Chapter 6
I/O Specifications and Wiring

I/O System Introduction

The Input/Output (I/O) of the Series One and Series One Plus PCs is provided on modules (figure 6-1) each typically with 4, 8, or 16 input circuits or 4, 8, or 16 output circuits. These modules are inserted into slots in the racks. Up to 4 modules in a 5-slot rack or 9 modules in a 10-slot rack of any I/O mix can be placed in the first rack with the CPU. Up to 5 modules in a 5-slot rack or 10 modules in a 10-slot rack, again of any I/O mix can be placed in each of the expansion racks.

The I/O references are assigned to each slot by its physical position (see table 5-5). The only address switches that need to be set are associated with the racks. In the 5-slot rack, a 2 position switch must be set which specifies whether the rack is a CPU or expansion rack. Series One Plus 10-slot racks have 2 bridge connectors, on the backplane, which must be set to specify whether the rack is a CPU or expansion rack and the I/O addressing configuration for slot 10 of the CPU rack and all slots in the expansion rack. Installation and wiring of these modules is discussed in Chapter 3, Installation. This chapter will discuss the capabilities of these I/O modules, to allow the user to properly design wiring diagrams and apply these modules.

Field Wiring to I/O Modules

Each of the 8 circuit I/O modules, has a terminal block attached to it with 10 screw terminals. The 16 point I/O modules, with screw terminals, have a removable socket type terminal board on the front of the module. The terminal board can be easily removed, which allows modules to be readily removed or changed without removing the field wiring to the module. Each of these terminals are capable of accommodating one AWG No. 12 or two AWG No. 14 stranded wires. A clear plastic cover snaps over the terminals as a safety precaution. An insert is included with the covers to record circuit identification.

Some of the 16 point I/O modules are connected to field wiring through a connector mounted on the faceplate. A description of these modules is on the following page.

The rest of this chapter provides specifications, wiring diagrams, typical schematics, and sample reference numbers for each module type. The typical schematics are to provide details for interfacing and not for maintenance or repair of these modules.

The sample reference numbers should be adjusted by the user to the actual slot in which the modules will be installed. Every slot is provided with eight references. Those modules that provide eight circuits still consume 8 I/O references. When 4 circuit modules are used, the four references not used to interface to ''real world'' I/O, are available for use as internal references for the user's logic program. A 16 circuit I/O module uses 2 groups of 8 I/O references.

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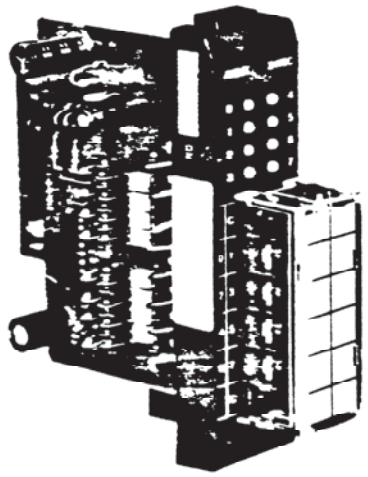

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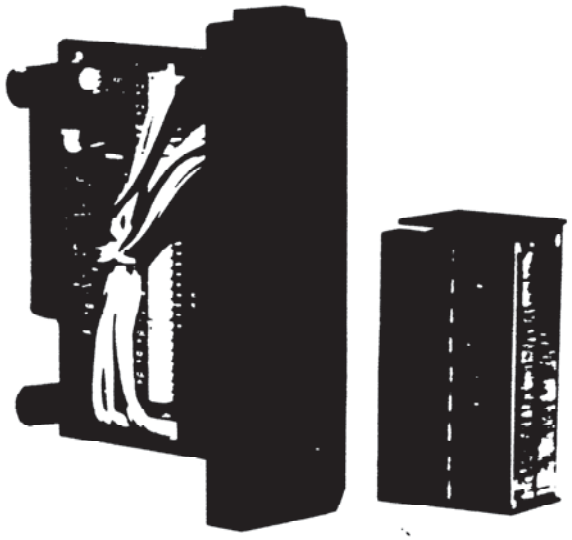

Figure 6-1. A. Typical I/O Module B. High Density Module With Removable Connector

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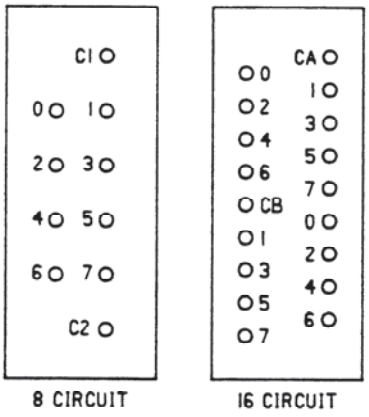

Figure 6-2. Typical I/O Terminal Configuration

16 Circuit I/O Modules with Connectors

Some of the I/O modules providing 16 input or 16 output circuits have a 24-pin connector on the faceplate. These modules are connected to user supplied input devices or user supplied loads through an I/O Interface cable which is 10 feet (3m) in length (Catalog Number IC610CBL105). One end of this cable has a 24-pin female connector which mates with a 24-pin male connector mounted on the faceplate of the I/O module. The wires on the opposite end of the cable are stripped and tinned for connection to user devices. Each of the wires is color coded for easy identification. Figure 6-3 is a wiring list for the I/O Interface cable.

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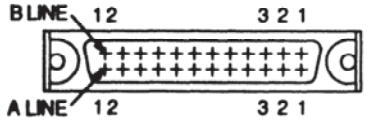
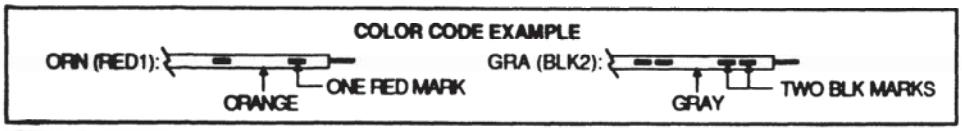


ORN ..... ORANGE PNK ..... PINK
GRA .....GRAY RED ..... RED
WHT ..... WHITE BLK ..... BLACK
YEL ..... YELLOW



PIN NO.	SIGNAL	WIRE COLOR CODE
A1	0	ORN (RED1)
A2	2	GRA (RED1)
A3	4	WHT (RED1)
A4	6	YEL (RED1)
A5	COMMON	PNK (RED1)
A6		ORN (RED2)
A7	0	GRA (RED2)
A8	2	WHT (RED2)
A9	4	YEL (RED2)
A10	6	PNK (RED2)
A11	COMMON	ORN (RED3)
A12	COMMON	GRA (RED3)

PIN NO.	SIGNAL	WIRE COLOR CODE
B1	1	ORN (BLK1)
B2	3	GRA (BLK1)
B3	5	WHT (BLK1)
B4	7	YEL (BLK1)
B5	COMMON	PNK (BLK1)
B6		ORN (BLK2)
B7	1	GRA (BLK2)
B8	3	WHT (BLK2)
B9	5	YEL (BLK2)
B10	7	PNK (BLK2)
B11	COMMON	ORN (BLK3)
B12	COMMON	GRA (BLK3)

NOTE: THE WHITE WIRE WITH THREE RED MARKS AND THE WHITE WIRE WITH THREE BLACK MARKS ARE NOT USED

Figure 6-3. I/O Interface Cable Wiring List

I/O References for 16 Circuit Modules

When using a 16 circuit I/O module, addresses are borrowed from future slots. The illustration in figure 6-4 is used as an example of this concept. For instance, if a 16 circuit module is installed in slot 02, the I/O references for that module will be 020-027 and 120-127. Slot 12 is then no longer available for use since its references have been used (borrowed) by the module in slot 02. Additional examples of I/O addressing can be found in Appendix B.

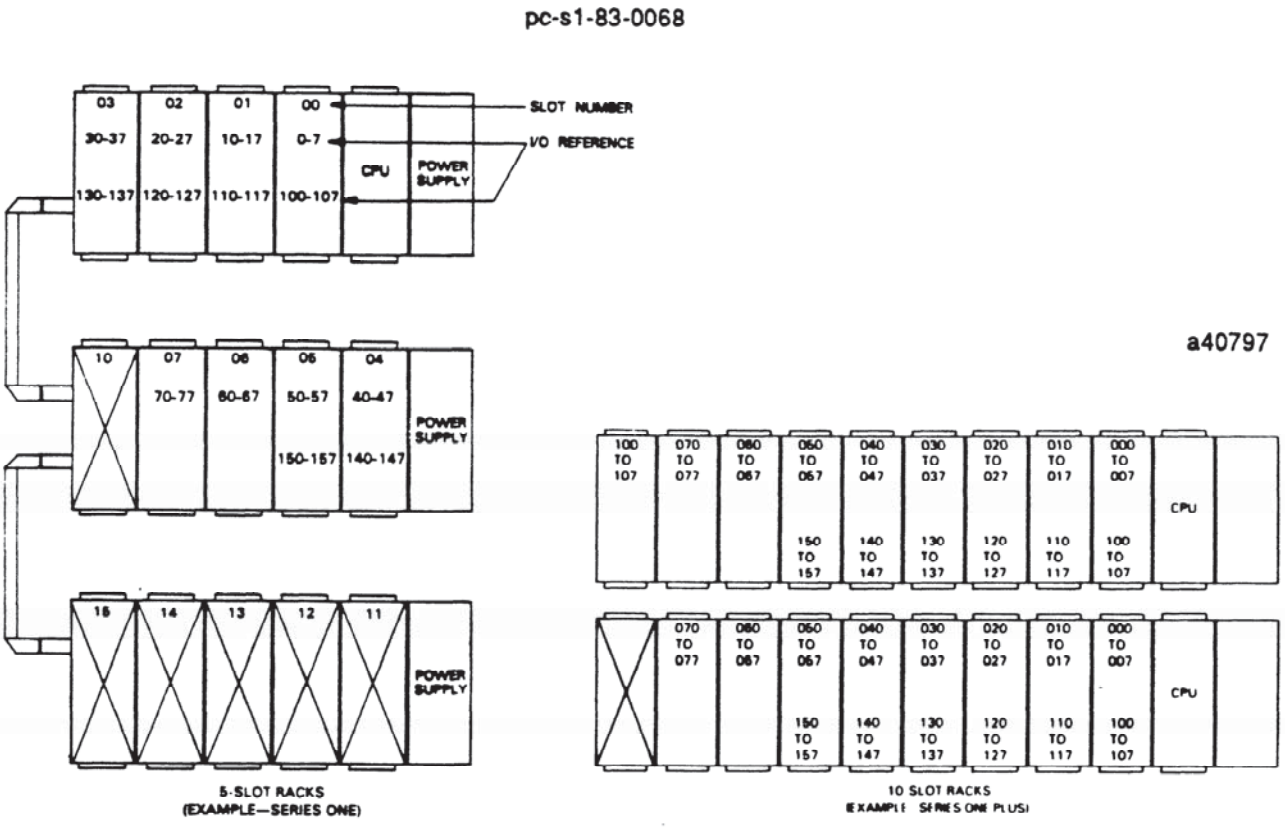


Figure 6-4. Example of 16 Circuit I/O References

NOTE

When using the maximum number of 16 point I/O modules possible, the slots marked with an X are no longer available for system use.

I/O Interface Cable Cross Reference List

The following list provides a reference to the available I/O Interface cables and the module or modules with which they may be used.

Cable Description	Module Description
IC610CBL105 24 Pin Connector 10' (3 meters)	IC610MDL105 Thumbwheel Interface IC610MDL106 High Density Input IC610MDL156 High Density Output
IC610CBL107 32 Pin Connector 10' (3 meters)	IC610MDL110 High Speed Counter

I/O Module Catalog Numbers

Table 6-1 is a list of catalog numbers for Series One/Series One Plus I/O modules.

Table 6-1. I/O Module Catalog Numbers

DESCRIPTION	CATALOG NUMBER
I/O Modules - Input	
115 V ac Input, 8 Circuits	IC610MDL125
230 V ac Input, 8 Circuits	IC610MDL127
115 V ac Isolated Input, 4 Circuits	IC610MDL126
24 V dc Sink Input, 8 Circuits	IC610MDL101
24 V dc Sink Input, 16 Circuits	IC610MDL106 (2)
24 V dc Sink Load Input, 16 Circuits	IC610MDL107 (1)
24 V ac/dc Source Input, 8 Circuits	IC610MDL111
24 V ac/dc Source Input, 16 Circuits	IC610MDL112 (1) (3)
Analog Input, 4 Channels	IC610MDL116
I/O Modules - Output	
115/230 V ac Output, 8 Circuits	IC610MDL175
115/230 V ac Isolated Output, 4 Circuits	IC610MDL176
24 V dc Sink Output, 8 Circuits	IC610MDL151
24 V dc Sink Output, 16 Circuits	IC610MDL156 (2)
24 V dc Sink Output, 16 Circuits	IC610MDL157 (1)
24 V dc 2 Amp Sink Output, 4 Circuits	IC610MDL153
24 V dc 2 Amp Sink/Source Output, 4 Circuits	IC610MDL154
24 V dc Source Output, 8 Circuits	IC610MDL155
24 V dc Source Output, 16 Circuits	IC610MDL158 (1)
Relay Output, 8 Circuits	IC610MDL180
Relay Output, 16 Circuits	IC610MDL182 (1)
Analog Output, 2 Channels	IC610MDL166
I/O Modules - Special	
24 V dc Input/Output, 4 In/4 Out	IC610MDL103
24 V dc Sink Input/Relay Output, 4 In/4 Out	IC610MDL104
Thumbwheel Interface	IC610MDL105 (2)
High Speed Counter	IC610MDL110 (4)
Fast Response I/O, 4 In/2 Out	IC610MDL115
I/O Simulator, 8 Input Circuits	IC610MDL124
I/O Modules - UL Listed	
115 V ac Input, 6 Circuits	IC610MDL135
Relay Output, 5 Circuits	IC610MDL181
115 V ac Output, 6 Circuits	IC610MDL185

1. Removable terminal board for I/O Wiring.
2. Connects to I/O through 24 pin connector on faceplate.
3. This module can also be used as a sink input. The user must provide the power source to operate the field devices.
4. Connects to I/O through a 32 pin connector on faceplate.

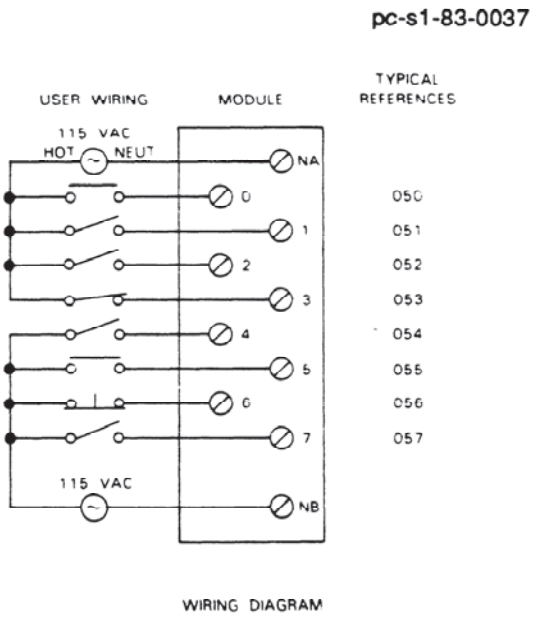
I/O Module Specifications and Wiring

The remainder of this chapter describes the available I/O modules for the Series One and Series One Plus PCs.

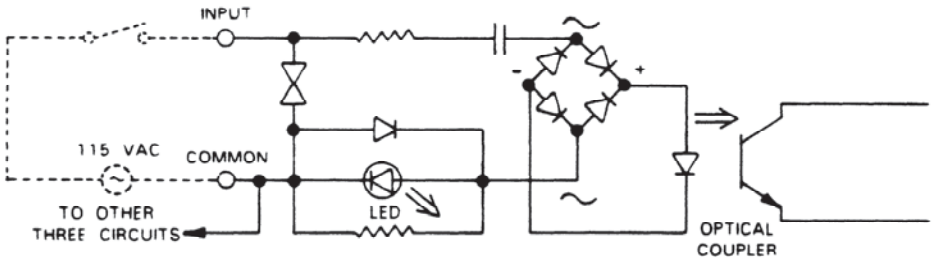
115 V ac Input
IC610MDL125

This module provides 8 circuits each designed to receive a single discrete (ON/OFF) signal from user supplied devices. Typical input devices include limit switches, pushbuttons, selector switches, and relay contacts. The 8 circuits are divided into two groups of 4 circuits each. Each group can be supplied from a separate power source. Power to operate the field devices must also be supplied by the user. Figure 6-5 provides wiring information for this module. Following are specifications for each of the 8 circuits.

Input Points	8
Operating Voltage	97-132 V ac
AC Frequency	47-63 Hz
Input Current	15 mA @ 60 Hz 11.5 mA @ 50 Hz
Input Impedance	9.5K ohms
ON Level	Above 80 V ac
OFF Level	Below 20 V ac
OFF to ON Response	10-30 ms
ON to OFF Response	10-60 ms
Circuit Indicator	Field Side
Internal Power Consumption	10 mA @ 9 V dc
Units of Load	1 Unit @ 9 V dc
Weight	5 oz (140 g)



WIRING DIAGRAM



SAMPLE INPUT CIRCUIT

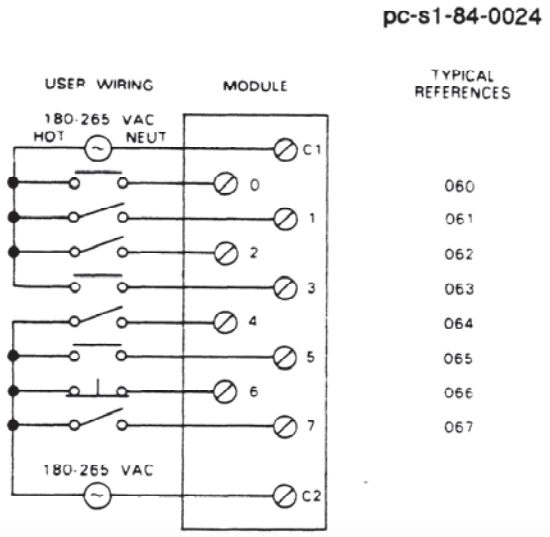
Figure 6-5. Wiring for 115 V ac Inputs

230 V ac Input
IC610MDL127

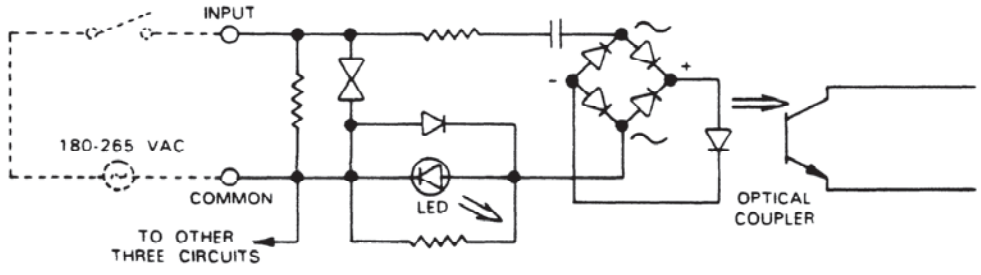
This module provides 8 circuits, each designed to receive a single discrete (ON/OFF) signal from user supplied devices. Typical input devices include limit switches, pushbuttons, selector switches, and relay contacts. The 8 circuits are divided into two groups of 4 circuits each. Each of the 2 groups can be supplied from a separate power source. Power to operate the field devices must also be supplied by the user. Following are specifications for each of these 8 circuits.

Input Points	8
Operating Voltage	180-265 V ac
AC Frequency	47-63 Hz
Input Current	18 mA (265V, 60 Hz), Max. 11 mA, Typical
Input Impedance	18 K ohms @ 60 Hz
ON Voltage	Above 180 V ac
OFF Voltage	Below 40 V ac
OFF Current	< 2 mA
OFF to ON Response	5-50 ms
ON to OFF Response	5-60 ms
Circuit Indicators	Field Side
Internal Power Consumption	10 mA, 9 V dc
Units of Load	1 Unit @ 9 V dc
Weight	5 oz (140 g)

Field connections are made to screw terminals on a terminal block mounted on the faceplate. Each terminal will accept up to one No. 12 AWG wire or two No. 14 wires. The C1 and C2 common terminals are isolated from each other.



WIRING DIAGRAM



SAMPLE INPUT CIRCUIT

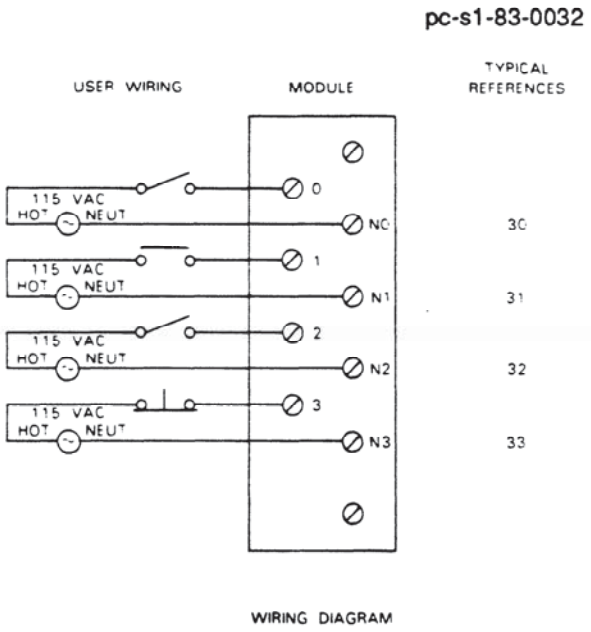
Figure 6-6. Wiring for 230 V ac Inputs

115 V ac Isolated Input
IC610MDL126

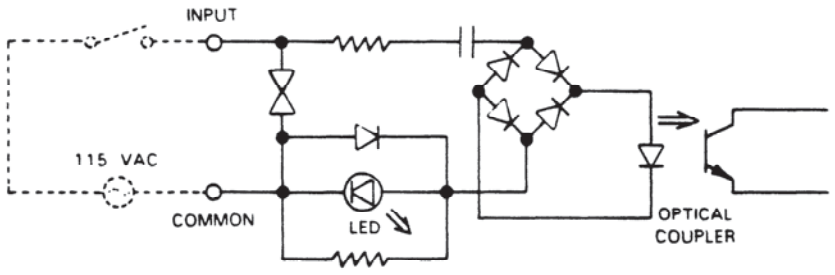
This module provides 4 circuits, each designed to receive a single discrete (ON/OFF) signal from user supplied devices. Typical input devices include limit switches, pushbuttons, selector switches, and relay contacts. Each of these circuits is isolated from the other circuits on this module relative to AC power source. The term isolation is not relative to optical-coupler noise and fault isolation which all I/O modules have. Each input is provided with 2 field terminals allowing separate AC power sources (that is, different phases) for each of the four inputs. The sources of AC power must be supplied by the user. Figure 6-7 provides wiring information for this modules.

Although this module consumes 8 discrete references assigned to the I/O slot into which it is inserted, only 4 are actually used. The other 4 can be used internally as coils, but they cannot be provided to hardware I/O modules. Following are specifications for each of the 4 circuits:

Input Points	4
Operating Voltage	97-132 V ac
AC Frequency	47-63 Hz
Input Current	15 ma @ 60 Hz
Input Impedance	10K ohms @ 60 Hz 12K ohms @ 50 Hz
ON Level	Above 80 V ac
OFF Level	Below 20 V ac
OFF to ON Response	10-30 ms
ON to OFF Response	10-60 ms
Circuit Indicator	Field Side
Internal Power Consumption	10 mA @ 9 V dc
Units of Load	1 @ 9 V dc
Weight	4.2 oz (120 g)



WIRING DIAGRAM



SAMPLE INPUT CIRCUIT

Figure 6-7. Wiring for 115 V ac Isolated Inputs

24 V dc Sink Input (8 Circuits)
IC610MDL101

This module provides 8 circuits each designed to receive a single discrete (ON/OFF) signal from user supplied devices. Typical input devices include limit switches, pushbuttons, selector switches, and relay contacts. Power (24 V dc) to sense the state of these inputs is provided by the rack power supply. No external power source is required with this module. All 8 circuits are powered from this one source. Figure 6-8 provides wiring information for this module. Following are specifications for each of the 8 circuits:

Input Points	8
Maximum Voltage (Open Circuit)	36 V dc
Input Current	18 mA
Input Impedance	1.8 K ohms
ON Level*	< 3 V dc
OFF Level*	> 3 V dc
OFF to ON Response	4 to 15 ms
ON to OFF Response	4 to 15 ms
Circuit Indicator	Field Side
Maximum OFF Leakage	3 mA
Minimum ON Current	7 mA
Internal Power Consumption	14 mA for each ON Circuit @ 24 V dc 10 mA @ 9 V dc
Units of Load	1 @ 9 V dc 10 @ 24 V dc
Weight	4.2 oz (120 g)

* Voltage levels measured between common and input terminals (across input device).

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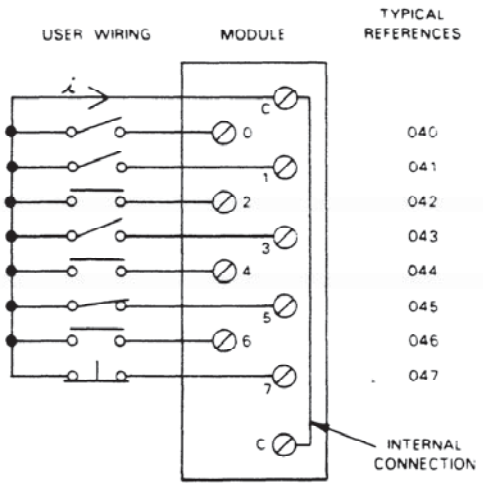
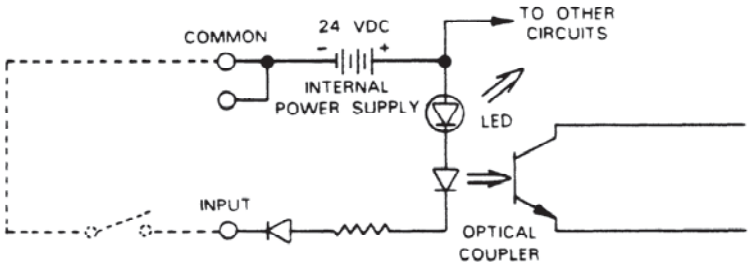


WIRING DIAGRAM



SAMPLE INPUT CIRCUIT

Figure 6-8. Wiring for 24 V ac Sink Inputs

24 V dc Sink Input (16 Circuits)
IC610MDL106

This module provides 16 circuits, each designed to receive a single discrete (ON/OFF) signal from user supplied devices. This module has 16 LED status indicators to reflect the ON or OFF status of each of the 16 circuits. Typical input devices include limit switches, pushbuttons, selector switches, and relay contacts. 24 V dc power to sense the state of these inputs is provided by the rack power supply; therefore, no external power source is required for this module. All 16 circuits are powered from this one source.

Figure 6-10 provides wiring information for this module. The 16 input circuits are connected to user devices through a 24-pin connector. An optional I/O Interface cable, catalog number IC610CBL105, is available for use with this module. Following are specifications for each of the 16 circuits:

Input Points	16
Maximum Voltage (Open Circuit)	36 V dc
Input Current	16 mA
ON Level	0 to 3 V dc
OFF Level	18 to 36 V dc
OFF to ON Response	4 to 15 ms
ON to OFF Response	4 to 15 ms
Maximum OFF Leakage	2 mA
Minimum ON Current	5 mA
Circuit Indicator	Field side
Internal Power Consumption	24 mA @ 9 V dc, Max. (16 circuits ON) 210 mA @ 24 V dc, Max. (16 circuits ON)
Units of Load	3 units @ 9 V dc 21 units @ 24 V dc
Weight	4.2 oz (120 g)

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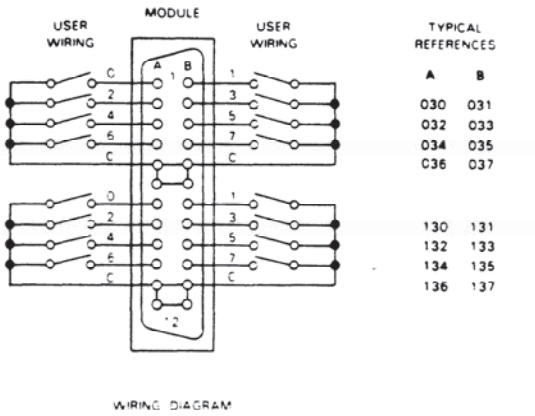

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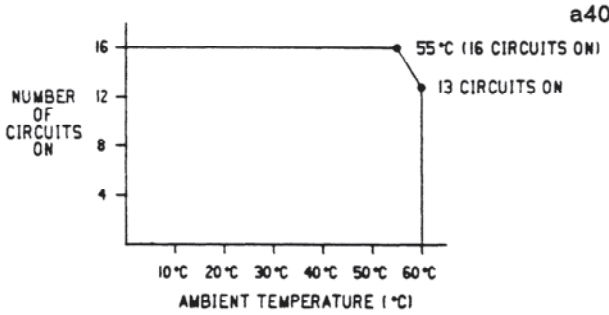

Figure 6-9. I/O Points VS Temperature

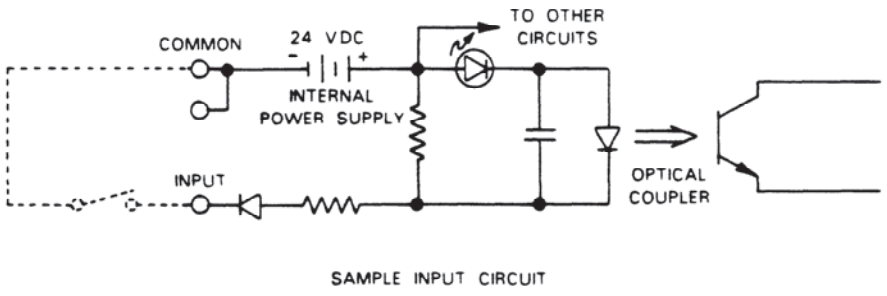

Figure 6-10. Wiring for 16 CIRCUIT, 25 V dc Sink Input Module

24 V dc Sink Load Input (16 Circuits) With Removable Terminal Board IC610MDL107

This module provides 16 circuits, each designed to receive a single discrete (ON/OFF) signal from user supplied devices. This module has 16 LED status indicators to reflect the ON or OFF status of each of the 16 circuits. Typical input devices include limit switches, pushbuttons, selector switches, and relay contacts. 24 V dc power to sense the state of these inputs is provided by the rack power supply; therefore, no external power source is required for this module. The 16 circuits are divided into 2 groups, with each group having its own common terminal. The 2 common terminals are tied together internally.

