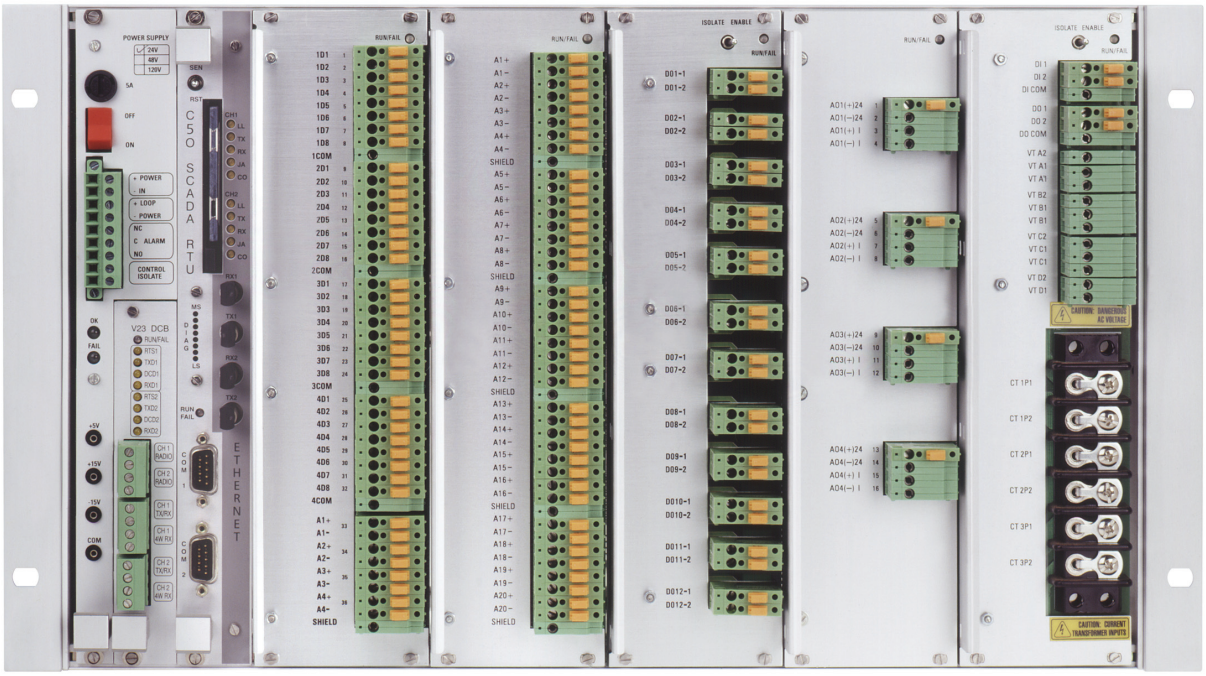
# I/A Series® HARDWARE
**Product Specifications**

invensys
Foxboro®

**PSS 21H-8C6 B4**

## I/A Series® Remote Terminal Unit (RTU)
## RTU50 Input/Output Modules



*The I/A Series® RTU50 product line includes an extensive family of input/output modules that provide connections to a wide range of field devices. From oil and gas applications to electricity monitoring and control, the I/A Series RTU50 provides an I/O solution tailored to the demanding needs of the SCADA user.*

Key features of the I/O modules include:

- Software configurable digital inputs
- High security control output logic boards with check-before-operate control execution
- Configurable output relay combinations as individual paired or multiple relays.

The I/A Series RTU50 family of discrete I/O modules comprises:

- Multiple I/O Module (24 V, 48 V, or 129 V versions)
- 20 Channel Analog Input Module (standard, isolated)
- 4 Analog/32 Digital Input Module (24 V to 129 V selectable via jumper settings)
- 12 Relay Output Module (electrically latched, magnetically latched, or 10 Amp relay version)
- 4 Channel Analog Output Module.

The flexible, modular design of the I/A Series RTU50 allows any combination of these input/output modules within a single Remote Terminal Unit (RTU); thus requirements from a few I/O points to a several hundred can be economically and simply accommodated.

The I/O modules are also designed for easy maintenance. Disconnect links with test points are provided on each side for inputs and outputs; termination boards are removable, allowing logic cards to be withdrawn without disconnecting field wiring; and module operating parameters are available as RTU database points.

The I/O modules meets the spectrum of SCADA discrete I/O requirements that can be user configured to match the application. Whether you need to control a circuit breaker, a transformer, or a flow control valve, measure high frequency Sequence of Events, or simply monitor a limit switch, the RTU50 promotes an economical, reliable, and secure solution.

## FUNCTIONAL DESCRIPTION

### Multiple Input/Output Module

The Multiple I/O Module provides a cost effective method for applications using a combination of status inputs, analog inputs and control outputs.

The Multiple I/O Module combines the technology of the Analog Digital and Digital Output Modules within the one module providing:

- 24 Digital Inputs
- 6 Analog Inputs
- 8 pilot relays outputs
- 24 V, 48 V, or 129 V nominal status input voltage variations.

#### Features

Key features include:

- Removable plug-connected termination board
- RUN/FAIL LED indicator
- Module operating conditions available as RTU database points

- Digital Inputs:
  - 24 software configurable digital inputs
  - Individually configurable chatter filters
  - Digital input bounce elimination circuitry
  - Optical isolation on digital inputs
  - Common voltage inputs
- Analog Inputs:
  - 6 analog inputs
  - Plug-in resistors for current loops
  - 12 bits plus sign analog-to-digital converter
  - ± 2 V dc range
  - Continuous auto input calibration/check
- Control Outputs:
  - 8 independent pilot relays
  - Configurable pulse and latched relays
  - High security control output logic
  - Built-in hardware and software monitoring of control operations
  - Check-before-operate control security
  - Individually configurable fixed and variable output duration.

