Product Description, Installation and Wiring for

SLCRETRO

MicroMod AUTOMATION

MicroMod Automation, Inc.

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MicroMod Automation is dedicated to improving customer efficiency by providing the most cost-effective, application-specific process solutions available. We are a highly responsive, application-focused company with years of expertise in control systems design and implementation.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivaled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

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△ **Warning.** An instruction that draws attention to the risk of injury or death.

✎ **Note.** Clarification of an instruction or additional information.

Caution. An instruction that draws attention to the risk of the product, process or surroundings.

i Information. Further reference for more detailed information or technical details.

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1. Warning Labels on containers and packages must be observed.
2. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given or injury or death could result.
3. Normal safety procedures must be taken to avoid the possibility of an accident occurring when operating in conditions of high
4. pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals, ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual may be obtained from the Company address on the back cover, together with servicing and spares information.

MicroMod AUTOMATION

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1
PRODUCT DESCRIPTION

1.1 OVERVIEW

The SLC RetroPAK Controller, Figure 1-1, is a 3x6 instrument with a 6 line 3 bar graph configurable display, removable rear terminations, and built-in communications. The controller has two built-in 4-20mA analog inputs, two modular 4-20mA analog inputs, two milliamp built-in milliamp outputs, three digital inputs and two digital outputs.

1.1.1 Features

Instrument

- 3X6 (72mm X 144mm) instrument with behind panel depth of 15.75 inches (400mm)
- Motorola 68302 processor, including on-chip RISC communications processor
- Universal ac power supply (85 to 250VAC/ 50 to 400 Hz)
- Optional dc power supply (nominal 24V dc)
- 64K bytes non volatile database RAM
- Embedded real-time clock with 1ms resolution
- A Service Manual switch under the front panel which allows a single point output to be manually adjusted and displayed (Jumper J5 for NEMA 4 as shown in Figure 1-1).
- Removable rear terminations.

Portable Memory Module

- Optional plug on module that provides 64K bytes of redundant, removable non volatile RAM for database backup, portability and integrity (allows a data base to be ported from one instrument to another)
- Updated every 50 ms

Process I/O

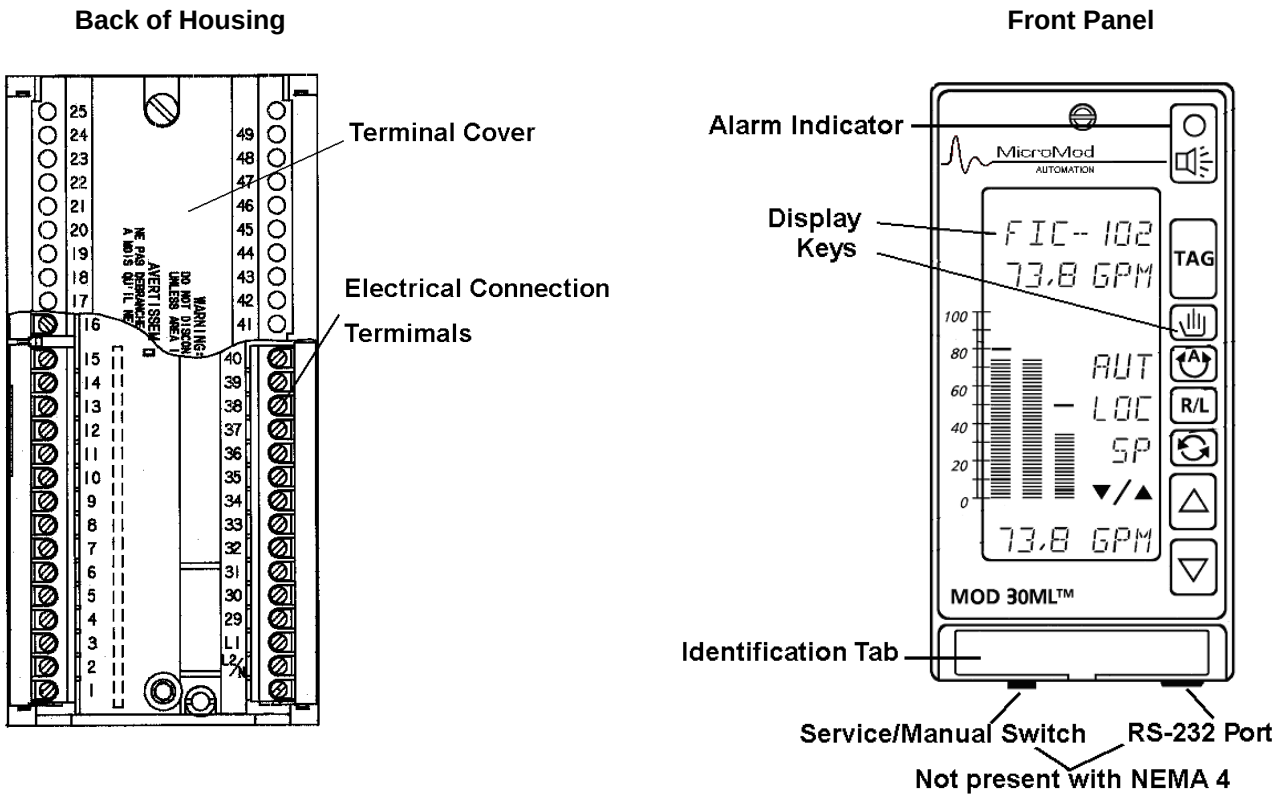
- Four direct connected milliamp inputs and two control outputs.
- Three direct connected digital inputs and four digital outputs
- Embedded microprocessor provides high-resolution signal conversion
- Individually Opto-isolated to 250Vrms, continuous
- Per-point, configurable fail-safe and power fail/restart settings
- Provide loop power for 2-wire transmitters

Communications

- Built-in RS-232 Modbus RTU communications
- Modular communications supporting a peer-to-peer communications network

Configuration

- Full data base configuration capability using Visual Application Designer software running on a personal computer. Includes Bailey Function Code library
- Display development for custom user defined displays
- Custom configuration by MicroMod Automation to match existing SLC or CLC installation.



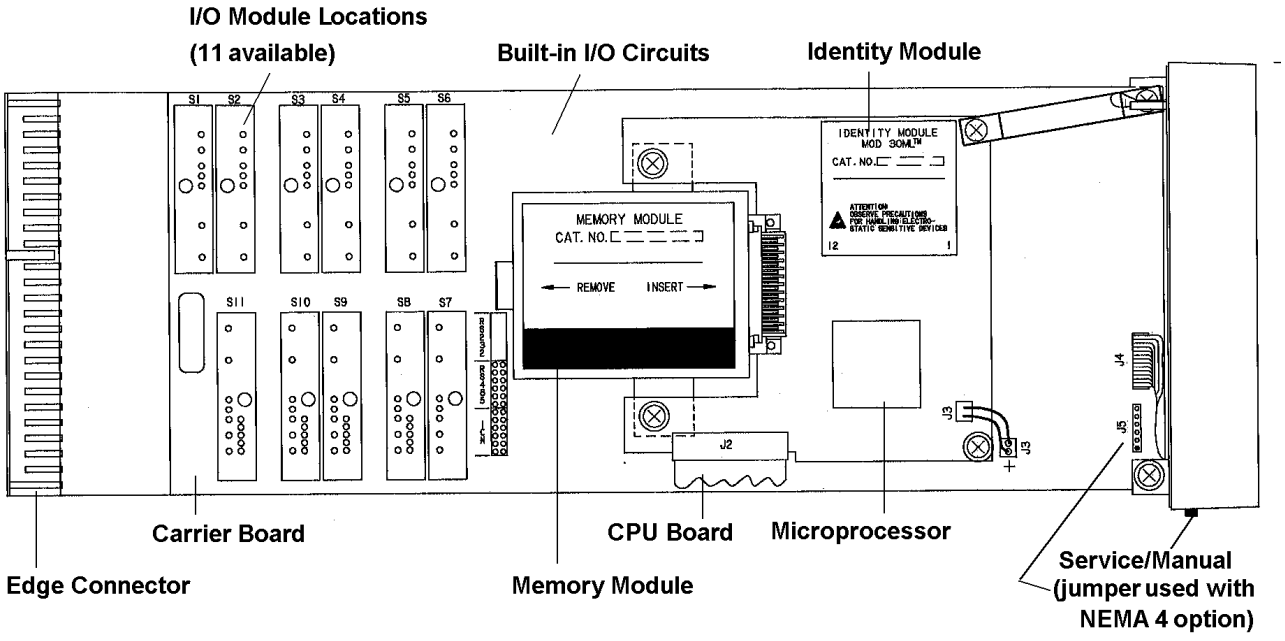


Figure 1-1. Location of Controller Components

1.1.2 Related Documents

Reference information on the Bailey Function Code library and the configuration software can be found in the following document:

- IB-RETROPAK-SLC

Reference information on the general data base structure and configuration parameters for this instrument can be found in the following documents:

- IB-1800R-APP Data Base Reference for MOD 30ML Functions
- IB-23G600 Data Base Reference for Logic, I/O and Communication Functions
- IB-23G601 Data Base Reference for Advanced Control Functions
- IB-23G602 Data Base Reference for Algorithms, Sequencers and Table Functions

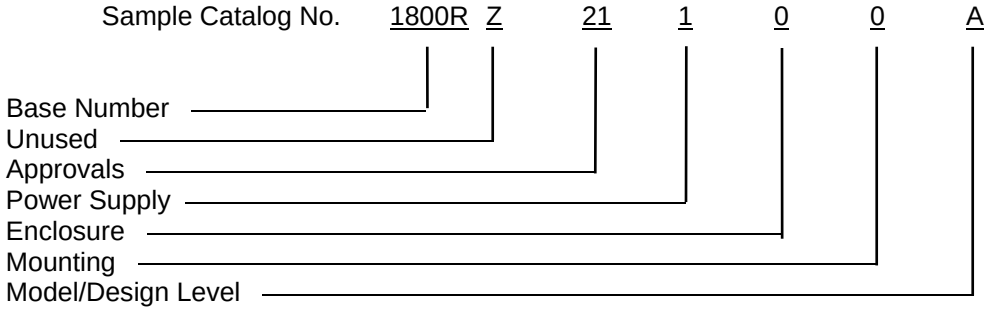
These documents are supplied on the Visual Application Designer CD.

1.2 EXPLANATION OF CATALOG NUMBERS

1.2.1 General

The products described in this book have catalog numbers that help identify specific features. In addition, some products are assigned a serial number which can be used to track manufacturing data. The general format of the catalog number is described in this section. Specific product descriptions are provided in the following sections.

The catalog number stamped on the product data plate contains a series of single and multiple-character codes. These codes provide specific information concerning various electrical and/or structural options. Certain code combinations are not allowed, and options and combinations are subject to change. An example of a typical catalog number is as follows:



1.2.2 Electrical Codes

Code 21 - FM Approved and CSA Certified
The SLC RetroPAK Controller is Factory Mutual (FM) Approved and Canadian Standards Association (CSA) Certified for installation in Class I, Division 2, Groups A, B, C or D Hazardous (Classified) locations.

Code 12 - EU EMC Compliant
The RetroPAK Controller complies with the requirements for European Union (EU) Electromagnetic Compatibility (EMC) when installed in accordance with the instructions in **Sections 2, 3, 4, and 5**. This compliance includes all modules described in **Sections 1.3, 1.4, and 1.5**, and listed in Table 2-1.

1.3 BASIC HARDWARE

1.3.1 RETROPAK CONTROLLER

The SLC RetroPAK controller, Figure 1-1, s designed for mounting in a panel with a 15.75-inch depth. The instrument housing contains a 50-point termination facility which accepts all instrument I/O, communications, and power connections. A separate grounding stud provides a safety ground connection. This assembly is designed to allow termination signal entry from either top or bottom, allowing for flexibility in signal separation for wiring considerations. The instrument connects to the terminals via an edge connector at the back of the carrier board, permitting interchangeability without disconnecting field wiring.

The carrier board provides the connection locations for the modular I/O. There are eleven locations for single width I/O modules, however, the SLC RetroPAK controller is already equipped with process I/O equivalent to the SLC and/or CLC controller. The carrier board also contains the built-in I/O and communications circuits. Four direct connected analog inputs accept 4-20mA inputs. A 24V dc transmitter power supply for 2-wire transmitters is available on all inputs. Two outputs provide a 4-20 mA dc signal. The built-in communications circuits terminate in five multi-purpose terminals for connection to RS-232 Modbus. The modular communication circuit provides connection to the peer-to-peer Instrument Communication Network (ICN).

The instrument CPU is based on the 16MHZ 68302 microprocessor. An identity module (1800P) provides the functionality that gives the instrument the capability to execute a user-configured database. The CPU supports 64K bytes of nonvolatile RAM for database storage, and a time-of-day clock with battery support. A high speed communications channel is used between the CPU and both the built-in I/O and any I/O modules installed on the instrument. The CPU board provides for connection of a plug-in memory module.

Catalog Number Description for SLC RetroPAK

BASE NUMBER	**SLCRETRO**	SLC RetroPAK Controller
POWER SUPPLY	**0**	24 Vdc (20 – 50 Vdc)
	1	85 – 250 Vac, 50 – 400 Hz
CONFIGURATION	**000**	None (user configured)
	SLC	Factory configured to match existing SLC program
	CLC	Factory configured to match existing CLC program

1.3.2 1800P Identity Module

The identity module, Figure 1-1, gives the instrument a specific level of process and communications functionality. The 1800P module is factory installed and provides the capability to execute a user-configured database which consists of built-in and modular I/O handling capabilities, PID functionality, and a collection of other control related functions. These include process alarms, input signal linearization, timers, totalization, signal selection, lead/lag filtering, dead time compensation, and automatic tuning. These functions reside in a group of basic data base elements called function blocks. The Identity Module is only ordered separately as a spare or upgrade.

Catalog Number Description for 1800P

BASE NUMBER	**1800P**	MOD 30ML Identity Module
UNUSED	**Z**	Unused Character
ELECTRICAL CODE	**10**	General Purpose
FUNCTION	**1**	Advanced Control
FIRMWARE VERSION	**01**	Version 1
	02	Version 2
MODEL	**A**	Design Level A
	C	Design Level C

Sample Number **1800PZ10102C** (Product is serialized)

1.3.3 1800F Housing and Termination Assembly

The 1800F Housing and Termination assembly consists of the instrument housing and the termination assembly for the controller. It does not include the instrument. This assembly is only ordered as a Spare Part.

Sample Number **1800FZ00003A**

1.3.4 2010P Memory Module

The optional memory module plugs directly into the CPU board, Figure 1-1, and provides a mechanism for porting a database from one instrument to another. An instrument with this option can upload from or download to this module. The memory module has a write protect setting to prevent accidental erasures. When a memory module is installed in an instrument with the write protection off, the operating software keeps the module up-to-date with all real time changes in the instrument. Enhanced security is thereby provided through this backup database copy. Data retention is typically 10 years with instrument unpowered.

Catalog Number Description for 2010P

BASE NUMBER	**2010P**	Memory Module
UNUSED	**Z**	Unused Character
ELECTRICAL CODE	**10**	General Purpose
UNUSED	**102**	Unused Characters
MODEL	**C**	Design Level
Sample Number	**2010PZ10102C** (Product is serialized)	

1.3.5 Downloading Cable

The downloading cable is used with the built-in RS-232 port in the front of the instrument. The ViZapp-SLC Configuration Software includes one cable.

Catalog Number for the Downloading cable

Sample Number	**109S1854**

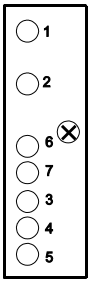
1.4 I/O MODULES

The descriptions included in this section give a brief overview of the functions and features of the I/O modules.

1.4.1 2012A Current Input Module (with 2-wire transmitter power)

This module is designed specifically for two-wire transmitters and provides the necessary 24 V DC current limited supply to power the transmitter. An internal current sense resistor converts the current to a voltage for application to the A/D converter. All other features are the same as the voltage input module. This module uses the Voltage/Current Input Module (VCIM) Block for configuration of input parameters.

VCIM



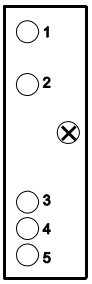
Catalog Number Description for 2012A

BASE NUMBER	**2012A**	Current Input Module (with 2-wire transmitter power)
UNUSED	**Z**	Unused Character
ELECTRICAL CODE	**10**	General Purpose
INPUT RANGE	**10**	4 – 20 mA
ISOLATION	**1**	Isolated
MODEL	**B**	Design Level
Sample Number	**2012AZ10101B**	

1.4.2 2004A Solid-State Relay Input Module

The Solid-State Relay Input module provides the necessary interfacing for AC or DC digital inputs when high isolation voltages are required (250V rms isolation limitation through connection terminals). This module uses the Digital Input Module (DIM) Block for configuration of input parameters.