Figure 6-12 provides wiring information for this module. The 16 input circuits are connected to user devices through a removable socket type terminal board.

Input Points	16
Maximum Voltage (Open Circuit)	36 V dc
Input Current	17 mA
ON Level *	0 to 3 V dc
OFF Level *	19 to 24 V dc
OFF to ON Response	3 to 15 ms
ON to OFF Response	4 to 15 ms
Maximum OFF Leakage	1 mA
Minimum ON Current	5 mA
Circuit Indicator	Field Side
Internal Power Consumption	25 mA @ 9 V dc, Maximum (16 circuits ON) 14 mA for each ON circuit @ 24 V dc
Units of Load	3 units @ 9 V dc 23 units @ 24 V dc
Weight	6.0 oz (170 g)

***Voltage levels measured between common and input terminals (across input device).**

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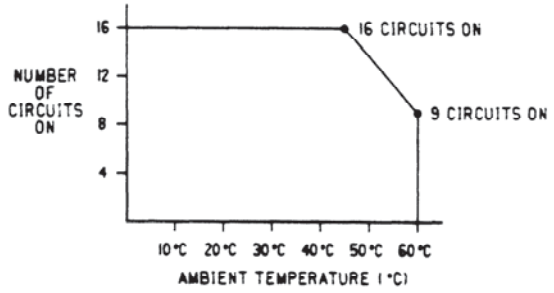

Figure 6-11. I/O Points VS Temperature

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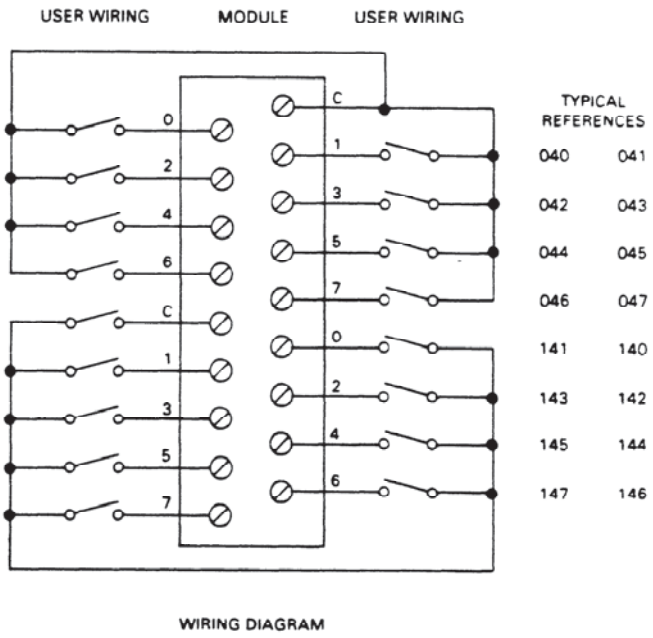


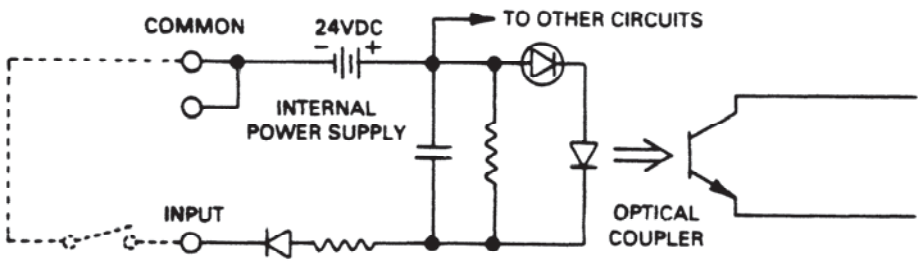


Figure 6-12. Wiring for 16 Circuit, 24 V dc Sink Load Inputs

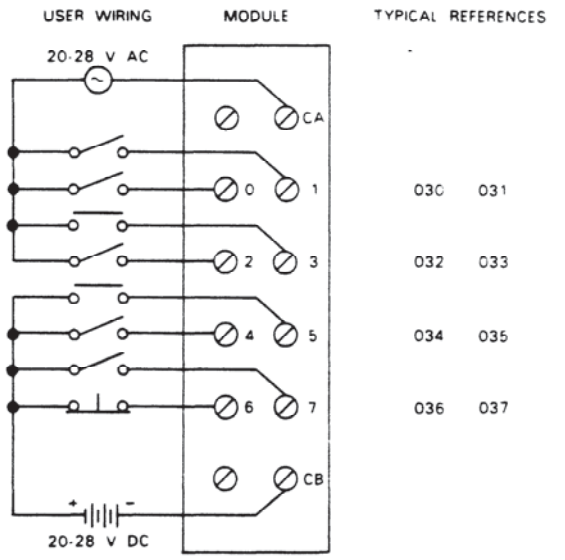
24 V ac/dc Source Input
IC610MDL111

This module provides 8 input circuits, each designed to receive a single discrete (ON/OFF) signal from user supplied devices. Typical input devices include pushbuttons, limit switches, selector switches and relay contacts. These input circuits can interface to either 24 V ac signals or 24 V dc source-type signals, thereby allowing the module to interface to input devices that provide their own voltage. Following are specifications for each of the 8 circuits.

	AC INPUT	DC INPUT
Input Voltage	20 to 28 V ac, 50-60 Hz	20-28 V dc (Source)
Input Current	19 mA (maximum) 13 mA Typical	19 mA (maximum) 13 mA Typical
ON Level	20 to 28 V ac	20 to 28 V dc
OFF Level	0 to 6 V ac	0 to 6 V dc
OFF to ON Response	5 to 50 ms	6 to 30 ms
ON to OFF Response	5 to 60 ms	5 to 60 ms
Circuit Indicator	Field Side	Field Side
Internal Power Consumption		9 V dc, 10 mA (supplied by rack power supply)
Units of Load		1 @ 9 V dc
Weight		5 oz (140 g)

a42681

User devices are connected to screw terminals on the faceplate of this module. Each screw terminal will accept up to one No. 12 AWG wire or two No. 14 AWG wires. The ON/OFF state of each circuit is indicated by an LED located in the field side of each circuit. The 8 circuits are divided into 2 groups of 4, each with its own common. The two commons, CA and CB are isolated from each other internally. Each input can accept either an AC input or a DC input.



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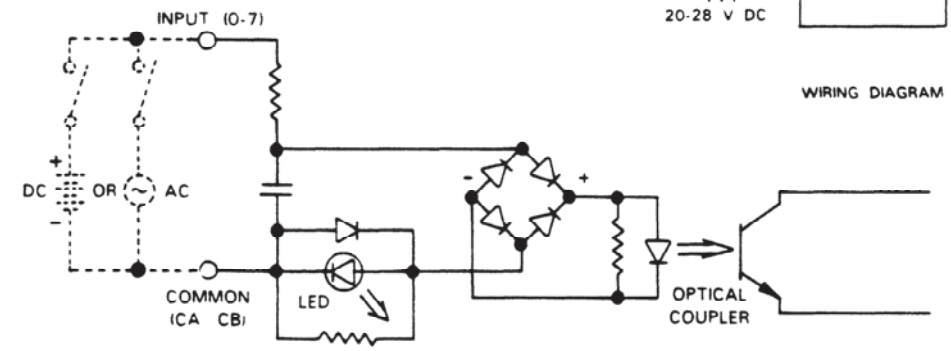


Figure 6-13. Wiring for 24 V ac/dc Inputs

24 V ac/dc Source Input (16 Circuits) With Removable Terminal Board IC610MDL112

This module provides 16 input circuits, with LED indicators, each designed to receive a single discrete (ON/OFF) signal from user supplied devices. Typical input devices include pushbuttons, limit switches, selector switches and relay contacts. These input circuits can interface to either 24 V ac signals or 24 V dc source-type signals, thereby allowing the module to interface to input devices that provide their own voltage. In addition, the module can be connected as a sink input. When using the sink configuration, the user must supply the source of power for the input devices, as when used in the source input configuration. Following are specifications for each of the 16 circuits.

	AC INPUT	DC INPUT
Input Voltage (Source or Sink)	14 to 30 V ac, 50-60 Hz	20-28 V dc
Input Current	12 mA @ 24 V ac	12 mA @ 24 dc
ON Level	14 to 30 V ac	14 to 30 V dc
OFF Level	0 to 3 V ac	0 to 3 V dc
OFF to ON Response	5 to 30 ms	5 to 25 ms
ON to OFF Response	5 to 30 ms	5 to 25 ms
Circuit Indicator	Logic Side	Logic Side
Internal Power Consumption		9 V dc, 130 mA (maximum) Typical, 25 mA + 4.5 mA for each ON circuit
Units of Load		13
Weight		6 oz (170 g)

User devices are connected to screw terminals on the removable connector mounted on the faceplate of this module. Each screw terminal will accept up to one No. 12 AWG wire or two No. 14 AWG wires. The On/OFF state of each circuit is indicated by an LED located in the logic side of each circuit. The 16 circuits are divided into 2 groups of 8, each with its own common. The two commons, CA and CB are isolated from each other internally. Each input can accept either an AC input or a DC input.

a40800

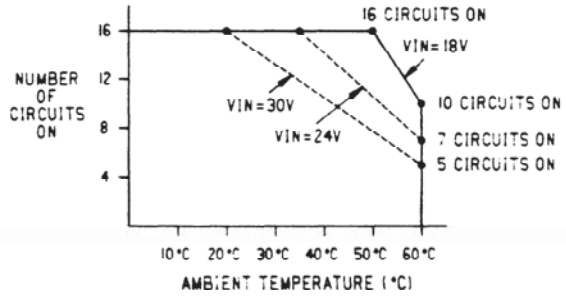
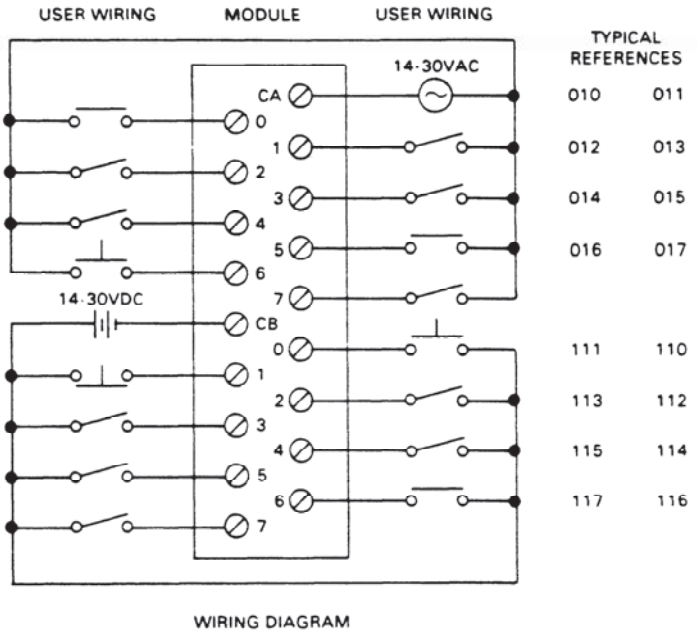
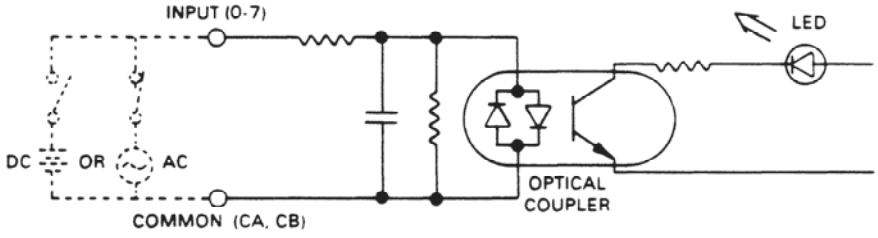


Figure 6-14. I/O Points vs Temperature Chart

a40801



WIRING DIAGRAM



SAMPLE INPUT CIRCUIT

FIGURE 6 15 WIRING FOR 16 CIRCUIT 24 VAC/DC SOURCE LOAD INPUTS

Figure 6-15. Wiring for 16 Circuit 24 V ac/dc Source Load Inputs

115/230 V ac Output
IC610MDL175

This module provides 8 circuits each capable of controlling user supplied discrete (ON/OFF) loads. Typical loads include relay coils, motor starters (up to No. 3), solenoid valves and indicator lights. The 8 circuits are divided into 2 groups of 4 circuits each. Each group can be supplied from a separate power source. Power to operate the field devices must also by supplied by the user. Figure 6-17 provides wiring information for this module. Following are specifications for each of the 8 circuits:

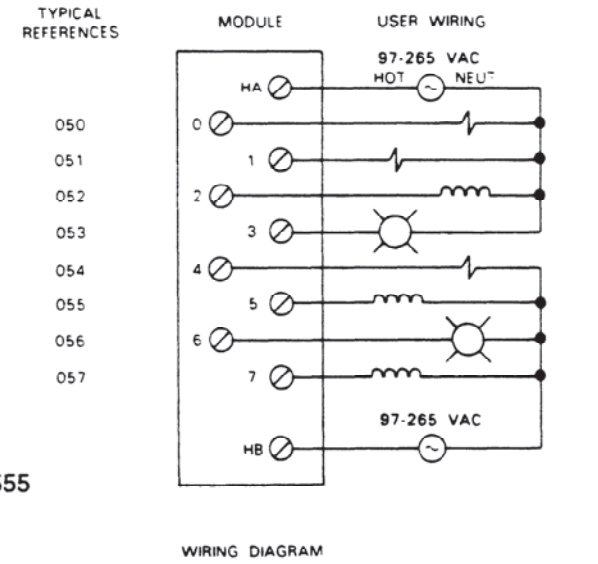
CAUTION

If this module is wired incorrectly or the listed specifications are exceeded, any damage incurred by the module or user devices connected to the module may not be covered by warranty.

pc-s1-83-0033

Output Points	8
Operating Voltage	97-265 V ac
AC Frequency	47-63 Hz
Maximum Current*	1 amp
Maximum Leakage Current	1.2 mA @ 220V, 60 Hz 0.5 mA @ 110V, 60 Hz
ON Voltage Drop	0.9V @ 1 amp 0.8V @ 0.5 amp
Smallest Recommended Load	25 mA
Maximum Inrush	10 amps for 16 ms 5 amps for 100 ms
OFF to ON Response	1 ms
ON to OFF Response	8-10 ms (1/2 cycle)
Circuit Indicator	Logic Side
Fuses (Internal, Soldered)	(2) 5 amp fast blow (one on each group of 4)
Internal Power Consumption	20 mA for each ON Circuit @ 9 V dc
Units of Load	16 @ 9 V dc
Weight	6.4 oz (180 g)

***Maximum load current is dependent upon ambient temperature as shown on the chart in figure 6-16.**



a40555

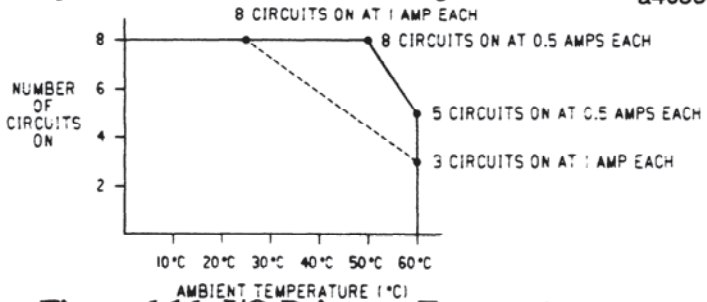


Figure 6-16. I/O Points vs Temperature

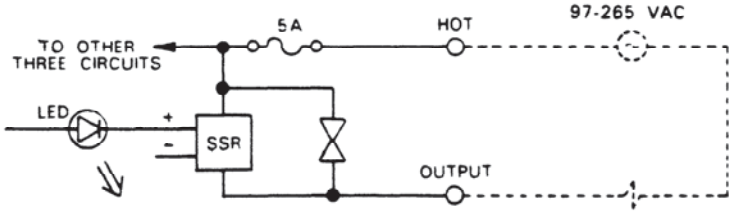


Figure 6-17. Wiring for 115/230 V ac Outputs

115/230 V ac Isolated Output
IC610MDL176

This module provides 4 circuits each capable of controlling user supplied discrete (ON/OFF) loads. Typical loads include relay coils, motor starters (up to No. 4), solenoid valves, and indicator lights. Each of these circuits is isolated from the other circuits on this module relative to AC power source. The term isolation is not relative to optical-coupler noise and fault isolation which all I/O modules have. Each output is provided with 2 field terminals allowing separate AC power sources (that is, different phases) for each of the 4 outputs. These power sources must be supplied by the user. Figure 6-19 provides wiring information for this module. Although this module consumes 8 discrete references assigned to the slot into which it is placed, only 4 are actually used. The other 4 can be used internally as coils, but they cannot be provided to hardware I/O modules. Following are specifications for each of the four circuits:

Outputs	4
Operating Voltage	97-265 V ac
AC Frequency	47-63 Hz
Maximum Current*	2 amps
Maximum Leakage Current	7 mA @ 220V, 60 Hz 3.5 mA @ 110V
Maximum Inrush	20 amps for 16 ms
ON Voltage Drop	.8V @ 2 amps
Smallest Recommended Load	25 mA
OFF to ON Response	1.0 ms
ON to OFF Response	8-10 ms (1/2 Cycle)
Circuit Indicator	Logic Side
Fuses (Internal) **(each circuit, Replaceable)**	(4) 3 amp fast blow
Internal Power Consumption	12 mA @ 9 V dc
Units of Load	8 units @ 9 V dc
Weight	5 oz (140 g)

* Maximum load current is dependent upon ambient temperature as shown on the chart in figure 6-18.

a40549

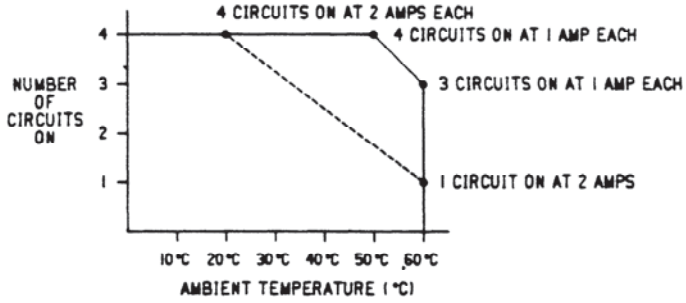
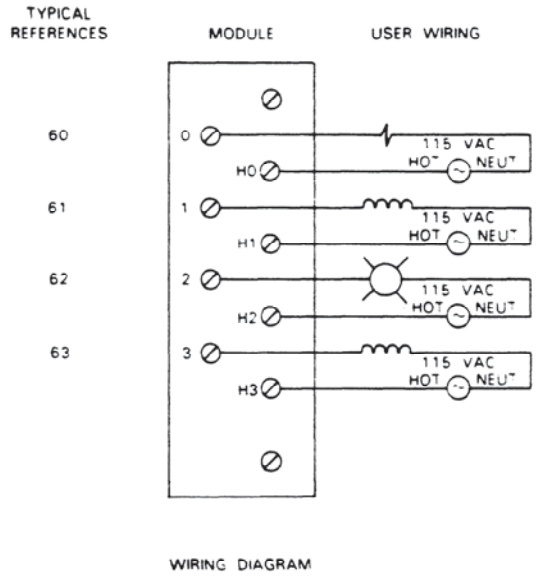


Figure 6-18. I/O Points vs Temperature Chart

pc-s1-83-0038



WIRING DIAGRAM

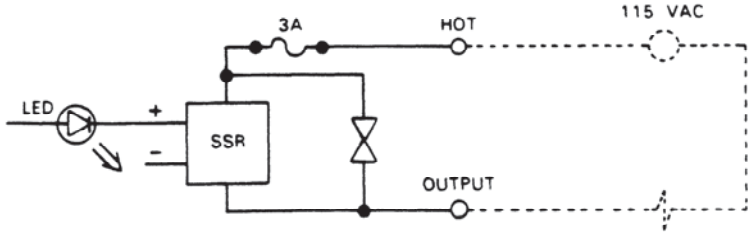


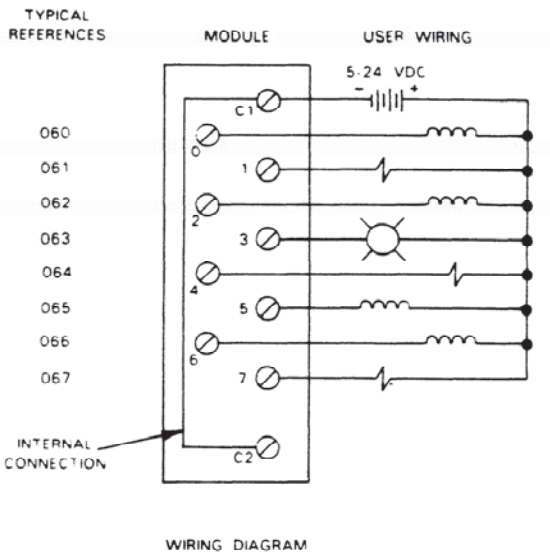
Figure 6-19. Wiring for 15 V ac Isolated Outputs

24 V dc Sink Output (8 Circuits)
IC610MDL151

This module provides 8 circuits each capable of controlling user supplied discrete (ON/OFF) loads. Typical loads include relay coils, motor starters, solenoid valves, and indicator lights. The 8 circuits are provided referenced to a single DC power source, that must be supplied by the user. Figure 6-21 provides wiring information for this module. Since current flows from the load into the field terminal for each circuit when the output is energized, these circuits are referred to as sink DC outputs. Following are specifications for each of the 8 circuits:

Output Points	8
Operating Voltage	5-24 V dc
Peak Voltage	45 V dc
Maximum Current*	0.5 amp
Max. Leakage Current	0.1 mA @ 40 V dc
ON Voltage Drop	0.8V @ 0.5 amp 0.65V @ 0.1 amp
Smallest Recommended Load	1 mA
Maximum Inrush	3 amp for 20 ms 1 amp for 100 ms
OFF to ON Response	100 msec
ON to OFF Response	100 msec
Circuit Indicator	Logic Side
Fuses (Internal)	(2) 3 amp (one on each group of 4)
Internal Power Consumption	20 mA @ 9 V dc. 3 mA for each ON Circuit @ 24 V dc
Units of Load	2 units @ 9 V dc 3 units @ 24 V dc
Weight	4.2 oz (120 g)

pc-s1-83-0035



WIRING DIAGRAM

* Max. load current is dependent upon ambient temperatures as shown in fig. 6-20.

a40550

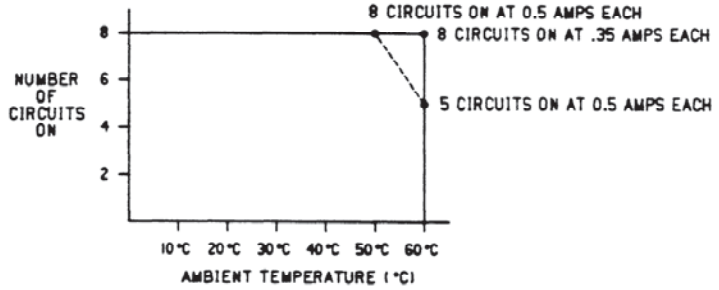


Figure 6-20. I/O Points vs Temperature Chart

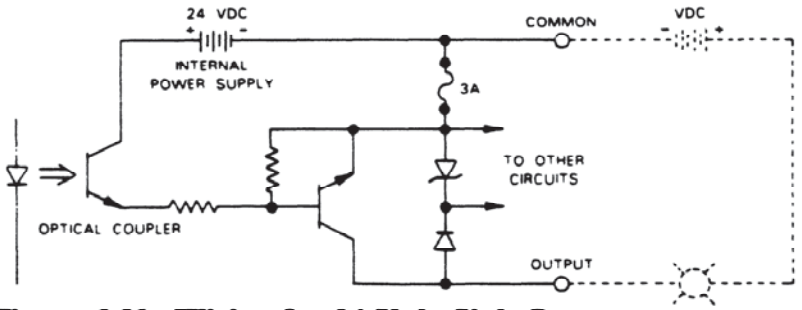


Figure 6-21. Wiring for 24 V dc Sink Outputs

24 V dc Sink Output (16 Circuits)
IC610MDL156

This module provides 16 circuits, each designed to be capable of controlling user supplied discrete (ON/OFF) loads. There are 16 LEDs on the faceplate, which are status indicators to reflect the ON or OFF status of each of the circuits. Typical loads include relay coils, motor starters, solenoid valves, and indicator lights. The 16 circuits are referenced to a single DC power source that must be supplied by the user. Output switching capacity of this module is 0.5 A at 24 V dc. The output switching circuitry is arranged in 4 groups with 4 circuits in each group. Each group is protected by a 3 amp fuse.

The 16 circuits are connected to user loads through an optional I/O Interface cable, Catalog number IC610CBL105, which connects to a 24-pin connector mounted on the module faceplate. Figure 6-23 provides wiring information for this module. Following are specifications for each of the 16 circuits.

Output Points	16
Operating Voltage	5-24 V dc
Peak Voltage	40 V dc
ON Voltage Drop, Typical	0.9 V dc @ 0.5 amp
ON Voltage Drop, Maximum	1.5 V dc @ 0.5 amp
Maximum Current*	0.5 amp
Maximum Leakage Current	0.1 mA @ 40 V dc
Maximum Inrush	3 amp for 20 ms 1 amp for 100 ms
OFF to ON Response	0.1 ms
ON to OFF Response	0.1 ms
Fuse (Internal)	3 amp (In Output Common Line, one for each group of 4).
Internal Power Consumption	40 mA @ 9 V dc, Maximum (16 outputs ON) 96 mA @ 24 V dc, Maximum (16 outputs ON)
Units of Load	4 units @ 9 V dc 10 units @ 24 V dc
Weight	3.9 oz (110 g)

*Maximum load current is dependent upon ambient temperature as shown in figure 6-22.

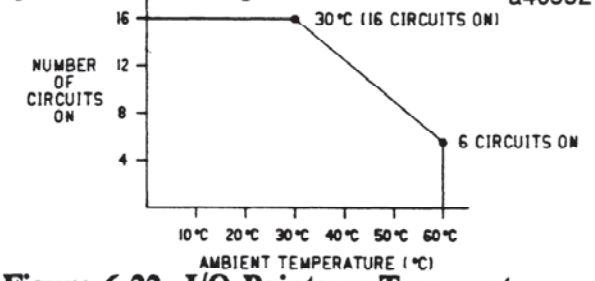
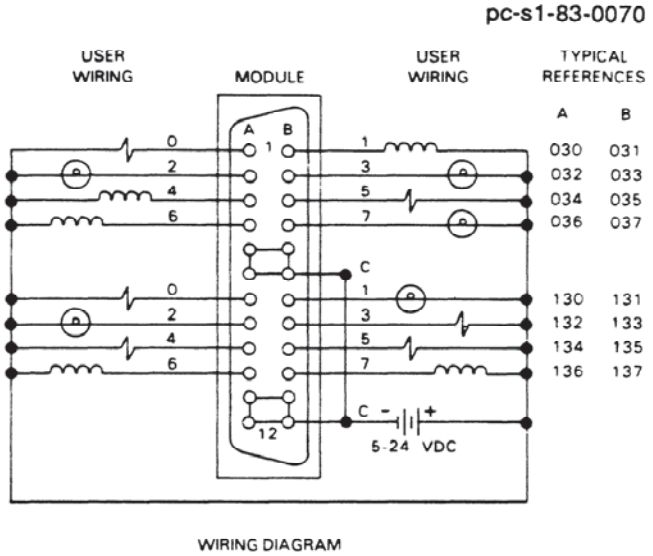


Figure 6-22. I/O Points vs Temperature Chart



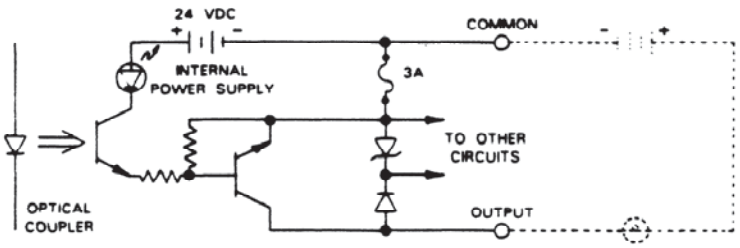


Figure 6-23. Wiring for 16 Circuit 24 V dc Sink Outputs

24 V dc Sink Output (16 Circuits) With Removable Terminal Board IC610MDL157

This module provides 16 circuits, each designed to be capable of controlling user supplied discrete (ON/OFF) loads. There are 16 LEDs on the faceplate, which are status indicators to reflect the ON or OFF status of each of the circuits. Typical loads include relay coils, motor starters, solenoid valves, and indicator lights. The 16 circuits are referenced to a single DC power source that must be supplied by the user. Output switching capacity of this module is 0.5 A at 24 V dc. The output switching circuitry is arranged in 2 groups with 8 circuits in each group. Each group is protected by a 3 amp fuse.

The 16 circuits are connected to user loads through a removable socket type terminal board. Figure 6.25 provides wiring information for this module. Following are specifications for each of the 16 circuits:

Output Points	16
Operating Voltage	5-24 V dc
Peak Voltage	40 V dc
ON Voltage Drop, Typical	1.0 V dc @ 0.5 amp
ON Voltage Drop, Maximum	2.0 V dc @ 0.5 amp
Maximum Current*	0.5 amp
Maximum Leakage Current	0.11 mA @ 40 V dc
Maximum Inrush	3 amp for 20 ms 1 amp for 100 ms
OFF to ON Response	0.1 ms
ON to OFF Response	0.1 ms
Fuse (Internal)	3 amp (In Output Common Line, one for each group of 8)
Internal Power Consumption	9 V dc: 3 mA + 2.3 mA for each ON circuit 24 V dc: 6mA for each ON circuit
Units of Load	4 units @ 9 V dc 10 units @ 24 V dc
Weight	5.6 oz (160 g)

* Maximum load current is dependent upon ambient temperature as shown in figure 6.24.