#### Digital Inputs

The subsystem optically isolates, filters, and protects against surge transients; it also interfaces the contact information to the on-board microprocessor. Digital input circuits employ contact bounce elimination circuitry, which rejects noisy contact transitions until the input signal has been stable for a period of 2 msec. Variants of the module provide customers with a selection of 24 V, 48 V, and 129 V nominal status input voltages.

The 24 digital inputs are grouped into three groups of 8. Each group shares a common terminal which accepts common positive or common negative.

Digital inputs are scanned once every millisecond and may be time tagged for Sequence of Events processing if required. Each of the digital inputs may be individually configured as Accumulators, Momentary Change Detection inputs, Status inputs, or a combination of these. Digital input types may be intermixed within a module. Configuration data determines the treatment of each input.

**Analog Inputs**

The subsystem performs the data sampling and processing for all analog input points. The subsystem provides protection against surge transients and noise, delivering a multiplexed sample to the analog-to-digital converter.

The analog input subsystem consists of an amplifier and an analog-to-digital converter. The circuitry provides a multiplexed sample to the analog-to-digital converter, which converts the signal to a 12-bit plus sign word. These results are then stored in shared memory for access by the I/A Series RTU50 Master Processor Module via the Electrobus interface. Automatic zero drift correction is provided by the on-board microprocessor. Zero and full scale voltage references are available as internal database points, enabling access by the Master Station.

**Digital Outputs**

The digital output subsystem within the Multiple I/O Module provides security and control for all digital outputs. The 8 relays of the Multiple I/O Module are individually isolated contacts.

The subsystem contains source and sink drivers for each relay which may be driven as fixed length pulse, variable length pulse or latched outputs. Configuration data determines the treatment of each relay.

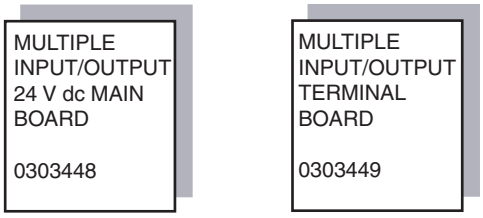
**Two-Pass Operation**

During pass 1, the on-board microprocessor accepts command data from the I/A Series RTU50 Master Processor Module through shared memory. The validity of the command is confirmed and then the hardware is checked on the output driver circuits. If all tests succeed, feedback of the command is sent to the Master Processor Module.

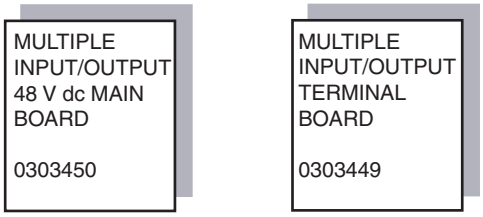
During pass 2, the Master Processor Module sends the execute command and the RTU50 Multiple I/O Module drives the required relays. The RTU50 Multiple I/O Module automatically times the duration of pulse outputs and turns the required relays off.

**Constituent Assemblies**

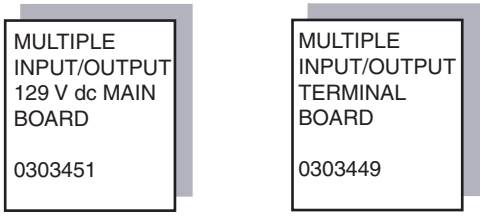
The following board assemblies combine to form the 24 V dc Multiple I/O Module (Part Number SY-0399075).




The following board assemblies combine to form the 48 V dc Multiple I/O Module (Part Number SY-0399076).




The following board assemblies combine to form the 129 V dc Multiple I/O Module (Part Number SY-0399077).



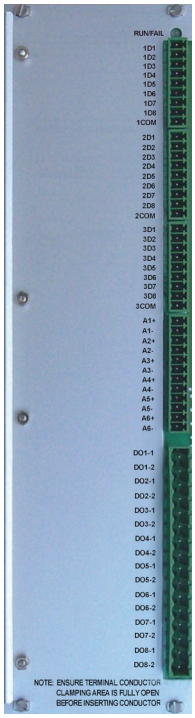



*Figure 1. Multiple I/O Module*

## 20 Channel Analog Input Module

The 20 Channel Analog Input Module provides a cost effective method for gathering a large volume of analog information from the field. It is available with 1 KV isolation on the analog inputs or with non-isolated inputs.

The isolated module utilizes a self-calibrating analog-to-digital converter, which provides accurate 12-bit resolution over wide temperature ranges. In the non-isolated module, calibration values of zero and full scale voltage reference are available as database points.

### Features

Key features include:

- 20 analog inputs
- 12 bits plus sign analog-to-digital converter
- ± 2 V dc ranges
- RUN/FAIL LED indicator
- Plug in current loop resistors that use screw type terminals and are on the field side of isolation links
- Removable plug-connected termination board
- Disconnect links with test points on either side.

### Constituent Assemblies

The following board assemblies combine to form the Standard (Non-Isolated) 20 Channel Analog Input Module (Part Number SY-0399007).