DIM



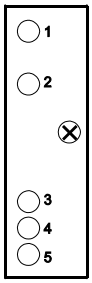
Catalog Number Description for 2004A

BASE NUMBER	**2004A**	Non-isolated Digital Input Module
UNUSED	**Z**	Unused Character
ELECTRICAL CODE	**10**	General Purpose
INPUT RANGE	**10**	2.5 to 28 VDC
UNUSED	**0**	Unused Character
MODEL	**A**	Design Level
Sample Number	**2004AP10100A**	

1.4.3 2005A Solid-State Relay Output Module

The Solid-State Relay Output module provides the necessary interfacing for AC or DC digital outputs when high isolation voltages are required (250V rms isolation limitation through connection terminals). This module uses the Digital Output Module (DOM) Block for configuration of output parameters.

DOM



Catalog Number Description for 2005A

BASE NUMBER	**2005A**	Nonisolated Digital Input Module
UNUSED	**Z**	Unused Character
ELECTRICAL CODE	**21**	General Purpose
OUTPUT RANGE	**10**	5 to 60 VDC
UNUSED	**0**	Unused Character
MODEL	**A**	Design Level
Sample Number	**2005AP10100A**	

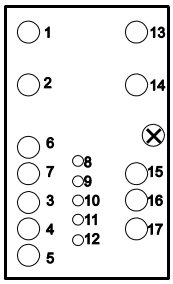
1.5 COMMUNICATIONS MODULES

The descriptions included in this section give a brief overview of the functions and features of the communication modules. These modules can be used to add a second communication channel to the MOD 30ML.

1.5.1 2030N ICN Communication Module

The ICN Communication module provides Instrument Communication Network (ICN) communications capability for the MOD 30ML Multiloop Controller. The ICN is a proprietary network that allows peer-to-peer communications between the controllers and can be used with the MOD 30 Instrument line. It also uses a communication link to a computer running the Application Builder or PC30 series software or other operator interface software. The ICN Baud rate is 31,250 bits per second. The Model B ICN requires an external terminator such as the 2030F ICN Terminator.

ICN



Catalog Number Description for 2030N

BASE NUMBER	**2030N**	ICN Communication Module
UNUSED	**Z**	Unused Character
ELECTRICAL CODE	**10**	General Purpose
UNUSED	**000**	Unused Character
MODEL	**B**	Design Level
Sample Number	**2030NZ10000B**	

1.5.2 2030F ICN Terminator

The ICN Terminator is used to provide a termination scheme for a peer-to-peer ICN network. One termination is required per ICN.

Catalog Number Description for 2030F

BASE NUMBER	**2030F**	ICN Terminator
UNUSED	**Z**	Unused Character
Unused	**0000**	Unused Characters
FORMAT	**1**	Eurocard or 1800R
	2	Flush Mount
MODEL	**A**	Design Level
Sample Number	**2030FZ00001A**	

4
MODULAR I/O CONNECTIONS

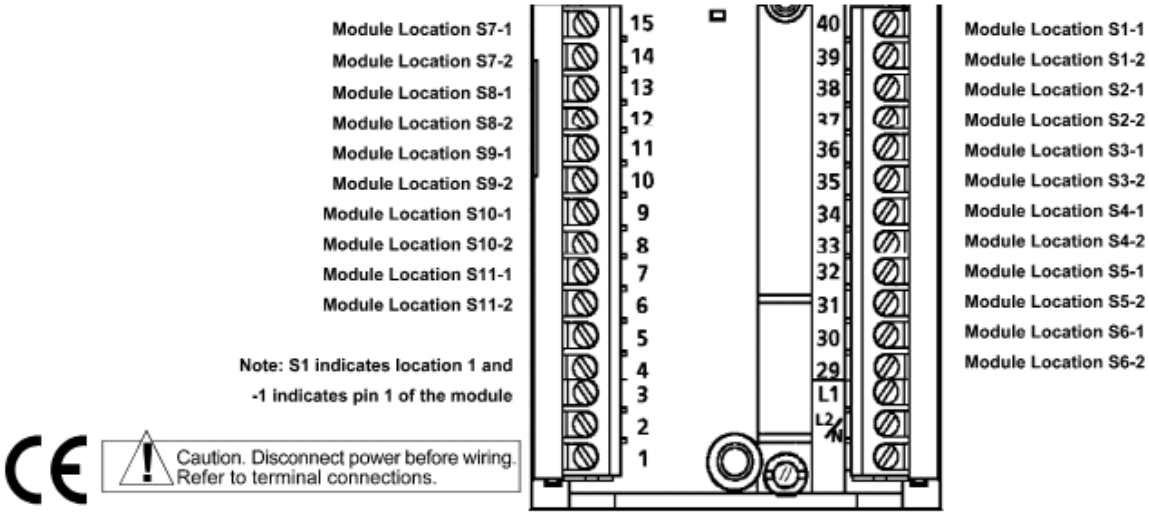


Figure 4-1. Terminal Identifications for Modular I/O

4.1 GENERAL

Read this section thoroughly before making any connections to modules. Installation personnel should be qualified technicians. Observe all electrical code requirements and safety standards applicable to these wiring procedures.

Specific instructions and connection diagrams for the various input and output modules are provided in **Sections 4.3 and 4.4**. A listing of the applicable electrical specifications is included with each diagram.

4.2 MODULAR I/O CONNECTION GUIDELINES

The wiring connections described in this section are made with the controller installed in its operating location and with the power off. All connection terminals are located under a cover on the back of the instrument housing. Figure 4-1 shows the modular connection terminals with the cover removed.

The recommended procedure for making, connections to I/O modules is as follows:

1. The diagrams for single width modules show connections to a sample location (usually location 1). The terminal numbers for the actual location being used must be determined by matching pin numbers 1 and 2 in each diagram to the terminal numbers for the selected location as shown in Figure 4-1.
2. The spacing of module locations on the carrier board divides locations 1 through 10 into pairs allowing double wide modules to occupy only five different locations. The terminal numbers applicable to each dual location are shown on the connection diagrams for double wide modules.

3. Route low-level signal wiring from the top left hand side of the housing and ac voltage wiring from the bottom right hand side and distribute to appropriate terminals.

4. Use a small, flat-head screwdriver to loosen appropriate connection screws and clamps on terminal blocks.

5. Strip approximately 5/16 inch (8 mm) of insulation from the end of each wire, insert wires at assigned terminals, and secure terminal screws and clamps.

> **Δ WARNING** All wiring connected to the controller terminals must be rated for the maximum voltage present, or alternately, wiring in circuits operating at greater than 30 volts must be rated for at least twice the circuit voltage.

7. After all connections are completed and checked, do the following:

   a. If communications are required, follow the applicable procedure in **Section 5**.

   b. If all connections are completed, the ac power wiring can be connected at the distribution panel (ac source).

* *NOTE*: Before putting the controller into operation, it must be configured using the Visual Application Designer Software. See **Section 1.1.2** for related documents.

4.3 MODULAR PROCESS INPUT CONNECTIONS

This section describes the process input connections for the following input module types:

- **2004A** Solid-State Relay Input Module - **Section 4.3.2**
- **2012A** Current Input Module with Two-Wire Transmitter - **Section 4.3.4**

4.3.1 2004A SSR Input (DIM)

Make Solid-State Relay (SSR) connections as shown in Figure 4-3. These input modules are used for sensing ON/OFF voltage levels. Each module provides optical isolation between the field devices and the control logic. This isolation is limited to 250 Vrms at the terminal block. Typical uses and applications for these input modules include sensing voltage and contact conditions from: proximity switches, limit switches, selector switches, push buttons, photoelectric switches, TTL compatible devices, float switches, or thermostats.

Wire rating: 600 V, -20°C +105°C UL, CSA approved

> **Δ WARNING** All wiring connected to the controller terminals must be rated for the maximum voltage present, or alternately, wiring in circuits operating at greater than 30 volts must be rated for at least twice the circuit voltage.

Input specifications are:

Input voltage range	2.5-28Vdc
mA Input current at Max Line	30
Max Logic Low Input	1V, 0.2 mA
Input Resistance (Ohms)	900
Module Response Time (msec)	1.5

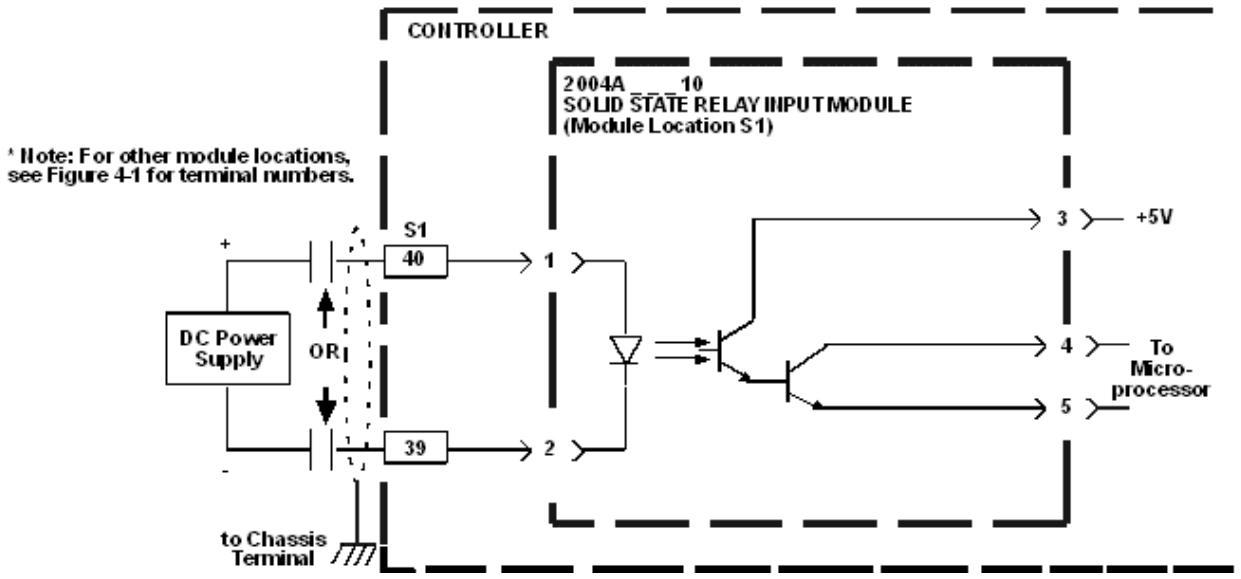
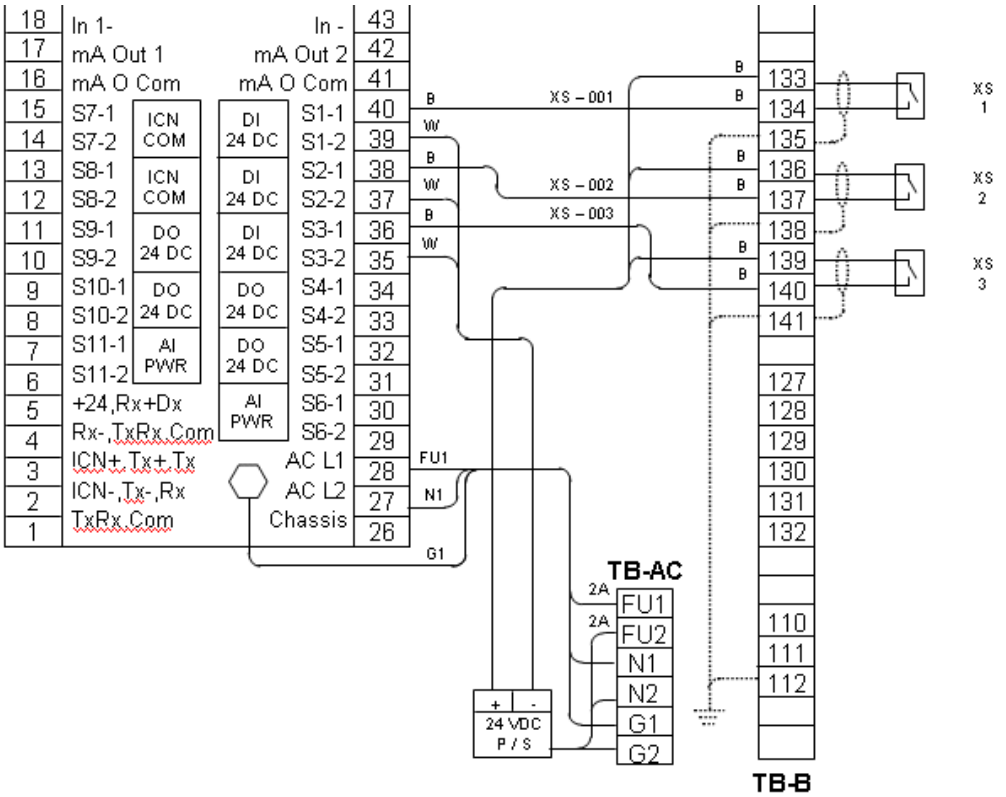


Figure 4-2. Typical Connections for a 2004A Solid State Relay Input Module



4.3.2 2012A Current Inputs (VCIM)

Make current input connections as shown in Figure 4-5 for 2-Wire Transmitter (2012A).

2-Wire Transmitter (2012A)
The 2-wire version of the milliampere input receives its loop current from a 24V dc current supply built into the module. This current supply is automatically connected in the circuit when the 2-wire input connection is made. The load on the transmitter is nominally 100 ohms. Due to heat generated, this module must be installed in a location with no adjacent module on either side. Input specifications are:

ANALOG INPUT (CURRENT WITH 2-WIRE TRANSMITTER POWER)
- Range: (0-100%) 4 to 20mA
- Low limit: 0 mA
- Upper limit: 27.5 mA
- Input Resistance: 50 ohms
- Noise filter: 3 db at 5 Hz
- Resolution: 14 bits
- Sensitivity: 1 uA
- Accuracy (calibrated): ±0.2% of span
- Two Wire Excitation Supply
  - Open circuit voltage: 24V ±5%
  - Short circuit current: maximum at 38 mA
- Isolation : 250 Vrms
- Max Survivable Input: ±300 Vdc or 250 Vac (Differential)
- Common mode rejection: 100 db at 60 Hz minimum
- Normal mode rejection: 40 db at 60 Hz minimum

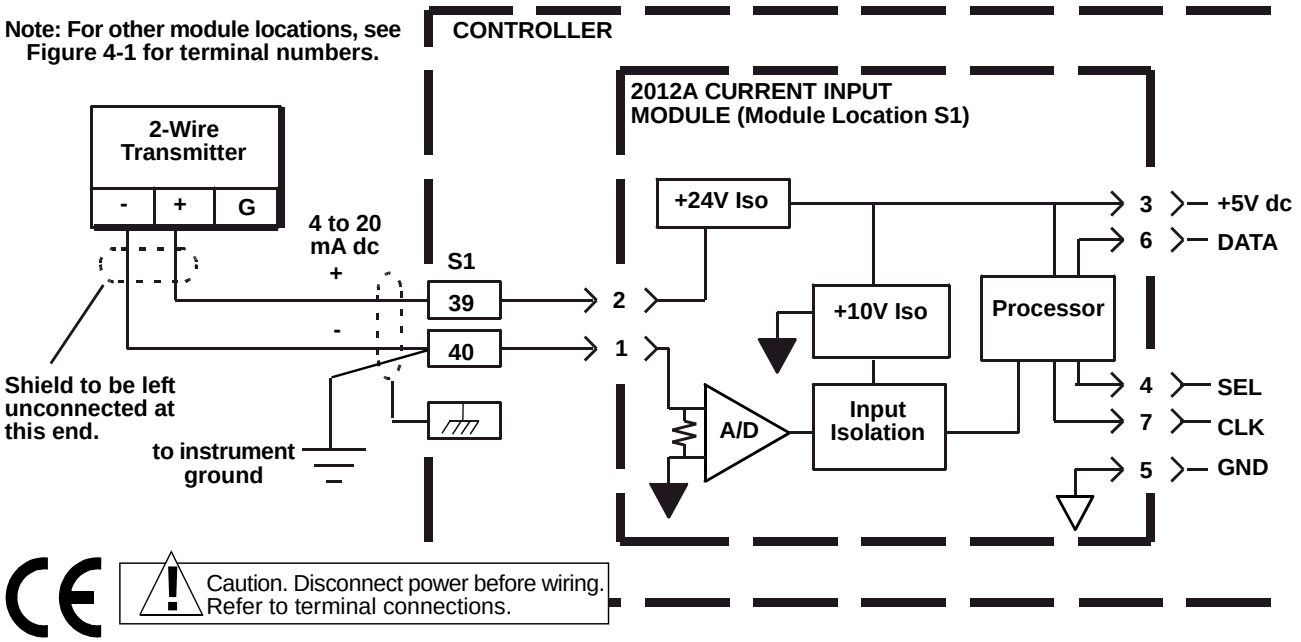


Figure 4-3. Typical Connections for a 2012A Current Input Module with 2-Wire Transmitter Power

4.4 MODULAR OUTPUT CONNECTIONS

This section describes the process input connections for the following input module types:

- **2005A** Solid-State Relay Output Module - **Section 4.4.2**

4.4.1 2005A SSR Output (DOM)

Recommended connections to a customer relay are shown in Figure 4-11. Make SSR output connections as shown in Figure 4-12.