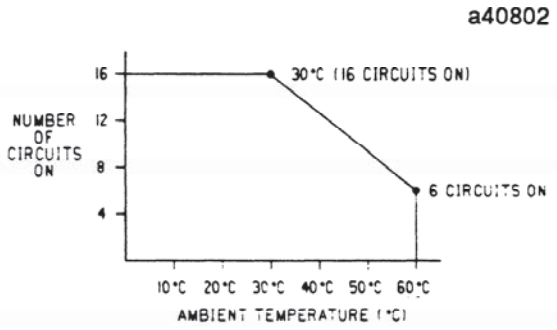
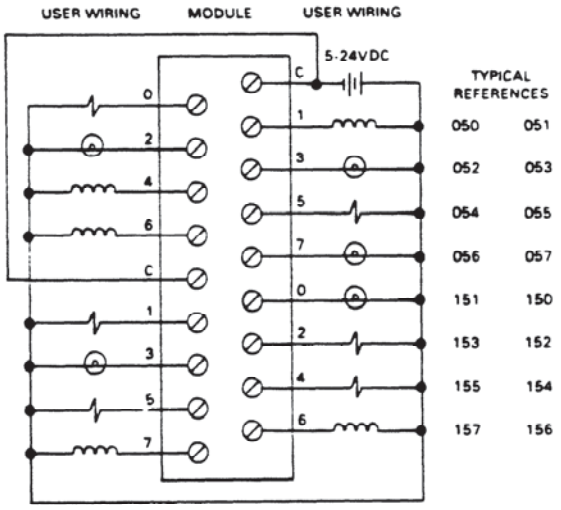


Figure 6-24. I/O Points vs Temperature Chart

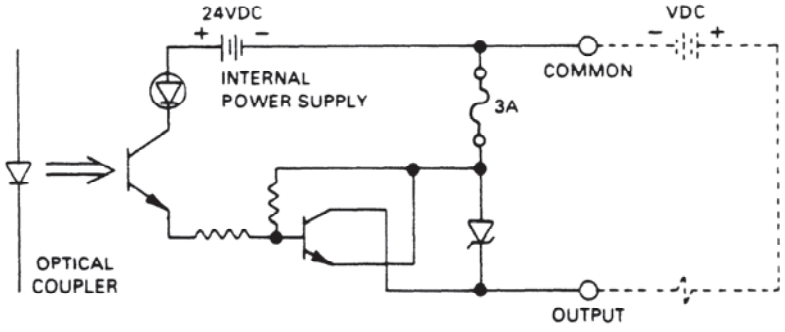
a40803



The following rules should be used when applying this module.

1. Each group of 8 outputs is limited to 2A total current.
2. The maximum current for each array of 4 outputs (0-3), (4-7) is:

1 point on - .7 amps,
3 points on - .4 amps each,
2 points on - .5 amps each
4 points on - .35 amps each



SAMPLE OUTPUT CIRCUIT

Figure 6-25. Wiring for 16 Circuit 24 V dc Sink Outputs

24 V dc 2 Amp Sink Output
IC610MDL153

This module provides 4 fused 24 V dc sink output circuits each capable of controlling user supplied discrete (ON/OFF) loads. Each circuit is rated at 2 amps continuous current. Typical loads include motor starters, relay coils, solenoid valves, and indicator lights. The circuits on this module are referred to as sink outputs since current flows from the load into the field terminal for each circuit when the output is energized. Field connections are made to screw terminals on a terminal block mounted on the faceplate. Each terminal will accept up to one No. 12 AWG wire or two No. 14 AWG wires. The ON/OFF state of each circuit is indicated by a corresponding LED. This module, although having only 4 output circuits, will consume 8 consecutive discrete references. The 4 references not available as "real world" outputs can be used as internal coils. Following are specifications for each of the four output circuits.

Output Points	4
Operating Voltage	5 to 24 V dc
Peak Voltage	45 V dc
ON Voltage Drop	.15 V dc @ 1 amp .6 V dc @ 4 amp
Maximum Current*	2 amps
Maximum Leakage Current	< .4 mA @ 40 V dc
OFF to ON Response	.1 ms
ON to OFF Response	.1 ms
Circuit Indicator	Logic Side
Fuses, Internal	5 amp (1 for each circuit) Replaceable
Internal Power Consumption	5 mA @ 24 V dc 12 mA @ 9 V dc
Units of Load	1 unit @ 24 V dc 2 units @ 9 V dc
Weight	4.2 oz (120 g)

a40551

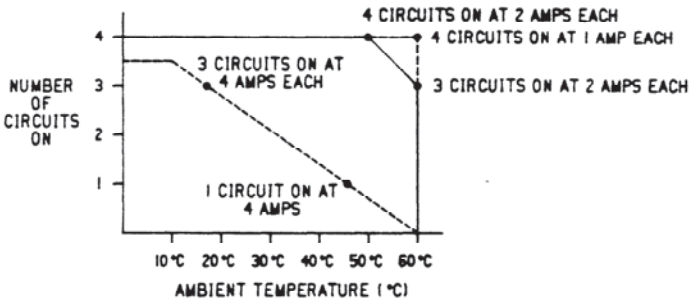


Figure 6-26. I/O Points vs Temperature Chart

*Maximum load current is dependent on ambient temperature as shown in figure 6.26.

pc-s1-84-0022

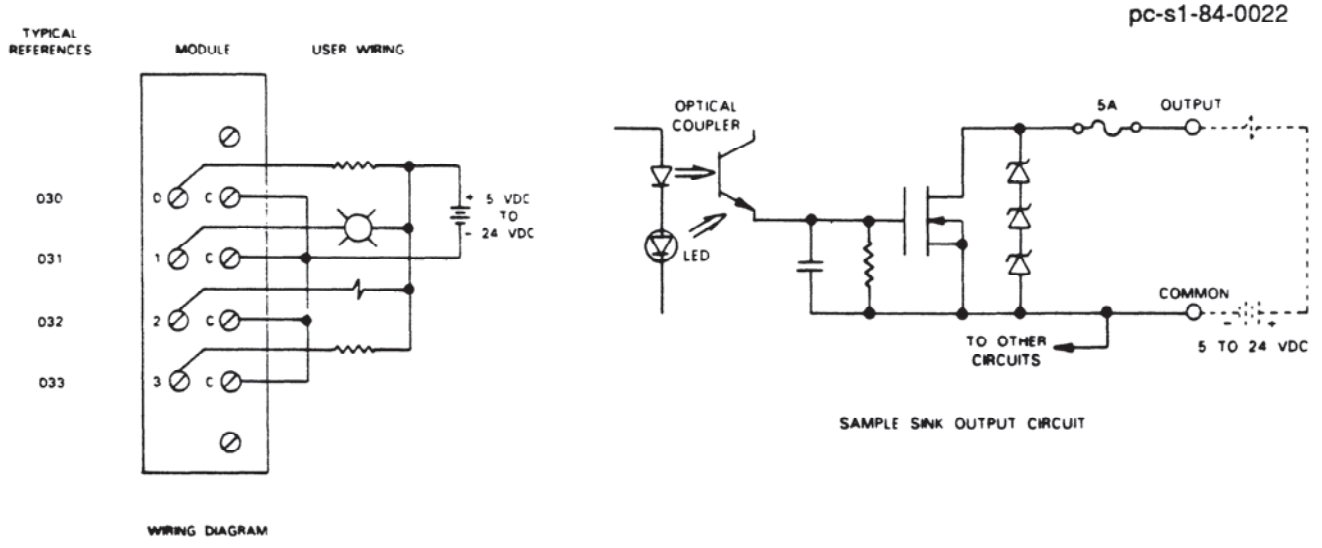


Figure 6-27. Wiring for 24 V dc 2 Amp Sink Outputs

24 V dc 2 Amp Sink/Source Output
IC610MDL154

This module provides 4 isolated, fused 24 V dc sink or source output circuits each capable of controlling user supplied discrete (ON/OFF) loads. Each circuit is rated at 2 amps continuous current. Outputs can be connected in parallel to increase output current capacity. Types of loads that can be controlled by this module would include motor starters, relay coils solenoid valves, and indicator lights. All 4 circuits can be referenced to a separate DC source of power. The circuits on this module can be used as either source outputs or sink outputs, depending on how the load is wired in relation to the load power supply.

Field connections are made to screw terminals on a terminal block mounted on the faceplate. Each terminal will accept up to one No. 12 AWG wire or two No. 14 AWG wires. The ON/OFF state of each circuit is indicated by a corresponding LED on the logic side. This module will consume 8 consecutive discrete references. The 4 references not used as "real world" outputs can be used as internal coils in your program. Following are specifications for each of the four circuits.

Output Points	4
Operating Voltage	5 to 24 V dc
Peak Voltage	45 V dc
Maximum Current*	2 amps Continuous 8 amps Maximum Peak
Maximum Leakage Current	< .4 mA @ 40 V dc
ON Voltage Drop	1 V dc @ 6 amps .6 V dc @ 4 amps .3 V dc @ 2 amps .15 V dc @ 1 amp
OFF to ON Response	.1 ms
ON to OFF Response	.1 ms
Circuit Indicator	Logic Side
Fuses, Internal	5 amp (1 for each circuit) Replaceable
Internal Power Consumed	12 mA @ 9 V dc 30 mA @ 24 V dc
Units of Load	2 units @ 9 V dc 3 units @ 24 V dc

Lamp load should be .8 amps or less.
*Load current (max.) is dependent on ambient temperature as shown below.

a40553

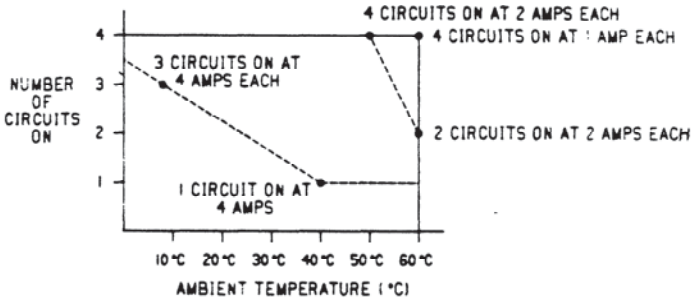
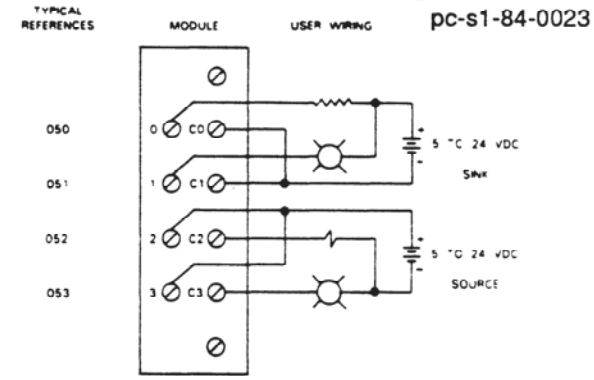


Figure 6-28. I/O Points vs Temperature

pc-s1-84-0023



Although not shown as such, the 4 circuits are isolated from each other and can be connected to separate power sources.

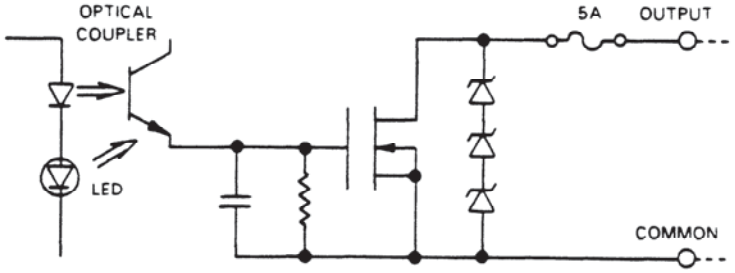


Figure 6-29. Wiring of 24 V dc 2 Amp Sink/Source Output

24 V dc Source Output
IC610MDL155

This module provides eight 24 V dc source output circuits, each capable of controlling user supplied discrete (ON/OFF) loads. Each circuit is rated at 0.5 amps continuous current. Typical loads that can be controlled by this module are motor starters, relay coils, solenoid valves, and indicator lights. The output switching circuits on the module are arranged in 2 groups with 4 circuits in each group. Each group of 4 output circuits is protected by a 3 amp fuse. All 8 circuits should be referenced to a single source of dc power. Field connections are made to screw terminals on a terminal block mounted on the module's faceplate. Each terminal will accept up to one No. 12 AWG wire or two No. 14 AWG wires. The operating state, either ON or OFF, is indicated by a corresponding LED viewed on the module's faceplate. Following are specifications for each of the 8 circuits.

Output Points	8
Operating Voltage	5 to 24 V dc
Peak Voltage	40 V dc
ON Voltage Drop	1.0 V @ 0.5 amp 0.75 V @ 0.1 amp
Maximum Current*	0.5 amps
Maximum Leakage Current	0.1 mA at 24 V dc
Smallest Recommended Load	1.0 mA
OFF to ON Response	100 µsec
ON to OFF Response	100 µsecs
Circuit Indicator	Logic Side
Fuses (Internal)	(2) 3 amp (in output common line, one for each group of 4 circuits)
Internal Power Consumption	30 mA maximum @ 9 V dc, Supplied by rack power supply
Units of Load	3 Units @ 9 V dc
Weight	4.2 oz (120 g)

*Maximum load current is dependent on ambient temperature as shown in figure 6.30.

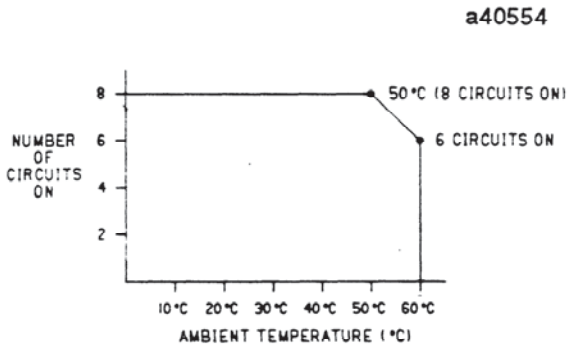
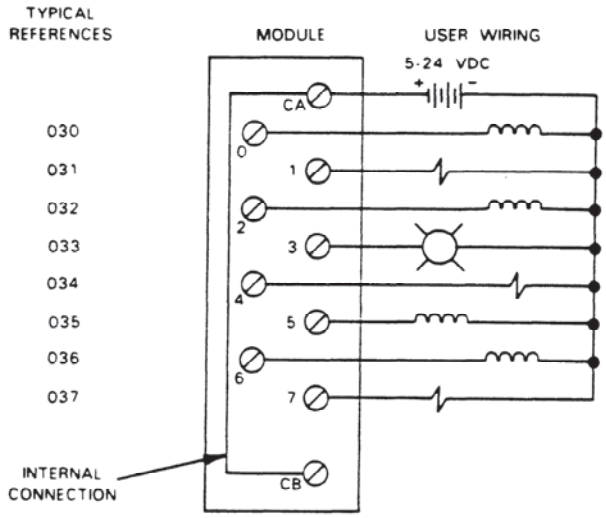
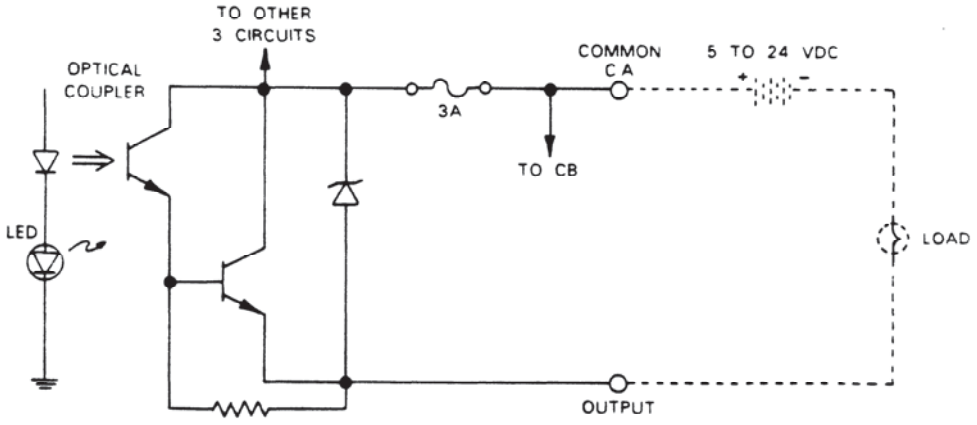


Figure 6-30. I/O Points vs Temperature Chart

a40626



WIRING DIAGRAM



SAMPLE OUTPUT CIRCUIT

Figure 6-31. Wiring for 24 V dc Source Outputs

24 V dc Source Output (16 Circuits) With Removable Terminal Board IC610MDL158

This module provides sixteen 24 V dc source output circuits, each capable of controlling user supplied discrete (ON/OFF) loads. The output switching capacity of this module is 0.5 amps at 24 V dc. Typical loads that can be controlled by this module are motor starters, relay coils, solenoid valves, and indicator lights. The output switching circuits on the module are arranged in 2 groups with 8 circuits in each group. Each group of 8 output circuits is protected by a 5 amp fuse. All 16 circuits can be referenced to a single source of dc power or each group of 8 can be referenced to a separate source of power. Field connections are made to screw terminals on a removable terminal board mounted on the module's faceplate. Each terminal will accept up to one No. 12 AWG wire or two No. 14 AWG wires. The operating state, either ON or OFF, is indicated by a corresponding LED viewed on the module's faceplate. Following are specifications for each of the 16 circuits.

Output Points	16
Operating Voltage	5 to 24 V dc
Peak Voltage	40 V dc
ON Voltage Drop	Maximum 1.5 V dc 0.8 V dc @ 0.5 amp (Typical) 0.7 V dc @ 0.1 amp (Typical)
Maximum Current*	0.5 amps
Maximum Leakage Current	10 mA @ 40 V dc
OFF to ON Response	0.1 ms (Resistive)
ON to OFF Response	1.0 ms (Resistive)
Circuit Indicator	Logic Side
Fuses (Internal)	(2) 5 amp (in output common line, one for each group of 8 circuits)
Internal Power Consumption	12 mA for each ON circuit
Units of Load	20 Units @ 9 V dc
Weight	7.1 oz (200 g)

*Maximum load current is dependent on ambient temperature as shown in figure 6.32.

a40804

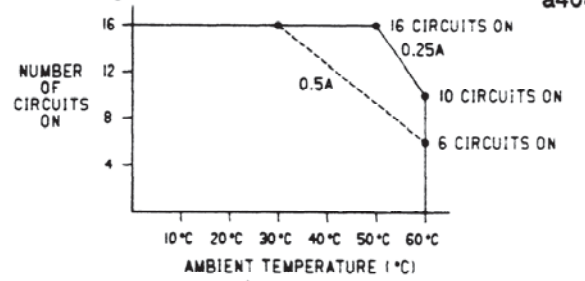
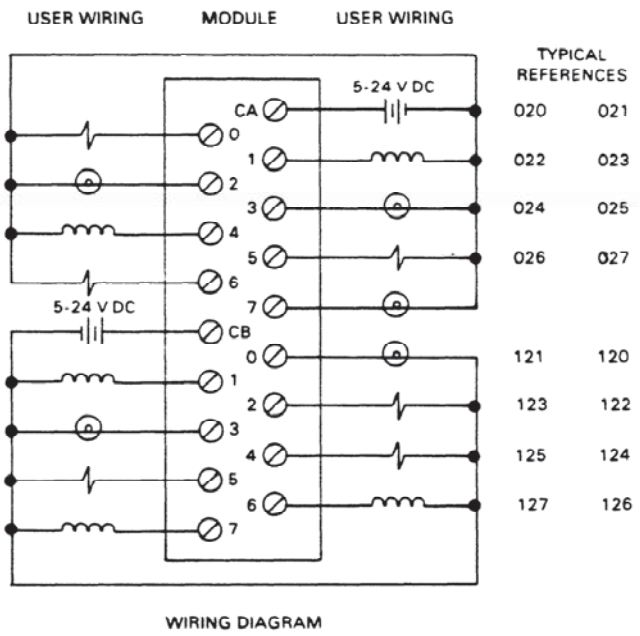


Figure 6-32. I/O Points vs Temperature

a40805



WIRING DIAGRAM

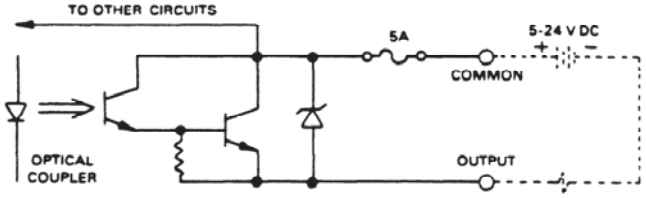


Figure 6-33. Wiring for 24 V dc Source Outputs

Relay Output (8 Circuits)
IC610MDL180

This module provides 8 circuits each capable of controlling user supplied discrete (ON/OFF) loads. Typical loads include relay coils, motor starters, solenoid valves, and indicator lights. Since this module is not designed for a specific current type such as 115 V ac or 24 V dc, it can be used with a wide variety of loads and signal types. The 8 circuits are divided into two groups of 4 circuits each. Each group can be supplied from a separate power source. Power to operate the field devices must also be supplied by the user. Following are specifications for each of the eight circuits:

Outputs	8
Operating Voltage	5 to 265 V ac/dc
AC Frequency	47-63 Hz
Maximum Current*	4 amp (resistive)
Maximum Leakage Current (Across Contacts)	1 mA
Smallest Recommended Load	5 mA
Maximum Inrush	5 amps
OFF to ON Response	5 ms
ON to OFF Response	5 ms
Circuit Indicator	Logic Side
Fuses (Internal)	(2) 10 amp (Replaceable) (one for each group of 4)
Internal Power Consumption	45 mA for each ON Circuit @ 9 V dc
Units of Load	34 units @ 9 V dc
Weight	7 oz (200 g)

*Since non-solid state devices are used as the power switching devices, the following limitations must be observed for reliable operation:

Table 6-2. Maximum Current vs Load Type for Relay Outputs

OPERATING VOLTAGE	MAXIMUM CURRENT FOR LOAD TYPE			TYPICAL LIFE (OPERATIONS)
	RESISTIVE	LAMP	SOLENOID	
220 V ac	4.0 Amp	0.5 Amp	0.5 Amp	100,000
220 V ac		.05 Amp	.05 Amp	800,000
110 V ac	4.0 Amp	0.5 Amp	0.5 Amp	150,000
110 V ac		0.1 Amp	0.1 Amp	650,000
24 V dc	5.0 Amp	0.5 Amp	0.5 Amp	100,000
50 V dc	1.0 Amp	0.1 Amp	0.1 Amp	100,000
100 V dc	0.5 Amp	.05 Amp	.05 Amp	100,000
250 V dc	0.3 Amp	.03 Amp	.03 Amp	100,000

NOTE

Lamp loads are defined as a X10 inrush with a power factor (PF) of 1.00 and when turned OFF represent a PF of 1.00. Solenoids are defined with a X10 inrush, a PF of 0.65, and when turned OFF represent a PF of 0.35.

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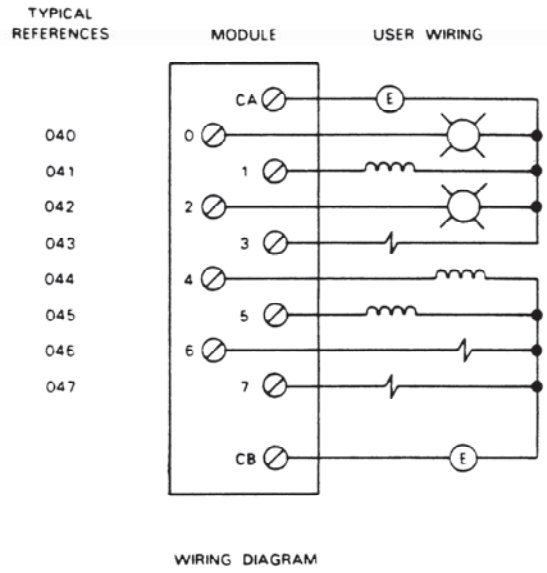
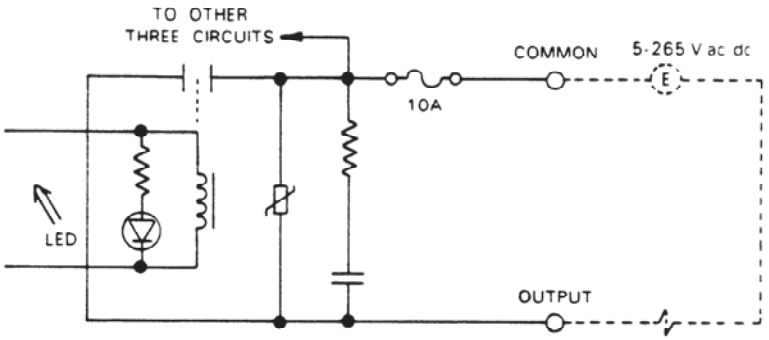


WIRING DIAGRAM



SAMPLE OUTPUT CIRCUIT

Figure 6-34. Wiring for 8 Circuit Relay Outputs

Relay Output (16 Circuits) With Removable Terminal Board IC610MDL182

This module provides 16 circuits each capable of controlling user supplied discrete (ON/OFF) loads. Typical loads include relay coils, motor starters, solenoid valves, and indicator lights. Since this module is not designed for a specific current type such as 115 V ac or 24 V dc, it can be used with a wide variety of loads and signal types. The 16 circuits are divided into two groups with 8 circuits each. Each group can be supplied from a separate power source. Power to operate the field devices must also be supplied by the user. The ON/OFF status of each circuit is indicated by an LED, which is located on the logic side of the circuitry. The 16 output circuits are connected to user loads through a removable socket type terminal board. Following are specifications for each of the 16 circuits:

Outputs	16
Operating Voltage	5 to 220 V ac 5 to 30 V dc
AC Frequency	47-63 Hz
Maximum Current*	2 amps (Resistive) 8 amps per Common (maximum)
Maximum Leakage Current (Across Contacts)	0.1 mA
Smallest Recommended Load	5 mA
Maximum Inrush	2 amps
OFF to ON Response	10 ms
ON to OFF Response	10 ms
Circuit Indicator	Logic Side
Fuses (Recommended, External)	2 amp in series with load
Internal Power Consumption	30 mA for each ON Circuit @ 9 V dc
Units of Load	48 units
Weight	8.5 oz (240 g)

*Since non-solid state devices are used as the power switching devices, the following limitations must be observed for reliable operation:

Table 6-3. Maximum Current vs Load Type for Relay Outputs

OPERATING VOLTAGE	MAXIMUM CURRENT FOR LOAD TYPE			TYPICAL LIFE (OPERATIONS)
	RESISTIVE	LAMP	SOLENOID	
220 V ac	2 Amp	0.25 Amp	0.25 Amp	100,000
220 V ac		0.03 Amp	0.03 Amp	800,000
110 V ac	2 Amp	0.25 Amp	0.25 Amp	100,000
110 V ac	0.05 Amp	0.05 Amp	650,000	
24 V ac	2 Amp	0.25 Amp	0.25 Amp	100,000

NOTE

Lamp loads are defined as a X10 inrush with a power factor (PF) of 1.00 and when turned OFF represent a PF of 1.00. Solenoids are defined with a X10 inrush, a PF of 0.65, and when turned OFF represent a PF of 0.35

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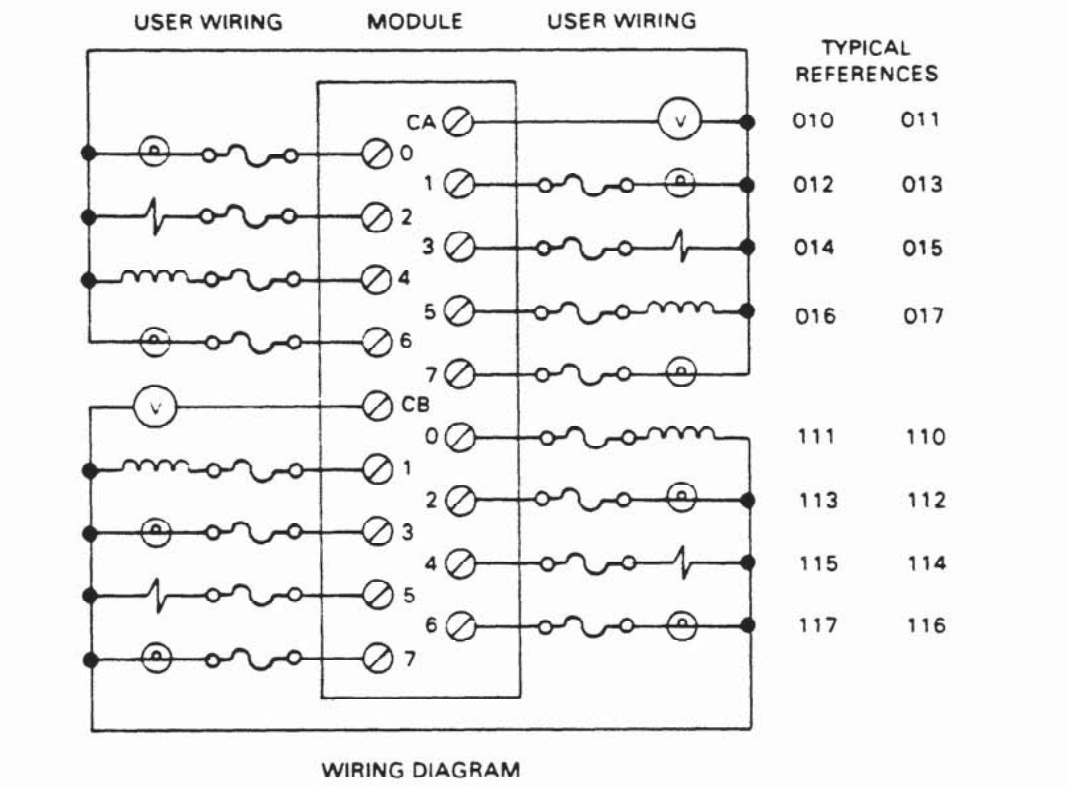

Figure 6-35. Wiring for 16 Circuit Relay Outputs

24 V dc Input/Output (4 In/4 Out)
IC610MDL103

This module provides a dual function since it provides 4 input circuits each designed to receive a single discrete (ON/OFF) signal from user supplied devices and 4 output circuits each capable of controlling user supplied discrete (ON/OFF) loads. Typical input devices include limit switches, pushbuttons, selector switches, and relay contacts. Typical loads include relay coils, motor starters, solenoid valves, and indicator lights.