20 CHANNEL ANALOG INPUT BOARD 1 KV STANDARD 0303349

20 CHANNEL ANALOG INPUT NON-ISOLATED TERMINAL BOARD 0303350

The following board assemblies combine to form the Isolated 20 Channel Analog Input Module (Part Number SY-0399071).

20 CHANNEL ANALOG INPUT BOARD 1 KV ISOLATED 0303440

20 CHANNEL ANALOG INPUT TERMINAL BOARD 0303443

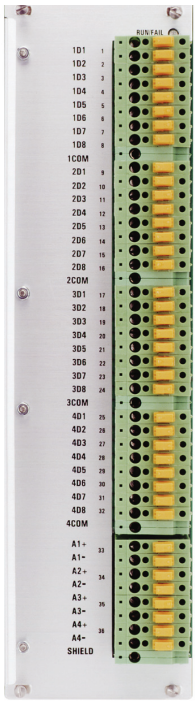



*Figure 2. 20 Channel Analog Input Module Front Panel*

## Analog/Digital Input Modules

The I/A Series RTU50 Analog/Digital Input Modules provide flexible data collection and input monitoring facilities through 32 individually configured digital inputs and four high-resolution (4x12 bit) analog inputs.

The Analog/Digital Input Module has 1 kV isolation on the analog inputs.

The module supports digital inputs over the nominal ranges of 24 V to 48 V and 48 V to 129 V. A jumper for each digital input can be individually set to select either of these ranges. The factory default setting is for 48 V to 129 V operation.

**WARNING**

In this module, the jumpers J3 to J34 must be removed when using digital input voltages in the range 60–129 V (dc) or 72–144 V RMS (ac). Failure to do so may result in permanent damage to the module and possible electric hazard.

The Analog/Digital Input Module has 1 KV isolation on its analog inputs.

### Features

Key features include:

- Removable plug-connected termination board
- 1 KV isolated analog inputs
- Plug in current loop resistors that use screw type terminals and are on the field side of isolation links
- Software configurable digital inputs provide, Status, Momentary Change Detect (MCD), Accumulator (12/24/32 bit), and Sequence of Events (SOE) combinations
- Optical isolation on all digital inputs
- Common voltage inputs (+VE or –VE) that are selectable in groups of eight digital inputs
- Digital input bounce elimination circuitry
- Individually configurable chatter filters
- Disconnect links with test points on either side.

### Module Description

The digital input subsystem processes contact type inputs to the I/A Series RTU50. The module optically isolates, filters, and protects against surge transients; it also interfaces the contact information to the on-board microprocessor.

All digital input circuits employ contact bounce elimination circuitry, which rejects noisy contact transitions until the input signal has been stable for a period of 2 msec.

The analog input subsystem performs the data sampling and processing for all analog input points. The module provides protection against surge transients and noise, delivering a multiplexed sample to the analog-to-digital converter.

### Digital Inputs

The digital inputs are grouped into four groups of eight, with a common terminal for each group. Each group accepts common positive or common negative.

Digital inputs are scanned once every millisecond and may be time tagged for Sequence of Events processing if required. Each of the digital inputs may be individually configured as Accumulators, Momentary Change Detection inputs, Status inputs, or a combination of these. Digital input types may be intermixed within a module.

### Analog Inputs

The isolated module utilizes a self-calibrating analog-to-digital converter, which provides accurate 12-bit resolution over wide temperature ranges. Zero and full scale voltage references are available as internal database points in the non-isolated module.

### Constituent Assemblies

The following board assemblies combine to form the 4 Analog/32 Digital Input Module (24 V to 129 V) (Part number SY-0399161).

| 4 ANALOG/32 DIGITAL INPUT MODULE 24 V to 129 V<br><br>0303480 | 4 ANALOG/32 DIGITAL INPUT TERMINAL BOARD<br><br>0303442 |
|---|---|

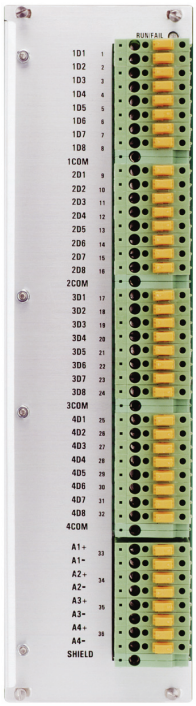



*Figure 3. Analog/Digital Input Module Front Panel*

## 12 Channel Digital Output Modules

Three versions of the output module are available:

- 12 Relay Digital Output Module
- 12 Magnetically Latched Relay Output Module
- 12 10 Amp Relay Output Module.

The I/A Series RTU50 12 Relay Digital Output Modules offer numerous configuration possibilities. Relay outputs can be configured as individual relays, pairs, or multiples in set point combinations. Two-pass operation with built-in hardware checking ensures reliable control over equipment.

### Features

Key features include:

- 12 independent relays
- RUN/FAIL LED indicator
- Relays configurable as ON/OFF (individual), Trip/Close or Raise/Lower (pairs), Digital Set Point (multiples) or Pulse (individual)
- Intelligent high security control output logic boards
- Built-in hardware and software monitoring of all control operations
- Control ISOLATE/ENABLE switch per output module
- Removable plug-connected termination board, which allows the input card to be changed without disconnecting the field wiring
- Disconnect links with test points on either side for each output
- Security control: Check before operating
- Control output duration is individually configurable.