DC output modules are used for controlling or switching DC loads. Each module provides optical isolation between the field devices and the control logic. This isolation is limited to 250 Vrms at the terminal block. Typical uses and applications for DC output modules include switching the following loads: DC relays, DC Solenoids, DC motor starters, or DC lamps or indicators. Wire rating: 600 V, -20°C +105°C UL, CSA approved.
Module Fuse rating: 4 Amps, 250V.

DC DIGITAL OUTPUTS (ISOLATED)	
Output voltage ranges	5-60 V
Max Output current	1A
Turn-off time	0.75 msec
Max Output voltage drop	1.6 V
Off-state leakage at max V	1 mA

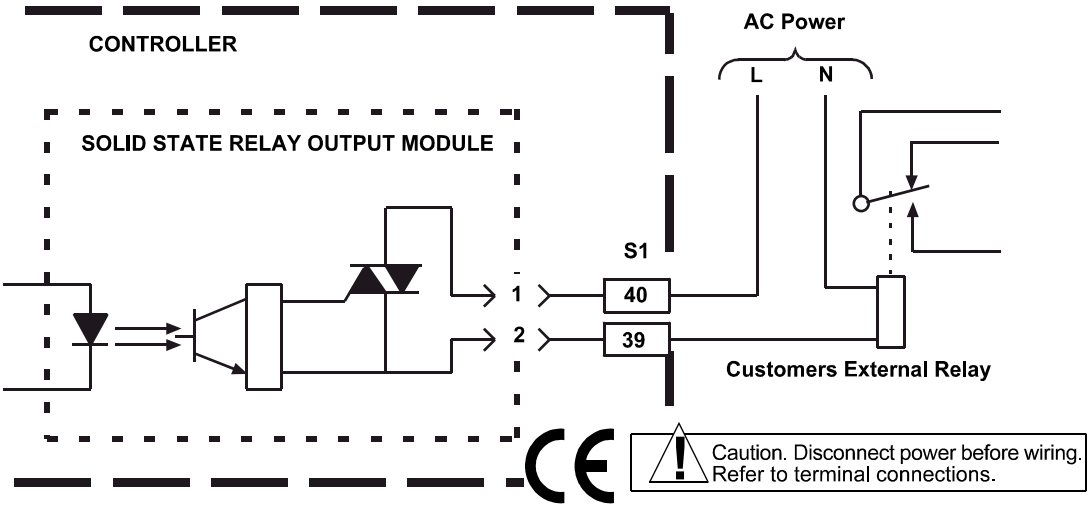


Figure 4-4. Recommended Connection to Solid State Relay

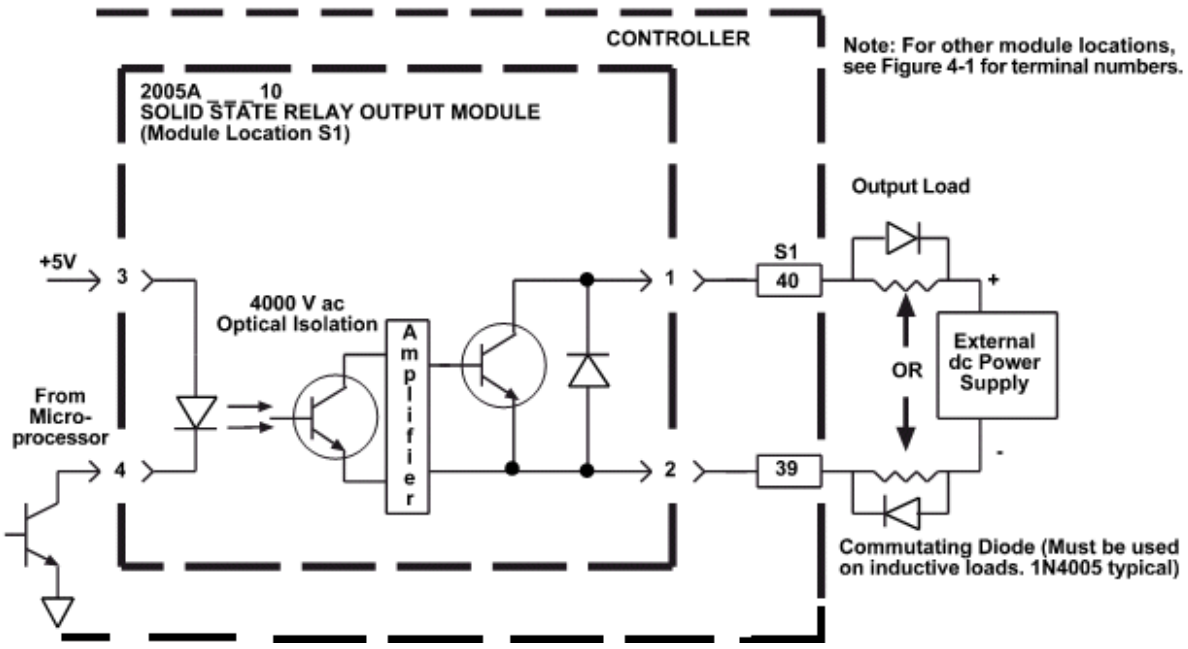
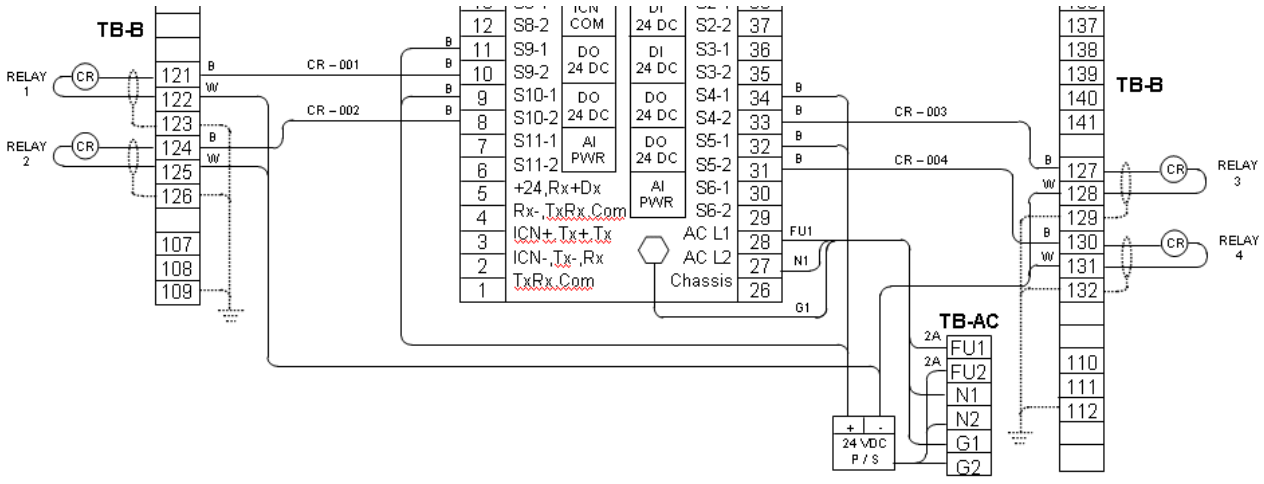


Figure 4-5. Typical Connections for a 2005A Solid State Relay Output Module



1
PRODUCT DESCRIPTION

1.1 OVERVIEW

The SLC RetroPAK Controller, Figure 1-1, is a 3x6 instrument with a 6 line 3 bar graph configurable display, removable rear terminations, and built-in communications. The controller has two built-in 4-20mA analog inputs, two modular 4-20mA analog inputs, two milliamp built-in milliamp outputs, three digital inputs and two digital outputs.

1.1.1 Features

Instrument

- 3X6 (72mm X 144mm) instrument with behind panel depth of 15.75 inches (400mm)
- Motorola 68302 processor, including on-chip RISC communications processor
- Universal ac power supply (85 to 250VAC/ 50 to 400 Hz)
- Optional dc power supply (nominal 24V dc)
- 64K bytes non volatile database RAM
- Embedded real-time clock with 1ms resolution
- A Service Manual switch under the front panel which allows a single point output to be manually adjusted and displayed (Jumper J5 for NEMA 4 as shown in Figure 1-1).
- Removable rear terminations.

Portable Memory Module

- Optional plug on module that provides 64K bytes of redundant, removable non volatile RAM for database backup, portability and integrity (allows a data base to be ported from one instrument to another)
- Updated every 50 ms

Process I/O

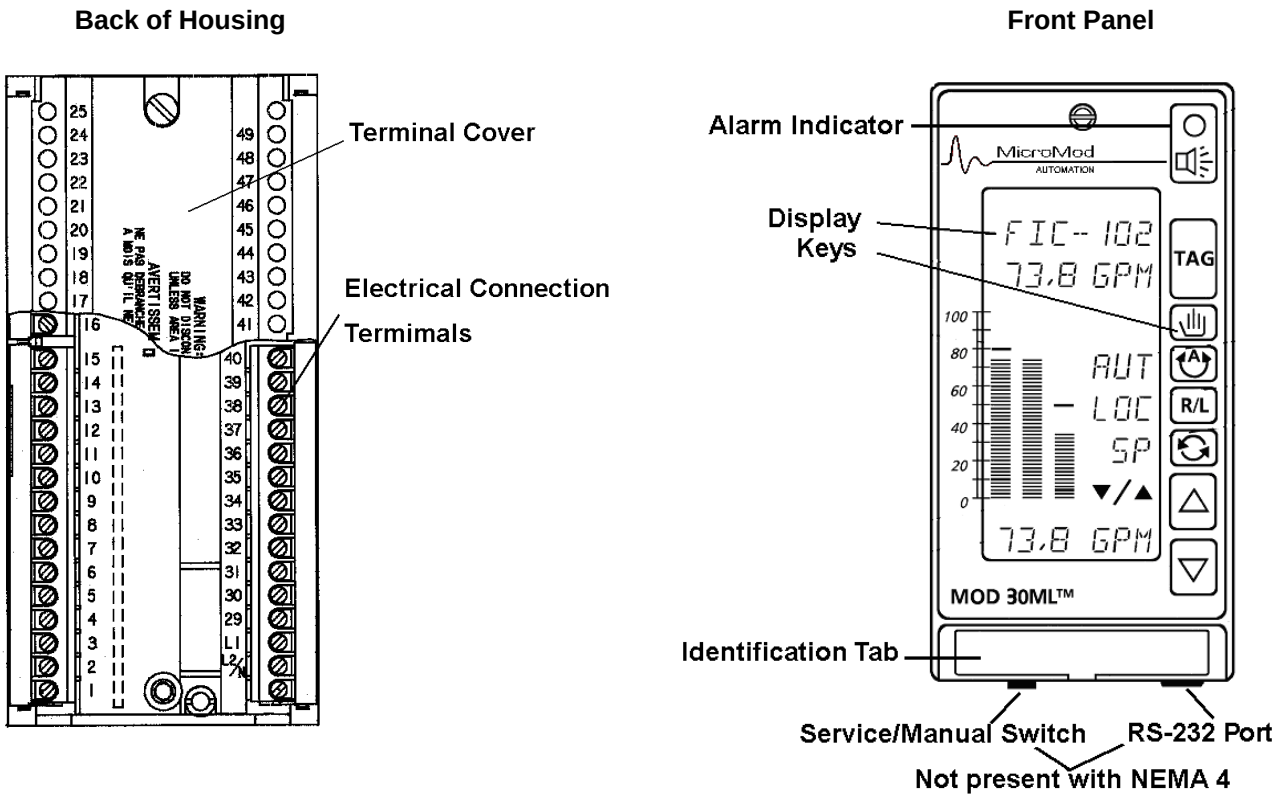
- Four direct connected milliamp inputs and two control outputs.
- Three direct connected digital inputs and four digital outputs
- Embedded microprocessor provides high-resolution signal conversion
- Individually Opto-isolated to 250Vrms, continuous
- Per-point, configurable fail-safe and power fail/restart settings
- Provide loop power for 2-wire transmitters

Communications

- Built-in RS-232 Modbus RTU communications
- Modular communications supporting a peer-to-peer communications network

Configuration

- Full data base configuration capability using Visual Application Designer software running on a personal computer. Includes Bailey Function Code library
- Display development for custom user defined displays
- Custom configuration by MicroMod Automation to match existing SLC or CLC installation.



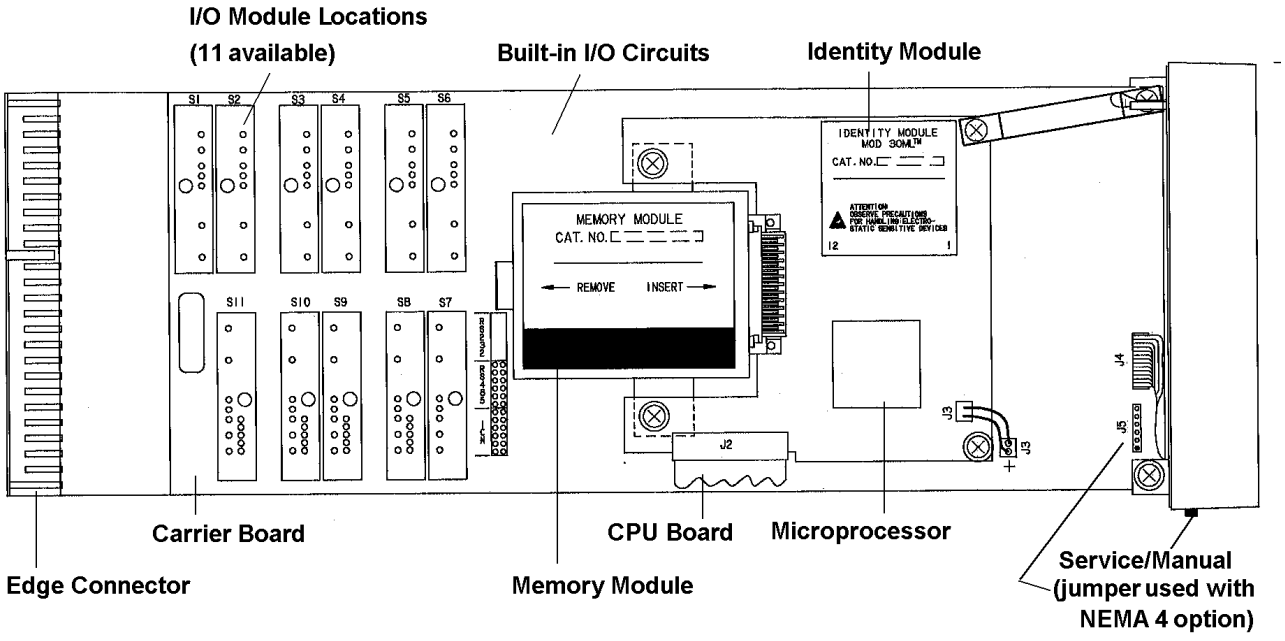


Figure 1-1. Location of Controller Components

1.1.2 Related Documents

Reference information on the Bailey Function Code library and the configuration software can be found in the following document:

- IB-RETROPAK-SLC

Reference information on the general data base structure and configuration parameters for this instrument can be found in the following documents:

- IB-1800R-APP Data Base Reference for MOD 30ML Functions
- IB-23G600 Data Base Reference for Logic, I/O and Communication Functions
- IB-23G601 Data Base Reference for Advanced Control Functions
- IB-23G602 Data Base Reference for Algorithms, Sequencers and Table Functions

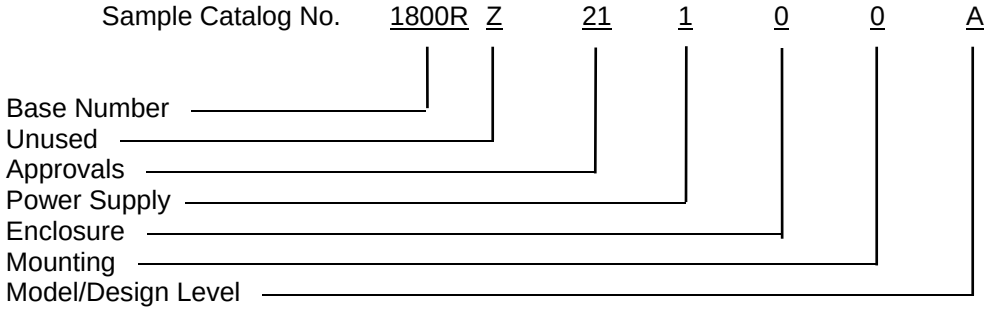
These documents are supplied on the Visual Application Designer CD.