24 V dc power to sense the state of the inputs is provided by the rack power supply. The 4 output circuits are referenced, through their respective loads, to a single DC power source. The ON/OFF state of each input and output circuit is indicated by an LED. Figure 6.36 provides wiring information for this module. Following are specifications for each of the 4 input and 4 output circuits:

INPUT CIRCUITS	
Input Points	4
Maximum Voltage (Open Circuit)	36 V dc
Input Current	18 mA
ON Level	0-3 V dc
OFF Level	18-36 V dc
OFF to ON Response	4-15 ms
ON to OFF Response	4-15 ms
Maximum OFF Leakage	3 mA
Minimum ON Current	7 mA
OUTPUT CIRCUITS	
Output Points	4
Operating Voltage	5-24 V dc
Peak Voltage	45 V dc
Maximum Current	0.5 amp
Maximum Leakage Current	0.1 mA @ 40 V dc
ON Voltage Drop (Typical)	0.8 V dc @ 0.5 amp 0.65 V dc @ .1 amp
ON Voltage Drop (Max)	1.5 V dc @ 0.5 amp
OFF to ON Response	0.1 ms
ON to OFF Response	0.1 ms
Fuse (Internal)	3 amp (In Output common line)
Internal Power Consumption	20 mA @ 9 V dc
Inputs	14 mA for each On Circuit
Outputs	3 mA for each On Circuit
Units of Load	2 units @ 9 V dc
7 units @ 24 V dc	
Weight	4.6 oz (130 g)

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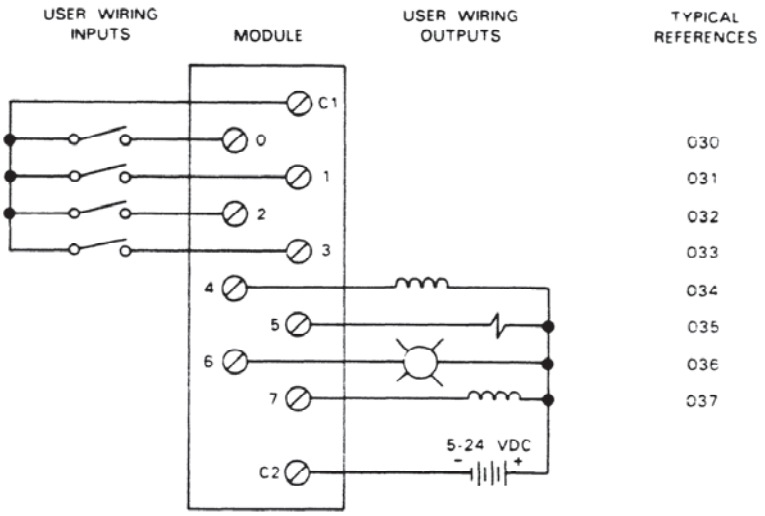
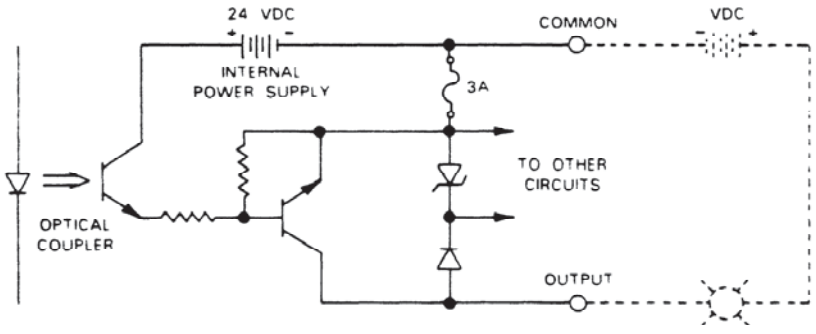


WIRING DIAGRAM



SAMPLE OUTPUT CIRCUIT

Figure 6-36. Wiring for 24 V dc Inputs/Outputs

24 V dc Input/Relay Output (4 In/4 Out)
IC610MDL104

This module provides 4 dc input circuits and 4 relay output circuits. The 4 input circuits are each designed to receive a single discrete (ON/OFF) signal from user supplied devices such as limit switches, pushbuttons, and relay contacts. The 4 relay output circuits are each capable of controlling user supplied discrete (ON/OFF) loads. Typical loads include relay coils, motor starters, and indicator lights. Since the relay output circuits were not designed for a specific current type, such as 24 V dc or 115 V ac, they can be used for a wide variety of loads and signal types. The ON or OFF state of each input and output circuit is indicated by an LED. Figures 6.37 and 6.38 provide wiring information for this module. Following are specifications for each input and output circuit.

DC INPUT CIRCUITS	
Input Points	4
Maximum Voltage	36 V dc
Input Current	18 mA (max)
ON Level	0-3 V dc
OFF Level	18-36 V dc
OFF to ON Response	4-15 ms
ON to OFF Response	4-15 ms
Maximum OFF Leakage	3 mA
Minimum ON Current	7 mA
RELAY OUTPUT CIRCUITS	
Outputs	4
Operating Voltage	5 to 265 V ac/dc
AC Frequency	47-63 Hz
Maximum Current*	4 amp (resistive)
Maximum Leakage Current (Across Contacts)	1 mA
Smallest Recommended Load	5 mA
Maximum Inrush	5 amps
OFF to ON Response	5 ms
ON to OFF Response	5 ms
Circuit Indicator	Logic Side
Fuse (In Output Common Line, Replaceable)	10 amp
Internal Power Consumption	45 mA for each ON Circuit @ 9 V dc
Units of Load 6 units @ 24 V dc	20 units @ 9 V dc

*Since non-solid state devices are used as the power switching devices, the limitations listed in table 6-4 must be observed for reliable operation:

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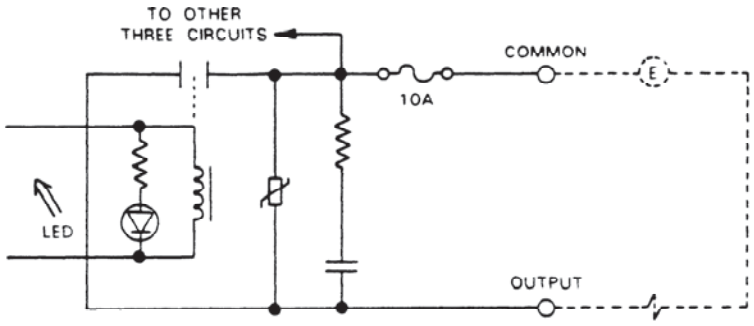
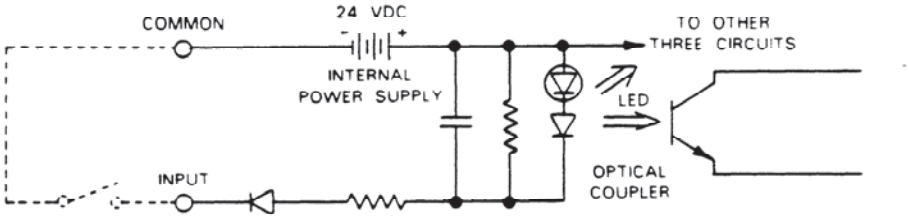


SAMPLE RELAY OUTPUT CIRCUIT



SAMPLE INPUT CIRCUIT

Figure 6-38. Sample 24 V dc INPUT/RELAY OUTPUT Circuits

Thumbwheel Interface
IC610MDL105

This module provides an interface between the Series One or Series One Plus PCs and up to four sets of user supplied thumbwheels. Each set of thumbwheels will allow the operator to control the preset on a timer or counter. In fact, these timer/counters (references 674 to 677) will not function without this interface module. The power (24 V dc) to sense the state of these thumbwheels is provided by the power supply in the CPU base unit. This interface module must be installed in the same base unit as the CPU and can only be located in slots 2 through 5. Only one interface module is allowed per system. The thumbwheels and their associated wiring must be supplied by the user. The thumbwheels are standard BCD coded and diode isolated, a standard option available with most thumbwheels. The following is the required setting for each digit of the thumbwheel:

Digit	Internal	Switch	Closure	(X=Closed)
Value	8	4	2	1
0				
1				X
2			X	
3			X	X
4		X		
5		X		X
6		X	X	
7		X	X	X
8	X			
9	X			X

Whenever the interface is installed in the CPU base unit, eight discrete references are assigned to this module slot. These references have no significance relative to the operation of the interface. They can be used as internal coils, but not as status to other hardware I/O. All four presets are read into the Series One or Series One Plus PC each scan. Figure 6.39 illustrates the wiring for the 20 terminals on the interface module. No special terminations are required for circuits that are not being used.

One thumbwheel is read into the CPU every scan assuring rapid response to new values. Care should be used when changing the value on the thumbwheels, since intermediate values can be brought in and used during a scan or for several scans. For example, if the thumbwheel is set for the value 095 and the new value 105 is desired, altering the hundreds digit first results in 195 being detected and used by the CPU, until the tens digit is changed from 9 to 0. Normally, higher values are more acceptable than lower values and the natural tendency to enter new values from the left or high order digit will result in larger values. However, if the tens digit is changed first, the value 005 could be read prior to the 105 being set. The exact results depend upon the application and the specific logic entered.

Internal Power Consumption	90 mA @ 24 V dc (9 units of load) 10 mA @ 9 V dc (1 unit of load)

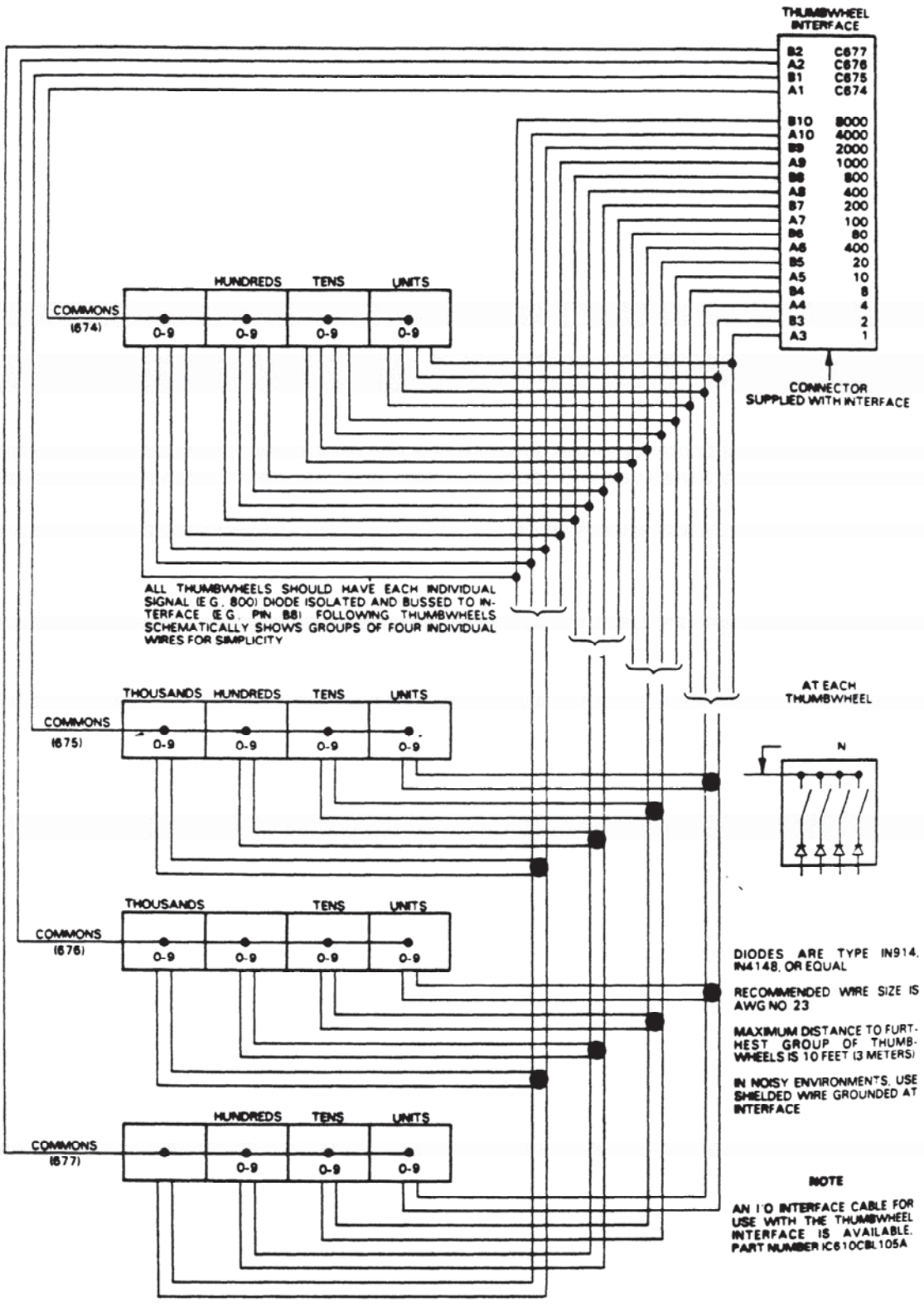


Figure 6-39. Wiring for Thumbwheel Interface

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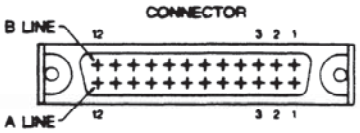
GEJ-7000
Thumbwheel Interface Cable
Wire List and Installation Diagram



Pin No	Signal		Wire color code
A1	674 Thumbwheel switch common		ORN (RED1)
A2	676 Thumbwheel switch common		GRA (RED1)
A3	units digit	1	WHT (RED1)
A4		4	YEL (RED1)
A5	tens digit	1	PNK (RED1)
A6		4	ORN (RED2)
A7	hundreds digit	1	GRA (RED2)
A8		4	WHT (RED2)
A9	thousands digit	1	YEL (RED2)
A10		4	PNK (RED2)
A11	not connected *		ORN (RED3)
A12	not connected *		GRA (RED3)

Pin No.	Signal		Wire color code
B1	675 Thumbwheel switch common		ORN (BLK1)
B2	677 Thumbwheel switch common		GRA (BLK1)
B3	units digit	2	WHT (BLK1)
B4		8	YEL (BLK1)
B5	tens digit	2	PNK (BLK1)
B6		8	ORN (BLK2)
B7	hundreds digit	2	GRA (BLK2)
B8		8	WHT (BLK2)
B9	thousands digit	2	YEL (BLK2)
B10		8	PNK (BLK2)
B11	not connected *		ORN (BLK3)
B12	not connected *		GRA (BLK3)

Color Code Example

ORN ····· orange
GRA ····· gray
WHT ····· white
YEL ····· yellow
PNK ····· pink
RED ····· red
BLK ····· black

The white wire with three red marks and the white wire with three black marks are not used.

* If solid state BCD input is used, connect to BCD input device common.

Figure 6-40. Thumbwheel Interface Cable Wire List

High Speed Counter
IC610MDL110

The High Speed Counter module (HSC) allows a Series One or Series One Plus PC to monitor and control a number of process variables (position, velocity, flow rate) that the CPU cannot control due to timing constraints. A logical relationship between the counters seven inputs, the preset, and current value determines the status of its own two external outputs as well as others through CPU user logic. Figure 6.41 illustrates this concept.

The module can be installed in any of the first 4 I/O slots adjacent to the CPU, and uses 8 I/O and 2 counter references to interface with user logic. Indicators on the front face of the module give output and count status.

General Specifications	
Up/Down Counter Inputs	Increment (Up) Count Decrement (Down) Count Reset/Marker Preset Value (0 - 9999) Current Value (0 - 9999)
Up/Down Counter Outputs	Two Discrete DC (5 - 24 V) Current Value (BCD)
Reaction Time	< 100 Microseconds Between Pulse Received and Transition of Output
Environmental	
Operating Temperature	0 to 60° C
Humidity, Non-Condensing	5 to 95 %
Power Consumption from Internal Supply	70 mA @ 9 V dc
Pulse Rate	Without Filter < 10 kHz With Filter < 500 Hz (Filter selection by three dip switches on module, see page 6-69)
Range	0 to 9999 Binary Coded Decimal(BCD)
Minimum Pulse Width	25 mS

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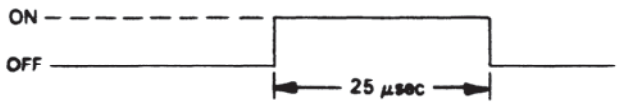

Module Location

The High Speed counter module (HSC) can be installed in any one of the four I/O slots adjacent to the CPU slot in the CPU chassis. In figure 6.42, these slots are shown (A, B, C and D) for a 5-slot rack. In a 10-slot rack, the HSC must also occupy 1 of the 4 slots adjacent to the CPU. Also shown in this figure are the I/O references used by the HSC to interface with user logic. Note how an HSC located in Slot A uses I/O references associated with both Slot A (0-3) and Slot A' (100-103).

Since each slot in a Series One or Series One Plus PC I/O system corresponds to a special group of eight I/O references, an HSC in Slot A eliminates Slot A' from the I/O system. Likewise an HSC located in Slot B eliminates Slot B' from the I/O system. In summary, an HSC physically occupies one I/O slot, but requires two slots worth of I/O references to interface with user logic (Refer to table 6.5).

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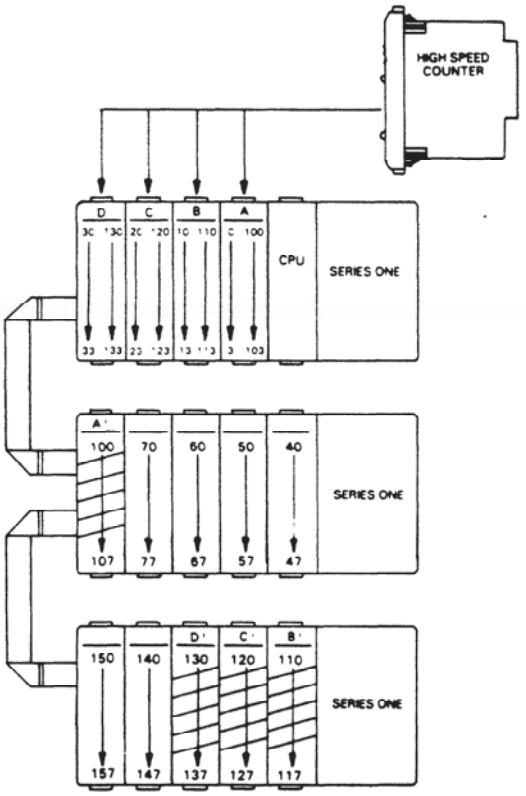

Figure 6-42. HSC Location in 5-Slot Rack

Table 6-5. Number of HSCs vs Discrete I/O Capacity

NUMBER OF HIGH SPEED COUNTER MODULES IN SYSTEM	REMAINING DISCRETE I/O CAPACITY	
	Series One	Series One Plus
0	112	168
1	96	152
2	80	136
3	64	120
4	48	104

Interface to Field Devices

A 32 PIN Connector (Refer to figure 6.43) on the faceplate of the HSC is the interface between the module and its associated field devices which include:

1. Counting mechanism which controls the Up/Down counter (typically a bi-directional incremental encoder).
2. Four digit binary coded decimal (BCD) display of counters current value.
3. Two 5 to -24 V dc loads under control of two counter outputs.

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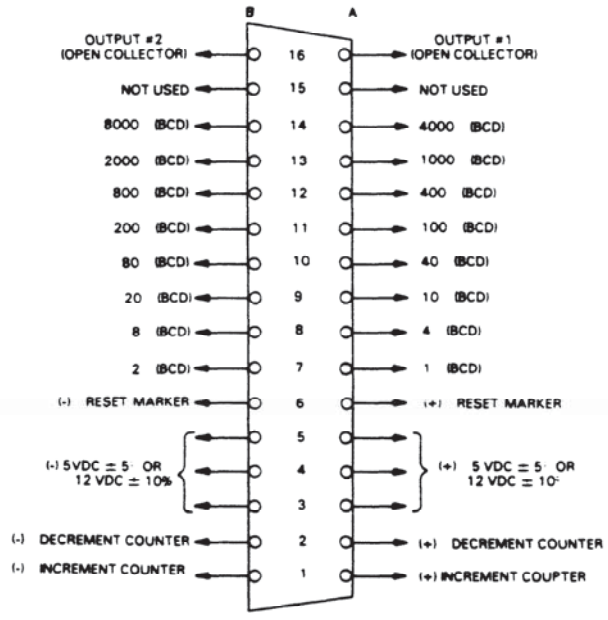

Figure 6-43. HSC Connector Pin Definition

In the interest of clarity the specifications for each field device are addressed separately.

Up/Down Counter Inputs

SPECIFICATIONS		
ITEM	UP/DOWN INPUT	RESET INPUT
Minimum Input Pulse Width	25 nSec	100 nSec
Supply Voltage	+12 V dc, 10%	+12 V dc, 10%
On Current	< 3 mA	10 to 15 mA
Off Current	10 to 15 mA	< 3 mA
On Voltage	< 3 V dc	> 7 V dc
Off Voltage	> 7 V dc	< 3 V dc

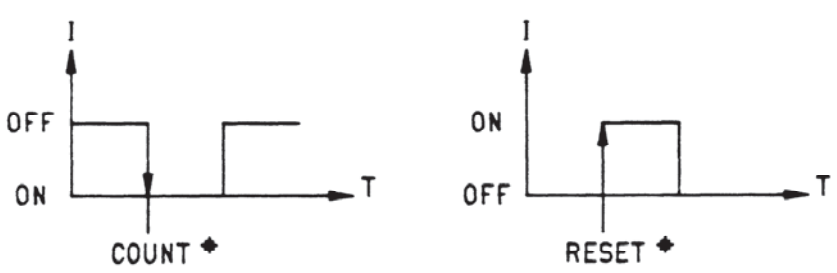

Figure 6-44. Signal Direction

The conditions necessary to increment/decrement, or reset the counter are described below. This is of particular interest when counting in one direction only.

DESIRED ACTION	CONDITION
Increment Current Count	Increment Input: (Disabled) -- (Enabled) Decrement Input: Disabled Reset Input: Disabled
Decrement Current Count	Decrement Input: (Disabled) -- (Enabled) Increment Input: Disabled Reset Input: Disabled
Reset Current Count	Reset Input: (Disabled) -- (Enabled) Increment Input: Disabled or Enabled Decrement Input: Disabled or Enabled
Increment Input:	Disabled, > 10 V dc Between Pins B1 and A1 Enabled, < 2 V dc Between Pins B1 and A1
Decrement Input:	Disabled, > 10 V dc Between Pins B2 and A2 Enabled, < 2 V dc Between Pins B2 and A2
Reset Input:	Disabled, < 2 V dc Between Pins B6 and A6 Enabled, > 10 V dc Between Pins B6 and A6

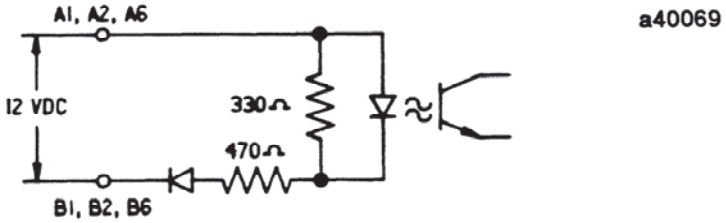

Figure 6-45. UP/DOWN/RESET Input Circuit

Encoder Interface 1

Typically an incremental encoder controls the counter through the Up/Down, and Reset Inputs. To comply with HSC circuitry, the encoder should represent clockwise and counterclockwise movement of its shaft with two separate pulse trains that increment and decrement the counter. Figures 6.46, 6.47, and 6.48 illustrate sample connections.

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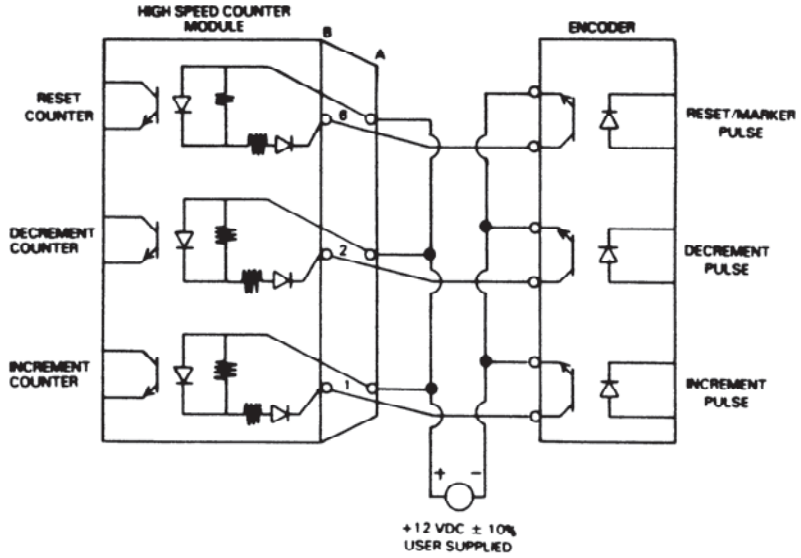

Figure 6-46. Encoder with RESET/MARKER Option Resetting Counter Once per Revolution of Encoder Shaft

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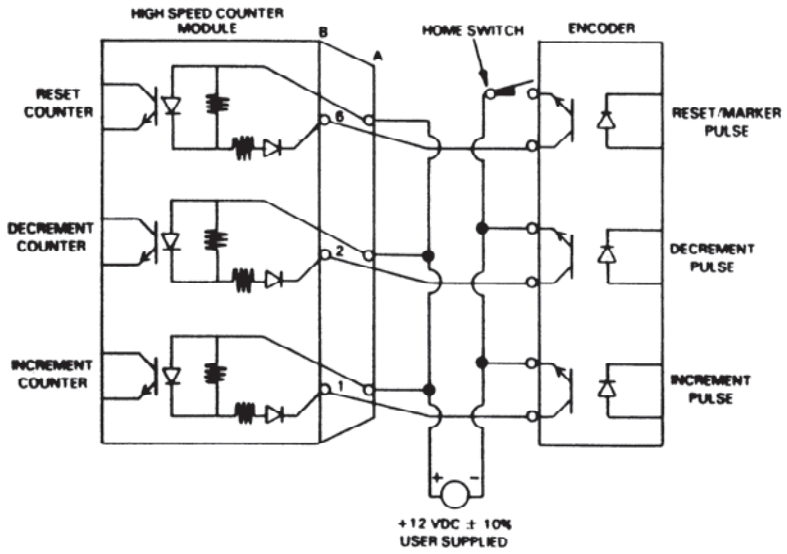

Figure 6-47. Encoder with RESET Option in Series with Home Limit Switch Such That Counter is Reset When Both Home Limit Switch and RESET/MARKER Pulse are Enabled

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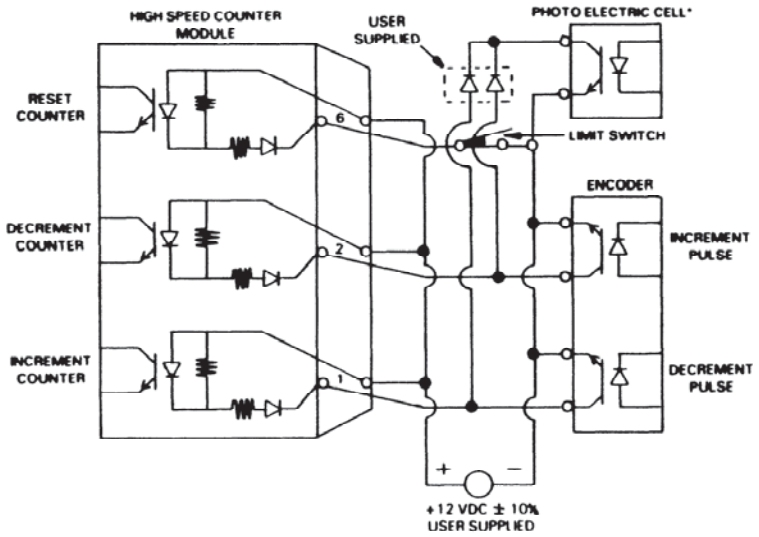

Figure 6-48. Encoder With Limit Switch Resetting Counter and Photoelectric Cell Inhibiting the Counter Operation

Binary Coded Decimal (BCD) Output

To view the counter current value, a four digit BCD (sink/source) output is provided.

SPECIFICATIONS		
ITEM	**RATING**	
OUTPUT POLARITY	1: Optoisolator OFF 0: Optoisolator ON See Sample Circuit Below	
SOURCE MODE Supply Voltage Allowable Ripple Current Consumption Output Voltage	 5 V dc 5% < 1% < 10 mA 3.5 V dc at 0.1 mA	 12 V dc + 10% < 3% < 25 mA 6 V dc at 0.4 mA
SINK MODE Output Voltage	 0.4 V dc @ 2 mA 0.1 V dc @ 3 mA	

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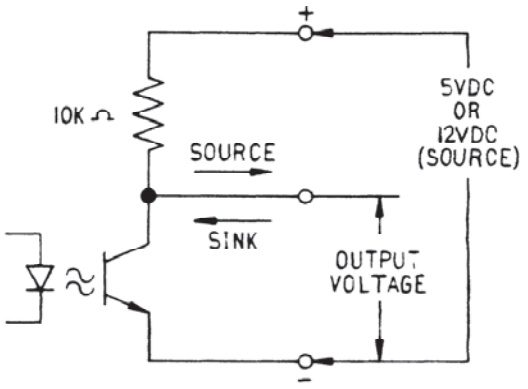


Figure 6-49. Sample BCD Output Circuit

Figure 6.50 illustrates the connections necessary to use an external BCD Display. For a source type output the 5 V or 12 V supply is required.