### Module Description

The 12 Relay Digital Output subsystem provides security and control for all digital outputs. The 12 Relay Digital Output Module consists of an on-board microprocessor and security circuits mounted on a logic board with a plug and terminal assembly. The relay outputs are determined by a customer's selection of relay platform boards. Among the available options is a choice between electrically latched relays, magnetically latched relays, and high current (10 Amp) relays.

A control ISOLATE/ENABLE switch on the front panel allows servicing of the controlled equipment without risking remote operation. An external switch can also be wired from the power supply to simultaneously disable all digital output boards.

### Digital Output Subsystem

The digital output subsystem is based on an intelligent output logic board containing relay drivers, an associated relay platform board and a termination board. The 12 Relay Digital Output Module contains source and sink drivers for 12 relays which may be driven as fixed length pulse outputs or variable length pulse outputs.

The 12 Relay Digital Output Module contains an on-board microprocessor with associated RAM and ROM. Configuration data from the I/A Series RTU50 Master Processor Module determines the treatment of each output port by the on-board processor.

### Two-Pass Operation

During pass 1, the on-board microprocessor accepts command data from the I/A Series RTU50 Master Processor Module through shared memory. The validity of the command is confirmed and then the hardware is checked on the output driver circuits. If all tests succeed, feedback of the command is sent to the I/A Series RTU50 Master Processor Module.

During pass 2, the I/A Series RTU50 Master Processor Module sends the execute command and the 12 Relay Digital Output Module drives the required relays. The 12 Relay Digital Output Module automatically times the duration of pulse outputs and turns the necessary relay off.

### Constituent Assemblies

The following board assemblies combine to form the 12 Relay Output Module (Part Number SY-0399008).

The following board assemblies combine to form the 12 Magnetically Latched Relay Output Module (Part Number SY-0399009).

| 12 CHANNEL DIGITAL OUTPUT BOARD | MAG LATCH RELAY PLATFORM | CONTROL OUTPUT TERMINAL BOARD |
|---|---|---|
| 0303383 | 0303386 | 0303355 |

The following board assemblies combine to form the 12 10 Amp Relay Output Module (Part Number SY-0399010).

| 12 CHANNEL DIGITAL OUTPUT BOARD | 10 AMP RELAY OUTPUT PLATFORM | CONTROL OUTPUT TERMINAL BOARD |
|---|---|---|
| 0303383 | 0303360 | 0303355 |

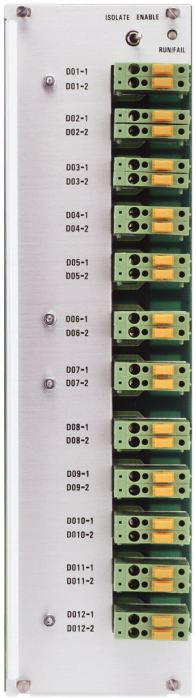



*Figure 4. Output Module's Front Panel*

## 4 Channel Analog Output Module

The module provides four isolated current outputs. Outputs of 4 to 20, 0 to 10 and 0 to 16 mA are independently configurable. Two-pass operation with built-in hardware checking ensures that reliable control of equipment is maintained.

The module provides security and control for all analog outputs. The module consists of an on-board microprocessor, controlling four channels. Each analog output can be scaled independently for the selected output current range as part of the RTU database configuration.

### Features

Key features include:

- Four channel analog output
- 12-bit resolution
- 4 to 20, 0 to 10, and 0 to 16 mA ranges
- Optical isolation of output circuits
- Internal monitoring of external voltage fail and open circuit alarms
- Removable plug-connected termination board which allows removal of the logic card without disconnecting the field wiring
- Disconnect links for each output with test points on each side.

### Optical Isolation

The digital-to-analog converters are serially linked to the rest of the module via optical isolators. Power is supplied from an external source, which results in an electrically isolated interface to the external devices. This design also sustains outputs, even in the event of the RTU or module failing.

### Internal Monitoring

Each analog output has two internal alarm points associated with it. If the external voltage source fails, or the current loop is open circuit to the output, the on-board processor is notified via optically isolated digital inputs. These inputs are then passed to the Master Processor Module, to be made available for

scanning if required by the SCADA Master Station.

An operator can be notified if an analog device has been disconnected from the RTU, or if the external voltage source has failed, enabling problems in the field to be located remotely.

Each output is configurable as 4 to 20, 0 to 10, or 0 to 16 mA. Using 12-bit resolution, it is possible to get up to 4000 steps within the output range.

**Constituent Assemblies**

The following board assemblies combine to form the 4 Channel Analog Output Module (Part Number SY-0399012).

| 4 CHANNEL ANALOG OUTPUT BOARD<br><br>0303342 | ANALOG OUTPUT TERMINAL BOARD<br><br>0303338 |
|---|---|


*Figure 5. 4 Channel Analog Output Module Front Panel*

## MULTIPLE I/O MODULE FUNCTIONAL SPECIFICATIONS

### Multiple I/O Board

24 Status Input, 6 Analog Input, 8 pilot relay. (24 V, 48 V, or 129 V)

**NUMBER OF CHANNELS**

24x digital inputs
6x analog inputs
2x Internal check analog
8x pilot relay control