1.2 EXPLANATION OF CATALOG NUMBERS

1.2.1 General

The products described in this book have catalog numbers that help identify specific features. In addition, some products are assigned a serial number which can be used to track manufacturing data. The general format of the catalog number is described in this section. Specific product descriptions are provided in the following sections.

The catalog number stamped on the product data plate contains a series of single and multiple-character codes. These codes provide specific information concerning various electrical and/or structural options. Certain code combinations are not allowed, and options and combinations are subject to change. An example of a typical catalog number is as follows:



1.2.2 Electrical Codes

Code 21 - FM Approved and CSA Certified
The SLC RetroPAK Controller is Factory Mutual (FM) Approved and Canadian Standards Association (CSA) Certified for installation in Class I, Division 2, Groups A, B, C or D Hazardous (Classified) locations.

Code 12 - EU EMC Compliant
The RetroPAK Controller complies with the requirements for European Union (EU) Electromagnetic Compatibility (EMC) when installed in accordance with the instructions in **Sections 2, 3, 4, and 5**. This compliance includes all modules described in **Sections 1.3, 1.4, and 1.5**, and listed in Table 2-1.

1.3 BASIC HARDWARE

1.3.1 RETROPAK CONTROLLER

The SLC RetroPAK controller, Figure 1-1, s designed for mounting in a panel with a 15.75-inch depth. The instrument housing contains a 50-point termination facility which accepts all instrument I/O, communications, and power connections. A separate grounding stud provides a safety ground connection. This assembly is designed to allow termination signal entry from either top or bottom, allowing for flexibility in signal separation for wiring considerations. The instrument connects to the terminals via an edge connector at the back of the carrier board, permitting interchangeability without disconnecting field wiring.

The carrier board provides the connection locations for the modular I/O. There are eleven locations for single width I/O modules, however, the SLC RetroPAK controller is already equipped with process I/O equivalent to the SLC and/or CLC controller. The carrier board also contains the built-in I/O and communications circuits. Four direct connected analog inputs accept 4-20mA inputs. A 24V dc transmitter power supply for 2-wire transmitters is available on all inputs. Two outputs provide a 4-20 mA dc signal. The built-in communications circuits terminate in five multi-purpose terminals for connection to RS-232 Modbus. The modular communication circuit provides connection to the peer-to-peer Instrument Communication Network (ICN).

The instrument CPU is based on the 16MHZ 68302 microprocessor. An identity module (1800P) provides the functionality that gives the instrument the capability to execute a user-configured database. The CPU supports 64K bytes of nonvolatile RAM for database storage, and a time-of-day clock with battery support. A high speed communications channel is used between the CPU and both the built-in I/O and any I/O modules installed on the instrument. The CPU board provides for connection of a plug-in memory module.

Catalog Number Description for SLC RetroPAK

BASE NUMBER	**SLCRETRO**	SLC RetroPAK Controller
POWER SUPPLY	**0**	24 Vdc (20 – 50 Vdc)
	1	85 – 250 Vac, 50 – 400 Hz
CONFIGURATION	**000**	None (user configured)
	SLC	Factory configured to match existing SLC program
	CLC	Factory configured to match existing CLC program

1.3.2 1800P Identity Module

The identity module, Figure 1-1, gives the instrument a specific level of process and communications functionality. The 1800P module is factory installed and provides the capability to execute a user-configured database which consists of built-in and modular I/O handling capabilities, PID functionality, and a collection of other control related functions. These include process alarms, input signal linearization, timers, totalization, signal selection, lead/lag filtering, dead time compensation, and automatic tuning. These functions reside in a group of basic data base elements called function blocks. The Identity Module is only ordered separately as a spare or upgrade.

Catalog Number Description for 1800P

BASE NUMBER	**1800P**	MOD 30ML Identity Module
UNUSED	**Z**	Unused Character
ELECTRICAL CODE	**10**	General Purpose
FUNCTION	**1**	Advanced Control
FIRMWARE VERSION	**01**	Version 1
	02	Version 2
MODEL	**A**	Design Level A
	C	Design Level C

Sample Number **1800PZ10102C** (Product is serialized)

1.3.3 1800F Housing and Termination Assembly

The 1800F Housing and Termination assembly consists of the instrument housing and the termination assembly for the controller. It does not include the instrument. This assembly is only ordered as a Spare Part.

Sample Number **1800FZ00003A**

1.3.4 2010P Memory Module

The optional memory module plugs directly into the CPU board, Figure 1-1, and provides a mechanism for porting a database from one instrument to another. An instrument with this option can upload from or download to this module. The memory module has a write protect setting to prevent accidental erasures. When a memory module is installed in an instrument with the write protection off, the operating software keeps the module up-to-date with all real time changes in the instrument. Enhanced security is thereby provided through this backup database copy. Data retention is typically 10 years with instrument unpowered.

Catalog Number Description for 2010P

BASE NUMBER	**2010P**	Memory Module
UNUSED	**Z**	Unused Character
ELECTRICAL CODE	**10**	General Purpose
UNUSED	**102**	Unused Characters
MODEL	**C**	Design Level
Sample Number	**2010PZ10102C** (Product is serialized)	

1.3.5 Downloading Cable

The downloading cable is used with the built-in RS-232 port in the front of the instrument. The ViZapp-SLC Configuration Software includes one cable.

Catalog Number for the Downloading cable

Sample Number	**109S1854**

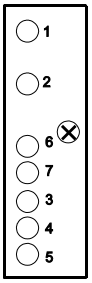
1.4 I/O MODULES

The descriptions included in this section give a brief overview of the functions and features of the I/O modules.

1.4.1 2012A Current Input Module (with 2-wire transmitter power)

This module is designed specifically for two-wire transmitters and provides the necessary 24 V DC current limited supply to power the transmitter. An internal current sense resistor converts the current to a voltage for application to the A/D converter. All other features are the same as the voltage input module. This module uses the Voltage/Current Input Module (VCIM) Block for configuration of input parameters.

VCIM



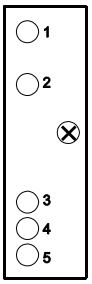
Catalog Number Description for 2012A

BASE NUMBER	**2012A**	Current Input Module (with 2-wire transmitter power)
UNUSED	**Z**	Unused Character
ELECTRICAL CODE	**10**	General Purpose
INPUT RANGE	**10**	4 – 20 mA
ISOLATION	**1**	Isolated
MODEL	**B**	Design Level
Sample Number	**2012AZ10101B**	

1.4.2 2004A Solid-State Relay Input Module

The Solid-State Relay Input module provides the necessary interfacing for AC or DC digital inputs when high isolation voltages are required (250V rms isolation limitation through connection terminals). This module uses the Digital Input Module (DIM) Block for configuration of input parameters.

DIM



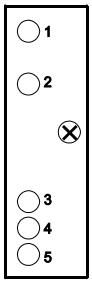
Catalog Number Description for 2004A

BASE NUMBER	**2004A**	Non-isolated Digital Input Module
UNUSED	**Z**	Unused Character
ELECTRICAL CODE	**10**	General Purpose
INPUT RANGE	**10**	2.5 to 28 VDC
UNUSED	**0**	Unused Character
MODEL	**A**	Design Level
Sample Number	**2004AP10100A**	

1.4.3 2005A Solid-State Relay Output Module

The Solid-State Relay Output module provides the necessary interfacing for AC or DC digital outputs when high isolation voltages are required (250V rms isolation limitation through connection terminals). This module uses the Digital Output Module (DOM) Block for configuration of output parameters.

DOM



Catalog Number Description for 2005A

BASE NUMBER	**2005A**	Nonisolated Digital Input Module
UNUSED	**Z**	Unused Character
ELECTRICAL CODE	**21**	General Purpose
OUTPUT RANGE	**10**	5 to 60 VDC
UNUSED	**0**	Unused Character
MODEL	**A**	Design Level
Sample Number	**2005AP10100A**	

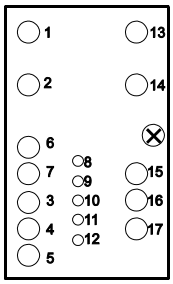
1.5 COMMUNICATIONS MODULES

The descriptions included in this section give a brief overview of the functions and features of the communication modules. These modules can be used to add a second communication channel to the MOD 30ML.

1.5.1 2030N ICN Communication Module

The ICN Communication module provides Instrument Communication Network (ICN) communications capability for the MOD 30ML Multiloop Controller. The ICN is a proprietary network that allows peer-to-peer communications between the controllers and can be used with the MOD 30 Instrument line. It also uses a communication link to a computer running the Application Builder or PC30 series software or other operator interface software. The ICN Baud rate is 31,250 bits per second. The Model B ICN requires an external terminator such as the 2030F ICN Terminator.

ICN



Catalog Number Description for 2030N

BASE NUMBER	**2030N**	ICN Communication Module
UNUSED	**Z**	Unused Character
ELECTRICAL CODE	**10**	General Purpose
UNUSED	**000**	Unused Character
MODEL	**B**	Design Level
Sample Number	**2030NZ10000B**	

1.5.2 2030F ICN Terminator

The ICN Terminator is used to provide a termination scheme for a peer-to-peer ICN network. One termination is required per ICN.

Catalog Number Description for 2030F

BASE NUMBER	**2030F**	ICN Terminator
UNUSED	**Z**	Unused Character
Unused	**0000**	Unused Characters
FORMAT	**1**	Eurocard or 1800R
	2	Flush Mount
MODEL	**A**	Design Level
Sample Number	**2030FZ00001A**	

2
MECHANICAL INSTALLATION

2.1 GENERAL

Read these instructions thoroughly before starting installation. Installation personnel should be qualified technicians.

Mechanical installation involves:

- Unpacking (**Section 2.2**)
- Planning and Installing optional I/O and memory modules if these items are being used (**Section 2.3**)
- Mounting (**Section 2.4**)

2.1.1 Displays and Cleaning

The display is protected by an overlay that can be removed after installation. The face of the display, while made of scratch-resistant plastic, can be abraded by harsh materials such as paper towels and industrial wipes. Lens cleaning tissues and soft cloths are suitable for cleaning displays. Remove dust from the rear of the instrument by removing it from the instrument housing and spraying exposed surfaces with non-corrosive, non-toxic, non-flammable inert dusting gas.

2.1.2 Environmental Specifications

Operating Temperature:	0 to +50°C (32 to 122°F)	
Storage Temperature:	–40 and+75°C (–40 and 167°F)	
Humidity	5 to 95 % RH, non condensing	
Altitude:	2000 meters max	
Ingress Protection:	Front: IP22	Rear: IP20
Pollution degree:	2	

2.2 UNPACKING

Unpack and visually inspect the instrument housing, controller, and associated modules for any damage. The instrument may be removed from its housing, if necessary, to install modules or change the communication jumper. Remove the controller from its housing by loosening the two retaining screws in the front panel and pulling the unit out of the housing. Save packing materials for any reshipment, or to support any claim of shipment damage. All damage claims are made against the carrier and are the responsibility of the customer.

Included in the shipping container is a bag containing mounting brackets and screws, and an information package. A card containing several copies of a writeable instrument identification tag is included in the information package. Write required data on the tag and insert it under the translucent strip at the bottom of the front panel after the controller is installed.

2.3 USING THE MEMORY MODULE

The optional memory module plugs directly into the CPU board and can be used to back up a controller database, or transfer a database from one instrument to another.

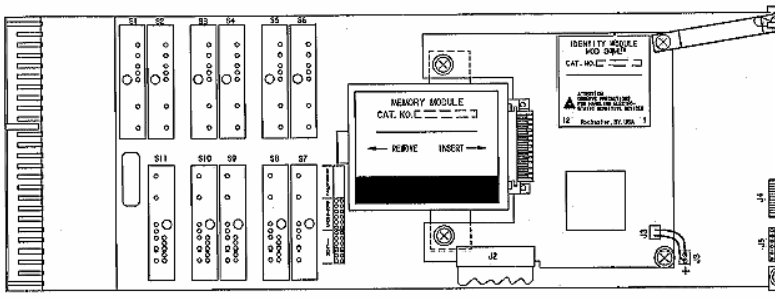


Figure 2-1. Controller with Memory Module Installed

A controller database can be copied into the Memory Module and the module removed for safekeeping. Data retention, when the module is not installed on a working instrument, is typically 10 years. A module installed on a working controller will retain its data much longer. This provides a known good configuration as a backup. (Note: any changes to tuning parameters, setpoints etc. that were made by the operator from the controller keypad will be overwritten).

When a memory module is installed in a working instrument with the write protection off, the operating software keeps the module up-to-date with all real time changes in the instrument, including: tuning parameter changes; output values and states; changes made by operators; calculation results; sequence steps; alarm trip points and values; etc. These changes are written to the module every 50 milliseconds. Checksums protect the data in the module from being overwritten by bad data in the event of an instrument failure.

Should a controller need to be replaced, the Memory Module containing the database for that controller can be plugged into a new controller and the database will be instantly transferred to the new controller when it is plugged into the housing (with power applied). This allows rapid replacement of controllers without programming. If the memory module was being updated by the old controller, the last good values of all parameters will also be loaded into the new controllers.

The controller provides the option to automatically download from an installed Memory Module after a loss of power. This option must be selected during initial configuration of the controller.

2.3.1 Memory Module Installation Procedure

If the Portable Memory Module is to be used, install as follows:

1. Loosen the 2 retaining screws in the front panel, Figure 1-1, and pull the instrument out of its housing.

! CAUTION:	Support the instrument from the front and bottom or from the insulator plate whenever the instrument is outside its housing. Do not allow the full weight of the circuit boards to be suspended unsupported from the front panel as this may overstress the brackets at that end.

2. Position the memory module over the metal plate on the carrier board. Orient the memory module so that the catalog number label is visible when the module is plugged into the connector on the CPU board.

3. Slide the memory module onto the connector on the CPU board, making sure it is firmly seated on the connector and the metal retaining bracket is in place at the rear of the module. **IMPORTANT: READ THE "SWITCH POSITIONS" SECTION BELOW PRIOR TO RESTORING POWER TO THE INSTRUMENT!**
Failure to do so may result in overwriting the configuration database in the instrument or the module.

2.3.2 Switch Positions

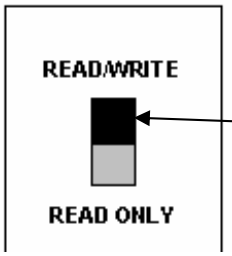
There are two switches on the memory module, which control the flow of data between the module and the controller.

Read / Write Switch
This switch has two positions: READ/WRITE and READ ONLY.

Read / Write Position

With the switch in the READ/WRITE position, data can be writing to the memory module by the controller.

Use this position for backing up the database in a controller, or when the memory module is left on the instrument during operation and you want the controller to update the parameters in the memory module's database.



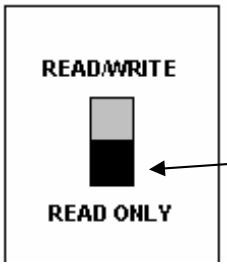
Allows updates to memory module, from the controller

Read Only Position

With the switch in the READ ONLY position, the database in the memory module cannot be updated or overwritten by the controller.

If a module is installed on a controller with the switch in this position, the controller generates a diagnostic indicating the Memory Module is write-protected.

Use this position on a module being used to back up and store a known good database.



Database in memory module cannot be updated or overwritten.

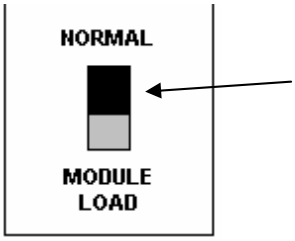
MECHANICAL INSTALLATION

Normal / Module Load Switch

This switch has two positions: NORMAL and MODULE LOAD.

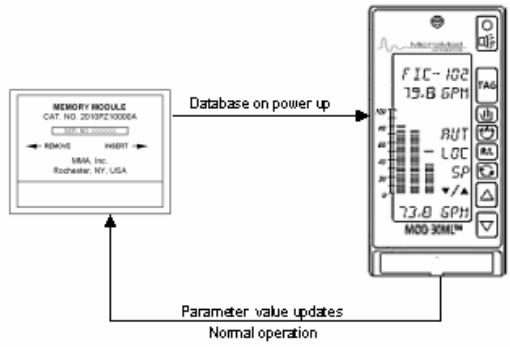
Normal Position

With this switch in the NORMAL position, data is automatically transferred from the Memory Module to the instrument, on power up only. This is also referred to as downloading a database from the Memory Module.



