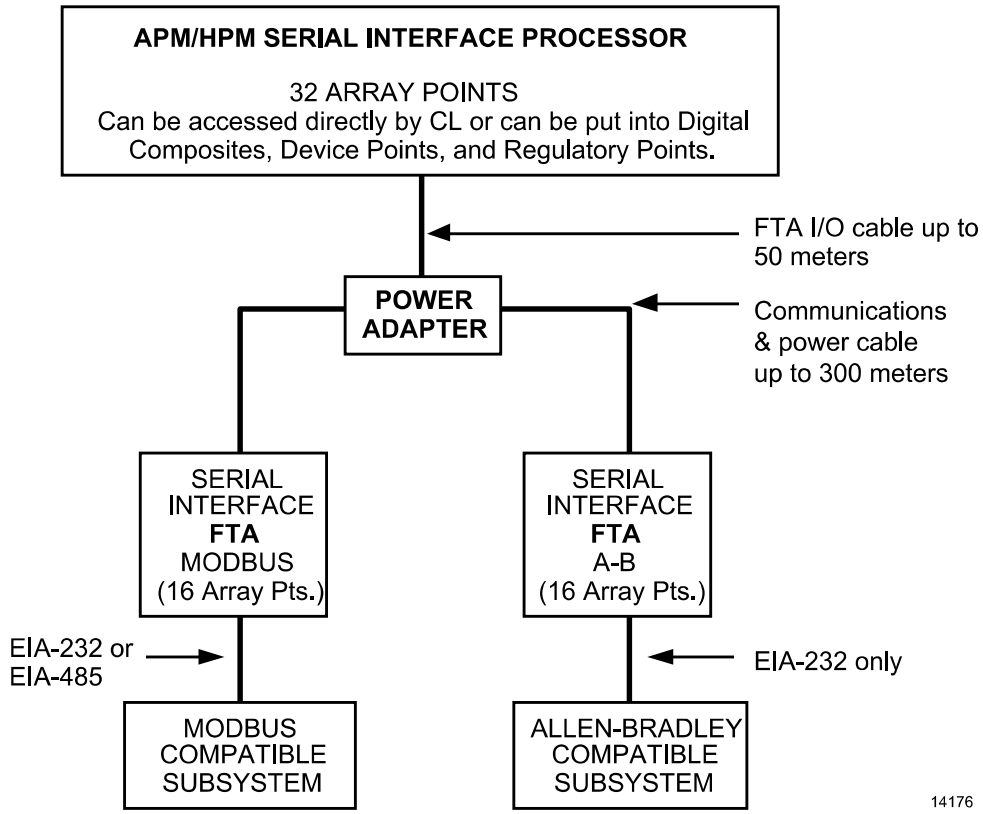


Figure 3 — PM/APM/HPM I/O Functions

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 and HPM 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 and HPM 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 met your specific interfacing requirements. Contact your account manager for more information.

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.

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.

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.

Digital Input Sequence of Events (APM and HPM 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 and HPM *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.

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.

I/O Simulation Option

(APM/HPM only)

The optional I/O Simulator package simulates the functions of the IOPs for the APM and HPM. 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 or HPM 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

Card File Assemblies

A maximum of 40 logical IOPs can be configured per PM, APM, and HPM. A "logical" IOP consists of either a single IOP or a redundant IOP pair). Typical PM, APM, and HPM 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, or HPM 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 (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 files, a single cabinet side can hold up to 40 I/O Processors along with redundant High-Performance Process Manager Modules. Figure 4 shows typical cabinet layouts with redundant HPMs, APMs, and PMs.

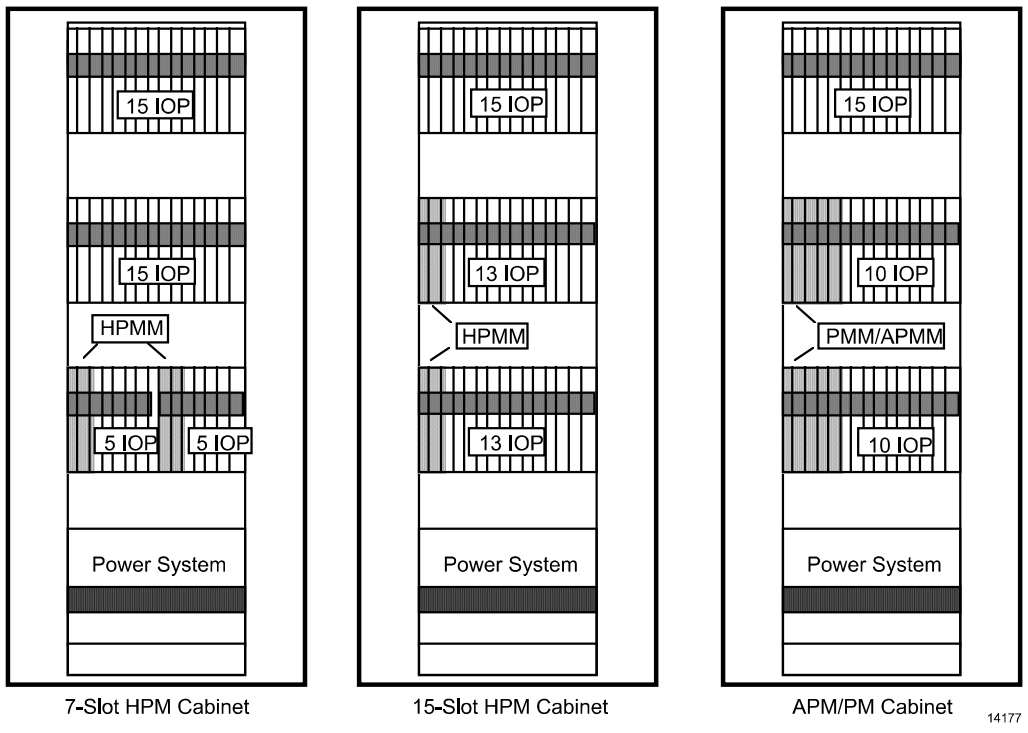


Figure 4 — Typical Cabinets

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.