**PROCESSOR**

Z80 interfaces to Electrobus via dual access memory

**ANALOG INPUTS**

*Input Circuit*
6 differential inputs
*Analog-to-Digital Converter Type*
Sigma-Delta
*Resolution*
12 bits plus sign
*Input Update Rate (Data Age)*
<600 ms
*Input Signal Range*
±2 V dc
*Input Signal Scaling*
Dropping resistor for current inputs or voltage
*Full Scale Range*
±4000 counts (over range ±4095 counts)
*Maximum Error at 25°C and 0 V Common Mode*
±0.1% full scale
*Common Mode Error*
0.01% per Volt to a maximum of ±6 V
*Temperature Error*
0.0016% per °C to Minimum of 0°C
Maximum of 60°C
*Maximum Error Over Temperature and Common Mode Range*
±0.25% full scale
*Differential Mode Rejection*
60 dB minimum at 50/60 Hz
*Differential Mode Voltage Without Damage*
±50 V dc or peak ac

**ANALOG INPUTS (CONT.)**

*Common Mode Reject*
80 dB at 6 V peak, dc to 50/60 Hz balanced input
*Maximum Common Mode Voltage*
Operating within spec ±6 V
Without damage ±50 V 'dc or peak ac
*Reference Voltages*
Zero volts and full scale positive (+1 V)
*Transient Protection*
IEC 60255-4 Class 3
Impulse Voltage Withstand
Common mode 5 KV (input to ground)
Differential mode 5 KV (across input terminals)
High Frequency Disturbance
Common mode 2.5 KV (input to ground)
Differential mode 1 KV (across input terminals)
Fast Transient (IEC 61000-4-4)
2 KV 5 kHz Capacitive Coupling

**DIGITAL INPUTS**

*Input Circuits*
24 per input module grouped in 3 groups of 8
*Input Types*
Any input can be used as: Status, Momentary Change Detect, Sequence of Events, Accumulator
*Circuit Types*
Common return for each group of 8 inputs
Common positive or common negative
*Input Voltage*
24 V, 48 V or 129 V dc from field supply
*Input Current*
5 mA per input (nominal)
*Isolation Type*
Opto-coupler
*Insulation*
2 KV RMS for 1 minute input to frame (ground)

## MULTIPLE I/O MODULE FUNCTIONAL SPECIFICATIONS (CONTINUED)

**DIGITAL INPUTS (CONT.)**

*Transient Protection*

IEEE C37.90-1989
IEC 255-22-4
Impulse Voltage Withstand
Common mode 5 KV (input to frame)
Differential mode 5 KV (input to common return)
High Frequency Disturbance
Common mode 2.5 KV (input to ground)
Differential mode 1 KV (input to common return)
Fast Transient (IEC 61000-4-4)
2 KV 5 kHz Capacitive Coupling

**CONTROL OUTPUTS**

Relays are mounted on the rear of termination board

*Output Types*

Outputs can be configured as: Trip/Close pairs, Raise/Lower pairs, Single Variable Pulse Relay, Latched or Setpoint

*Security*

One or more than one relay energized test
Check before execute
Control to pulse

### Multiple I/O Termination Board

24 V dc, 48 V dc, or 129 V dc with 2 KV ac RMS isolation to chassis. Printed circuit board 261.8 mm x 70 mm attached to frame by screws.

**ANALOG INPUTS**

6 analog Inputs

**STATUS INPUTS**

24 status inputs
3 removable blocks of 9 terminals
1 Terminal per point
1 common terminal per group of 8 inputs
Suppression device across each input to its common

**CONTROL OUTPUTS**

Removable block of 16 terminals
2 Terminals per relay
Terminals sized for 1.5 $mm^2$ wire

**NUMBER OF RELAYS**

Eight

**RELAY COIL CURRENT**

45 mA

**CONTACT ARRANGEMENT**

Two-pole N/O relays with contacts connected in series to boost dc rating (output is single pole)

**CONTACT RATING**

5 A 30 V dc resistive or 250 V ac ($10^5$ operations)
1 A 50 V dc inductive
130 V dc 200 mA L/R 40 msec 30,000 operations

**ISOLATION**

2 KV RMS for 1 minute output to frame
1 KV RMS for 1 minute across open contact
2 KV RMS for 1 minute between outputs

**TRANSIENT PROTECTION**

IEC 60255-4 Class 3
ANSI/IEEE C37.90.1 - 1989

*Impulse Voltage Withstand*

Common mode 2.5 KV (output to frame)
Across output contact 12.5 KV

*High Frequency Disturbance*

Common mode 1 KV (output to frame)

*Fast Transient (IEC 61000-4-4)*

2 KV 5 kHz capacitively coupled

**MONITORS/INDICATORS**

Red/green RUN/FAIL LED

## 20 CHANNEL ANALOG INPUT MODULE (STANDARD) FUNCTIONAL SPECIFICATIONS

### 20 Channel Analog Board (Standard)

**PROCESSOR**

Z80 interfaces to Electrobus via dual access RAM

**ANALOG INPUTS**

*Input Circuit*
20 differential inputs per input modules (Non-isolated)

*Analog-to-digital Converter Type*
Successive approximation

*Resolution*
12 bits plus sign

*Input Update Rate (Data Age)*
<65 ms includes calibration cycle

*Input Signal Range*
±2 V dc

*Input Signal Scaling*
Dropping resistor for current inputs or voltage

*Full Scale Range*
±4000 counts (over range ±4095 counts)