Loads Memory Module database into controller on power up.
Allows updates to Memory Module during operation.

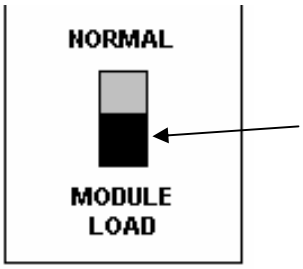
> Δ *CAUTION:* There are no partial downloads. **The existing database in the controller will be overwritten.**



If the module is left on the controller during normal operation, it allows the module to accept updates to current process parameters. Data does not pass from the Module to the Controller during normal operation.

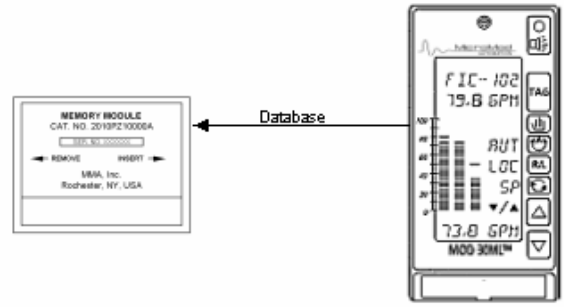
Module Load Position

With the switch in MODULE LOAD position, the entire database in the Controller is automatically transferred to the Memory Module. This is also known as “UPLOAD”. This transfer can only take place if the Read/Write switch is in the READ/WRITE position.



Transfers Controller database into Memory Module.

> Δ *CAUTION:* The current database in the Memory Module will be overwritten.



When the database has been transferred successfully to the module, the Controller display indicates UPLOAD COMPLETE.

The following table shows the data flow for each combination of switch positions:

SWITCH POSITION				
SWITCH 1		**SWITCH 2**		
READ/WRITE	READ ONLY	NORMAL	MODULE LOAD	
X		**X**		Database transfer from memory module to controller on power up. Memory module updated every 50ms by controller during operation.
X			**X**	Complete contents of controller memory transferred to memory module (UPLOAD). Existing program is overwritten.
	X	**X**		Instrument and/or PC cannot write to memory module. Contents remain unchanged.
	X		**X**	Invalid combination

SLC RETROPAK I/O LAYOUT

Controller No._____

Built-in I/O

Input 1: *4-20mA w/ 24Vdc Transmitter Power Supply*

Output 1: *20 mA*

Input 2: *4-20mA w/ 24 Vdc Transmitter Power Supply*

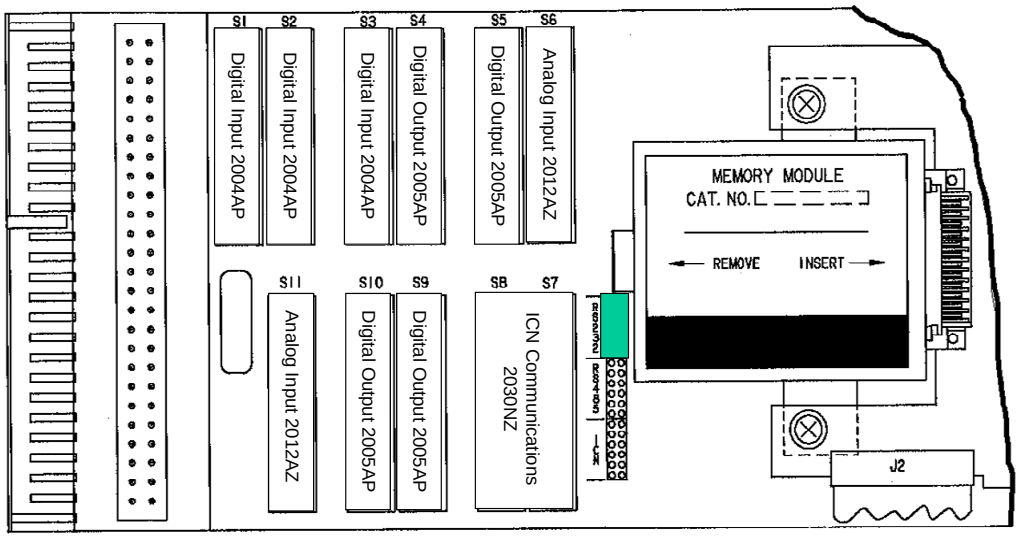
Output 2: *20 mA*

Communications: *RS-232 Modbus (port 1)*

Modular I/O

I/O Module Locations

No.	Module	No.	Module	No.	Module	No.	Module	No.	Module	No.	Module
S1	*2004A*	***S2***	*2004A*	***S3***	*2004A*	***S4***	*2005A*	***S5***	*2005A*	***S6***	*2012A*
S7	*2030N*	***S8***	*>---------*	***S9***	*2005A*	***S10***	*2005A*	***S11***	*2012A*		*////////////*



2.4 MOUNTING

The controller must be installed in an approved enclosure or installed in a means acceptable to the authority having jurisdiction for electrical installations.

ΔWARNING	*Do not install a RetroPAK controller in a residential, commercial or light industrial environment in the European Union.*

Select a mounting location where:

- There is minimum vibration.
- The ambient temperature is between 32 and 122°F (0 and 50°C) with a relative humidity of 5-95% RH (noncondensing). The ambient temperature and humidity requirements apply to the air directly below the controller.
- The installation allows for free air flow above and below the controller
- If it is necessary to mount two or more controllers above each other, and the room ambient temperature is above 70°F, heat generated by the lower instruments may raise the ambient of the upper instruments above the 122°F limit. To assure that operating temperatures are within specified limits, it is recommended that a fan be installed below the instruments to force air circulation over the instruments in an upward direction. Air velocity should should be at least 100 to 200 feet per minute.
- The panel provides rigid support for a fully loaded 5.5-pound (2.5 kg) controller and any other panel devices.
- Electrical wiring routing and support are planned.

Mount the controller as follows:

1. Prepare the panel as indicated in Figure 2-2. Be sure to allow enough clearance under the front panel of each controller to access the communications jack in the bottom of the front panel.

2. Slide instrument housing only into panel cutout.

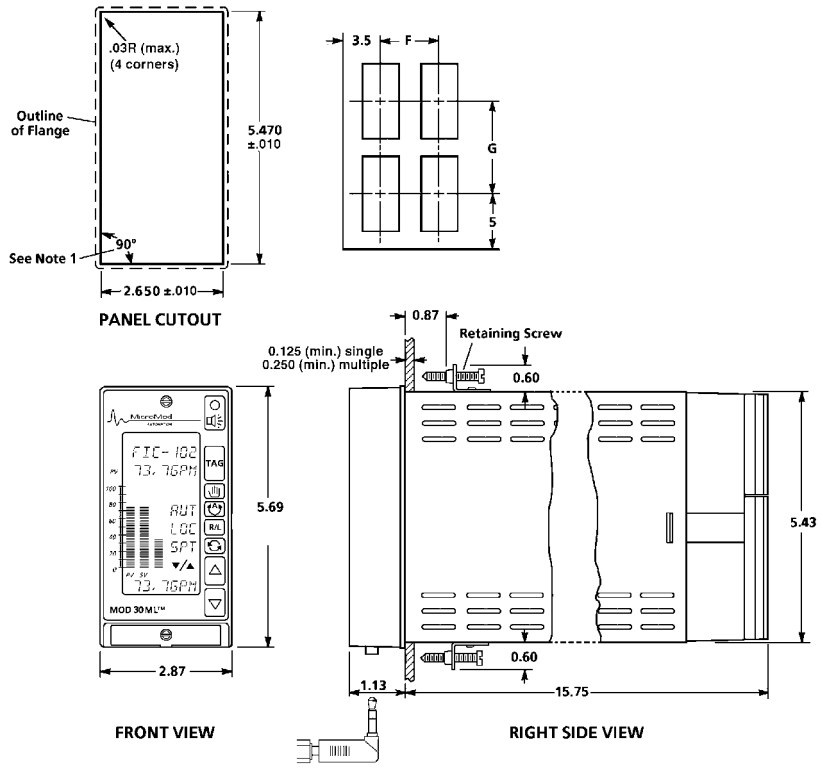
3. Insert brackets into slots in top and bottom of instrument housing.
   Be sure the housing gasket is not pinched or twisted between the instrument housing and the front of the panel.

4. Tighten retaining screws to a torque of 5 inch-pounds (0.6 Nm) or 1-1/2 turns after contact is made with the back of the panel.

5. insert the instrument into the housing and tighten the jack screw to 7 to 10 inch-pounds (0.8 to 1.1 Nm) or 1-1/2 turns after the front face draws into the gasket

MECHANICAL INSTALLATION

MOUNTING DIMENSIONS FOR SLC RETROPAK



Center-to-Center Distance	F	G
Recommended	4	8
Minimum	3.5	7

Inches	mm	Inches	mm
0.60	15.2	5.43	137.9
0.87	22.1	5.47	138.9
1.13	28.7	5.69	144.5
2.69	68.3	7.00	177.8
2.87	72.9	8.00	203.2
3.50	88.9	15.75	400.0
4.00	101.6		

1.5 inch (38.1mm) clearance for optional communications jack.

NOTES: 1. When mounting housing in panel cutout or rack and panel mounted bezel, turn retaining screws until point of screw touches rear of panel or bezel. Overtightening of retaining screws will distort housing. Housing must be square after retaining screws are tightened.

Figure 2-2 Controller Mounting Dimensions

SECTION 3
POWER, GROUNDING, AND BUILT-IN I/O CONNECTIONS

3.1 GENERAL

Read this section thoroughly before making any connections. Installation personnel should be qualified technicians. Observe all electrical code requirements and safety standards applicable to these wiring procedures.

Specific instructions and connection diagrams for the various built-in inputs and outputs are provided in **Sections 3.3 through 3.7**. A listing of the applicable electrical specifications is included in each section.

3.2 CONNECTION GUIDELINES

The wiring connections described in this section are made with the controller installed in its operating location and with the power off. All connection terminals are located under a cover on the back of the instrument housing. Figure 3-1 shows the terminals with the cover removed.

! CAUTION *Do not connect any wires to terminals 23, 24, 48, and 49. Connections to these terminals can cause an instrument malfunction.*

The recommended procedure for making power, grounding, and built-in I/O connections is as follows:

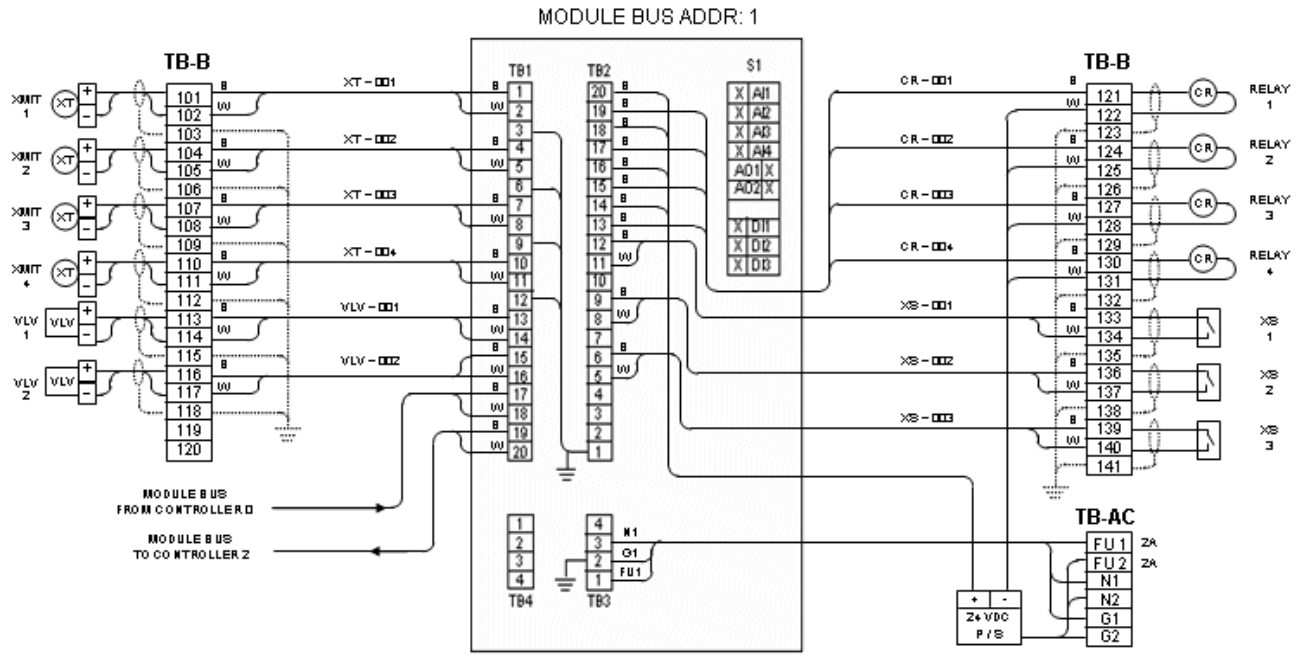
1. Make a copy of the wiring planning sheet, **Appendix A**, and list each wire connection. It is recommended that the planning sheet be used to plan and document all wiring connections: power, grounding, built-in I/O, modular I/O, and communications. Connection instructions for modular I/O and communications are provided in **Sections 4 and 5**.

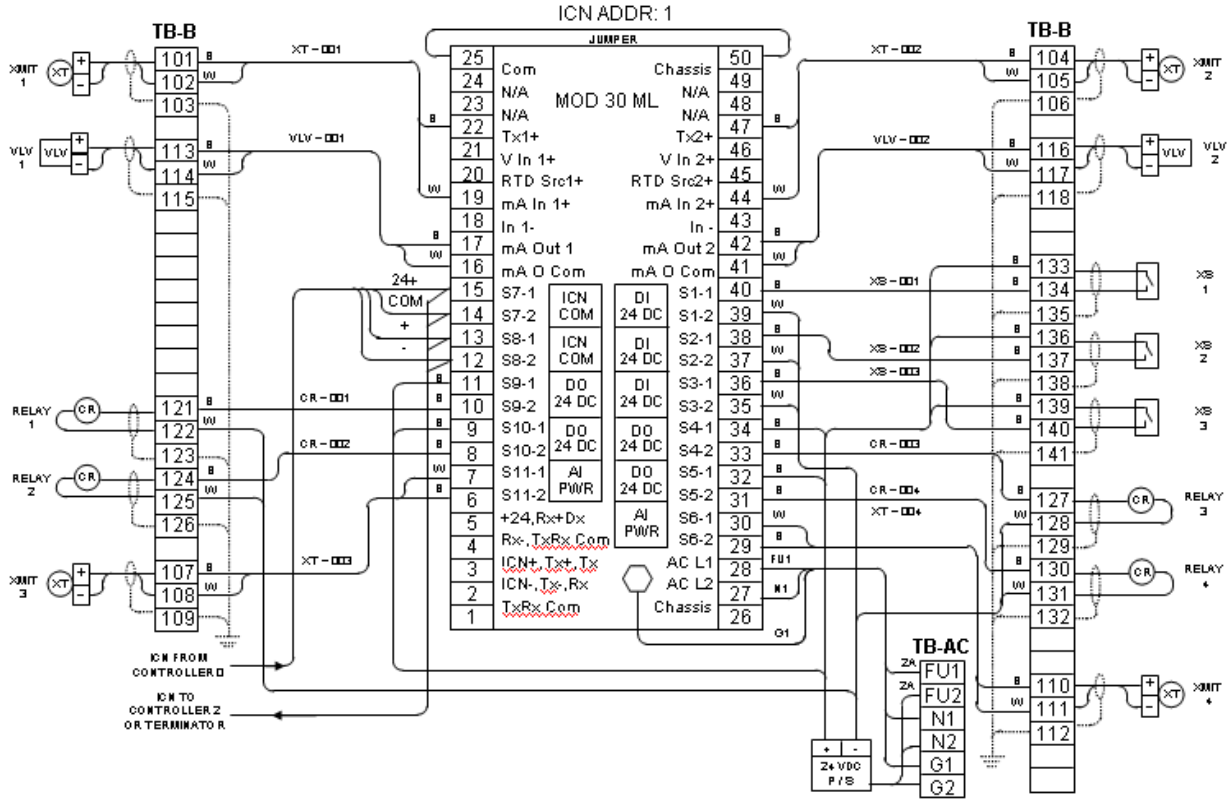
2. The power wire size must be from 14 AWG (1.6 mm) to 18 AWG (1.0 mm) with a 600V, -20°C +105°C UL, CSA approved rating.