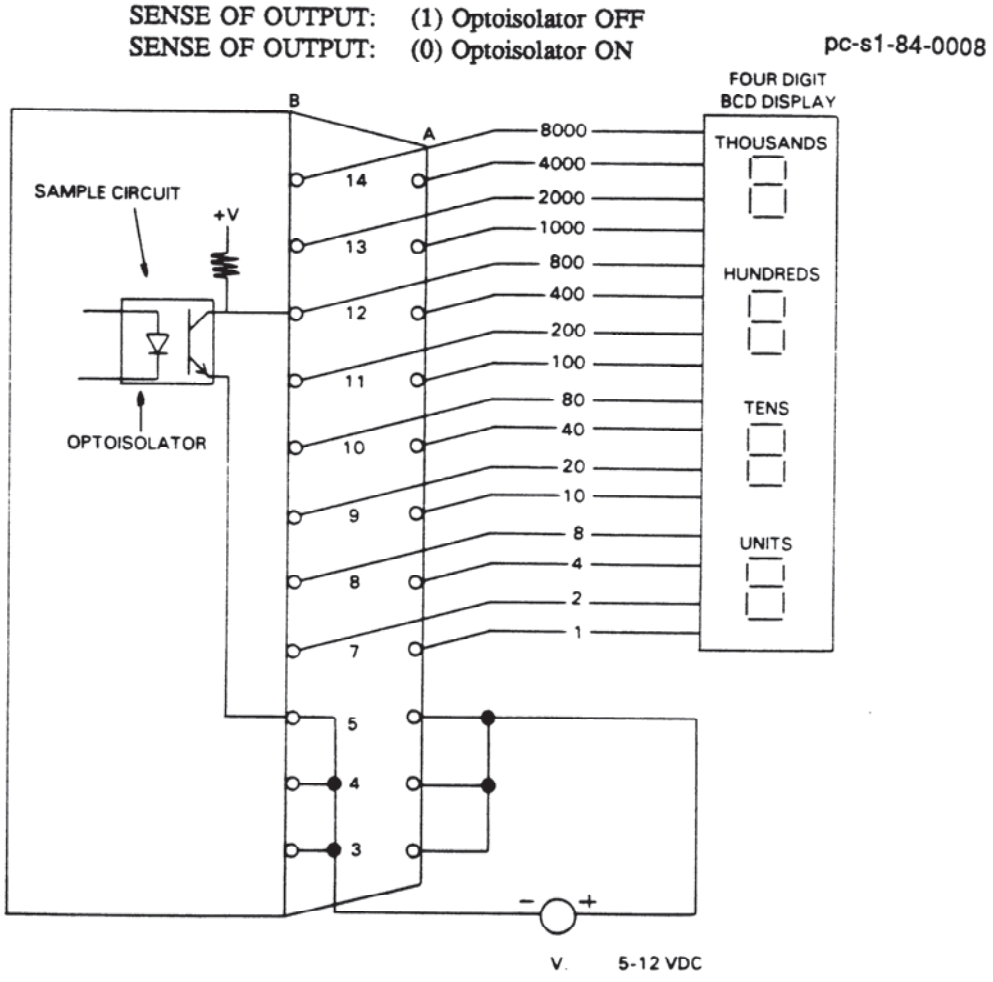


Figure 6-50. BCD Output Wiring Diagram

Counter Output

The HSC has two discrete outputs that can be controlled from ladder logic or by the relationship (>=<) between the present and current value of the counter.

SPECIFICATIONS	
ITEM	**RATING**
Type	NPN Transistor, open collector, sinking
Voltage Range	5 to 24 V dc
Peak Voltage	< 45 V dc
Current Range	> 0.3 A

A typical wiring schematic to field devices and a sample circuit are shown in figure 6.51.

pc-s1-84-0009

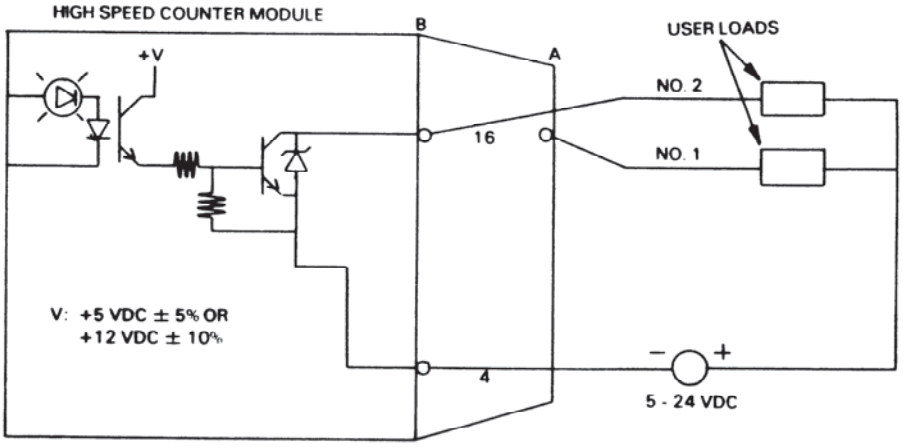
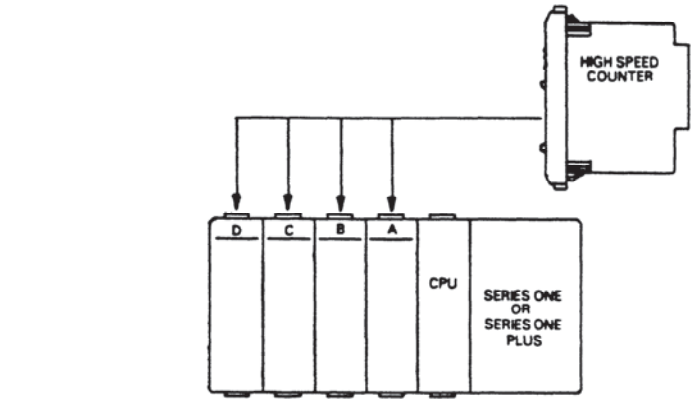


Figure 6-51. User Load Wiring Diagram

Interface to User Logic

Eight I/O and two counter functions interface the HSC to user logic. The specific references associated with these functions depend upon the location of the module in the CPU rack. Figure 6.52 illustrates how these references correspond to the modules location.

pc-s1-84-0011



COUNTER FUNCTION	COUNTER REFERENCES			
SET CURRENT VALUE	106	104	102	100
PRESET VALUE	107	105	103	101
INPUT FUNCTION	**INPUT REFERENCES**			
> PRESET VALUE	30	20	10	00
= PRESET VALUE	31	21	11	01
< PRESET VALUE	32	22	12	02
CARRY/BORROW	33	23	13	03
OUTPUT FUNCTION	**OUTPUT REFERENCES**			
OUTPUT NO. 1 STATE	130	120	110	100
OUTPUT NO. 1 MODE SELECT	131	121	111	101
OUTPUT NO. 2 STATE	132	122	112	102
OUTPUT NO. 2 MODE SELECT	133	123	113	103

Figure 6-52. I/O and Counter Function Reference Chart

Interface Function Definition

Shown below is the definition and user logic symbol for each interface function.

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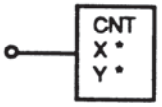
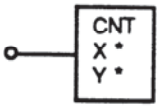
COUNTER FUNCTIONS	USER LOGIC SYMBOL	DEFINITION
SET CURRENT VALUE	 X: 100, 102, 104, 106 Y: 0 - 9999	WHEN COUNTER X IS ENABLED, CURRENT COUNT IS SET TO A VALUE OF Y
PRESET VALUE	 X: 101, 103, 105, 107 Y: 0 - 9999	WHEN COUNTER X IS ENABLED, PRESET VALUE OF COUNTER IS SET TO Y

* X = Counter Reference
* Y = Valid Range

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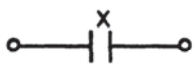
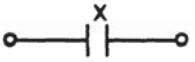
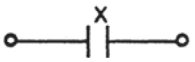
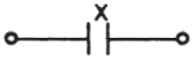
INPUT FUNCTIONS	USER LOGIC SYMBOL	DEFINITION
> PRESET VALUE* *	 X: 00, 10, 20, 30	ENABLED WHEN CURRENT VALUE OF COUNTER IS GREATER THAN ITS PRESET VALUE
= PRESET VALUE* *	 X: 01, 11, 21, 31	ENABLED WHEN CURRENT VALUE OF COUNTER IS EQUAL TO ITS PRESET VALUE
< PRESET VALUE* *	 X: 02, 12, 22, 32	ENABLED WHEN CURRENT VALUE OF COUNTER IS LESS THAN ITS PRESET VALUE
CARRY / BORROW	 X: 03, 13, 23, 33	*

* Enabled when current value of the counter undergoes one of the six sequences described below :

1. 0001 - 0000 - 9999 (Decrement Rollover)
2. 9999 - 0000 - 0001 (Increment Rollover)
3. 0001 - 0000 - 0001
4. 9998 - 9999 - 9998
5. (Increment Current Count) - (Externally Reset Counter) - (Decrement Current Count)
6. (Decrement Current Count) - (Externally Reset Counter) - (Increment or Decrement Current Count)

* * The status of these input functions is given to the CPU once per scan. Therefore, if a particular condition is true for less than the scan time of the user logic, its associated Input function would not be enabled in the user program.

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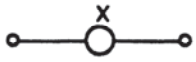
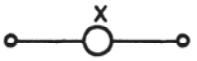
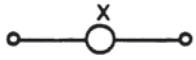
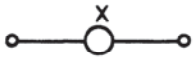
OUTPUT FUNCTIONS	USER LOGIC SYMBOL	DEFINITION *
OUTPUT NO. 1 MODE SELECT	 X: 101, 111, 121, 131	• IF DISABLED OUTPUT NO. 1 IS IN MANUAL MODE • IF ENABLED OUTPUT NO. 1 IS IN COUNTER MODE
OUTPUT NO. 1 STATE	 X: 100, 110, 120, 130	• IN MANUAL MODE OPERATES OUTPUT NO. 1 AS NORMAL OUTPUT • IN COUNTER MODE DETERMINES IF OUTPUT NO. 1 IS ENABLED BEFORE OR AFTER PRESET IS REACHED
OUTPUT NO. 2 MODE SELECT	 X: 103, 113, 123, 133	• IF DISABLED OUTPUT NO. 2 IS IN MANUAL MODE • IF ENABLED OUTPUT NO. 2 IS IN COUNTER MODE.
OUTPUT NO. 2 STATE	 X: 102, 112, 122, 132	• IN MANUAL MODE OPERATES OUTPUT NO. 2 AS NORMAL OUTPUT • IN COUNTER MODE DETERMINES IF OUTPUT NO. 2 IS ENABLED BEFORE OR AFTER PRESET IS REACHED

* For further description on the operation of outputs, refer to Output Logic Section.

Ouptut Logic

Each of the two HSC outputs operate in either the manual or counter mode. The operating mode of each output is determined by the state of its mode select function (refer to output function section). The logic of each mode will be covered separately.

If Mode Select Function Disabled (0): Manual Mode, Enabled (1): Counter Mode.

Manual Mode

The state of an output in the manual mode corresponds to the status of its associated Output State Function as shown below in the manual mode output truth table.

Table 6-6. Manual Mode Output Logic Truth Table

OUTPUT MODE SELECT	OUTPUT STATE	OUTPUT
0	0	0
0	1	1

Counter Mode

In the counter mode of operation outputs can react immediately when the current count reaches specific preset values. In this mode each output is controlled by a combination of three factors.

1. Initial relationship between preset and current count.
2. Real time relationship between preset and current count.
3. Status of Output State function.

When the HSC receives a preset value from user logic (via preset counter function), it is initially compared to the current value of the counter. If the preset is greater than the current count in this initial comparison the real time comparison*[2]between the preset and current count is "true" when the current count is greater than or equal to the preset. In other words when the current count reaches the preset moving in the POSITIVE direction the real time comparison becomes "true". This concept is shown below in table 6.7.

Table 6-7. Real Time Comparison Table for Preset Initially > Current Count

	CURRENT COUNT < PRESET	CURRENT COUNT ≥ PRESET
REAL TIME COMPARISON STATUS	FALSE	TRUE

*Real Time Compariston = continuous comparison between preset value and current value of counter.

Conversely, if the preset is initially less than the current count, the real time comparison is "true" when the current count is less than or equal to the preset. In other words, when the current count reaches the preset moving in the negative direction the real time comparison becomes "true". This concept is shown below in table 6.8.

Table 6-8. Real Time Comparison Table for Preset Initially < Current Count

	CURRENT COUNT > PRESET	CURRENT COUNT < PRESET
REAL TIME COMPARISON STATUS	FALSE	TRUE

Once the status of the real time comparison between the preset and current count has been determined, the status of the output is easily obtained. If the outputs associated output state function is disabled its status corresponds directly to the real time comparison status. If the output state function is enabled the output's status is the inverse of the real time comparison status. This concept is shown in table 6.9.

Table 6-9. Output State vs Real Time Comparison Status in Counter Mode

OUTPUT STATE FUNCTION	REAL TIME COMPARISON IS FALSE	REAL TIME COMPARISON IS TRUE
DISABLED	0	1
ENABLED	1	0
1: OUTPUT ENABLED **0: OUTPUT DISABLED**		

Table 6.10 summarizes the logic associated with an output in the counter mode of operation.

Table 6-10. Output Logic in Counter Mode

INITIALLY PRESET > CURRENT COUNT		
OUTPUT STATE FUNCTION	CURRENT COUNT < PRESET	CURRENT COUNT ≥ PRESET
0	0	1
1	1	0
INITIALLY PRESET < CURRENT COUNT		
OUTPUT STATE FUNCTION	CURRENT COUNT > PRESET	CURRENT COUNT < PRESET
0	0	1
1	1	0

Filter Selection

In some electrical noisy environments it may be necessary to filter out noise through filters available on the module. The HSC provides this capability on the incremental count, decremental count, and reset/marker inputs. The location of these switches on the module is shown in figure 6.53.

Sense of switch: OPEN - Filter Disabled (< 10 Khz)
CLOSED - Filter Enabled (< 500 Hz)

pc-s1-84-0004

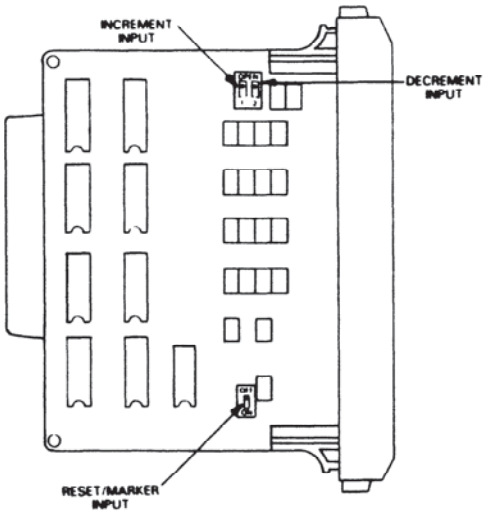


Figure 6-53. Filter Selection with Dip Switch

Fast Response I/O
IC610MDL115

The Fast Response I/O module allows a Series One or Series One Plus PC to respond quickly to an input and/or monitor very short input pulses. The module's four 24 V dc inputs and two relay outputs use 8 I/O references to interface with user logic. Each of the 2 outputs can operate in a manual or fast response mode. An output in manual mode is controlled from user logic similar to any other discrete output. An output in the fast response mode can be controlled independent of CPU scan time by its 2 associated inputs, with one input enabling it, and the other disabling it. Up to 14 Fast Response I/O modules can be included in a Series One or Series One Plus PC system, thereby providing 28 fast response outputs and 56 inputs total. Following are specifications for each of the input and output circuits.

DC INPUT CIRCUITS	
Number of Circuits	4
Maximum Voltage (Open Circuit)	36 V dc
Input Current	16 mA (maximum)
ON Level	0 - 3 V dc
OFF Level	18 - 36 V dc
OFF to ON Response	0.3 to 1 ms
ON to OFF Response	50 to 150 ms
Maximum OFF Current	3 mA
Minimum ON Current	7 mA
Input Pulse Width	1 ms (minimum)
Circuit Indicator	Field Side

NOTE

Input Switching Voltage Provided by Module

RELAY OUTPUT CIRCUITS	
Number of Circuits	2
Operating Voltage	5-265 V ac/dc
Ac Frequency Range	47-63 Hz
Maximum Current*	4 amp (resistive) 0.5 amp (inductive)
Maximum Leakage Current	1 mA
Smallest Recommended Load	10 mA
Maximum Inrush	5 amps
OFF To ON Response	5 ms (maximum)
ON To OFF Response	5 to 10 ms
Circuit Indicator	Field Side
Circuit Indicator	Field Side
Fuse (In Output Common Line)	3 amp
Internal Power Consumption	50 mA + 53 mA/Output ON Circuit at 9 V dc, 15 mA/Input @ 24 V dc Units of Load: 16 (9 V dc) 6 (24 V dc)

Since non-solid state relays are used as the power switching devices, the limitations as shown in table below must be observed for reliable operation.

Table 6-11. Maximum Current vs. Load Type for Relay Outputs

OPERATING VOLTAGE	MAXIMUM CURRENT FOR LOAD TYPE			TYPICAL LIFE (OPERATIONS)
	RESISTIVE	LAMP	SOLENOID	
220 V ac	4 Amp	0.5 Amp	0.5 Amp	100,000
220 V ac		0.05 Amp	0.05 Amp	800,000
110 V ac	4 Amp	0.5 Amp	0.5 Amp	150,000
110 V ac		0.1 Amp	0.1 Amp	650,000
24 V dc	5 Amp	0.5 Amp	0.5 Amp	100,000
50 V dc	1 Amp	0.1 Amp	0.1 Amp	100,000
100 V dc	0.5 Amp	0.05 Amp	0.05 Amp	100,000
250 V dc	0.3 Amp	0.03 Amp	0.03 Amp	100,000

NOTE

Lamp loads are defined as a X10 inrush with a power factor (PF) of 1.00 and when turned OFF represent a PF of 1.00. Solenoids are defined with a X10 inrush, a PF of 0.65, and when turned OFF represent a PF of 0.35.

b40556

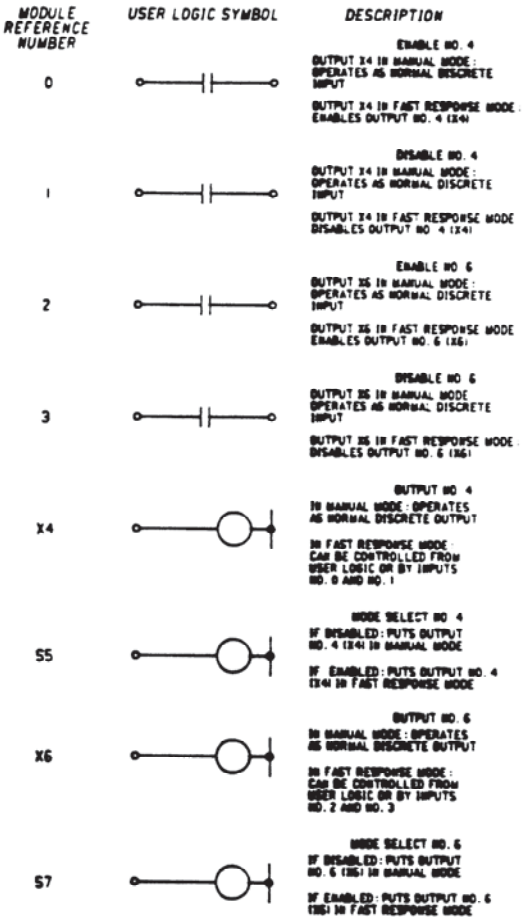


Figure 6-54. Module Reference NUMBER/LOGIC Symbol Definition

Mode Selection

The Operating Mode Selection of outputs X4 and X6 is determined by the status of their mode select references S5 and S7 as shown in table 6.12.

Table 6-12. Operating Mode Selection

MODE SELECT	OUTPUT
(S5 and S7) Disabled (0) Enabled (1)	(X4 and X6) Manual Mode Fast Response Mode

Output Logic - Manual Mode

An output operating in the manual mode is controlled through user logic similar to any other discrete output. Its associated inputs on the fast response module do not affect it any way.

Output Logic - Fast Response Mode

In the fast response mode of operation, a combination of three factors determines the status of the output.

- State of Associated Enable Input (Reference number 0 or 2)
- State of Associated Disable Input (Reference number 1 or 3)
- User Logic

The truth table (following) shows how the output can be controlled from user logic or with its enable and disable inputs.

Table 6-13. Truth Table for Output in Fast Response Mode (S5 or S7 Have Been Enabled)

ENABLE INPUT No. 0 or 2	DISABLE INPUT No. 1 or 3	USER LOGIC X4 or X6	OUTPUT
1	0	0	1
0	0	1	1
1	0	1	1
1	1	1	0
1	1	0	0
0	1	0	0
0	0	0	0

0: Disabled 1: Enabled

It can be seen from the first three rows in the truth table that the output can be enabled from its enable input or from user logic. The last four rows of this truth table show the various conditions that disable the outputs.

The logic diagram shown below in figure 6.55 summarizes the operation of this module.

a40547

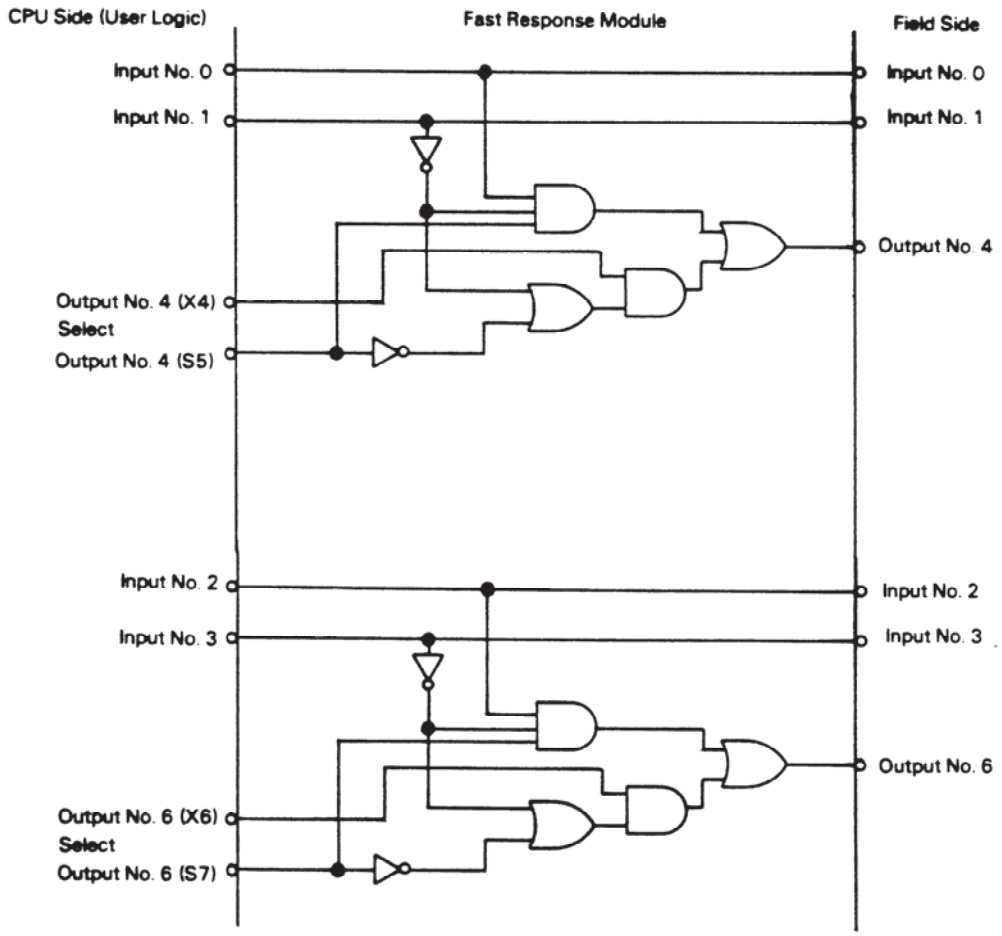
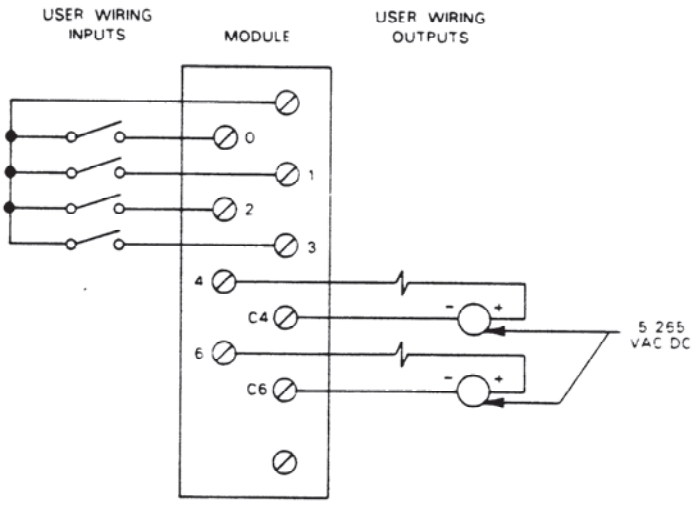


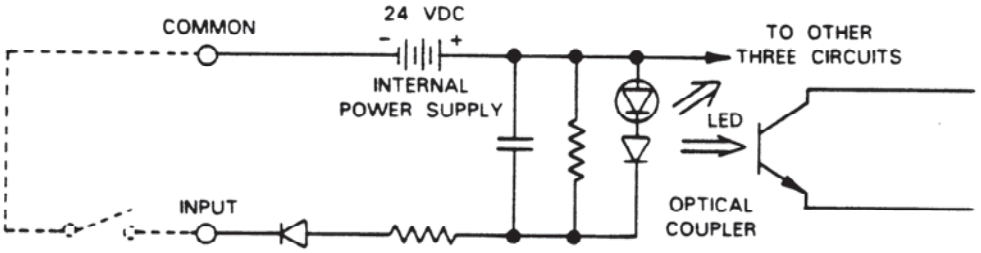
Figure 6-55. Fast Response Module Logic Diagram

pc-s1-84-0020

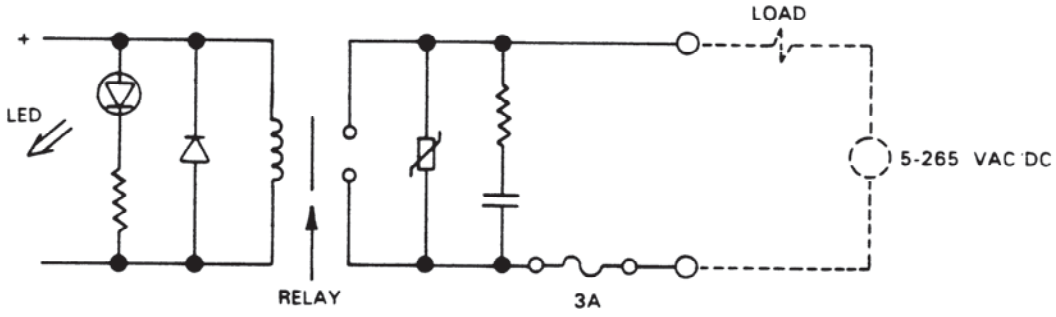


USER WIRING DIAGRAM

pc-s1-84-0016



pc-s1-84-0015



SAMPLE OUTPUT CIRCUIT

Figure 6-56. Wiring for Fast Response I/O Module

I/O Simulator
IC610MDL124

The I/O simulator module has 8 two-position (ON or OFF) switches, each having an associated LED, that is, if switch 1 is turned ON, LED 1 will light. An I/O simulator module uses one I/O slot and the 8 I/O references assigned to that slot. Each of the switches can be programmed as a discrete input device. This module requires no field connections since its function is controlled by programming. An I/O simulator module is a valuable tool in program development and troubleshooting. An I/O simulator could also be programmed to be used as conditional input contacts for control of output devices. Specifications for this module are as follows:

ON to OFF Response	4 to 15 ms
OFF to ON Response	4 to 15 ms
Internal Power Consumption	10 mA @ 9 V dc 14 mA/Circuit ON @ 24 V dc
Units of Load	1 unit @ 9 V dc 11 units @ 24 V dc
Weight	3.2 oz (90 g)

a40215

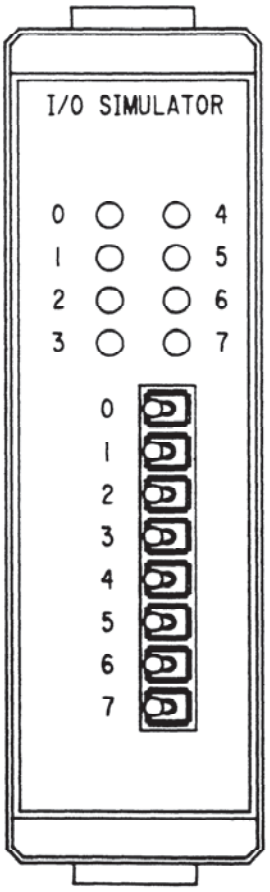


Figure 6-57. I/O Simulator Module Faceplate

Analog Input
IC610MDL116

Introduction

The Analog Input module provides four independent input channels capable of converting an analog input signal to a digital signal for processing by the programmable controller. This module can be used with Series One and Series One Plus programmable controllers. However, the input can only be provided in binary form with a Series One PC. The Series One Plus, in addition to the basic functions, provides data operations (including math functions), which allows other types of operations to be performed when using the analog input module. Each Analog Input module requires 16 I/O references for addressing.

Hardware Features

The user can select, by jumper placement, to use either voltage inputs (1 to 5 V dc) or current inputs (4 to 20 mA). The factory setting is for voltage input operation. Resolution is 8 bits, which allows a maximum digital value of 255 to be converted. Eight LEDs on the faceplate provide an 8-bit binary display of the input. The channel to be displayed is selected by depressing a pushbutton on the faceplate. Each time the pushbutton is depressed, the next channel in sequence is selected, i.e., channel 1, 2, 3, 4, 1, etc.

User field wiring is made to a removable terminal board on the module's faceplate. A hinged plastic terminal cover on the terminal board protects the terminals. The terminal cover has a removable label that can be used to record circuit information.

The maximum conversion time is 2 milliseconds and does not add to the scan time of the CPU. The four channels are converted one at a time, with one channel being converted each scan. Each successive scan converts the next channel in turn.

Power Requirements

This module requires an external 24 V dc power supply. The 24 V dc supply in Series One racks can be used, however the current provided by the rack is limited to 100 mA, which is sufficient current for one Analog Input module, since the module requires up to 65 mA for operation.

General and Electrical Specifications

Specifications for this module are provided in the following table.

Table 6-14. Analog Input Module Specifications

Number of Channels	4 (Independent)
Input Ranges	+1 to +5 V dc or 4 to 20 mA (jumper selectable for each channel)
Resolution	8-bit binary (1 in 256)
Digital Outputs	8 bits, binary data output 4 bits, channel status
I/O Points Required	16 consecutive (per slot assignments for 16 points, 0 to 7 and 100 to 117, etc.)
LED Display (16 LEDs)	8 bits: Data being read into the selected channel 4 bits: Channel selected for Data Display 4 bits: Channels being scanned
Operating Temperature	0 to 60° C (32 to 140° F)
Relative Humidity	5% to 95% (non-condensing)
Input Types	Differential
Input Impedance	> 1 MΩ (Voltage put) 250 Ω (Current put)
Absolute Maximum ratings	Voltage Input, 0 to +10 V dc Current Input, 0 to 30 mA
Conversion Method	Successive Approximation Method
Conversion Time	2 msec, maximum
Linearity Error	±0.8%, maximum
Accuracy	±1% at 25° C, maximum
Accuracy vs. Temperature	±50 ppm (parts per million) per 1°C
External Power Source	+25 V dc, 65 mA (maximum)
9 V dc Power Consumption	55 mA (Supplied by rack power supply)

I/O Reference Definitions

The Analog Input module uses 16 consecutive I/O points, beginning with the first I/O reference assigned to the I/O slot selected for the module. In the table, it is assumed that the Analog Input module is placed in slot 3 of a properly configured 5 or 10-slot CPU rack (references 10 to 17 and 110 to 117). These references are used for the example only, other valid references for I/O slots that allow 16 references can be used. The following table defines the use of each of the I/O points.