*Maximum Error at 25°C*
±0.1% full scale

*Common Mode Error*
0.01% per Volt to a maximum of ±6 Volt

*Temperature Error*
0.0015% per °C to Minimum of 0°C
Maximum of 60°C

*Maximum Error Over Temperature and Common Mode Range*
±0.25% full scale

*Differential Mode Rejection*
60 dB minimum at 50/60 Hz

*Differential Mode Voltage Without Damage*
±50 V dc or peak ac

### 20 Channel Analog Board (Standard) (Cont.)

*Common Mode Rejection*
80 dB at 6 Volt peak, dc to 50/60 Hz balanced input

*Maximum Common Mode Voltage*
Operating within spec ±6 Volts
Without damage ±50 V dc or peak ac

*Transient Protection*
IEC 60255-4 Class 2

Impulse Voltage Withstand
Common mode 2 KV (input to ground)
Differential mode 1 KV (across input terminals)

High Frequency Disturbance
Common mode 2.5 KV (input to ground)
Differential mode 2.5 KV (across input terminals)

Fast Transient (IEC 61000-4-4)
2 KV 5 kHz Capacitive Coupling

*Reference Voltages*
Zero volts and full scale positive (+1 Volt)

### 20 Channel Analog Terminal Board (Standard and Isolated)

**PRINTED CIRCUIT BOARD**

261.8 mm x 71 mm attached to frame by screws

**TERMINALS**

2 Terminals per point each with test points and isolation link
1 chassis terminal per four input channels with test point
Loop drop resistor and voltage divider terminals mounted on rear side of terminal board.

**MONITORS/INDICATORS**

Red/green RUN/FAIL LED

## 20 CHANNEL ANALOG INPUT MODULE (ISOLATED) FUNCTIONAL SPECIFICATIONS

### 20 Channel Analog Board (Isolated)

**PROCESSOR**

Z80 interfaces to Electrobus via dual access RAM

**ANALOG INPUTS**

*Input Circuit*
20 independently isolated analog inputs

*Analog-to-digital Converter Type*
Sigma Delta

*Resolution*
12 bits plus sign

*Input Update Rate (Data Age)*
<600 ms includes calibration cycle

*Input Signal Range*
±2 V dc

*Input Signal Scaling*
Current loop resistor

*Full Scale Range*
±4000 counts (over range 4095 counts)

*Maximum Error at 25°C*
±0.1% full scale

*Common Mode Error*
0.0001% per Volt to a maximum of 1000 V ac (120 dB)

*Temperature Error*
0.002% per °C to Minimum of 0°C
Maximum of 60°C

*Maximum Error Over Temperature and Common Mode Range*
±0.25% full scale

*Differential Mode Rejection*
60 dB minimum at 60 Hz

*Differential Mode Voltage Without Damage*
±24 V dc or peak ac

**ANALOG INPUTS (CONT.)**

*Common Mode Rejection*
120 dB at 1000 V ac, dc to 60 Hz balanced input

*Maximum Common Mode Voltage*
Operating within spec 1000 V ac RMS

*Transient Protection*
IEC 60255-4 Class 2

Impulse Voltage Withstand
Common mode 2 KV (input to ground)
Differential mode 1 KV (across input terminals)

High Frequency Disturbance
Common mode 2 KV (input to ground)
Differential mode 0.5 KV (across input terminals)

Fast Transient (IEC 61000-4-4)
2 KV 5 kHz Capacitive Coupling

*Reference Voltages*
Auto calibration on individual channels does not require external check voltages.

### 20 Channel Analog Terminal Board (Standard and Isolated)

**PRINTED CIRCUIT BOARD**

261.8 mm x 71 mm attached to frame by screws

**TERMINALS**

2 Terminals per point each with test points and isolation link
1 chassis terminal per four input channels with test point
Loop drop resistor and voltage divider terminals mounted on rear side of terminal board.

**MONITORS/INDICATORS**

Red/green RUN/FAIL LED

## ANALOG/DIGITAL INPUT MODULE (ISOLATED) FUNCTIONAL SPECIFICATIONS

### 4 Analog/32 Digital Input Module

**NUMBER OF CHANNELS**

4x Analog field inputs
32x Status inputs

**PROCESSOR**

Z80 interfaces to Electrobus via dual access RAM

**ANALOG INPUTS**

*Input Circuit*
4 differential inputs per input module

*Analog-to-Digital Converter Type*
Sigma Delta

*Resolution*
12 bits plus sign

*Input Update Rate (Data Age)*
20 ms

*Input Signal Range*
±2 V dc

*Input Signal Scaling*
Dropping resistor for current inputs or voltage

*Full Scale Range*
±4000 counts (overrange 4095 counts)

*Maximum Error at 25°C and 0 V Common Mode*
±0.1% full scale

*Common Mode Error*
0.0001% per Volt to a maximum of 1000 V ac (120 dB)

*Temperature Error*
0.002% per °C to Minimum of 0°C
Maximum of 60°C

*Maximum Error Over Temperature and Common Mode Range*
±0.25% full scale

*Differential Mode Rejection*
60 dB minimum at 60 Hz

*Differential Mode Voltage Without Damage*
±24 V dc or peak ac

*Common Mode Rejection*
120 dB at 1000 Vac, dc to 60 Hz balanced input

**ANALOG INPUTS (CONT.)**

*Maximum Common Mode Voltage*
Operating within spec 1000 V ac

*Reference Voltages*
Auto Calibration on individual channels does not require external check voltages

*Transient Protection*
Impulse Voltage Withstand
- Common mode 2 KV (input to ground)
- Differential mode 1 KV (across input terminals)

High Frequency Disturbance
- Common mode 1 KV (input to ground)
- Differential mode 0.5 KV (across input terminals)

Fast Transient (IEC 61000-4-4)
- 4KV 5KHZ Capacitively Couple
- 2KV 5KHz Direct Injection

**DIGITAL INPUTS**

*Input Circuits*
32 per input module in 4 groups of 8 inputs

*Input Types*
Any input can be used as: Status, Momentary Change Detect, Sequence of Events, Accumulator (1 or 2 inputs per accumulator)

*Circuit Types*
Common return per group of 8 inputs
Common positive or common negative

*Input Voltage*
24 V to 129 V, selected individually per input by jumper setting; factory default range is 48-129 V; field configurable to 24-48 V.