3. The signal wire size can be as small as 22 AWG (0.65 mm). All analog input wiring must be shielded twisted pairs. Shields must be connected to a good noise free ground (the chassis ground terminal at the upper right hand corner of the housing is recommended). See **Section 3.4.4** for more information.

4. Route signal wiring less than 30 V rms, 42.4 V peak or 60 V dc from top left. Route signal wiring greater than 30 V rms, 42.4 V peak or 60 V dc from bottom right. Distribute to appropriate terminals.

POWER, GROUNDING, AND BUILT-IN I/O CONNECTIONS





Caution. Disconnect power before wiring.
Refer to terminal connections.

Figure 3-1. Electrical Connection Terminals

5. Use a small flat-head screwdriver to loosen appropriate connection screws and clamps on terminal blocks.

6. Strip approximately 5/16 inch (8 mm) of insulation from the end of each wire, insert wires at assigned terminals and secure terminal screws and clamps.

7. Make wiring connections using the following procedures:

    a. Power connections - **Section 3.3**.

    b. Ground and shield connections - **Section 3.4**.

    c. Built-in process input connections for various types of inputs - **Section 3.5**

    d. Built-in output connections - **Section 3.6**

8. After all connections are completed and checked, do the following:

    a. If modular I/O and communications are required, follow the procedures in **Sections 4 and 5**.

    b. If all connections are completed, the ac power wiring can be connected at the distribution panel (ac source).

NOTE: Before putting the controller into operation, it must be configured using Visual Application Designer software. See **Section 1.1.2** for related documents.

☞ Common should not be left floating. Tie it to chassis or a separate instrument ground if available.

NOTES TO FIGURE 3-1:
1. CONTROLLER SUPPLIES LOOP POWER FOR ALL AI SHOWN.
2. LAND RTD, T/C OR 4-WIRE INPUTS ON BUILT-IN CHANNELS 1, 2.
3. NEMA 1 CONTROLLER STYLE, BUILT IN RS-232 FOR LAPTOP CONFIG.
4. FOR PERMANENT PC CONNECTION, CHG JUMPER, USE TERMS 1-5.
5. DIGITAL IN / OUT ARE WETTED BY EXTERNAL 24 VDC P / S.

3.3 POWER CONNECTIONS

> **⚠WARNING** *Avoid electrical shock. AC power wiring must **not** be connected at the **distribution panel** (ac source) until all wiring procedures are completed.*

All power wiring must be in compliance with the requirements of the National Electrical Code or Canadian Electrical Code. In any installation where the power source does not have one side of the line connected as a neutral conductor, both sides of the line must be overcurrent protected.

The controller does not contain a power disconnect switch. Install a disconnect switch or circuit breaker between the controller and its power source. Choose an accessible location as near to the controller as practical, and identify the switch or breaker as the disconnecting device for the controller.

The ac power connections are made to the power terminals shown in Figure 3-1 Route power cable from the bottom right hand side of the housing.

Power specifications for the controller are:

Power Supply Input:
- Instrument Power Code 1: 85 to 250 V rms, 50 to 400 Hz
- Instrument Power Code 0: 20 to 50 Vdc
- Power Consumption (120V rms, 60 Hz): 50 VA maximum
- Transient Overvoltages: Classified as Installation (Overvoltage) Category II per IEC 664 (Specfies a maxiumum impulse withstand voltage of 1500 V for phase to earth voltage of 150 Vrms)
- Interruption: No effect from 2 cycle dropout at 120V rms, 60 Hz.
- Interference: No permanent effect from exposure to IEC 801-4 fast transients level 3, or IEC 801-5 surges level 3.
- Internal Fuse:
  - DC Version: 4 amps, 250 V Slow Blow, soldered in
  - AC Version: 2.5 amps, 250 V Slow Blow, soldered in
- External switch or circuit breaker rating:
  - DC Version: 3 amps, 28 VDC
  - AC Version: 1 amps, 250 VAC

3.4 GROUND CONNECTIONS

A protective ground terminal (green metal stud) is provided at the bottom of the terminal blocks near the power connections, Figure 3-1. Connect this terminal directly to the plant safety ground system. This terminal is to be used only for the protective ground conductor. Keep the ground wire as short as possible and use the largest practical wire gage.

3.4.1 Chassis and Shield Grounds

The green metal protective ground stud connects directly to the metal instrument chassis, and to the power input filter in the instrument power supply. The two terminals identified as chassis in Figure 3-1 are also internally connected to the protective ground stud. The chassis terminals can be used for shield connections.

3.4.2 Circuit Common Connections

The instrument circuit common is isolated from the protective ground. This makes it easier to avoid dc ground loops, and helps isolate the instrument from noise which may be present on the protective ground.

Instrument common is the negative return for both of the built-in analog output circuits. Common is available on terminals 16 and 41 for convenient connection of the outputs (see Figure 3-1 and **Section 3-7**).

Circuit common is also available at terminal 25 for connection to an instrument system ground. If the installation does not include an instrument system ground, then connect circuit common to one of the terminals identified as chassis in Figure 3-1. Never leave circuit common completely floating. Circuit common must always have some dc path to ground to prevent the possible build up of static charges, and to reduce noise pickup.

3.4.3 Electrical Noise

Electrical disturbances can be caused by lightning, motors and motor driven devices, relays, solenoids, and communication equipment. These disturbances often introduce electrical noise in power lines, transmission lines, and site grounds. The successful operation of any microprocessor-based device depends, in part, on the precautions taken to minimize the effect of these disturbances. Often called "transients" or "voltage spikes", this form of noise is infinitely variable in terms of amplitude, frequency, and duration.

Common sources of this type of noise are:

- loose or poor quality connections (especially power connections)
- arc welding equipment
- switches operating inductive loads
- relays, solenoids and other coil operated devices
- high current conductors – electric heater circuits
- fluorescent or neon lamps
- motors and motor driven devices
- switch mode devices – SCRs, thyristors
- lightning
- electrostatic discharges

3.4.4 Noise Prevention Measures

Primary power circuit distribution system:

- Ideally, each microprocessor-based device should be provided with an independent dedicated power source. Where this approach is not feasible due to space availability or cost per device, an acceptable alternative is to install constant voltage, isolation transformers in the branch circuit where the microprocessor-based device is installed.
- In addition to the above, install a combination transient surge suppressor and noise filter in the instrument side of the power distribution system. The combination device suppresses transients and effectively reduces other noise forms such as electromagnetic (EMI) and radio frequency (RFI) interferences. These devices can be connected to multiple units to reduce overall cost.

Input signals

- Twisted wire pairs are essential. The wire type should be stranded, not solid. The largest wire gauge allowed is best and the more twists per foot the better. A 2-inch lay (6 twists per foot) should be the minimum used.
- In addition to the above, signal wires should be physically isolated from all power conductors (separate conduit, cable race, etc.)
- Shielded wire is also essential. Shields must be terminated at the instrument or in the field in accordance with local regulations.

! CAUTION

1. Never terminate a shield at both ends. One end must always be left "floating" or ground currents may be introduced.
2. Thermocouple shields should be terminated at the process measurement end. Most thermocouples are constructed where the sensor is electrically equivalent to the process connection (grounded junction).

Equipment grounding:

- Grounding practices defined by the National Fire Protection Agency (NFPA) in their National Electrical Code (NEC) handbook or State agency amendments to this code should be strictly observed.
- Existing ground conductors and ground paths should be periodically inspected and tested to insure continuity and compliance with current code requirements.
- For best noise reduction performance, the microprocessor-based device's ground terminal should be connected to a nearby grounded large metal structure, using the shortest length wire possible. If a three-wire cordset is used to power the microprocessor-based device through a receptacle, the ground wire is generally too long and too noisy to be a good ground.

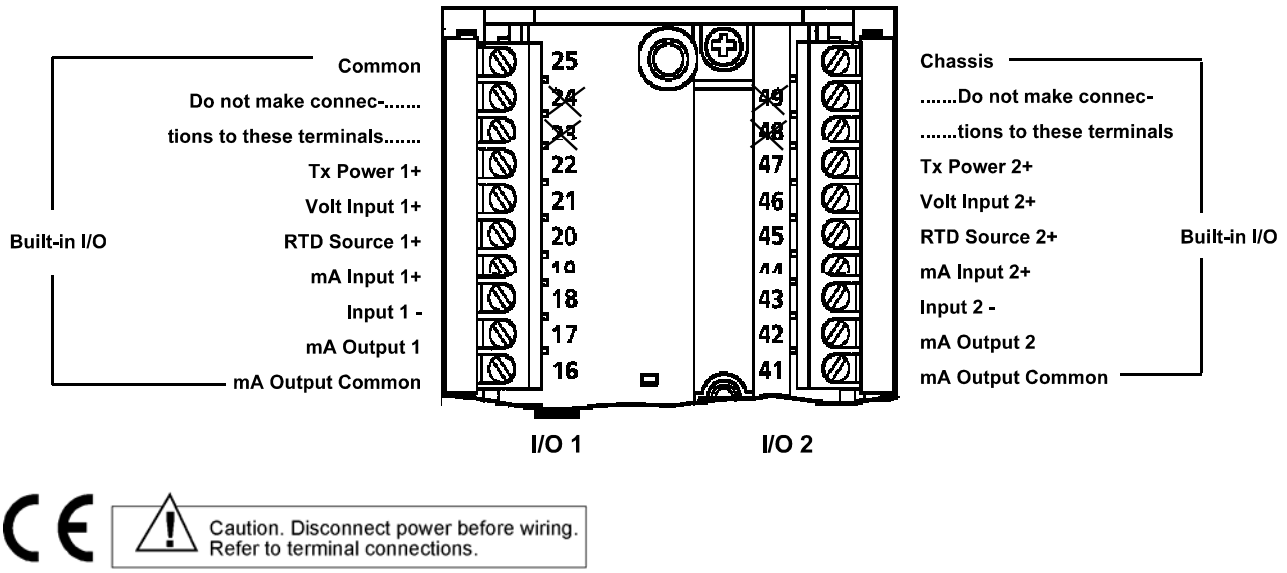


Figure 3-2. Terminal Identifications for Built-in I/O

3.5 BUILT-IN PROCESS INPUT CONNECTIONS

Built-in inputs 1 and 2 are isolated universal analog inputs which accept volts dc, millivolts dc, milliamps dc (includes 2-wire transmitters), RTD, Thermocouple, and resistance signals. Connections to these inputs are made to the terminals shown in Figure 3-2. The input circuit diagrams in this section (Figures 3-3 to 3-9) identify Input 1 terminals as **I/O 1** and Input 2 terminals as **I/O 2**.

Each of the two built-in analog input circuits is isolated from every other circuit. It is recommended that either the Input– or the mA Input + terminal be connected to ground at some point in the system to prevent possible buildup of static electricity and reduce the pickup of noise.

The input circuit and input signal specifications for each input type are shown in the following sections:

- Volt, Millivolt and Thermocouple Input - **Section 3.5.1**
- RTD Input - **Section 3.5.2**
- Current Input from a 2-Wire Transmitter - **Section 3.5.3**
- Current Input from a Non 2-Wire Transmitter - **Section 3.5.4**
- Resistance Input - **Section 3.5.5**

General specifications for built-in process inputs are:

Input Isolation: Galvanic isolation using transformers and optical isolators. Input Common Mode Rating: 45V dc Common Mode Rejection: 120 dB @ 50/60 Hz Normal Mode Noise Filter: 20 dB minimum @ 60 Hz Maximum Normal Mode Voltage: 30V dc (except current input) Display Accuracy: Input accuracy ± one least significant display digit

3.5.1 Built-In Voltage, Millivolt and Thermocouple Inputs

Make volt, millivolt and thermocouple input connections as shown in Figure 3.3. Always connect the first thermocouple input to the I/O 1 terminals to enable automatic cold junction compensation for all thermocouple inputs.

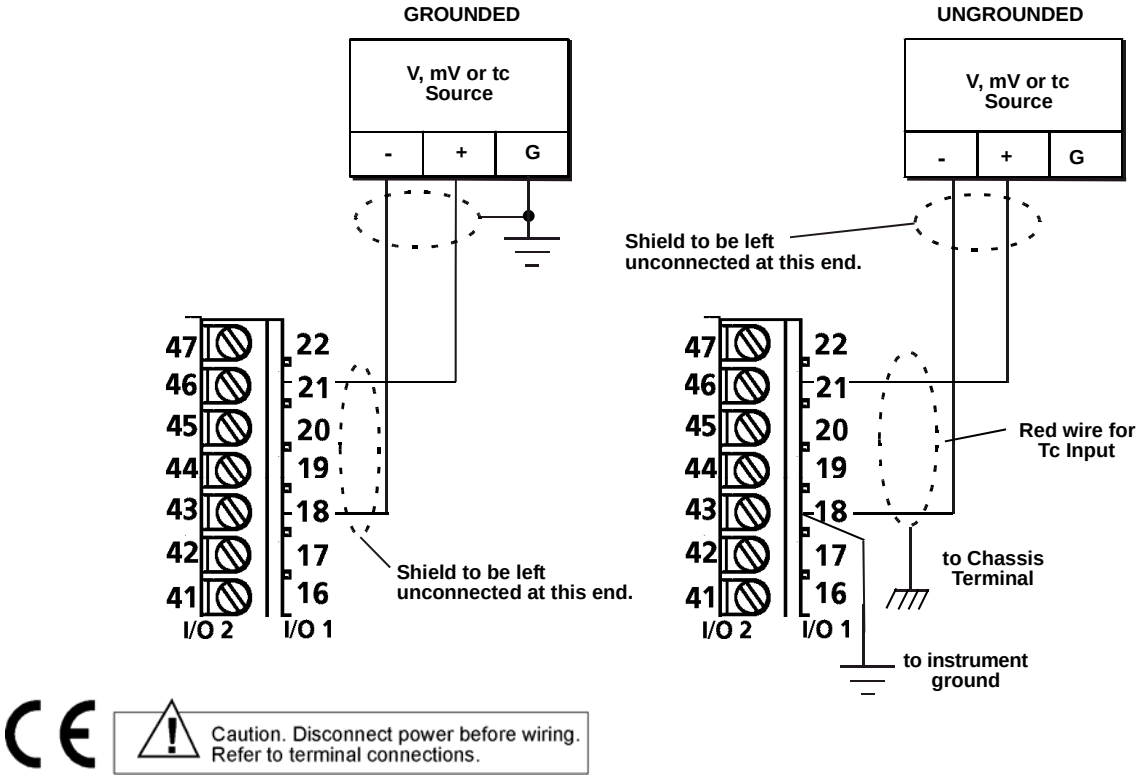


Figure 3-3. Built-in Voltage, Millivolt and Thermocouple Input Connections

Volt input specifications are:

Input Range: –10 mV to +6 Vdc
Input Impedance: 10M ohms minimum
Resolution: less than 50 microvolts
Accuracy: 0.05% of input or 100 microvolts, whichever is greater
Temperature Effect: 0.01% per °C or 10 microvolts per °C, whichever is greater
Burnout Detection: Reading goes downscale when any lead opens.

Millivolt and Thermocouple input specifications are:

Input Range: –10 to 120 mVdc
Temperature range limits for thermocouple inputs: See Table 4-1
Input Impedance: 10M ohms minimum
Resolution: less than 1 microvolt
Accuracy: 0.08% of input or 20 microvolts, whichever is greater
Temperature Effect: 0.01% per °C or 1 microvolt per °C, whichever is greater
Burnout Detection: Configurable for thermocouple inputs and millivolt signals which represent thermocouple inputs. Choices are upscale or downscale excursion of reading when any lead opens, or no detection.

3.5.2 Built-In RTD Input

Make RTD input connections as shown in Figure 3-4. See **Section 4.3.6** for a listing of materials, standards and sample RTDs supported by the instrument software.

