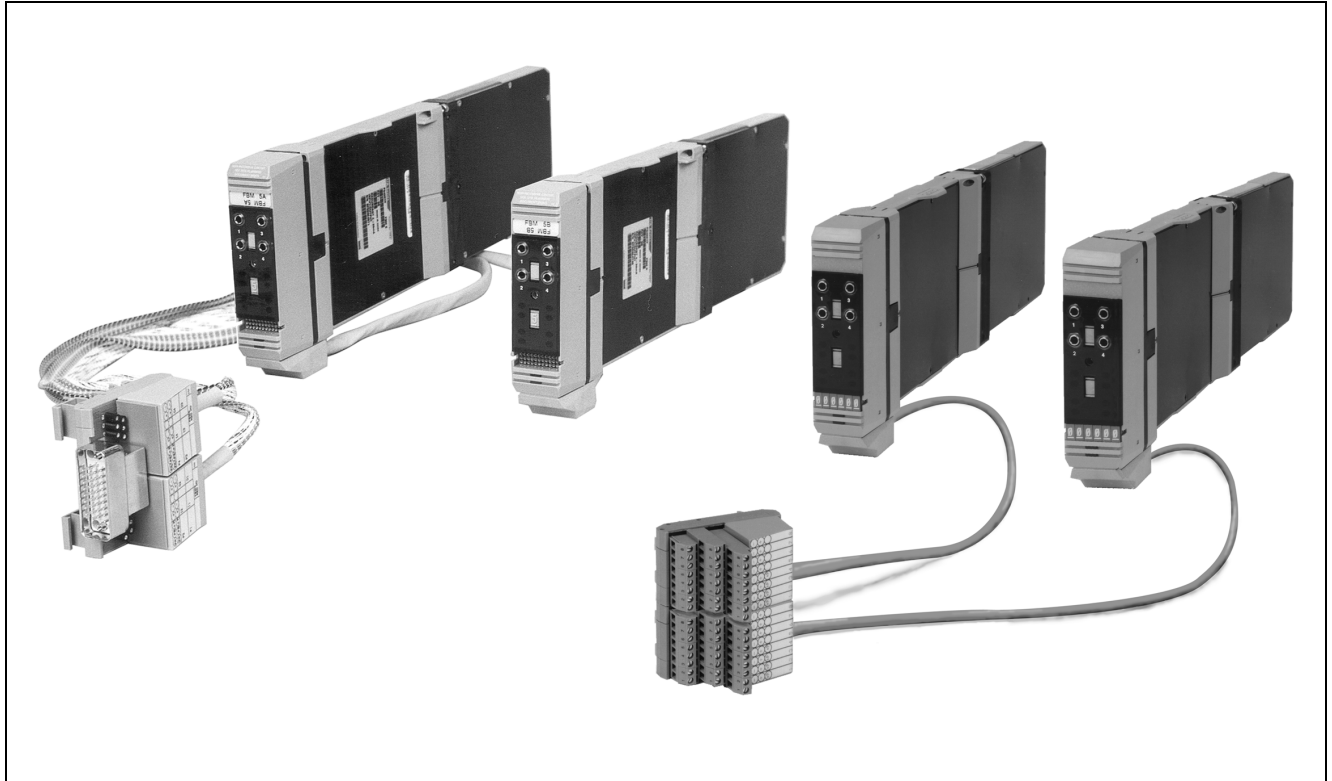


## **I/A Series® Hardware**

### **Redundant 0 to 20 mA I/O Interface (FBM05)**



The Redundant 0 to 20 mA I/O Interface consists of a pair of Fieldbus Modules (FBMs) that contain four 0 to 20 mA dc analog input channels and four 20 mA dc analog output channels. The pair of Fieldbus Modules combine to provide redundancy at the Fieldbus Module level. Field I/O is wired to one common connection block (Figure 1). Each Fieldbus Module independently attempts to hold the output(s) at its specified output value(s), and each independently reports its observed value of the inputs. A special analog input block in the control software validates each input in conjunction with information from the Fieldbus Module.

A special redundant analog output function block, AOCTR, is used for each redundant pair of outputs. The AOCTR block handles output writes and initialization logic for the redundant channels. On each execution cycle of the AOCTR block, identical output writes are sent to both Fieldbus Modules, fully exercising the Fieldbus and the Fieldbus Module logic of each module. When a failure is detected in one of the Fieldbus Modules, its output is driven to 0 mA, and the corresponding channel in the good module automatically continues supplying the proper current to the output current loop. Either Fieldbus Module may be replaced without upsetting field input or output signals to the good module.

Each input channel accepts an analog sensor input such as a 4 to 20 mA transmitter or a self-powered 20 mA source. Each output channel drives an external load and produces a 0 to 20 mA output. Transmitter power from each module is diode OR'd together in the termination cable assembly (TCA) to assure redundant power to either module.