*Input Current*
5 mA per input (nominal)

*Isolation Type*
Opto-coupler

*Insulation*
2 KV RMS for 1 minute input to frame (ground)

## ANALOG/DIGITAL INPUT MODULE (ISOLATED) FUNCTIONAL SPECIFICATIONS (CONTINUED)

**DIGITAL INPUTS (CONT.)**

*Transient Protection*

IEC 60255-22-4

Impulse Voltage Withstand

Common mode 5 KV (input to frame)
Differential mode 5 KV (input to common return)

High Frequency Disturbance

Common mode 2.5 KV (input to ground)
Differential mode 1 KV (input to common return)

Fast Transient (IEC 61000-4-4)

4KV 5KHz capacitively Coupled
2KV 5KHz direct injection

## 4 ANALOG/32 DIGITAL INPUT TERMINATION MODULE (ISOLATED) FUNCTIONAL SPECIFICATIONS

### 4 Analog/32 Digital Input Termination Module (Isolated)

Module withstands 2 KV ac RMS isolation to chassis
Printed circuit board 261.8 mm x 71 mm attached to frame by screws.

**ANALOG INPUTS**

2 Terminals per point each with test points and isolation link
1 Ground terminal with test point
Loop drop resistor and voltage divider terminals mounted on rear side of terminal board.
Suppression device to ground from each input terminal

**STATUS INPUTS**

4 Groups of 8 status inputs
1 Terminal per point each with test points and isolation link
1 Common terminal with test point for each group of 8 inputs
Suppression device across each input to its common

**MONITORS/INDICATORS**

Red/green RUN/FAIL LED

## 12 CHANNEL DIGITAL OUTPUT MODULES FUNCTIONAL SPECIFICATIONS

### 12 Channel Digital Output Module

**PROCESSOR**
Z80 interfaces to Electrobus via dual port memory

**NUMBER OF CHANNELS**
Twelve

**OUTPUT TYPES**
Outputs can be configured as Latched or Pulsed (individual), Trip/Close or Raise/Lower (pairs), or Digital Set Point (2 or more relays).

**SECURITY**
One or more than one relay energized test

### Control Output Termination Module

Printed circuit board 261.8 mm x 71 mm attached to frame by screws

**TERMINALS**
Two terminals per relay with test points and isolation link

**CONTROL ISOLATE**
Switch mounted on front of board

**MONITORS/INDICATORS**
Red/Green RUN/FAIL LED

### Relay Output Platform Module

**NUMBER OF RELAYS**
Twelve

**RELAY COIL CURRENT**
45 mA

**CONTACT ARRANGEMENT**
Two-pole N/O relays with contacts connected in series to boost dc rating (output is single pole)

**CONTACT RATING**
5 A 30 V dc resistive or 240 V ac ($10^{-5}$ operations)
1 A 50 V dc inductive
200 mA 130 V dc L/R 40 msec 30,000 operations

**CONTROLS ISOLATE**
Switch mounted on front of assembly

**ISOLATION**
2 KV RMS for 1 minute output to frame
1 KV RMS for 1 minute across open contact (without transient protection across contact)
2 KV RMS for 1 minute between outputs

### Relay Output Platform Module (Cont.)

**TRANSIENT PROTECTION**
IEC 255-4 Class 3
ANSI/IEEE C37.90.1 - 1989

*Impulse Voltage Withstand*
Common mode 5 KV (output to frame)
Across output contact 2.5 KV

*High Frequency Disturbance*
Common mode 2.5 KV (output to frame)
Between outputs 2.5 KV

*Fast Transient (IEC 61000-4-4)*
2 KV 5 kHz capacitively coupled

### Magnetically Latched Relay Output Platform Module)

**NUMBER OF RELAYS**
Twelve

**RELAY TYPE**
Latching

**RELAY COIL CURRENT**
30 mA

**CONTACT ARRANGEMENT**
Single form A

**CONTACT RATING**
5 A 30 V dc resistive or 250 V ac ($10^{-5}$ operations)
125 V dc 100 mA resistive

**ISOLATION**
2 KV RMS for 1 minute output to frame
1 KV RMS for 1 minute across open contact (without transient protection across contact)
2 KV RMS for 1 minute between outputs

**TRANSIENT PROTECTION**
IEC 255-4 Class 3
ANSI/IEEE C37.90.1 - 1989

*Impulse Voltage Withstand*
Common mode 5 KV (output to frame)
Between outputs 5 KV

*High Frequency Disturbance*
Common mode 2.5 KV (output to frame)
Between outputs 2.5 KV

*Fast Transient (IEC 61000-4-4)*
2 KV 5 kHz capacitively coupled

## 12 CHANNEL DIGITAL OUTPUT MODULES FUNCTIONAL SPECIFICATIONS (CONTINUED)

### 10 Amp Relay Output Platform Module

**NUMBER OF RELAYS**
Twelve

**RELAY COIL CURRENT**
110 mA

**CONTACT ARRANGEMENT**
Two-pole N/O relays with contacts connected in series to boost dc rating (output is single pole Form X, for example, 2 Form A in series).