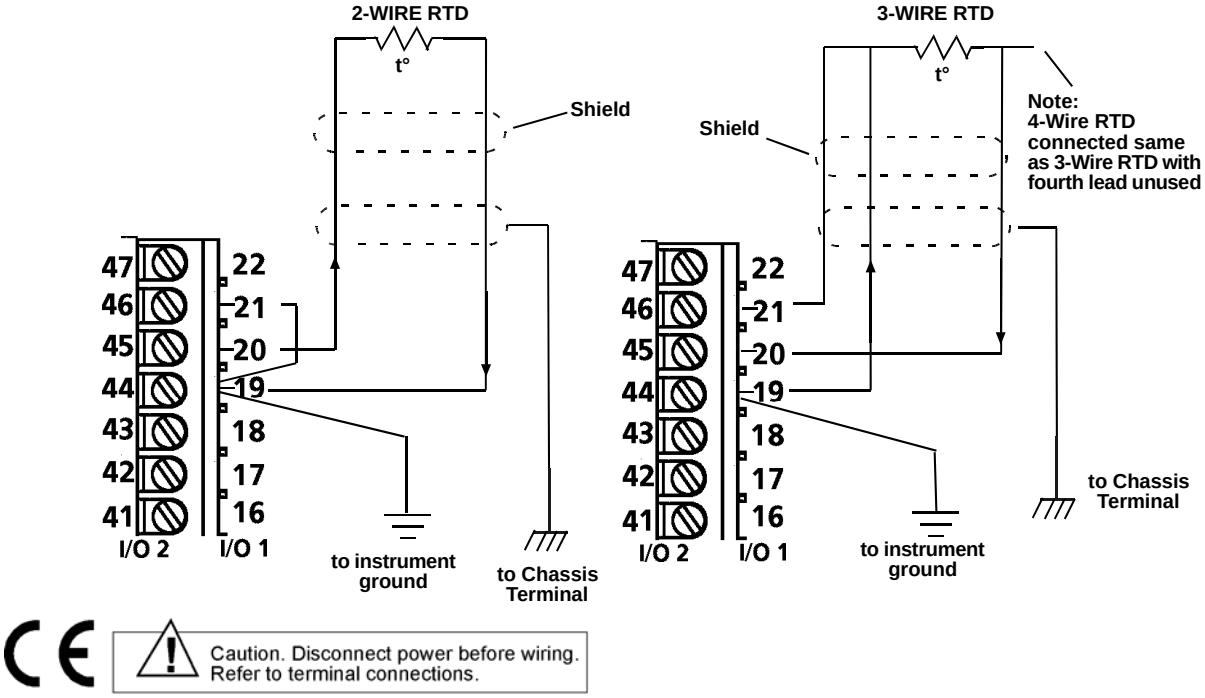


Figure 3-4. Built-in RTD Input Connections

RTD input specifications are:

RTD Type: 3-Wire or 2-Wire
Range: Configurable
- Normal Range: 0 to 430 ohms
- Low Range: 0 to 55 ohms

Resolution: less than 0.004 ohms
Accuracy: ±0.05% of input resistance or 0.1 ohms whichever is greater
Temperature Effect: ±0.01% per °C or 0.01 ohms per °C whichever is greater
RTD Current: 250 microamps typical
Burnout Detection: Reading goes upscale when any lead opens

3.5.3 Built-In Current Input - 2-Wire Transmitter

Make input connections from a 2-wire transmitter as shown in Figure 3-5.

22mA Maximum Loop Current
When the maximum required loop current is 22 mA or less, make connections as shown in the left hand view of Figure 3-5. In this connection arrangement, the 2-wire loop receives its current from a 24V supply in the controller. The current supply is automatically connected in the circuit when the 2-wire input connection is made.

50 mA Maximum Loop Current
If the maximum required loop current is 50 mA, make connections as shown in the right hand view of Figure 3-5. In this connection arrangement, an external power supply must be used to meet the 50 mA requirement.

Current input and transmitter power supply specifications are:

Input Range: 0 to 20 mA dc, Limited to below 70 mA
Input Impedance: 100 ohms nominal
Resolution: less than 1 microamp
Accuracy: ±0.1% of input or 2 microamps, whichever is greater
Temperature Effect: 0.01% per °C or 0.2 microamps per °C, whichever is greater
Transmitter Power Supply: Isolated 24V dc, 20 mA transmitter power supply is built into controller. For current inputs above 20 mA, a separate external power supply must be used.

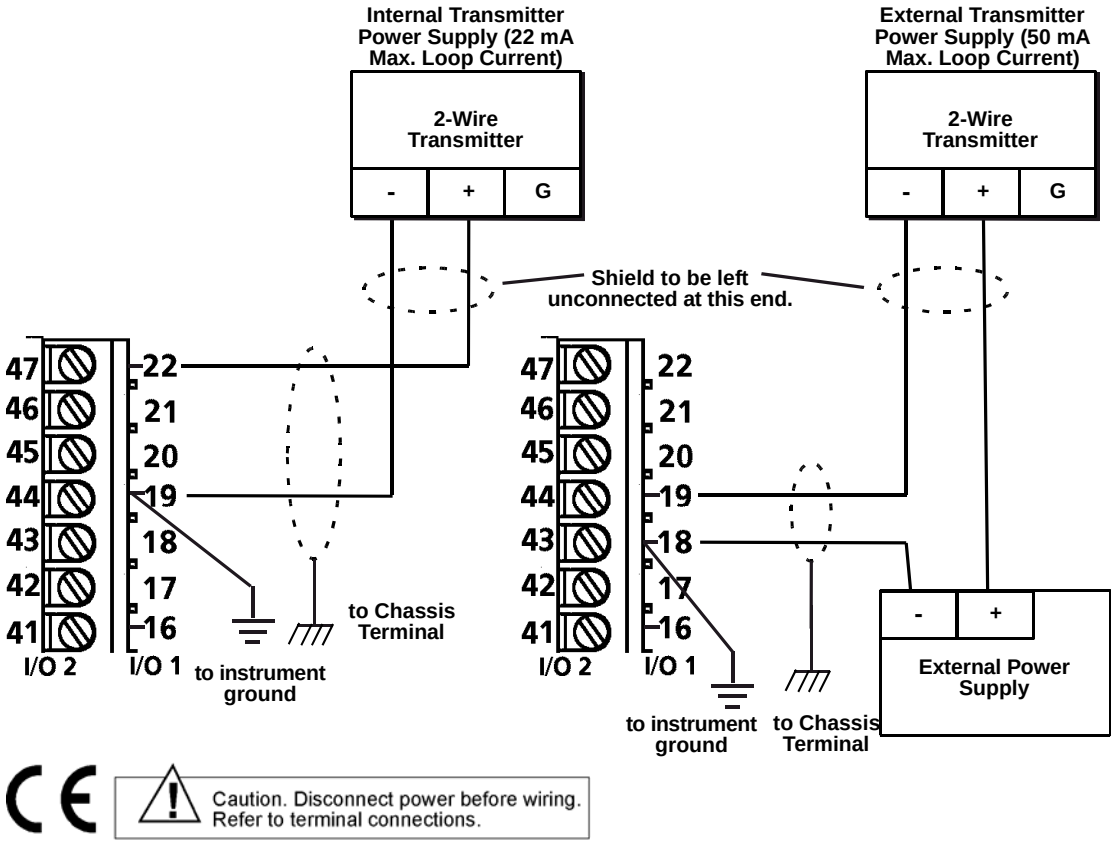


Figure 3-5. Built-in 2-Wire Milliampere Current Input Connections

3.5.4 Built-In Current Input - Non 2-Wire Transmitter

Make current input connections from a non 2-wire transmitter as shown in Figure 3-6. Note that the transmitter must be powered from an external source which meets the transmitter power specifications.

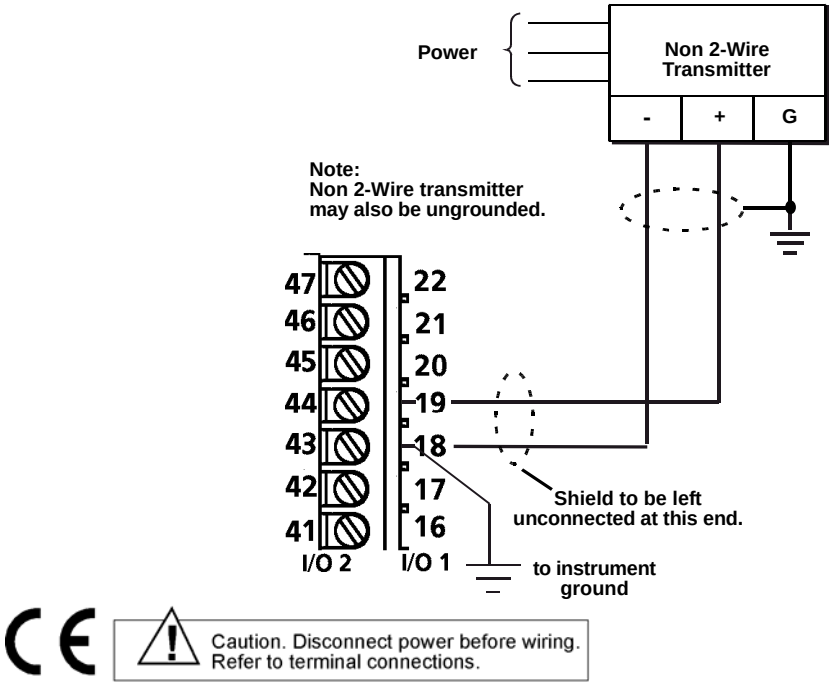


Figure 3-6. Built-in Non 2-Wire Current Input Connections

Current input specifications are:

Input Range: 0 to 54 mA dc, Limited to below 70 mA
Input Impedance: 100 ohms nominal
Resolution: less than 1 microamp
Accuracy: ±0.1% of input or 2 microamps, whichever is greater
Temperature Effect: 0.01% per °C or 0.2 microamps per °C, whichever is greater

3.5.5 Built-In Resistance Input

The resistance input can be used to monitor a resistance which changes in proportion to a process related value such as a set-point. Make resistance input connections as shown in Figure 3-7.

The resistance input can also be used for a 2-wire RTD, which is not on the list of supported RTDs in **Section 4.3.6**. Make the 2-wire RTD connections as shown in Figure 3-4. When using an RTD not supported by the instrument software, the database must be configured to provide a user defined linearization using the Application Builder Software. Refer to **Section 1.1.2 Related Documents.**

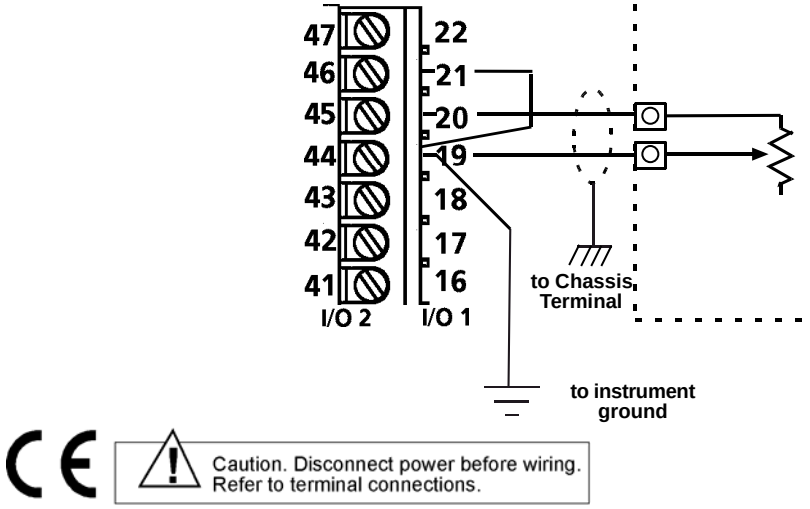


Figure 3-7. Built-In Resistance Input Connections

Resistance input specifications are:

Range: Configurable
- Normal Range: 0 to 430 ohms
- Low Range: 0 to 55 ohms

Resolution: less than 0.004 ohms
Accuracy: ±0.05% of input resistance or 0.1 ohms whichever is greater

3.6 BUILT-IN OUTPUT CONNECTIONS

Built-in outputs 1 and 2 are milliamp analog control outputs. Connections to these outputs are made as shown in Figure 3-2. The output circuit diagrams, Figures 3-8 and 3-9 identify the Output 1 terminals as **I/O 1** and the Output 2 terminals as **I/O 2**.

The built-in outputs are always milliamp signals. When an application requires a voltage signal, a precision dropping resistor must be connected across the output terminals to generate the required voltage as shown in Figure 3-9.

Specifications for built-in outputs 1 and 2 are:

Range: 0 to 20 mA maximum, non-isolated
Resolution: 14 microamps
Accuracy: ±0.2% of setting or 14 microamps, whichever is greater
Temperature Effect: 0.01% per °C or 1 microamp per °C , whichever is greater
Load Resistance: 1000 ohms maximum at 22 mA
at 54 mA: 400 ohms maximum
Open Circuit Voltage: 25.5 volts typical
Ripple: 20 millivolts peak to peak at 100K Hz typical

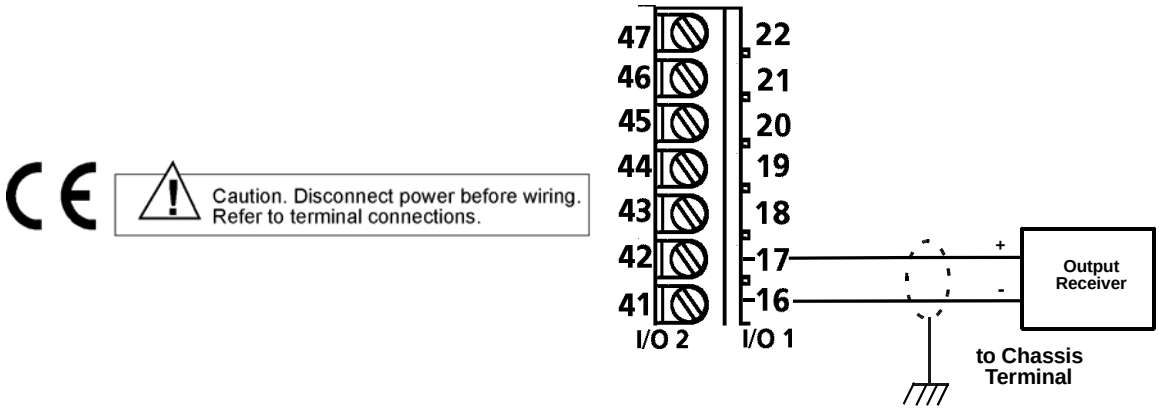


Figure 3-8. Built-in Milliampere Output Connections

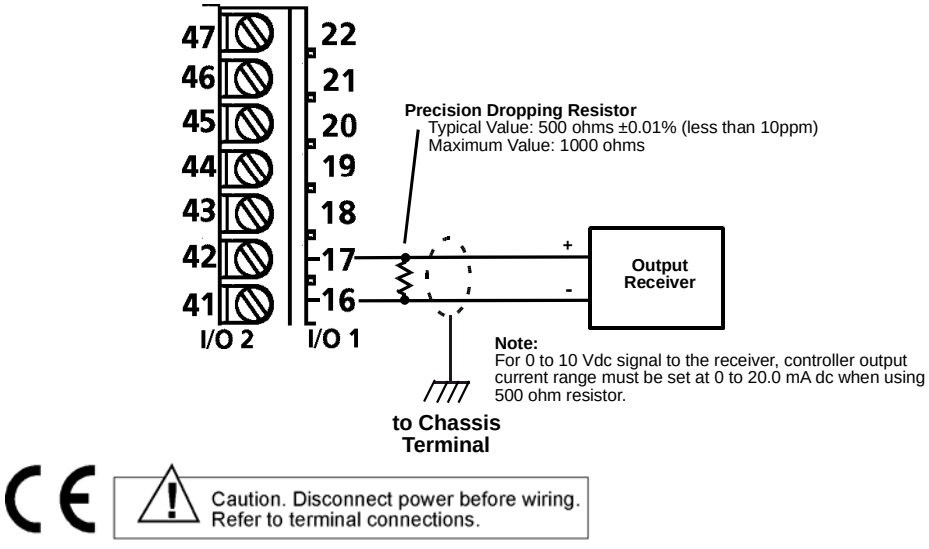


Figure 3-9. Built-in Voltage Output Connections

POWER, GROUNDING, AND BUILT-IN I/O CONNECTIONS

5
COMMUNICATIONS CONNECTIONS

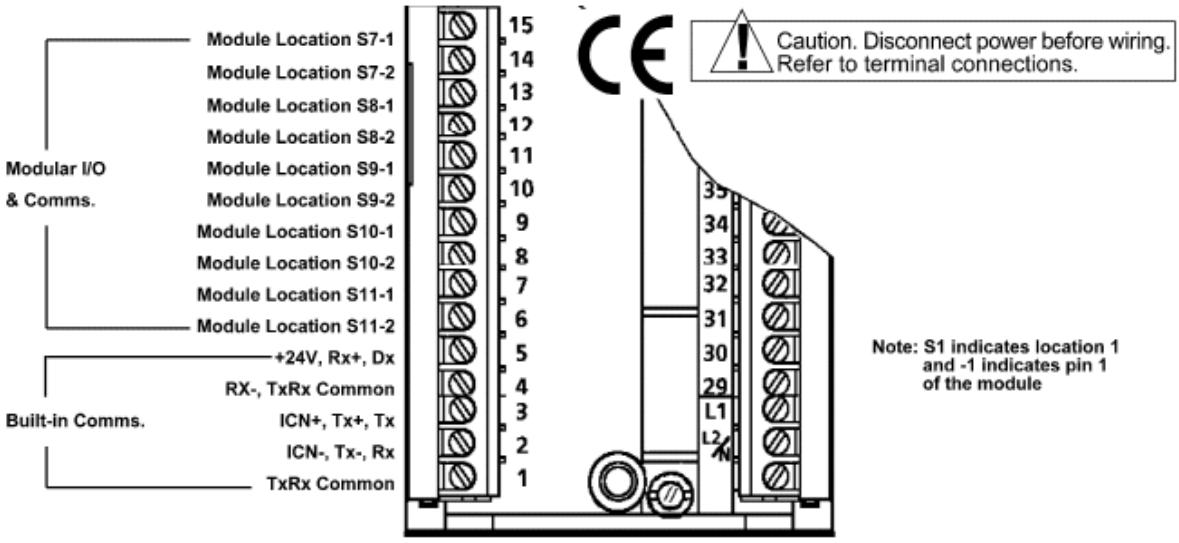


Figure 5-1. Terminal Identifications for Communications Network Connections

5.1 GENERAL

Read this section thoroughly before making connections. Installation personnel should be qualified technicians.