Options

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, or HPM, 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.

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.

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.

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 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.

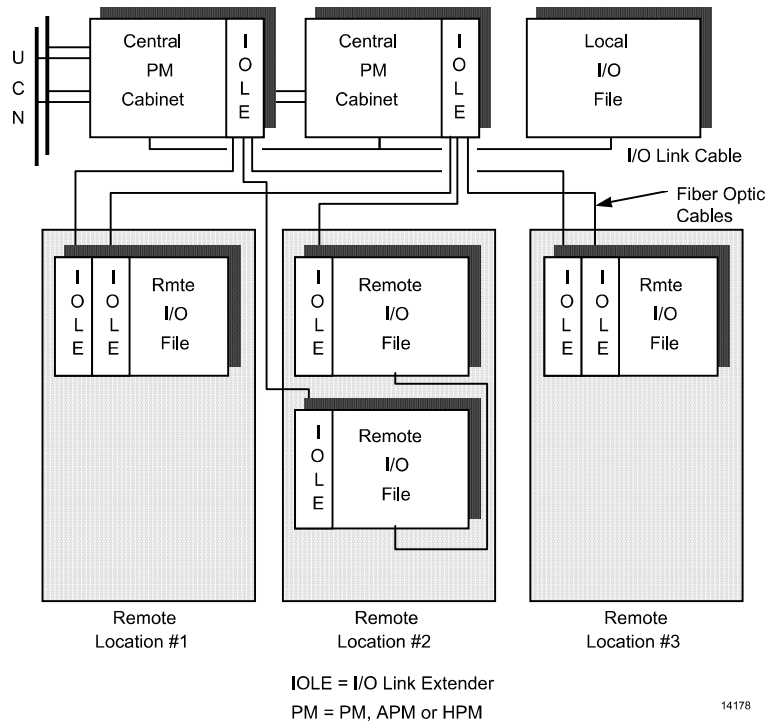


Figure 5 — Fiber Optic Remote I/O

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 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 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 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.

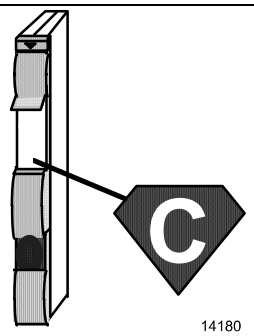


Figure 6 — IOP Conformal Coating Symbol Location

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.

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 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.

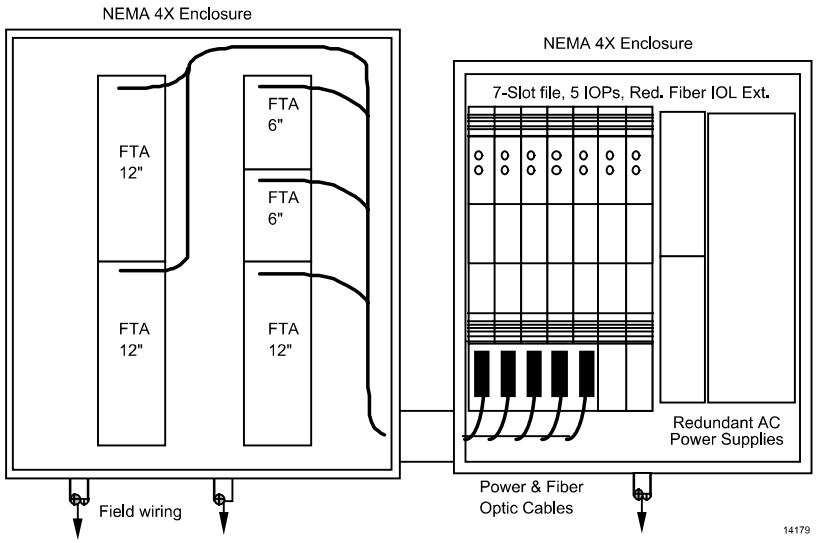


Figure 7 — Remote Hardened I/O Option

European Community (EC) Compliance

The APM and HPM 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, 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, customers must indicate whether or not CE compliance is required. APMMs, HPMMs, 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.

Model Numbers (continued)

Description	Uncoated Model Number	Coated Model Number
Field Termination Assemblies (Phone Connector Style* - Compression Terminals)		
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 (use ONLY w/ MU-PAOY22)**	MU-TAOY22	MC-TAOY22
Analog Output 16 FTA (16 Outputs), w/o StbyMan (use ONLY w/ MU-PAOY22)**	MU-TAOY23	MC-TAOY23
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

* For DIN-style FTAs, Cables and File Options, See the *Site Planning* manual.
** These FTAs can be used for single or redundant applications.
All FTAs are available conformally coated (MC-models).