Table 6-15. I/O Point Definition

I/O POINT	DEFINITION	WEIGHT	I/O TYPE
10	Data Bit - Binary	1	Input
11	Data Bit - Binary	2	Input
12	Data Bit - Binary	4	Input
13	Data Bit - Binary	8	Input
14	Data Bit - Binary	16	Input
15	Data Bit - Binary	32	Input
16	Data Bit - Binary	64	Input
17	Data Bit - Binary	128	Input
110	Channel 1 This bit is used in ladder logic to sense when the data received at the inputs is for this channel.		Input
111	Channel 2 Sense bit		Input
112	Channel 3 Sense bit		Input

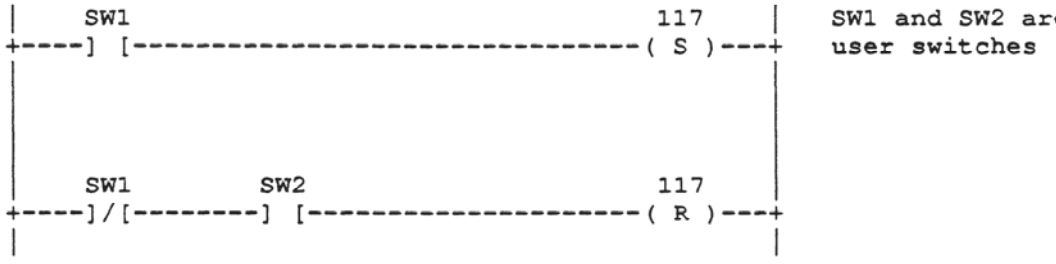
Table 6-15. I/O Point Definition - Continued

I/O POINT	DEFINITION	WEIGHT	I/O TYPE
113	Channel 4 Sense bit		Input
114	This output combined with the following output can		Output
115	be set to selectively scan only 1 channel, instead of all 4. These outputs are ignored if the scan selection output is on. The desired channel is selected by setting these two outputs in the ladder logic to the state, as shown below, for that channel.		Output
OUTPUT 114	OUTPUT 115		CHANNEL
0	0		1
1	0		2
0	1		3
1	1		4
116	Not used		
117	Scan selection output. This bit must be set for the module to read data input, unless the selected channel scan outputs are used. This output is set in the ladder logic program		Output

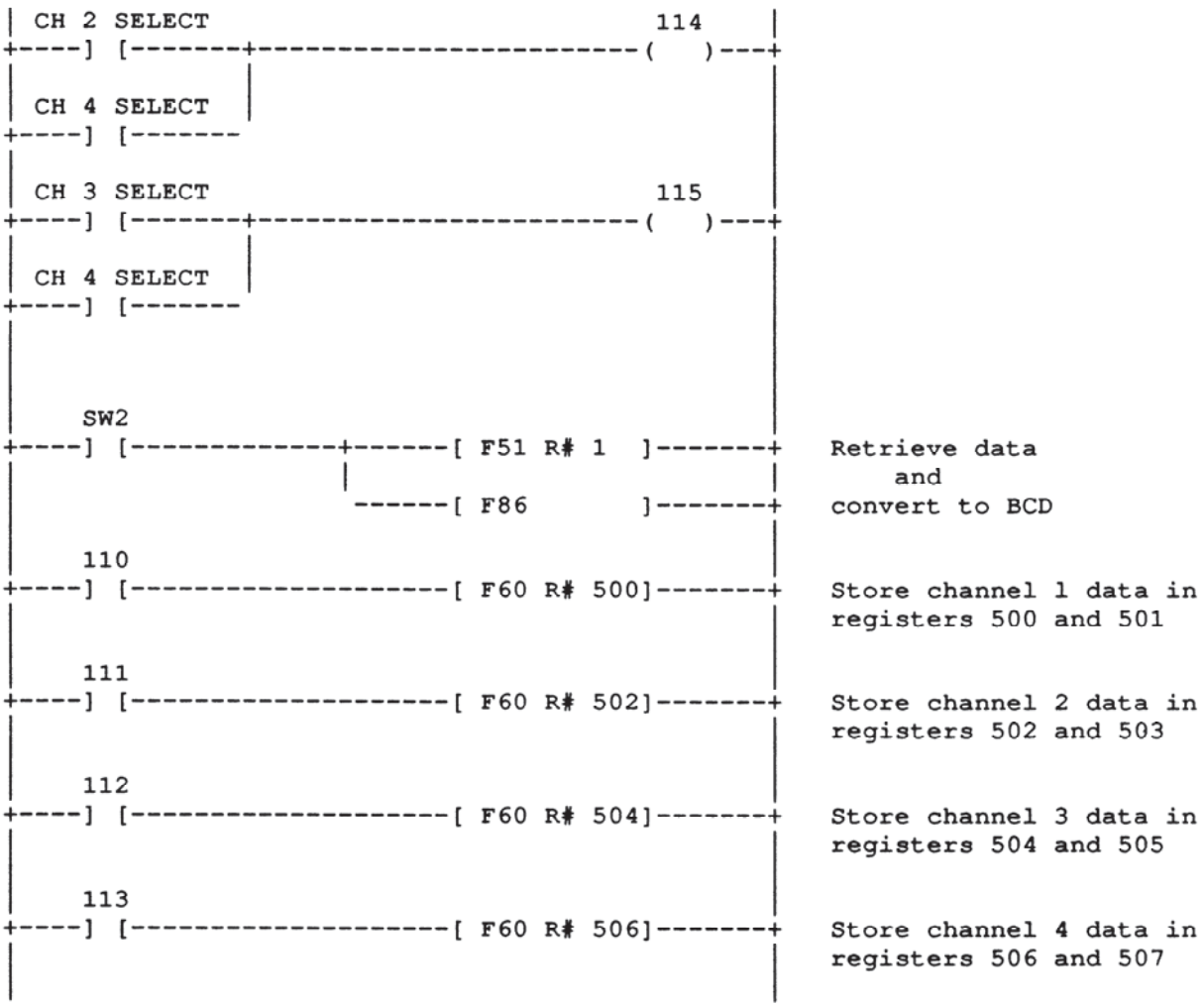
Sample Ladder Logic

Sample ladder diagrams are provided below using the same I/O referencing as is used in defining the I/O points in Table 6.15 on the previous page. These are examples of programming the Series One Plus.

Example 1. If all channels are to be scanned, output 117 must be on.



Example 2. This example of ladder logic allows you to select the channel to be scanned.



The Function codes used in the above example are as follows:
F51 = D STR1 (Data Store 1), F86 = BIN to BCD, F60 = D OUT (Data Out)

Analog Input Module Features

Figure 6.58 is an illustration of the faceplate for the Analog Input module, showing its features and user wiring connections.

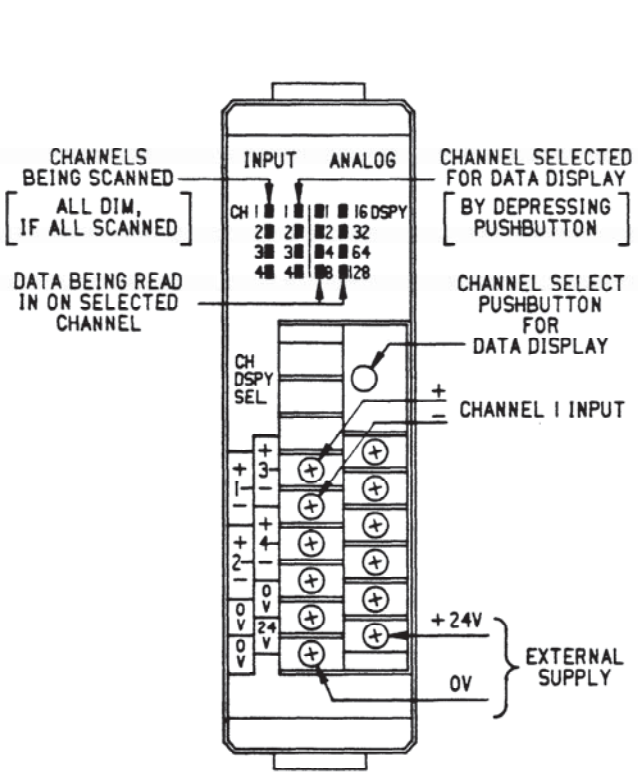


Figure 6-58. Analog Input Module Faceplate

Selection Of Operating Mode

The mode of operation, either 1 to 5 V or 4 to 20 mA is determined by the absence or presence of jumper plugs on pins that are located on the side of the bottom circuit board. There are four sets of pins (2 pins in each set), with one set for each channel. The first set of pins is labeled CH1 and the last set of pins is labeled CH4. The factory default setting is for 1 to 5 V operation, which is no jumper present. To select the 4 to 20 mA mode of operation for any channel, place a jumper on the two pins for the channel or channels and push the jumper firmly onto the pins.

Analog Output
IC610MDL166

Introduction

The Analog Output module provides two independent output channels, each capable of converting 8 bits of binary data to an analog output. This module can be used with any of the Series One family of programmable controllers. The Series One Plus, in addition to the basic functions, provides data operations (including math functions), which allows other types of operations to be performed when using the analog output module. Each Analog Output module requires 16 I/O references for addressing.

Although this module can be used with the Series One and Series One Junior, in addition to the Series One Plus, certain programming techniques will make better use of the capabilities of the Analog Output module with these PCs. An APPLICATION NOTE will be issued explaining those techniques in detail.

Hardware Features

Each channel can provide either a voltage output (0 to +10 V dc) or current output (4 to 20 mA source). Voltage or current selection for each channel is user selected by how the field wiring is connected on the screw terminals on the faceplate. Resolution is 8 bits, which allows a maximum digital value of 255 to be converted. Eight LEDs for each channel on the faceplate provide an 8-bit binary display of the data output for each channel.

User field wiring is made to a removable terminal board on the module's faceplate. A hinged plastic terminal cover on the terminal board protects the terminals. The terminal cover has a removable label that can be used to record circuit information.

The maximum conversion time is 10 microseconds and does not add to the scan time of the CPU. Both channels are converted with each scan.

Power Requirements

This module requires an external 24 V dc power supply. The 24 V dc supply in Series One racks can be used, however the current provided by the rack is 100 mA, which is sufficient current for one Analog Output channel, since the module requires up to 85 mA for operation. The maximum load for both channels is 170 mA.

General and Electrical Specifications

Specifications for this module are provided in the following table.

Table 6-16. Analog Output Module Specifications

Number of Channels	2 (Independent)
Analog Output Ranges	0 to +10 V dc or 4 to 20 mA (selectable for each channel on faceplate terminals)
Resolution	8-bit binary (1 in 256)
Digital Input Data	8 bits, binary from the CPU
I/O Points Required	16 consecutive (per slot assignments for 16 points, 0 to 7 and 100 to 117, etc.)
LED Display (16 LEDs) 8 LEDs for each channel	8-bit binary data display of output data for each channel
Operating Temperature	0 to 60° C (32 to 140° F)
Relative Humidity	5% to 95% (non-condensing)
Output Impedance	< 0.5L (Voltage Output)
Output Current	10 mA, maximum (Voltage Output)
External Resistor	550L, maximum (Current Output)
Conversion Start	At start of CPU's scan
Conversion Time	10 msec, maximum
Accuracy	0.2% at 25°C
Accuracy vs. Temperature	30 ppm (parts per million) per 1°C
External Power Source	+24 V dc, 85 mA (maximum)
9 V dc Power Consumption	55 mA (Supplied by rack power supply)

I/O Reference Definitions

The Analog Output module uses 16 consecutive I/O points, beginning with the first I/O reference assigned to the I/O slot selected for the module. In the table, it is assumed that the Analog Output module is placed in slot 2 of a properly configured 5 or 10-slot CPU rack (references 0 to 10 and 100 to 110). *These references are used for the example only, other valid references for I/O slots that allow 16 references can be used.*The following table defines the use of each of the I/O points.

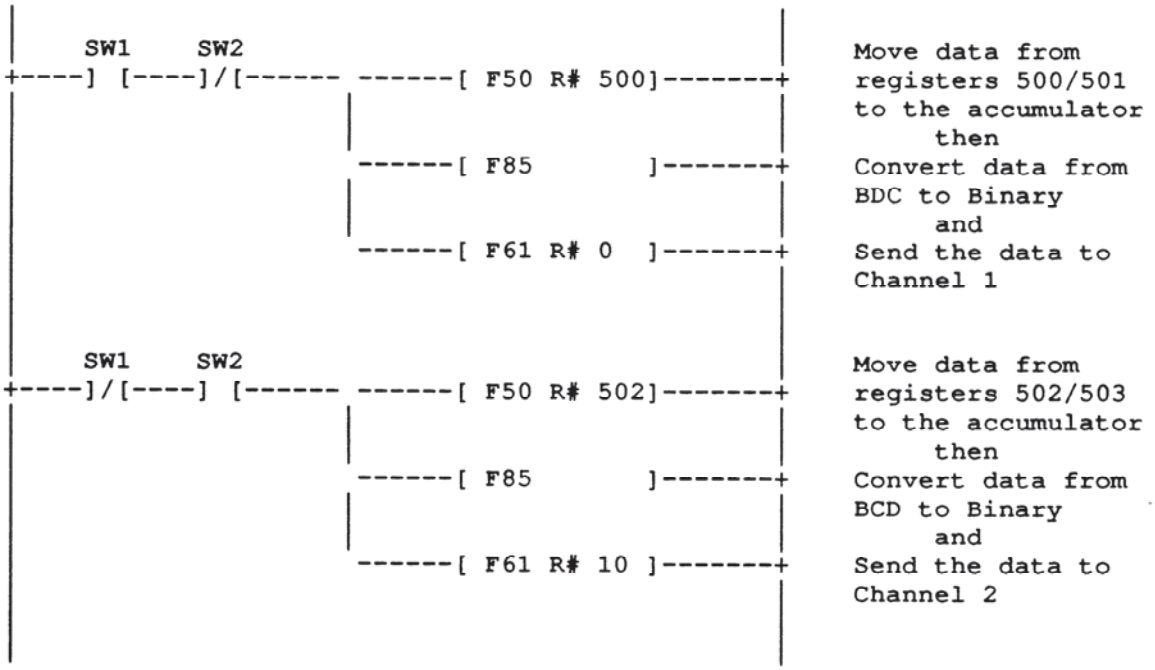
Table 6-17. I/O Point Definition

I/O POINT	DEFINITION		I/O TYPE
CHANNEL	DATA	WEIGHT	
0	Channel 1 - Data Bit 1	1	Output
1	Channel 1 - Data Bit 2	2	Output
2	Channel 1 - Data Bit 3	4	Output
3	Channel 1 - Data Bit 4	8	Output
4	Channel 1 - Data Bit 5	16	Output
5	Channel 1 - Data Bit 6	32	Output
6	Channel 1 - Data Bit 7	64	Output
7	Channel 1 - Data Bit 8	128	Output
100	Channel 2 - Data Bit 1	1	Output
101	Channel 2 - Data Bit 2	2	Output
102	Channel 2 - Data Bit 3	4	Output
103	Channel 2 - Data Bit 4	8	Output
104	Channel 2 - Data Bit 5	16	Output
105	Channel 2 - Data Bit 6	32	Output
106	Channel 2 - Data Bit 7	64	Output
107	Channel 2 - Data Bit 8	128	Output

Sample Ladder Logic

A sample ladder diagram is provided below showing a method of how to move output data to Channels 1 and 2. This is an example of programming the Series One Plus for using the Analog Output module.

Example. Move output data to Channels 1 and 2, using the same I/O references as are used in previous table; i.e., 0 to 7 for Channel 1 and 100 to 107 for Channel 2.



The Function codes used in the above example are as follows:
F50 = D STR (Data Store)
F85 = BCD to BIN
F61 = D OUT1 (Data Out 1)

Analog Output Module Features

Figure 6.59 is an illustration of the faceplate for the Analog Output module, showing its features and user wiring connections.

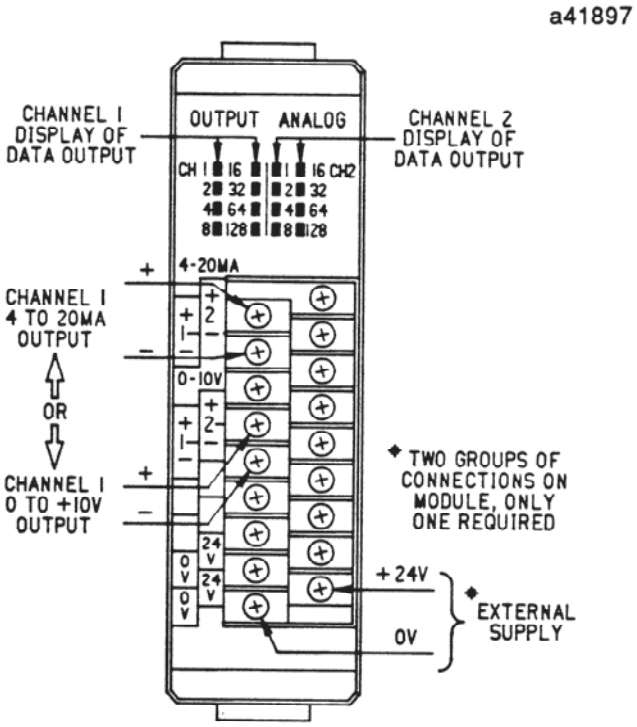


Figure 6-59. Analog Output Module Faceplate

UL Listed Products

The Series One products that have obtained UL approval or are UL pending are described in the following pages. These products are listed below. As with all products that have obtained UL approval, each listed item has an attached UL label.

- IC610CPU101 Series One CPU. Version C of the CPU is UL Listed. The functionality of the CPU has not changed, all specifications are the same as the previous version.
- IC610CHS111 Series One 5-slot rack. 115 V ac source of input power required.
- IC610MDL135 Series One 115 V ac Input module, 6 circuits.
- IC610MDL181 Series One Relay Output module, 5 circuits.
- IC610MDL185 Series One 115 V ac Output module, 6 circuits.

The following pages contain the technical specifications and wiring information required to implement the Series One UL listed products.

5-Slot Rack, UL Listed
IC610CHS111

The 5-slot UL Listed rack is similar to the existing 5-slot rack, IC610CHS110, in that it has a power supply to the right and slots to contain up to 5 modules. *The power supply for this UL rack requires an input power source of 115 V ac.* This rack does not accept 230 V ac input.

As with existing 5-slot rack, a terminal board is provided for field wiring connections, refer to the following figure. The two top terminals are for the 115 V ac HOT (H) and NEUTRAL (N) connections. The next two terminals are for connecting an external device to the RUN relay, the next two contacts (+ and -) provide a 24 V dc output voltage at 100 mA for connection to an external sensor, and the bottom terminal is the common (C) connection to an expansion rack.

When used as the first rack in an installation, it must contain the CPU which is placed in the slot next to the power supply. The rack can also be used as the second or third rack in a system if more I/O is required than can be contained in the first rack. A two-position switch on the inside, left of the rack, must be set determined by location of the rack in the system. For a UL approved installation, do not mix UL approved and non UL racks or modules. Specifications for this rack are as follows:

AC power Required:	115 V ac, 15%
Frequency:	47 to 63 Hz
Maximum Load:	0.8 A, max.
Output Current:	1.4 A, at 5 V dc 0.8 A, at 9 V dc 0.5 A, at 24 V dc

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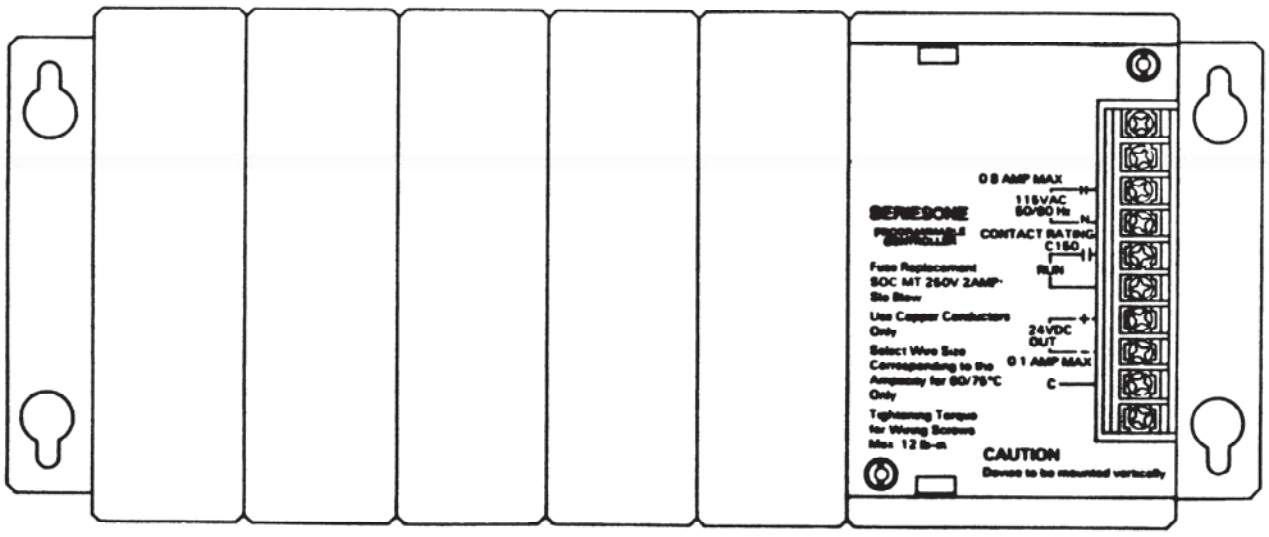

Figure 6-60. UL Listed 5-Slot Rack

115 V ac Input Module, UL Listed
IC610MDL135

This UL listed module provides 6 circuits, each designed to receive a single discrete (ON or OFF) signal from user supplied devices. Examples of these devices include limit switches, pushbuttons, selector switches, and relay contacts. The 6 circuits are grouped together and share a single common terminal. Power to operate the field devices must be supplied by the user. An LED, viewed on the faceplate, provides a visible indication of the ON or OFF state of each circuit. Specifications for each of the 6 circuits are provided below:

Input Points	6
Operating Voltage	97 to 132 V ac
AC Frequency	47 t 63 Hz
Input Current	7 mA per point maximum
Input Impedance	9.5 K ohms
ON Level	> 80 V ac
OFF Level	< 20 V ac
OFF to ON Response	10 to 30 ms
ON to OFF Response	10 to 60 ms
Circuit Indicator	Field Side
Internal Power Consumption	10 mA at 9 V dc
Units of Load	1 unit (9 V dc)

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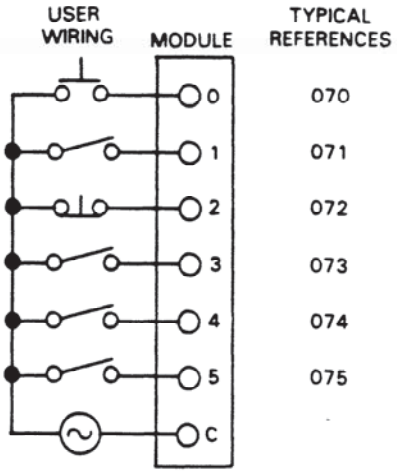

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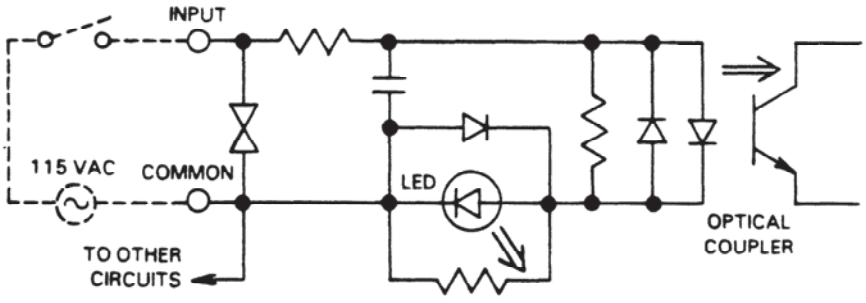


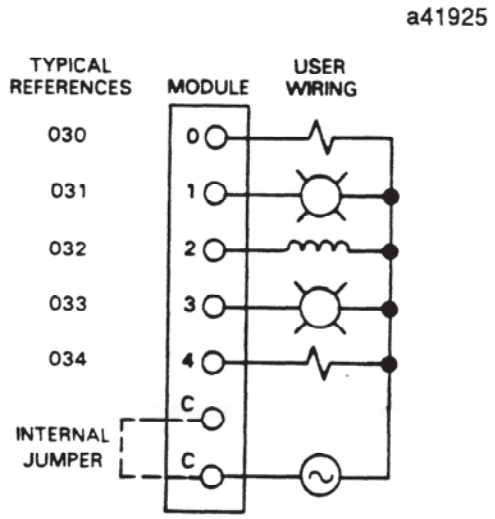
Figure 6-61. Wiring for UL Listed 115 V ac Input Module

Relay Output Module, UL Listed
IC610MDL181

This UL listed module provides 5 circuits, each capable of controlling user supplied discrete (ON or OFF) loads. These loads typically include relay coils, motor starters, solenoid valves, annunciation devices and indicator lights. Since this module is not designed to operate with a specific current type such as 115 V ac or 24 V dc. It can be used to control a wide variety of loads and signal types. The relay contact rating for this module is C150.

The 5 circuits are arranged in one group, with 2 common connections, which are tied together internally. Power to operate the field devices must be supplied by the user. An LED, viewed on the faceplate, provides a visible indication of the ON or OFF state of each circuit.

Outputs	5
Operating Voltage	5 to 132 V ac/dc
AC Frequency	47 to 63 Hz
Contact Rating	C150
Current, Continuous	2.5 Amps
Current, Make, 120 V	15 Amps
Current, Break, 120 V	1.5 Amps
Maximum Leakage Current (across contacts)	1 mA
Smallest Recommended Load	5 mA
Maximum Inrush	5 amps
OFF to ON Response	5 ms
ON to OFF Response	4 ms
Circuit Indicator	Logic Side
Fuses (Internal)	(1) 10 amp, replaceable
Internal Power Consumption	45 mA for each ON circuit at 9 V dc
Units of Load	23 Units at 9 V dc



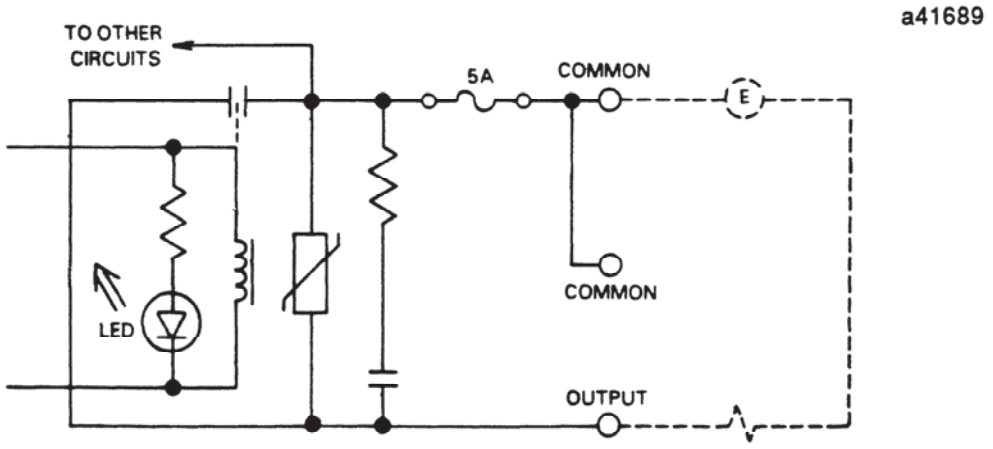


Figure 6-62. Wiring for UL Listed Relay Output Module

115 V ac Output Module, UL Listed
IC610MDL185

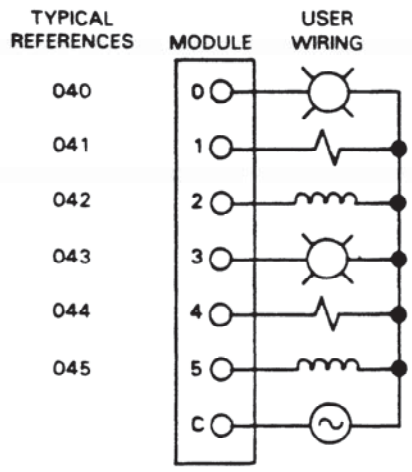
This UL listed module provides 6 circuits, each capable of controlling user supplied discrete (ON or OFF) loads. These loads typically include relay coils, motor starters, solenoid valves, annunciation devices and indicator lights. The 6 circuits are arranged in two groups, with a single common connection for all circuits. Power to operate the field devices must be supplied by the user. An LED, viewed on the faceplate, provides a visible indication of the ON or OFF state of each circuit.

CAUTION

If this module is wired incorrectly or the listed specifications are exceeded, any damage incurred by the module may not be covered by warranty.

Outputs	6
Operating Voltage	97 to 132 V ac
AC Frequency	47 to 63 Hz
Maximum Current	0.5 amp (per point)
Maximum Leakage Current	0.5 mA at 110 V ac, 60 Hz
ON Voltage Drop	0.8 V dc at 0.5 amp
Smallest Recommended Load	25 mA
Maximum Inrush	10 amps for 16 ms 5 amps for 100 ms
OFF to ON Response	1 ms
ON to OFF Response	8 to 10 ms (1/2 cycle)
Circuit Indicator	Logic Side
Fuses (Internal, soldered)	(2) 5 amp (one for each group of three circuits)
Internal Power Consumption	20 mA for each ON circuit at 9 V dc
Units of Load	12 Units at 9 V dc

a41926



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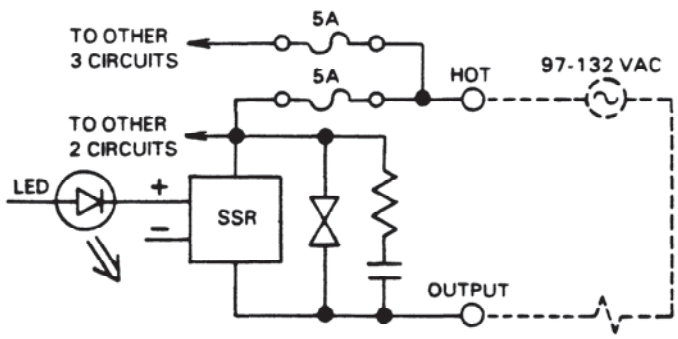

Figure 6-63. Wiring for UL Listed 115V ac Output Module

115 V ac Input Module (16 Circuits With Removable Terminal Board IC610MDL129

This module provides 16 circuits each designed to receive a single discrete (ON/OFF) signal from user supplied devices. Typical input devices include limit switches, pushbuttons, selector switches, and relay contacts. The 16 circuits are divided into two groups of 8 circuits each. Each group can be supplied from a separate power source. Power to operate the field devices must also be supplied by the user. Figure 6-64 provides wiring information for this module. Following are specifications for each of the 16 circuits.