The controller provides communications capability for both ICN (peer-to-peer) and Modbus networks, permitting the controller to communicate on two different networks simultaneously. Port 1 uses built-in communication drivers and is configured for Modbus RS-232 communications. Port 2 requires a modular driver and is configured for Instrument Communication Network (ICN) peer-to-peer communications. Communications connections are made to the terminals shown in Figure 5-1. The communications network diagrams in this section show connections for both the built-in and modular communications circuits.

The RS-232 communications port is in the bottom of the front panel. This port permits connection of a portable computer for data base configuration using Visual Application Designer software.

5.2 COMMUNICATION CONNECTION GUIDELINES

The wiring connections described in this section are made with the controller installed in its operating location and with the power off. All connection terminals are located under a cover on the back of the instrument housing. Figure 5-1 shows the communication connection terminals with the cover removed.

The recommended procedure for making communications connections is as follows:

1. Communications port 1 serves the built-in communications circuits and is used for port 1.
2. Communications port 2 serves I/O module location S8 and S7, where the ICN Communication Module is plugged in.
3. For communication port 1, a communications jumper on the carrier board, Figure 5-2, is positioned to select RS-232 Modbus communication for the built-in circuits, to allow connection of a portable computer through the front panel.
4. The built-in communications circuits are isolated from all other circuits. Terminal 1 (TX & RX common) is the communications circuit common for these built in circuits. Connect terminal 1 of each instrument on the communication bus together. This common line must be connected to ground at some point in the system to prevent the possible build up of a static charge, reduce noise pick up, and comply with EU EMC requirements.
5. Communications wiring should be shielded twisted pairs. Detailed cable requirements are provided in **Sections 5.4 and 5.5**.
6. The cable shields must be connected to a good noise free ground. Normally this should be one of the terminals identified as chassis in Figure 3-1. Alternatively, it is acceptable to to use the shield to connect the commons among the instruments. If this arrangement is used, noise rejection may not be optimal.
7. Route communications wiring from the top left hand side of the housing and distribute to appropriate terminals.
8. Use a small, flat-head screwdriver to loosen appropriate connection screws and clamps on terminal blocks.
9. Strip approximately 5/16 inch (8 mm) of insulation from the end of each wire, insert wires at assigned terminals, and secure terminal screws and clamps.
10. Make wiring connections using the following procedures:
    a. Front Panel RS-232 Communications Connections - **Section 5.3**.
    b. Instrument Communications Network (ICN) Connections - **Section 5.4**.
11. After all connections are completed and checked, the ac power wiring can be connected at the distribution panel (ac source).

* *NOTE:* Before putting the controller into operation, it must be configured using the Visual Application Designer Software. See **Section 1.1.2** for related documents.

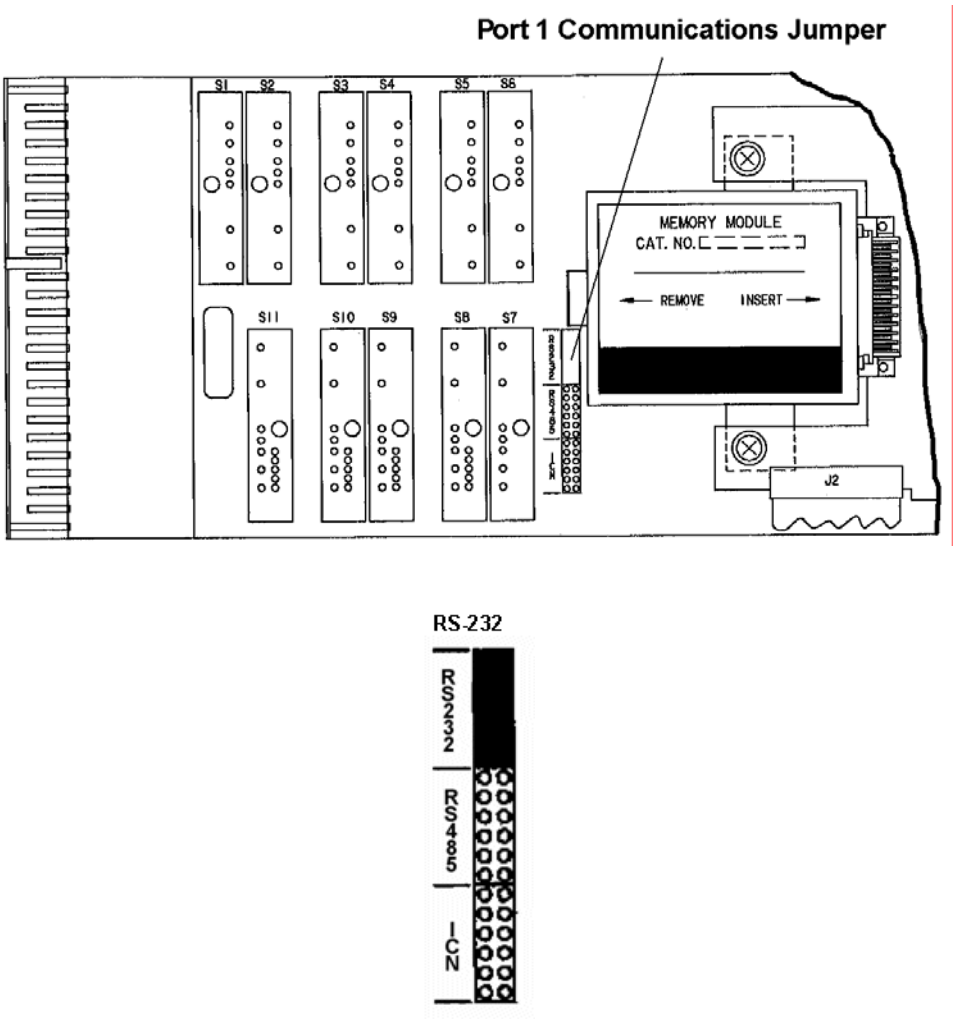


Figure 5-2. Locations for Port 1 Communications Jumper – Built-in Circuit

5.3 FRONT PANEL RS-232 COMMUNICATIONS CONNECTION

The RS-232 communication port in the instrument front panel is used exclusively for data base configuration via connection of a portable computer. Use of this RS-232 port is subject to the following requirements:

- Connection to the port must be made using a cable which is available as an accessory to the instrument. The cable is terminated at one end with a plug-in connector for the instrument port, and at the other end with a connector compatible with a computer serial communication port.
- The communication jumper, Figure 5-2, must be positioned for RS-232 communication.

- The instrument data base must be configured to provide RS-232 communication on the built-in circuit; this is the default configuration.

When the built-in RS-232 circuit is being used for network communication, making a connection to the front panel RS-232 port disables the network receive function so that the instrument can receive data only from the device connected to the port. The transmit line is not affected.

5.4 INSTRUMENT COMMUNICATIONS NETWORK (ICN) CONNECTIONS

An example of a typical ICN configuration with modular connections is shown in Figure 5-3.

5.4.1 Cable Requirements

The length of the ICN is the sum of the lengths of the physical two-wire bus between each node on the ICN. If the network includes MOD 30 instruments, the length of any MOD 30 instrument cables between the nodes and the instruments must be included in the total length. This length can be up to 2000 ft (609.6 m). Cable requirements for an ICN are dependent upon the length of the ICN as described below.

- When the total length is 500 ft (150 m) or less, use 18 AWG (1 mm) shielded twisted pair cable.
- When the total length is between 500 and 1500 ft (150 and 450 m):
  - Entire length of the ICN must be at virtually the same potential and voltage drop between any two points on ICN must not exceed 3V.
  - Cable capacitance for an ICN must be between 18 and 25 pf/ft (60-83 pf/m).
- When the total length exceeds 1500 ft (450 m) or if the ICN must be routed through high noise (EMI/RFI) environments, use 22 AWG (0.64 mm) shielded cable. If an ICN must be run next to power lines or other unusual noise frequencies, contact your service representative for assistance.

5.4.2 Addresses

Each device on an ICN must be assigned a unique address. Addresses are in the range of 0 through F hex (0 through 15 decimal). The address for the built-in circuit is configured through the front face of the instrument in Device Setup (see IB-1800R-OPR Setup Section). Addresses for modular circuits are set at the module as shown in Figure 5-3.

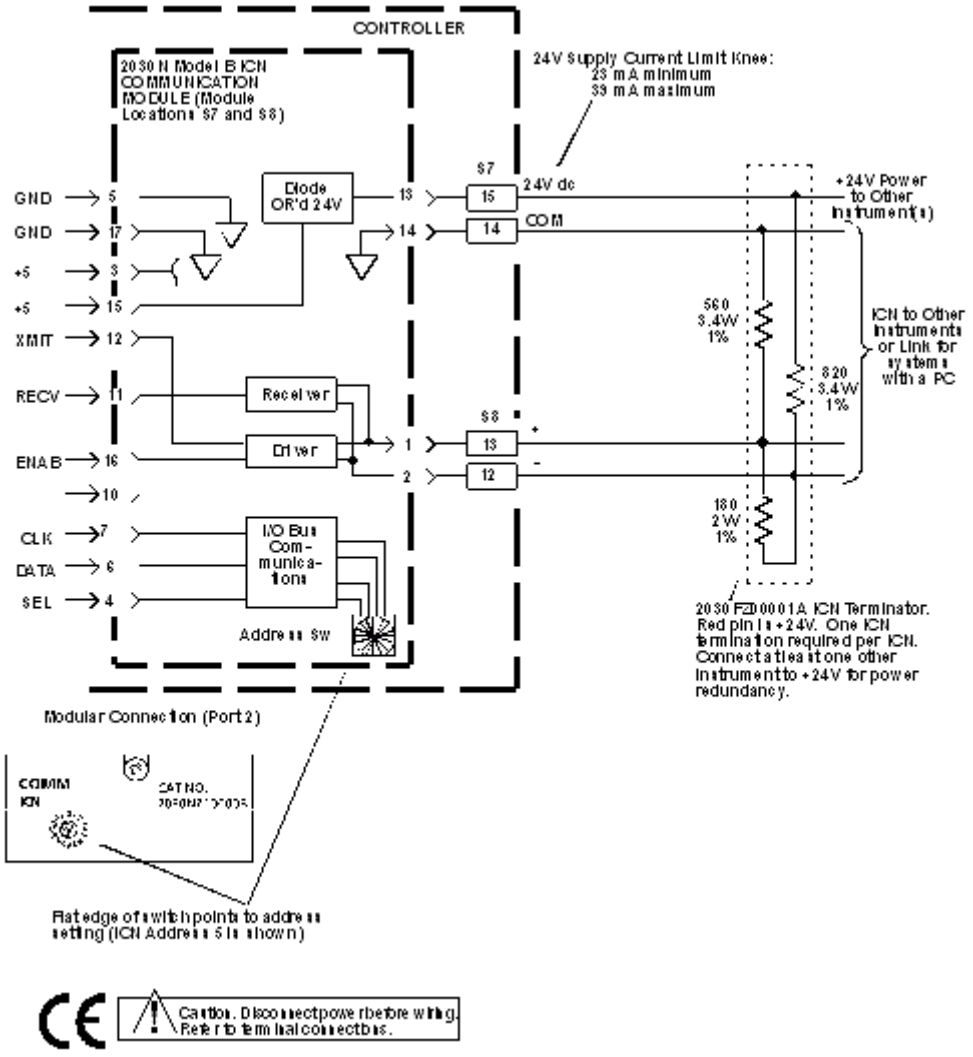


Figure 5-3. ICN Connections for Modular Communication Circuits

5.4.3 Termination

One set of ICN termination resistors must be installed on each ICN to prevent noise from being picked up by the ICN circuitry and generating a diagnostic alarm. The ICN termination scheme requires a nominal 24 volt DC power supply that can supply 15.4 mA. This supply is provided by both the built-in and modular circuits. The termination resistor network is provided in a 2030FZ00001A ICN Terminator. The terminator can be conveniently connected to an ICN at built-in terminals 2 - 5 as shown in Figure 5-3. Note that the terminator is connected to common via terminal 4 which is internally connected to terminal 1 (communications common) for ICN communication. The terminator can also be connected at the appropriate four terminals when a communications module is used.

Other factors affecting the termination scheme are as follows.

- The ICN cable shields should be connected directly to chassis ground **at one end only**.
- Be sure each network has only one terminator. If the controller is connected to an existing MOD 30 ICN, the network is already terminated and a terminator must not be connected to any new device.

5.5 MODBUS NETWORK CONNECTIONS

5.5.1 General

The RetroPAK controller is set up to provide Modbus RS-232 communications through the front port on the front panel assembly. This allows download of configured databases from a portable computer using the downloading cable 109S1854.

Communications Parameters
The baud rates available are: 150, 300, 600, 1200, 2400, 4800, 9600, 19200 or 38400. Parity can be none, even or odd, and there can be either 1 or 2 stop bits. These parameters are configurable via the front panel.

The transmission mode of Modbus networks using either the built-in circuits is RTU (Remote Terminal Unit).

Addresses
Each slave on a Modbus network must have a unique address. Addresses 1 through 247 (01 through f7 in hexadecimal) are supported by the Modbus protocol. Addresses for the built-in circuit are assigned by configuration of a data base attribute. Addresses for modular circuits are set at the module as shown in Figure 5-7.

5.5.2 RS-232 Modbus Communication

The built-in circuit for RS-232 communication uses a driver/receiver which supports a point-to-point Modbus network. These circuits meet all RS-232C and V.28 specifications. They have a±9V output swing with a+5V supply, and±30V receiver input levels. All field connection terminals are optically isolated from the instrument circuitry. The maximum network cable length is 50 feet.

The circuit supports the Extended Modbus protocol which provides full communications functionality between the controllers and the Visual Application Designer software.

Connections for a typical RS-232 Modbus network using the built-in circuit are shown in Figure 5-4.

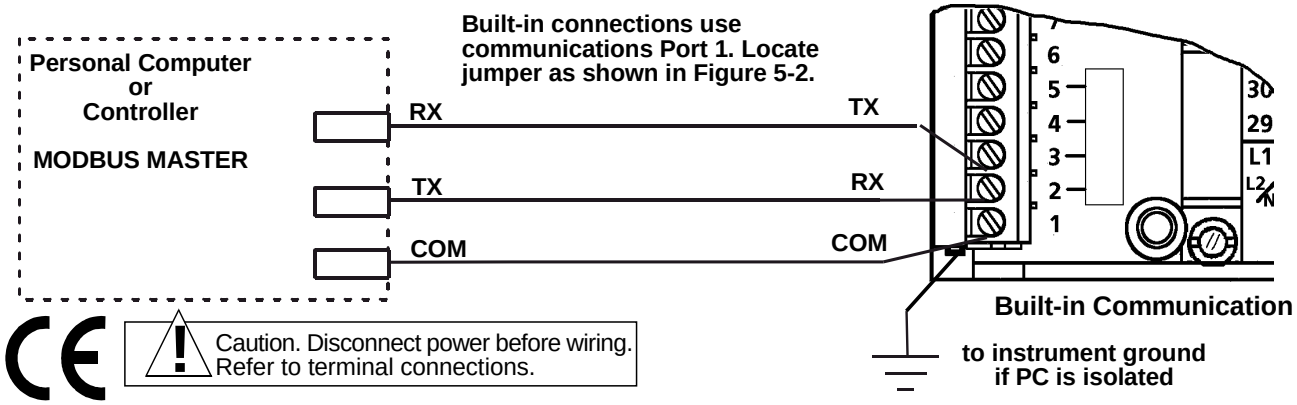


Figure 5-4. Typical Network Connections for Built-In Modbus RS-232 Communication

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