**CONTACT RATING**
10 A at 150 V dc Resistive 100,000 operations
10 A at 150 V dc L/R 7 msec 30,000 operations

**CONTROL ISOLATE**
Switch mounted on front of terminal board

**ISOLATION**
2 KV RMS for 1 minute output to frame
1 KV RMS for 1 minute across open contact (without transient protection across contact)
2 KV RMS for 1 minute between outputs

### 10 Amp Relay Output Platform Module (Cont.)

**TRANSIENT PROTECTION**
IEC 255-4 Class 3
ANSI/IEEE C37.90.1 - 1989

*Impulse Voltage Withstand*
Common mode 5 KV (output to frame)
Between outputs 5 KV

*High Frequency Disturbance*
Common mode 2.5 KV (output to frame)
Between outputs 2.5 KV

*Fast Transient (IEC 61000-4-4)*
2 KV 5 kHz capacitively coupled

## 4 CHANNEL ANALOG OUTPUT MODULE FUNCTIONAL SPECIFICATIONS

### 4 Channel Analog Output Module

**PROCESSOR**
Z80 interfaces to Electrobus via dual access memory

**OUTPUTS**
Each output is configurable:

| Range | Counts | Output Steps |
|---|---|---|
| 4 to 20 mA | 0 to 4000 | 4000 |
| 4 to 20 mA | 800 to 4000 | 3200 |
| 0 to 10 mA | 0 to 4000 | 2560[a] |
| 0 to 16 mA | 0 to 4000 | 4000 |
| 4 to 20 mA | 0 to 2000 | 2000 |
| 4 to 20 mA | 400 to 2000 | 1600 |
| 0 to 10 mA | 0 to 2000 | 1280[a] |
| 0 to 16 mA | 0 to 2000 | 2000 |

(a) Implies some counts will not effect a step change.

**ACCURACY (4 TO 20 MA)**
± 0.1% full scale at 25°C
± 0.25% full scale 0 to 60°C

**ACCURACY (0 TO 16 MA)**
±1% full scale at 0 to 60°C

**EXTERNAL LOOP POWER**
24 V (maximum 36 V, minimum 19 V)

**LOOP LOAD RESISTANCE**
0 ohms minimum, 600 ohms maximum

### 4 Channel Analog Output Module (Cont.)

**TRANSIENT PROTECTION**
IEC 255-4 Class 3 5 KV impulse, 2.5 KV HFD
ANSI/IEEE C37.90.1 - 1989
*Fast Transient (IEC 61000-4-4)*
2 KV 5 kHz capacitive coupling (current loop)

**CHANNEL ISOLATION**
50 V dc channel to chassis
50 V dc channel to channel

### 4 Channel Analog Output Termination Board

**PRINTED CIRCUIT BOARD**
263 to 261.8 mm

**TERMINALS**
Four terminals per channel with test points and isolation links

| | |
|---|---|
| Terminal 1 | +24 V (maximum 36 V) |
| Terminal 2 | 24 V common |
| Terminal 3 | +I (current out) |
| Terminal 4 | –I (current return) |

**MONITORS/INDICATORS**
Red/Green RUN/FAIL LED

## PHYSICAL SPECIFICATIONS

### Physical Size

Each plug-in module requires frame space of 71.12 mm. Modules are assemblies of one or more printed circuit boards. These modules plug into a backplane (Electrobus) via a DIN 41612 connector and are double Eurocard size (233.4 mm x 149 mm). DIN 41612 connectors are also fitted to the front edge of the PCB to provide connection to the terminal board assembly.

## ENVIRONMENTAL SPECIFICATIONS

### Ambient Temperature

**STANDARD**
0°C to +60°C (32°F to 140°F)

**EXTENDED(1)**
-20°C to +70°C (-4°F to +158°F)

### Humidity

10 to 95% (noncondensing)

(1) Extended temperature range modules are available on request.

## ORDERING INFORMATION

| Part Number[a] | Description |
|---|---|
| **Multiple I/O Module** | |
| SY-0399075 | 24 Digital Input/6 Analog Input/8 Relay Output Module 24 V |
| SY-0399076 | 24 Digital Input/6 Analog Input/8 Relay Output Module 48 V |
| SY-0399077 | 24 Digital Input/6 Analog Input/8 Relay Output Module 129 V |
| **20 Channel Analog Input Module** | |
| SY-0399007 | 20 Channel Analog Input Module Standard |
| SY-0399071 | 20 Channel Analog Input Module Isolated |
| **Analog/Digital Input Module** | |
| SY-0399161 | 32 Digital Input/4 Analog Input Module (24V to 129V) |
| **12 Channel Digital Output Modules** | |
| SY-0399008<br>SY-0399009<br>SY-0399010 | 12 Relay Output Module<br>12 Magnetically Latched Relay Output Module<br>12 10 Amp Relay Output Module |
| **4 Channel Analog Output Module** | |
| SY-0399012 | 4 Channel Analog Output Module |

(a) Extended temperature range modules are available on request.

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