Input Points	16
Operating Voltage	80-132 V ac
AC Frequency	47-63 Hz
Input Current	14.5ma @ 60 Hz
Interconnection	2 groups of 8 circuits each
ON Level	Above 80 V
OFF Level	Below 15 V
OFF to ON Response	5-50 ms
ON to OFF Response	5-60 ms
Circuit Indicator	Logic Side
Internal Power Consumption	64 mA @ 9 V dc (Typ)
Units of Load	10 Units @ 9 V dc
Weight	6.4 oz (180 g)

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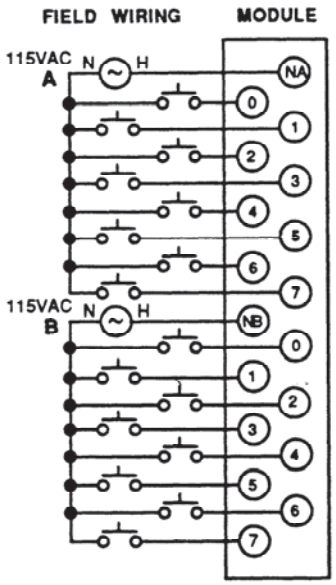

a42308

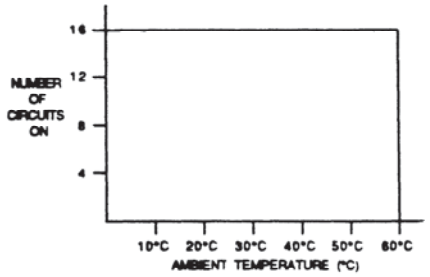

Figure 6-64. I/O Points vs Temperature Chart

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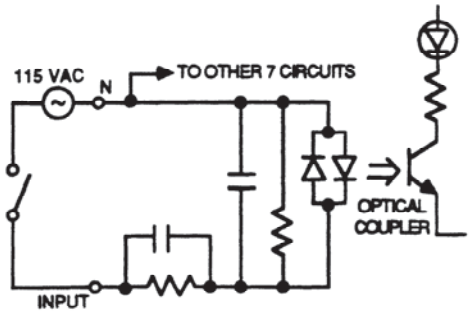


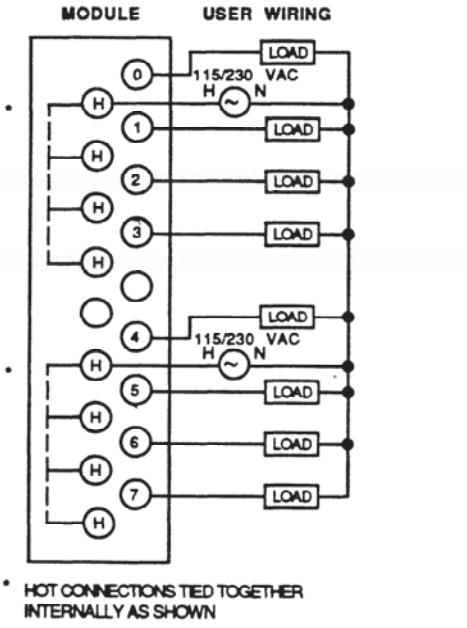
Figure 6-65. Wiring for 115 V ac Inputs with Removable Terminal Board

115/230 V ac Output Module (8 Circuits) with Removable Terminal Board IC610MDL179

This module provides 8 circuits each capable of controlling user supplied discrete (ON/OFF) loads. Typical loads include relay coils, motor starters (up to No. 3), solenoid valves and indicator lights. The 8 circuits are divided into 2 groups of 4 circuits each. Each group can be supplied from a separate power source. Power to operate the field devices must also by supplied by the user. Figure 6-65 provides wiring information for this module. Following are specifications for each of the 8 circuits:

Output Points	8
Operating Voltage	80-264 V ac
AC Frequency	47-63 Hz
Maximum Current	1 amp
Maximum Leakage Current	1.2 mA @ 230V, 60 Hz
ON Voltage Drop	1.5V @ 1 amp
Smallest Recommended Load	25 mA
Maximum Inrush	10 amps for 17 ms
OFF to ON Response	1 ms
ON to OFF Response	9 ms
Circuit Indicator	Logic Side
Fuses (Internal, Soldered)	(2) 5 amp (one on each group of 4)
Internal Power Consumption	12 mA for each ON Circuit @ 9 V dc
Units of Load	16 @ 9 V dc
Weight	7.4 oz (210 g)

a42492



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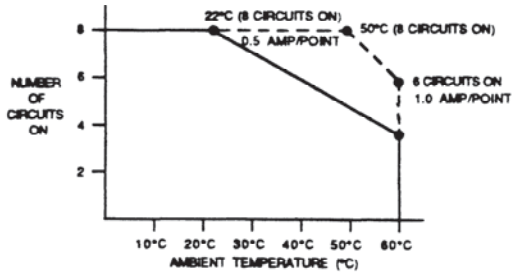

Figure 6-66. I/O Points vs Temperature Chart

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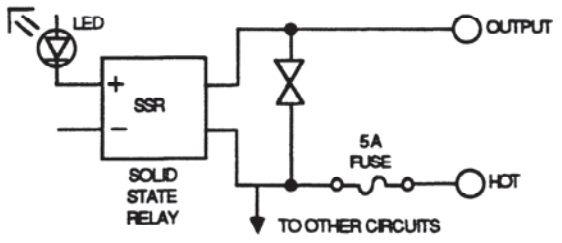

Figure 6-67. Wiring for 115/230 V ac Output with Removable Terminal Board

Introduction to Maintenance Procedures

The Series One and Series One Plus PCs are designed to provide trouble-free operation. However, occasionally situations requiring corrective action do occur and it is important to be able to quickly identify the source of such situations and correct them. Many times the need for corrective action originates outside of the PC.

Troubleshooting Aids

The advantages provided by the Series One and Series One Plus PC design are indicators and built-in aids to troubleshooting not only the PC, but also the overall control system. The main diagnostic tool is the programmer that can be easily attached to the PC. The programmer provides great insight to the status of the overall control system. When troubleshooting a Series One or Series One Plus PC based control system, make a habit of having a programmer with you.

Basic Troubleshooting Procedure

The following questions should be asked and appropriate action taken to negative answers. At the end of the list of questions are step by step procedures to be followed to replace various modules in a Series One or Series One Plus PC. All major corrective action can be accomplished by replacing modules. No special hand tools are required except for a screw driver and voltmeter. There is no requirement for an oscilloscope, highly accurate voltage measurements (digital voltmeters), or specialized test programs. Refer to figure 7.1 for location of the referenced indicators.

1. Is PWR (Power) light ON? If not, measure power at the input voltage terminals (98-126 V ac or 195-252 V ac as appropriate) on racks using an AC source of power. For racks requiring a DC power source, measure the DC voltage between the +24 and O V terminals. If the appropriate AC or DC power is not present, locate the source of the problem external to Series One or Series One Plus PC. If the AC or DC power levels are correct but the PWR light is off, fuses should be checked, then replacement of the CPU rack if necessary.
2. Is CPU light OFF? If ON, check which error code is displayed, refer to table 4.1 for error code definitions and take appropriate action.
3. Is RUN light ON? If not, check for the cause such as the programmer in the PRG or LOAD position or programming errors. If RUN light is OFF and a programmer is not connected, or the programmer in in the RUN mode without an error code being displayed, replace the CPU module.
4. Is the BATT light ON? If yes, replace the battery. Since the BATT light is only a warning level, the program may be unaltered even if the battery is low. After replacing the battery, examine the program or test the PC operation. If a fault is located reload the program from tape recorded at the completion of initial system programming.
5. In multiple rack systems if the CPU is operating, the RUN relay can be very useful in verifying operation of the other power supplies. If the RUN relay is not closed (high resistance) check the AC or DC power supply as in step 1 above. Adequate AC or DC power and an open relay requires replacement of the rack.

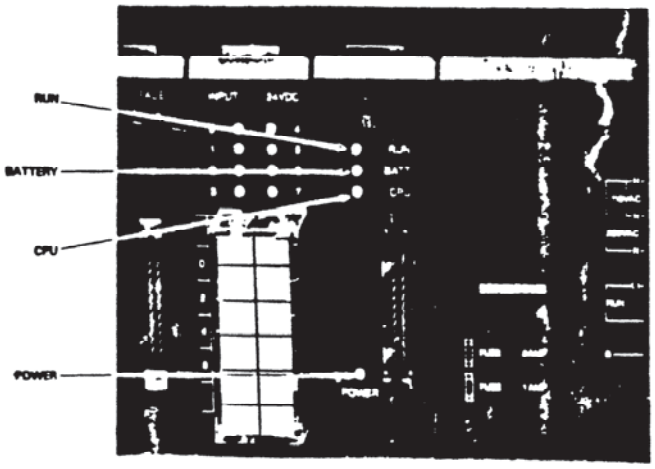

Figure 7-1. Troubleshooting Indicators

General Troubleshooting Procedure

Additional procedures depend upon knowledge of the logic installed by the user. The following steps are more general in nature and should be modified or adjusted as necessary to meet your specific application. There are no better troubleshooting tools than common sense and experience. First plug in the programmer and place it in the RUN mode, then follow these steps:

1. If the Series One or Series One Plus PC has stopped with some outputs energized or basically in mid-stream, locate the signal (input, timer, coil, sequencer, etc.) that should cause the next operation to occur. The programmer will display ON or OFF condition of that signal.
2. If the signal is an input, compare the programmer state with the LED on the input module. If they are different, replace the input module. If multiple modules in an expansion rack appear to require replacement, verify the I/O cable and its connection before replacing any modules.
3. If input state and LED on the input module agree, compare the LED status and the input device (pushbutton, limit switch, etc.). If they are different, measure the voltage at the input module (refer to Chapter 6 for typical I/O wiring). If the voltage indicates a problem, replace the I/O device, field wiring, or power source; otherwise; replace the input module.
4. If the signal is a coil wired to a field device, compare its status to the LED on the output module. If they are different, verify the source of field power to ensure excitation voltage is available. If field power is not present, examine the power source and its wiring. If the proper field power is available, but the status is wrong at the I/O module's output terminal, replace the output module or verify that the rack is providing the proper power to the module.
5. If the signal is a coil and either there is no output module or the output is the same as the coil state, examine the logic driving the output with the programmer and a hard copy of the program. Proceeding from right towards left, locate first contact that is not passing power that is otherwise available to it from immediate left. Troubleshoot that signal per steps 2 and 3 above if it is an input, or 4 and 5 if it is a coil. Ensure that Master Control Relays are not affecting operation of the logic.

6. If the signal is a timer that has stopped at a value below 9999, other than 0000, replace the CPU module.
7. If the signal is the control over a counter, examine the logic controlling the reset first and then the count signal. Follow steps 2 through 5 above.

Replacement of Components

The following procedures provide details on procedures to be followed when replacing components of a Series One or Series One Plus PC system.

Replacing a Rack

1. Turn OFF power and remove the programmer (if installed).
2. Remove the plastic cover and disconnect power wiring from the terminal board on the lower right side of the rack.
3. Remove all I/O modules. I/O wiring does not have to be disturbed if service loop was provided during the original installation. Note the position of each module in the rack for proper reinstallation.
4. Remove CPU module (if installed) and any filler modules. Place them aside in a safe location for later reinstallation.
5. Remove bottom two bolts holding the rack in place. Loosen but do not remove the top bolts.
6. Slide base unit up and then pull forward to clear the top mounting bolts. Set the rack aside.
7. Reinstall the new rack onto the top mounting bolts.
8. Insert bottom bolts and tighten all four mounting bolts.
9. Install the I/O modules in the same slots from which they were removed.

WARNING

Placing a module in the wrong slot can cause incorrect and dangerous operation of the control system.

10. Install the CPU and any filler modules that were removed.
11. Reconnect power wiring to the terminals on the right side of the rack. Reinstall the plastic cover over the power terminals.
12. Verify proper power wiring and then turn power ON. Carefully check operation of the entire system to ensure that all I/O modules are in their proper locations and the program is not altered.

Replacing a CPU Module

1. Turn OFF power and remove the programmer (if installed).
2. Squeeze the CPU module at the front, top and bottom to release securing tabs.
3. Pull the module straight out from its slot.
4. If PROM memory had been installed in the CPU, remove the PROM and install it in the new CPU.

5. Insert the new CPU module by first aligning the printed circuit boards into the bottom board guide.
6. Rotate the module upwards slightly to engage the top board guide.
7. Push the CPU module into the rack until both tabs snap into place.
8. Reinstall the programmer and reapply power.
9. Reload the program from tape recorded after initial system programming. Check operation of entire system.

Replacing I/O Modules

1. Turn OFF power from both the rack and the I/O system.
2. Remove the plastic cover from over the terminals on the I/O module to be replaced. Only field wiring on the defective module needs to be removed.
3. Disconnect field wiring from I/O terminals, detach the removable connector, or remove the connector to the I/O Interface cable, as applicable according to the type of module. Label each wire or note installed wire marking for future reconnection.
4. Squeeze the I/O module at the front, top and bottom to release securing tabs.
5. Pull the I/O module straight out.
6. Insert the new I/O module, aligning printed circuit boards first into the bottom board guide.
7. Rotate the module slightly upwards to engage the top board guide.
8. Push the module into the rack until both tabs snap into place.
9. Reconnect all field wiring, replace the removable connector board or replace the connector, then replace the plastic cover.
10. Reapply power to the CPU, then to the I/O system. Check operation of the system, especially the I/O module that was replaced.

Replacing the Battery

If the CMOS memory back-up battery requires replacement, refer to the following procedures. Figure 7.2 shows the battery location on the CPU, location of the battery connector and the battery tie-down straps.

a40289

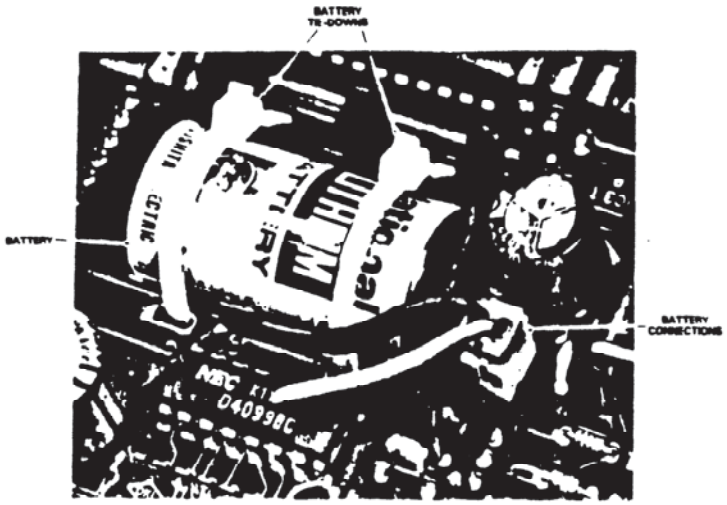

Figure 7-2. Battery Location and Connection

1. Remove the CPU following the previous instructions.
2. Cut the plastic tie down straps that secure the battery to the board.
3. Disconnect the battery. There is sufficient capacitance in the system to retain the CMOS memory contents even without the battery for about 20 minutes.

WARNING

The lithium battery should be handled with care. DO NOT discard the battery in fire. DO NOT attempt to recharge the battery. DO NOT short the battery. If these precautions are not followed, the battery may burst, burn or release hazardous materials.

4. Connect the new battery (catalog no. IC610ACC150) and place it in its proper position on the printed circuit board.
5. Secure with new tie downs or insulated wire.
6. Reinstall the CPU module.
7. Verify that the BATT light is OFF. If necessary, reload the CPU from a tape made after initial system programming. Then, check operation of the entire system.
8. If the two printed circuit boards that make up the CPU are separated, ensure that they are reconnected, installed in a rack, and powered up. Otherwise, logic may lock into a high current drain mode and prematurely drain the battery.

Adding Memory

The following procedure should be followed when adding memory to a Series One or Series One Plus PC. Either CMOS RAM memory can be added to increase memory capacity from 700 words to 1724 words or non-volatile PROM memory can be installed that contains a program previously entered into the PROM.

GEK-90842

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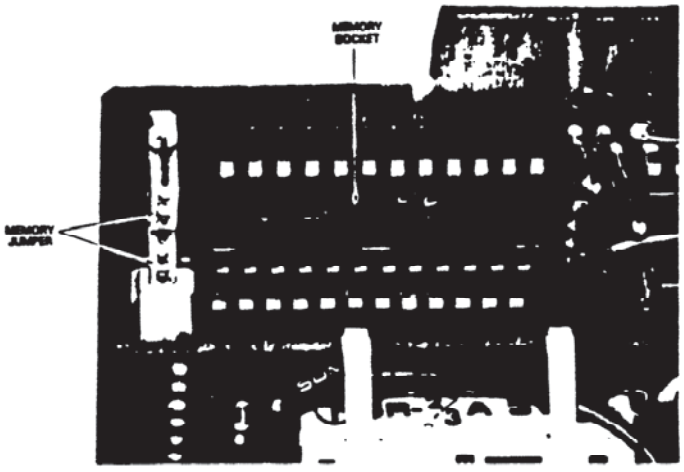

Figure 7-3. Location of Extra Memory Socket

1. Before installing additional memory, it is recommended that any program currently in memory be recorded on tape. If this is not done, the program will be lost after memory is added and a Clear All Memory operation is performed.
2. Remove the CPU following previous instructions.
3. Locate spare memory socket at the rear of the larger printed circuit board in the CPU.
4. Obtain the required memory IC either type 6116LP for Series One or 6264LP-15 for a Series One Plus, 2K x 8 bit CMOS RAM (or equivalent). If adding PROM memory, obtain an Intel type 2732A-2 for Series One or a 27256-25 for a Series One Plus (or equivalent PROMs). Ensure that the CMOS RAM or PROM is correct for your PC.

CAUTION

When handling CMOS memory ICs, always handle by the case and not leads. Static electricity on leads can damage internal circuits. This damage may not be apparent for several days or weeks of operation.

5. Orient the IC so that the notch at one end matches the notch in the memory socket.
6. For clearance when installing memory ICs, it may be necessary to lift the smaller printed circuit board 1/8" (3mm). Do not separate the boards. After the memory IC is installed, reseat the smaller board.
7. Insert the IC into the socket carefully and evenly so as not to bend any leads. Visually inspect to ensure that all leads are in place and then push down to firmly seat the IC. If necessary, readjust the jumpers and/or switch 2 as shown in table 3.2.
8. If the two printed circuit boards that make up the CPU are separated ensure that they are reconnected, installed in a base unit, and powered up. Otherwise, logic may lock into a high current drain mode and prematurely drain the battery.
9. Reinstall the CPU module following previous instructions.

10. Power-up the CPU, place the mode switch in the PRG position and perform a Clear All Memory operation (CLRSHF348DELNXT). The entire memory will now be entirely clear of data. Any program previously recorded on tape can now be loaded into the CPU from tape or a new program can be entered.

Spare Parts and Components

To support the Series One or Series One Plus PC, an Accessory Kit is available (IC610ACC120). This kit includes commonly needed components that may get damaged or lost in the normal course of operation. For a complete list of accessories for the Series One Family of programmable controllers, refer to GEP-762. Rather than attempting to place orders for plastic covers, fuses, audio cables, screws, etc., this kit can be ordered and provides sufficient material to support 3-5 CPUs depending upon their I/O count. Included in the kit are the following items:

ITEM	QTY.	ITEM	QTY.
Cable, Programmer to Tape Recorder	1	Fuses, 2A SB (Spiral Element)	3
Cable, Programmer to Peripheral	1	Fuses, 3A FB	5
Cover, CPU Connector	1	Fuses, 3A SB	5
Cover (large), DCU, PROM Writer, Printer Interface	2	Fuses, 4A SB	3
		Fuses, 5A FB	3
Cover (small), DCU, PROM Writer, Printer Interface	1	Fuses, 10A SB	5
		Key, Hand-Held Programmer	1
Cover, I/O Terminal	4	Screws, PH (M3x5)	10
Cover, Power Supply Terminal	2	Screws, PH (M3x7)	10
Cover, Rack Dust	1	Screws, PH (M3x16)	10
Fuses, 1A SB	5	Spacer	3
Fuses, 2A SB	3		

When supporting a Series One or Series One Plus installation, it is recommended that spare modules be available on site. These are in addition to the Accessory Kit previously discussed. As a guide to your requirements, the following percentages are presented. As a minimum, one each of all modules is recommended. Depending upon a number of application related conditions (location, average weekly hours of operation, cost of downtime, etc.) more units may be justified.

UNIT	% SPARES
Base with Power Supply	15
CPUs	15
Input Modules (each type)	10
Output Modules (each type)	15
Programmers	10
Cables	10
Peripheral Devices	10

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Figure 7-4. Accessory Kit for Series One/One Plus

Fuse List

Table 7.1 is a list of fuses used in Series One I/O modules.

Table 7-1. I/O Module Fuse List

I/O MODULE CATALOG NUMBER	CURRENT RATING (AMPS)	QUANTITY	CIRCUIT CONNECTION	TYPE OF FUSE
IC610MDL103	3 Amps	1	soldered	pico fb
IC610MDL104	10 Amps	1	fuse clip	miniature sb
IC610MDL115	3 Amps	2	fuse clips	miniature sb
IC610MDL151	3 Amps	2	soldered	pico
IC610MDL153	5 Amps	4	fuse clips	miniature fb
IC610MDL154	5 Amps	4	fuse clips	miniature fb
IC610MDL155	3 Amps	2	soldered	pico
IC610MDL156	3 Amps	4	soldered	pico
IC610MDL157	3 Amps	2	soldered	pico
IC610MDL158	5 Amps	2	soldered	pico
IC610MDL175	5 Amps	2	soldered	pico fb
IC610MDL176	3 Amps	4	fuse clips	miniature fb
IC610MDL180	10 Amps	2	fuse clips	miniature sb
IC610MDL181	5 Amps	1	fuse clip	miniature
IC610MDL182	2 Amps	2	fuse clip	miniature sb
IC610MDL185	5 Amps	2	soldered	pico

Application 1 - One-Shots

This application is particularly useful when applied with a Series One PC, since with a Series One Plus PC, a one-shot can be programmed simply by entering the key sequence SET OUT RESET. In many applications, a signal is required that is valid for a very short time period. These signals are called one-shots and are generated by transitions (OFF to ON, or ON to OFF) of a control signal. They are valid for exactly one scan, which is the shortest signal available within the Series One and Series One Plus PCs. Timing for typical One-Shots is as follows:

pc-s1-83-0040

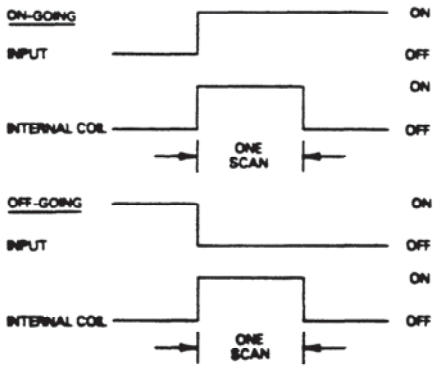

Figure 8-1. Typical One-Shot Timing

In this example, input 01 is the control signal and coil 160 the resulting one shot. Logic for these one-shots is shown below.

pc-s1-83-0041

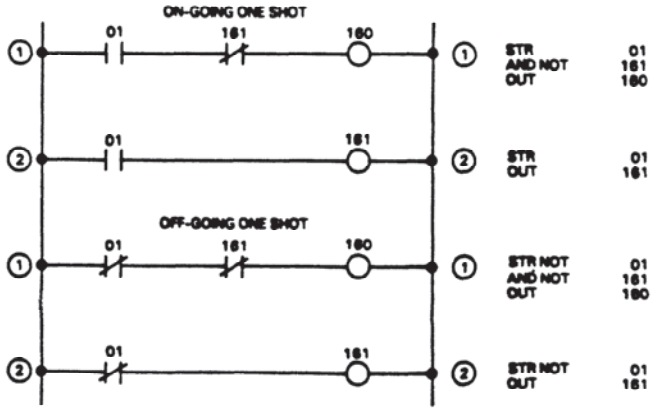

Figure 8-2. Typical One-Shot Logic

Application 2 - Flip Flop

This logic reverses states (ON/OFF/ON/OFF, etc.) each time a control signal is energized. In this example, the Flip/Flop changes state on the OFF to ON transition of the control signal. A typical timing diagram is as follows:

pc-s1-83-0042

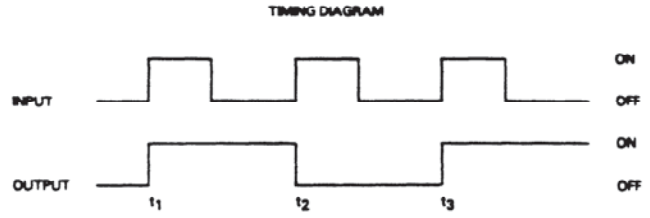

Figure 8-3. Typical Flip-Flop Timing Diagram

In the following typical logic, input 01 is the control signal and output 20 is the flip/flop.

pc-s1-83-0043

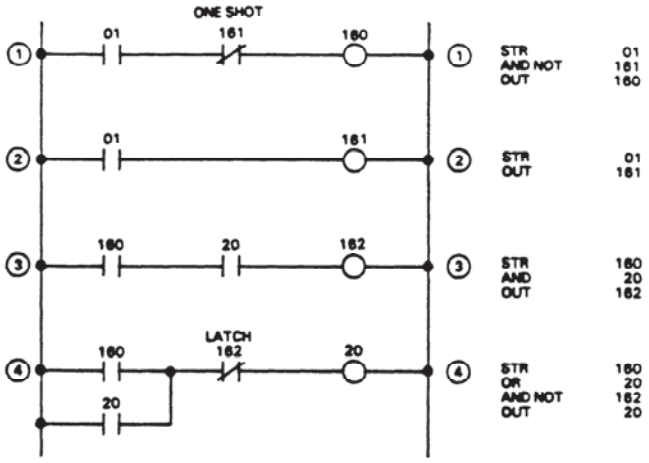

Figure 8-4. Typical Flip-Flop Logic

Application 3 - Event/Time Drum

Many control requirements can be defined as a sequence of established states for each output. The decision to shift from one step to another can be based upon time or specific input states. To illustrate this concept, the following 6 step example is provided. The control on incrementing the step is a confirmation of both events (for example, input 11) and a time value (for example, timer 601).