The module performs the signal conversion required to interface the electrical input/output signals from/to the field sensors to/from the redundant Fieldbus. Each module is a non-expandable main type, and independently connects to the redundant Fieldbus. Output channels of the modules are tied together via a special termination cable assembly.

The TCA provides test points that may be used for periodic test and measurement (for example, testing the output voltage of each redundant transmitter power supply). Such periodic testing can increase the statistical availability of the redundant pair of modules.

Pairs of modules may be mounted several different ways, in order of increasing security, to avoid commonality. The more favorable configuration is mounting in different mounting structures (for example, separate bus configuration). Other less desirable configurations place the module pair in the same Y-adapter or mounting structure.

The microprocessor of each module executes the analog I/O application program, plus security routines that validate the health of the FBM. User-configurable security options are stored in battery backed registers. To retain these settings during power outages, battery backup of the FBMs via IPM06 battery backup modules is recommended.

Input channel options include a configurable choice of analog input resolution on a per module basis. Input channel security is enhanced by redundantly powering the input current loop from per channel power supplies in each module of the pair. Test points are provided on the wiring termination cable to allow periodic checking of transmitter power supply voltage, redundant transmitter power supply blocking diodes, and termination cable integrity. Increased availability can be achieved by periodic inspection through the use of these test points.

Configurable options in the Fieldbus Modules for output security include Fail-Safe Action (Hold/Fallback), Analog Output Fail-Safe Fallback Data (on a per channel basis), Fieldbus Fail-Safe Enable, and Fieldbus Fail-Safe Delay Time. The Analog Output Fail-Safe Fallback Data option must be set for 0 mA output. This removes one of the pair of redundant output channels from service for detectable problems such as a module not properly receiving output writes, not passing security tests on FBM microprocessor writes to output registers, failure of internal FBM diagnostics, or FBM watchdog timer time-out. Setting of the Analog Output Fail-Safe Fallback Data option for 0 mA output also minimizes the possibility of a "fail high" result.

The redundancy of the module pair, coupled with high coverage of faults, provides an expected subsystem availability above 0.999974 with yearly test point inspection, and above 0.999996 with quarterly test point inspection. This assumes that the module pair resides in a single 2x8 cell bus, with a non-stop powering system. It also assumes an MTTR of eight hours.

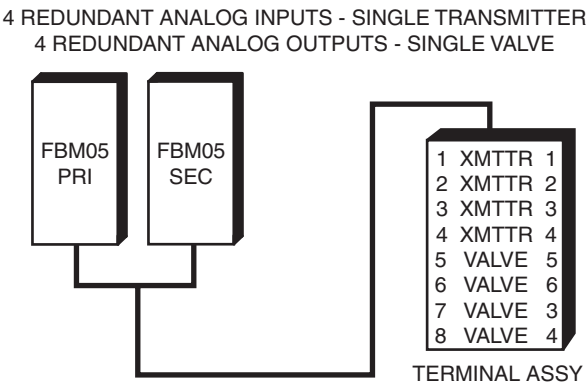


Figure 1. Redundant I/O Configurations

## FUNCTIONAL SPECIFICATIONS

### Common Characteristics

#### POWER REQUIREMENTS (PER FBM)

*Input Voltage (Redundant)*

24 V, ac or dc (nominal)

*Consumption*

10 W (typical)

*Heat Dissipation*

12 W (maximum)

#### ISOLATION

The module withstands, without damage, a potential of 600 V ac applied for one minute between any channel and earth (ground), or between a given channel and any other channel.

#### NOTE

This does not imply that these channels are intended for permanent connection to hazardous voltage circuits. Connection of these channels to voltages greater than 30 V ac or 60 V dc violates electrical safety code requirements and may expose users to electric shock.

#### CONVERSION TIME (SOFTWARE CONFIGURABLE)

See Table 1 (Input Specifications)

#### INPUT CONNECTIONS

Two configurations (see Figure 2)

### Input Channels

#### INPUT

4 isolated and independent redundant channels(a)

#### INPUT RANGE (EACH CHANNEL)

0 to 20.4 mA dc

#### ACCURACY

Externally Powered Transmitter

$\pm 0.25\%$  of span

Module Powered Transmitter

$\pm 0.5\%$  of span

#### COMMUNICATION

Via a redundant Fieldbus

### Output Channels

#### OUTPUT

4 isolated and independent redundant channels(b)

#### OUTPUT RANGE (EACH CHANNEL)

0 to 20.4 mA dc

#### OUTPUT LOAD (MAXIMUM)

735  $\Omega$

#### COMPLIANCE VOLTAGE

18.0 V nominal at 20 mA dc at I/O field terminals

#### ACCURACY

$\pm 0.10\%$  of span (25°C)

#### OUTPUT TEMPERATURE COEFFICIENT

100 ppm/°C

#### COMMUNICATION

Via a redundant Fieldbus

#### SETTLING TIME

100 ms to settle within a 1% band of steady state for a 10 to 90% input step change

#### LINEARITY ERROR

$\pm 0.05\%$  of span

#### RESOLUTION

12 bits

(a) Redundant inputs pairs are connected by a common field I/O connector and therefore, are not isolated from each other.

(b) Redundant output pairs are connected by a common field I/O connector and therefore, are not isolated from each other.

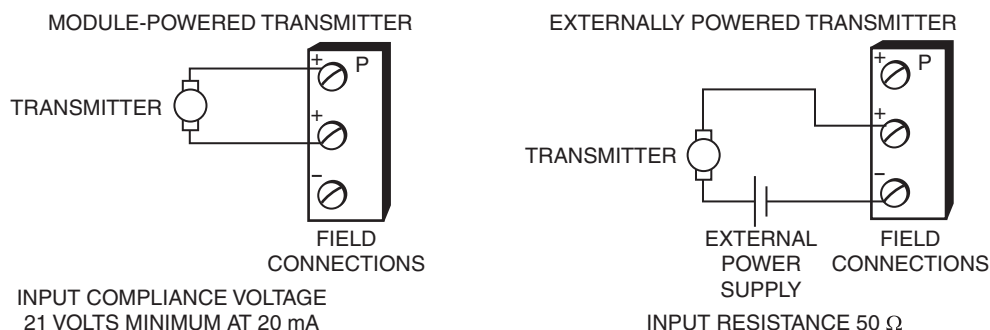


Figure 2. Input Connections

Table 1. Input Specifications

| Conversion Time<br>(Seconds) | Update Time<br>(Milliseconds) | Settling Time(a)<br>(Seconds) | Linearity Error(a)<br>(% of Range) | Resolution (Bits) |
|------------------------------|-------------------------------|-------------------------------|------------------------------------|-------------------|
| 0.1                          | 10                            | 0.25                          | 0.025                              | 12                |
| 0.2                          | 10                            | 0.50                          | 0.015                              | 13                |
| 0.5                          | 25                            | 1.00                          | 0.010                              | 14                |
| 1.0                          | 50                            | 2.00                          | 0.010                              | 15                |

(a) Value settles within a 1% band of steady state for a 10 to 90% input step change.

### ENVIRONMENTAL SPECIFICATIONS(a)

#### Operating

##### TEMPERATURE

0 to 60°C (32 to 140°F)

##### RELATIVE HUMIDITY

5 to 95% (noncondensing)

##### ALTITUDE

-300 to +3,000 m (-1,000 to +10,000 ft)

#### Storage

##### TEMPERATURE

-40 to +70°C (-40 to +158°F)

##### RELATIVE HUMIDITY

5 to 95% (noncondensing)

##### ALTITUDE

-300 to +12,000 m (-1,000 to +40,000 ft)

#### Contamination

Harsh (less than 2000 angstroms of copper corrosion in one month)

(a) The environmental limits of this module may be enhanced by the type of enclosure containing the module. (Refer to the applicable Specification Sheet (PSS) which describes the specific type of enclosure that is to be used.)

### PHYSICAL SPECIFICATIONS

#### Mounting

##### WITH Y-ADAPTER

Installable in the 1x8 Mounting Structure,  
I/A Series Industrial Enclosures and Field  
Enclosure 8

##### WITHOUT Y-ADAPTER

Installable in I/A Series Field Enclosure 4 and the  
1x8 FBM Mounting Structure

#### Mass

1.4 kg (3.08 lb)

#### Indicators (Mounted on Termination Connector)

##### OPERATIONAL STATUS

Red and green light-emitting diodes (LEDs)

#### Field Termination Connections(a)

##### DISCRETE WIRE BLOCK

##### *Input Channels*

12 screw-clamp terminals

##### *Output Channels*

8 screw-clamp terminals

##### *Plug Connector Block*

34-pin connector. Mates with:

- Burndy MSD 34 PM 118  
(plug with bar-type cable clamp)
- Burndy MSD 34 PM 124  
(plug with clam shell hood)
- Burndy MSD 34 PM 824  
(plug with suitcase hood)
- or equivalent

#### Bypass Jack

Built into the termination connector of the output channels. (Accepts a bypass plug from an external 20 mA source).

(a) The discrete wire connector block is available on termination cable assemblies for all enclosures excluding the Field Enclosure 4, and Multiple (Bridged) Industrial Enclosure 32.







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