Step Number	Input	Time	20	21	22	23	24	25	26	27
1	10	T600	0	1	1	0	1	1	1	0
2	11	T601	0	0	0	0	1	0	0	1
3	12	T602	0	1	1	1	0	1	1	0
4	13	T603	1	1	1	0	0	0	1	0
5	14	T604	1	0	1	1	1	1	1	1

Each step can have different output states and more or less control can be implemented as the application requires. The ladder diagram required to implement this function is as follows:

pc-s1-83-0046

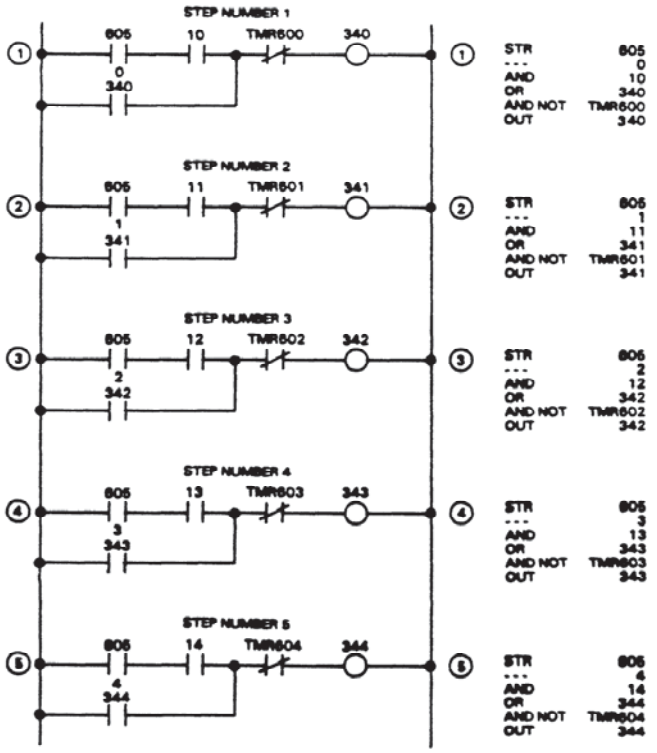

Figure 8-5. Event/Time Drum Logic

pc-s1-83-0047

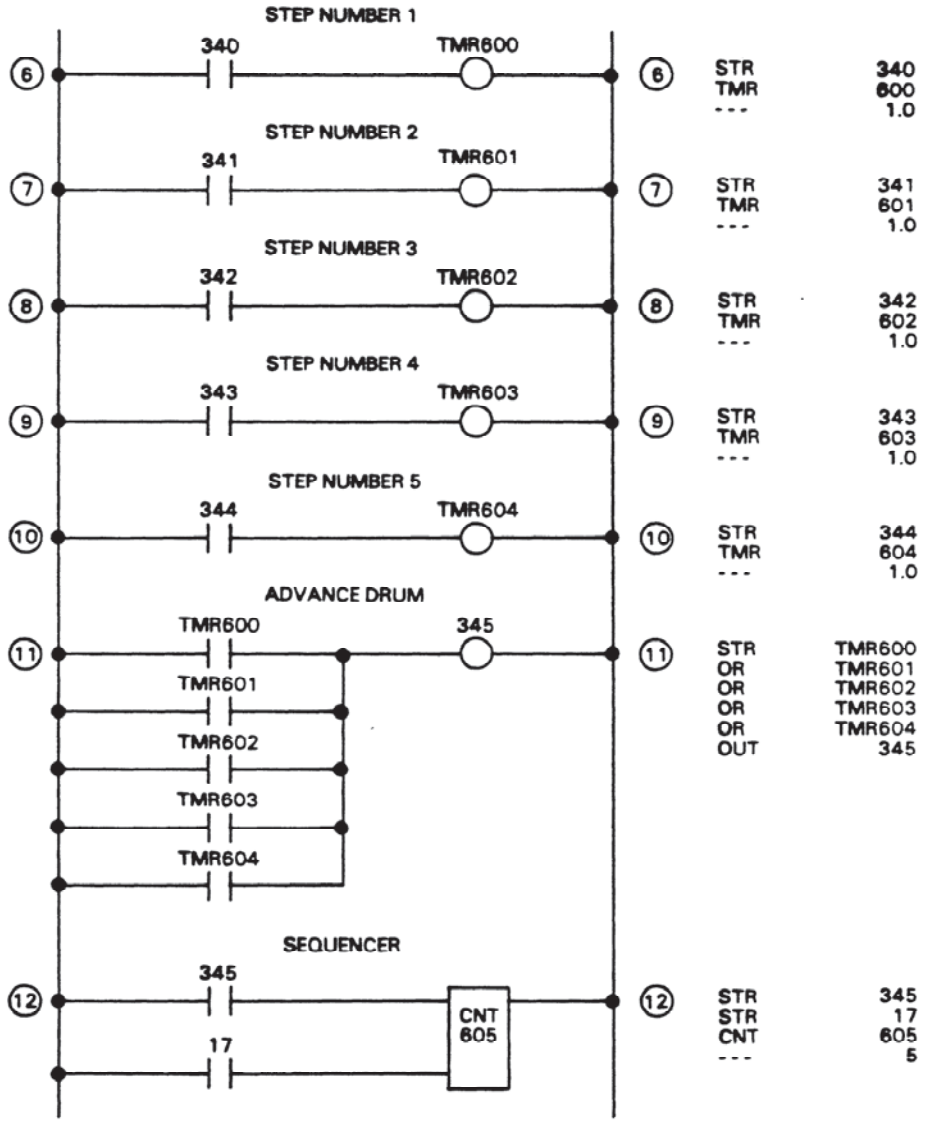

Figure 8-5. Event/Time Drum Logic (Continued)

pc-s1-83-0048

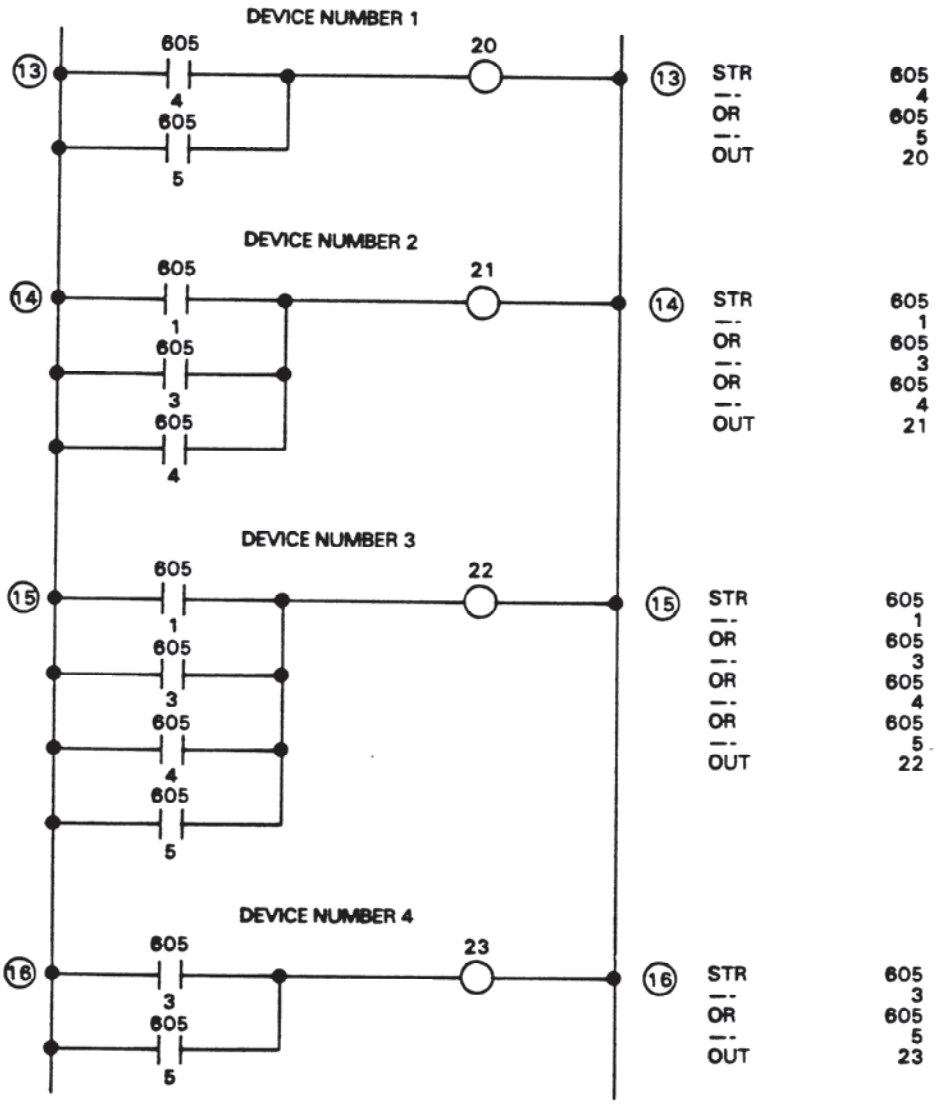

Figure 8-5. Event/Time Drum Logic (Continued)

pc-s1-83-0049

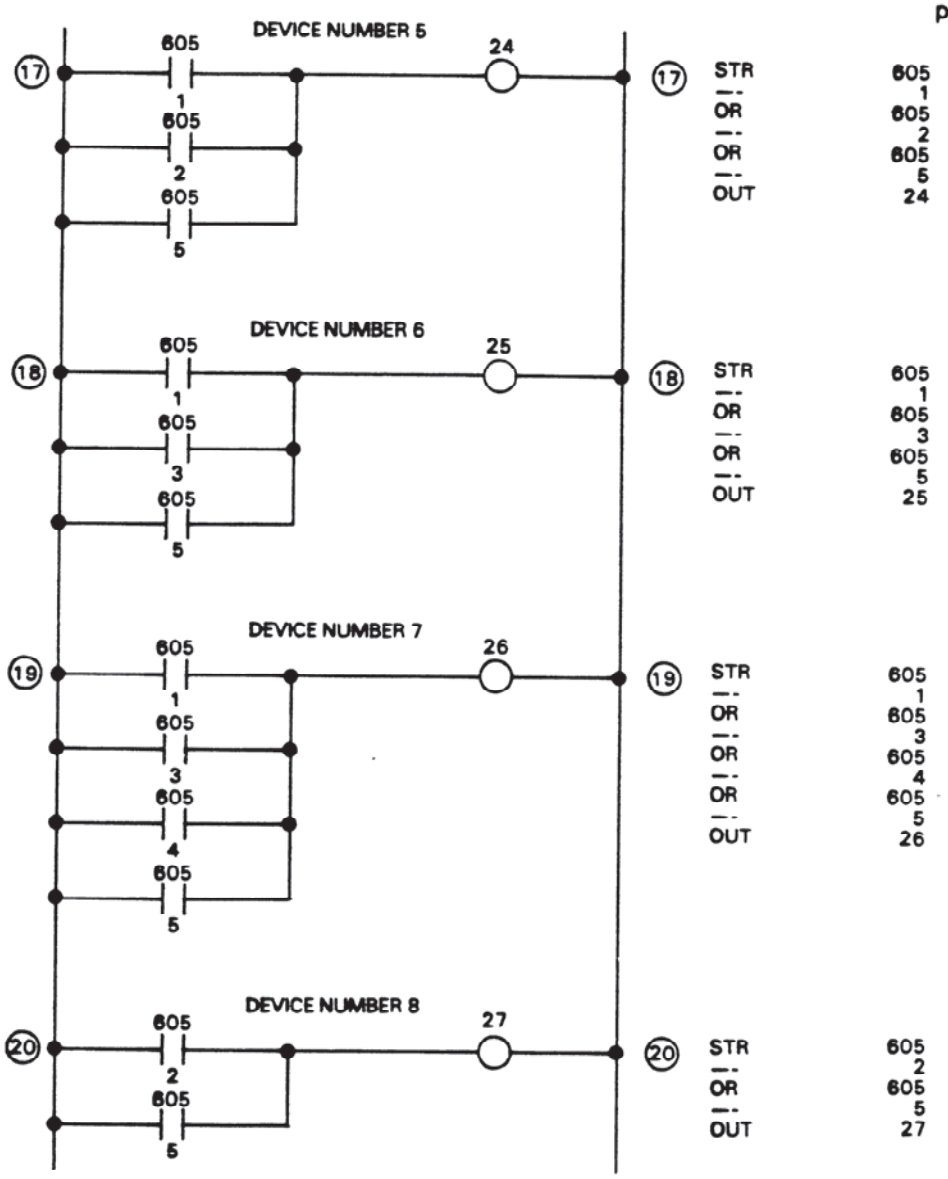

Figure 8-5. Event/Time Drum Logic (Continued)

Application 4 - Cascaded Counters

If an application requires a counter with presets greater than 9999, multiple counters can be assigned to that function. Two counters can record values up to 99,999,999 and three up to 999,999,999,999 etc. Additional logic is incorporated to generate a reset signal at 10,000 counts instead of the normal 9999.

The following logic uses two counters to record up to 99,999,999 events. Counter 601 records the low order values (thousands, hundreds, tens, and units) and counter 602 the high order values (tens of millions, millions, hundreds of thousands, tens of thousands).

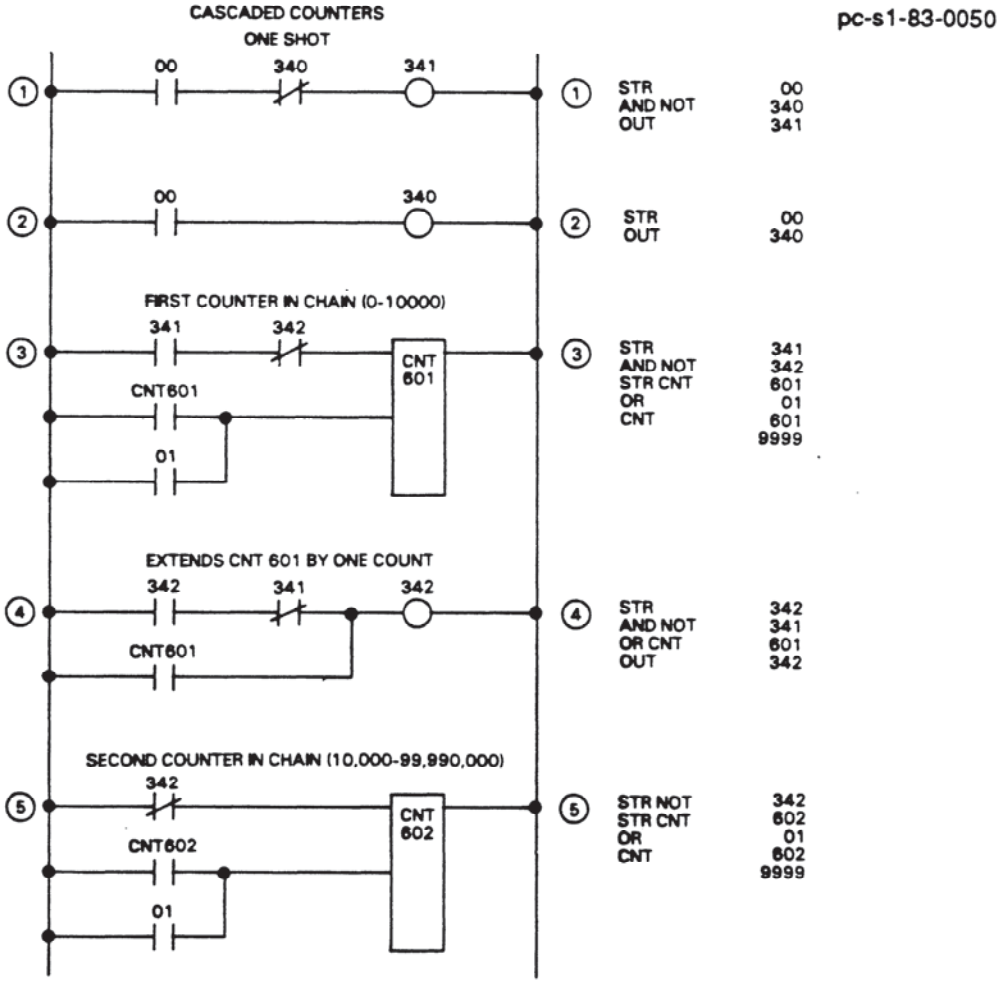

Figure 8-6. Sample Cascaded Counter Logic

Application 5 - Coil 374, Power-Up One-Shot

In industry, power loss to machines and process equipment is a frequent event. When such an event occurs it creates havoc with automatically controlled equipment and processes. The moment power returns it may be desirable to place the machine or process in a "hold" state until verification or critical limits, position of moving parts, and support equipment interfaces are confirmed to be correct by authorized personnel.

Description of Operation

The Series One and Series One Plus PCs have a special function reference (internal coil 374) that provides a pulse during the first scan only after powering up the CPU (or going from program to run mode). Using this pulse in the ladder logic, as shown below, will place the machine or process in the desired hold state.

The instant power returns to an automatic machine or process, certain phases (for instance, activating a cylinder, starting a motor etc.) of the automatic cycle need to be inhibited until a correct state is determined allowing the continuation of the cycle. The following program scheme will inhibit those critical outputs from activating field devices until a reset pushbutton is depressed, thereby, releasing all inhibited outputs and allowing the cycle to continue.

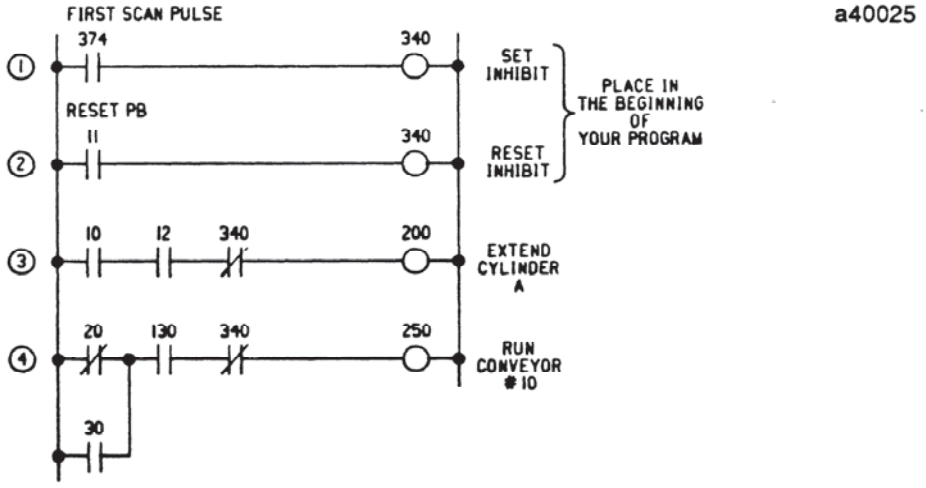

Figure 8-7. Typical Machine or Process Power-Up Inhibit Logic

The program logic in the above figure is an example you can use to inhibit certain phases of a cycle. In this example, when power returns to the process, 374 will be on during the first scan of the CPU, latching coil 340 on. The referenced NC contact of coil 340 is placed in series with the logic that actuates output coils 200 and 250. Even if the program logic is calling for coils 200 and 250 to turn on, they will not until 340 is unlatched. The only way to unlatch 340 is to depress the reset pushbutton (I100), allowing outputs 200 and 250 to be turned on.

Application 6 - Coil 375, 10Hz Clock

The Series One and Series One Plus PCs have a special function reference that continuously provides a pulse every tenth of a second. The following two examples use the function of this reference (10 Hz Internal Coil 375) to create a cumulative timer and a time of day clock.

Example 1: - Cumulative Timer

In this example, when reference 01 is on, time (in tenths of a second) would be accumulated by counter 600. If the time to be measured is anticipated to be larger than 999.9 seconds, cascading another counter will increase the range to 9,999,999.9 seconds. This technique allows you to measure the duration of an intermittent event that would otherwise reset the standard timer when changing state.

pc-s1-83-0078

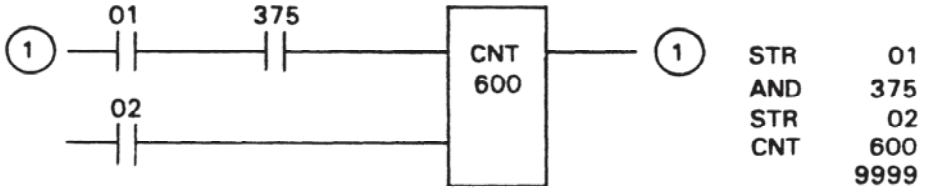

Figure 8-8. Cumulative Timer

Example 2: - Time of Day Clock

In this example, the 10HZ clock (Internal Coil 375) is used to program a time of day clock with reset capabilities. This is a 24-hour time clock, with the time format being XX:YY, where XX = hours (0-23) and YY = minutes (0-59). The 10HZ clock provides the 0.1 second pulse to counter 603 which in turn produces one pulse every second. The remaining three counters, 600, 601 and 602 keep track of seconds, minutes and hours that have elapsed. If power goes off and the clock needs resetting, the combined use of a 3 position switch and a pushbutton, as shown in Figure 8.10, will allow you to set the correct time. The lower portion of Figure 8.10 is the ladder logic which resets the clock. An I/O Simulator module, IC610MDL124, could also be used and programmed to reset the clock).

a40509

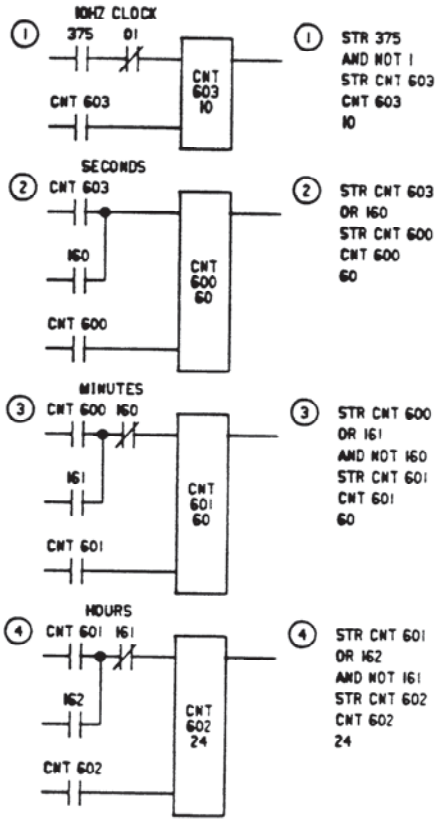

Figure 8-9. Sample 24 Hour Time Clock Logic

a40557

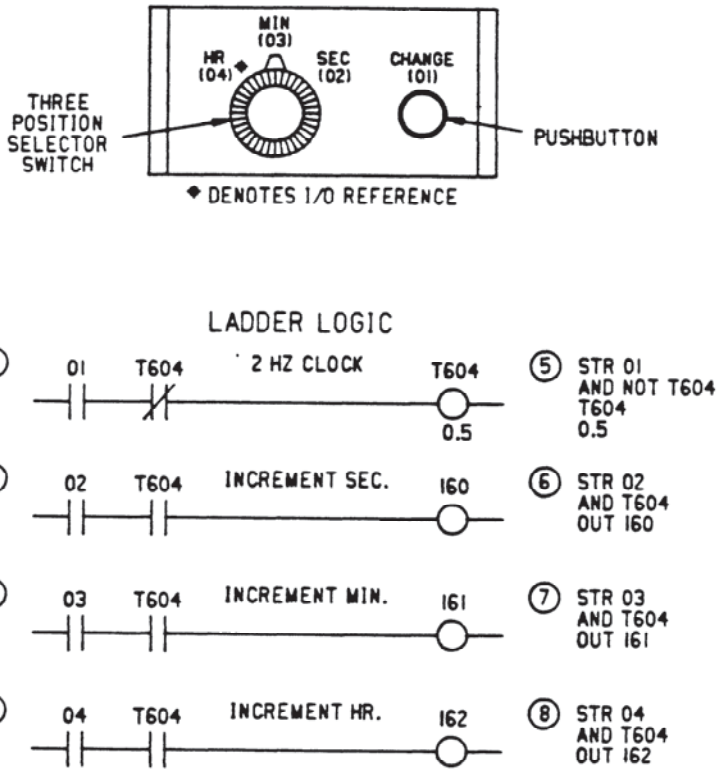

Figure 8-10. Time Clock Resetting

To reset the time, use the following procedure.

1. Select hours, minutes or seconds with the 3 position selector switch.
2. Monitor the appropriate counter.

   CNT 600: Seconds
   CNT 601: Minutes
   CNT 602: Hours
   Keystroke sequence is SHF, 6XX, MON
3. Depress the change button until the proper value (time) is displayed on the programmer.

Application 7 - Start/Stop Circuit

A simple but informative application for the Fast Response module is the Start/Stop circuit. In this example, Output 4 is in the Fast Response mode and is controlled by Inputs 0 and No. 1. The timing diagram shows worst case response times.

pc-s1-84-0018

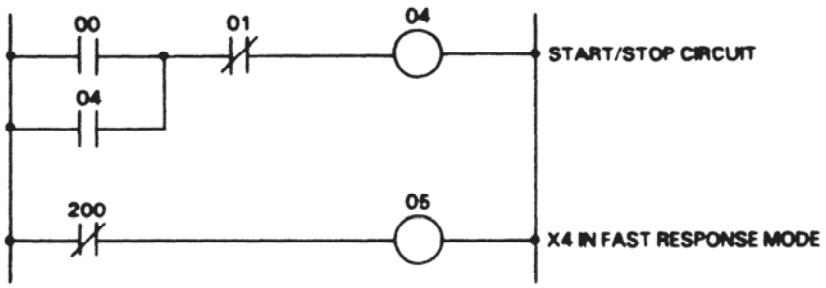

Figure 8-11. Fast Response Start/Stop Logic

I/O REFERENCE	DEFINITION
00	Enable output, X4 in fast response mode
01	Disable output X4 in fast response mode
04	Output X4 tied to field device being controlled
05	Mode select for output X4 DISABLED: manual mode ENABLED: fast response mode
200	Dummy contact to put output X4 in fast response mode

pc-s1-84-0019

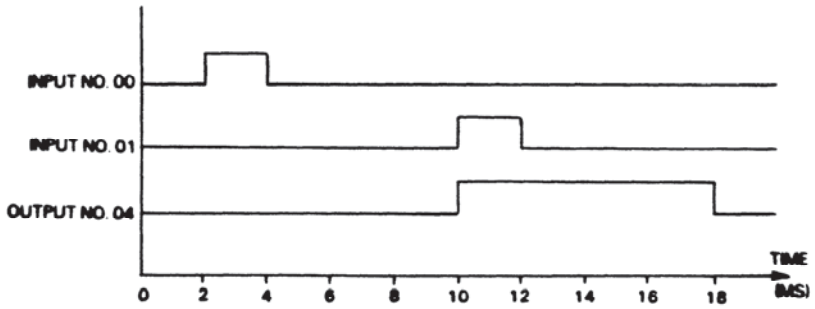

Figure 8-12. Worst Case Timing Diagram

Application 8 - High Speed Counter Applications

Three general types of application examples will be covered within this application.

1. Programmable CAM Switch
2. Cut to Length
3. Measurement of length

In the development of these applications the following system configuration will be used.

pc-s1-84-0010

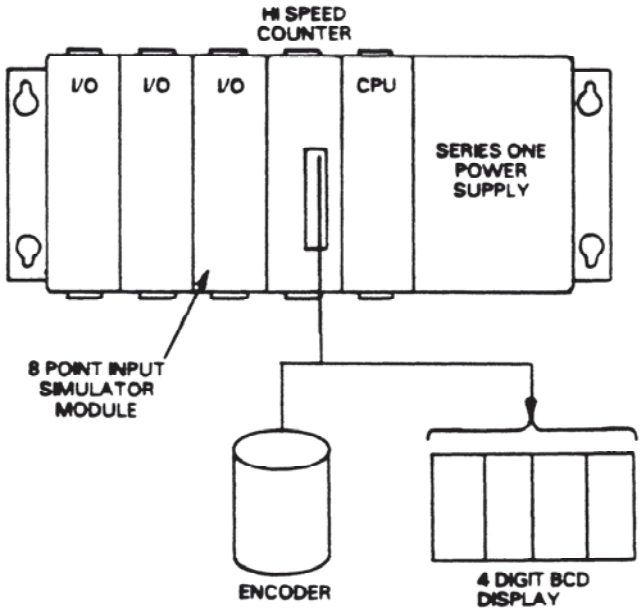

Figure 8-13. Application System

Programmable Cam Switch

The basic concept behind a CAM switch is to enable/disable certain devices at various points in the cycle of a machine. Using one or more high speed counters this type of control can easily be implemented. The following example illustrates this, cycling the high speed counter's two outputs at different preset values. The timing diagram below shows the output logic, with the user program necessary to implement this logic shown on the following pages. This example assumes that the encoder is resetting the counter once per revolution, and that the machine will not travel from one transition point to the next in less than twice the scan time.

a40023

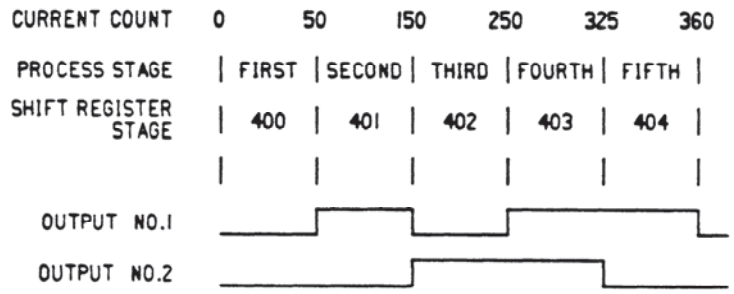

Figure 8-14. Programmable CAM Switch Logic Timing Diagram

a40893

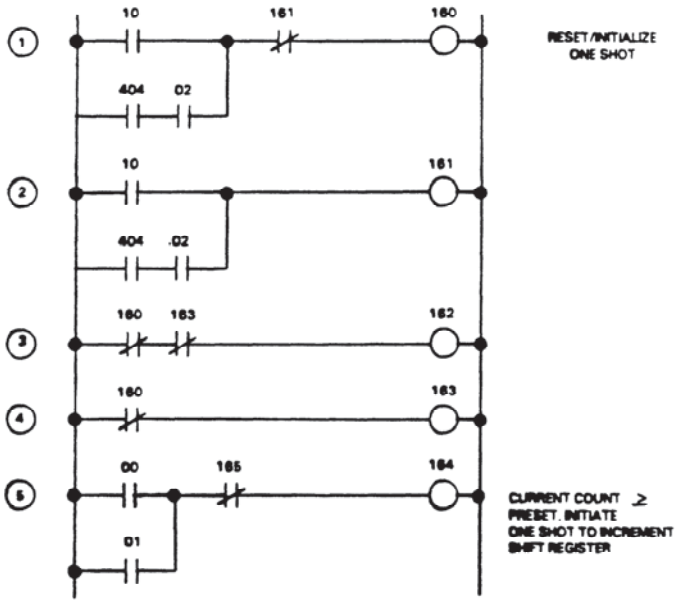

Figure 8-15. Programmable CAM Switch

a40893

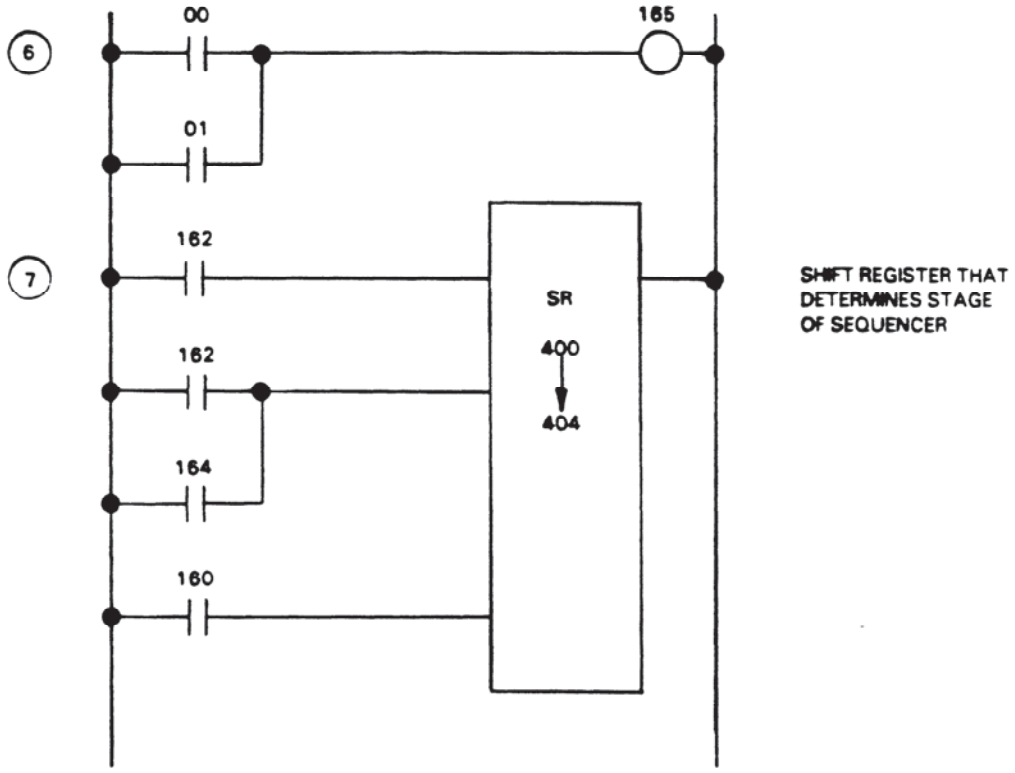

Figure 8-15 Programmable CAM Switch (Continued)

a40893

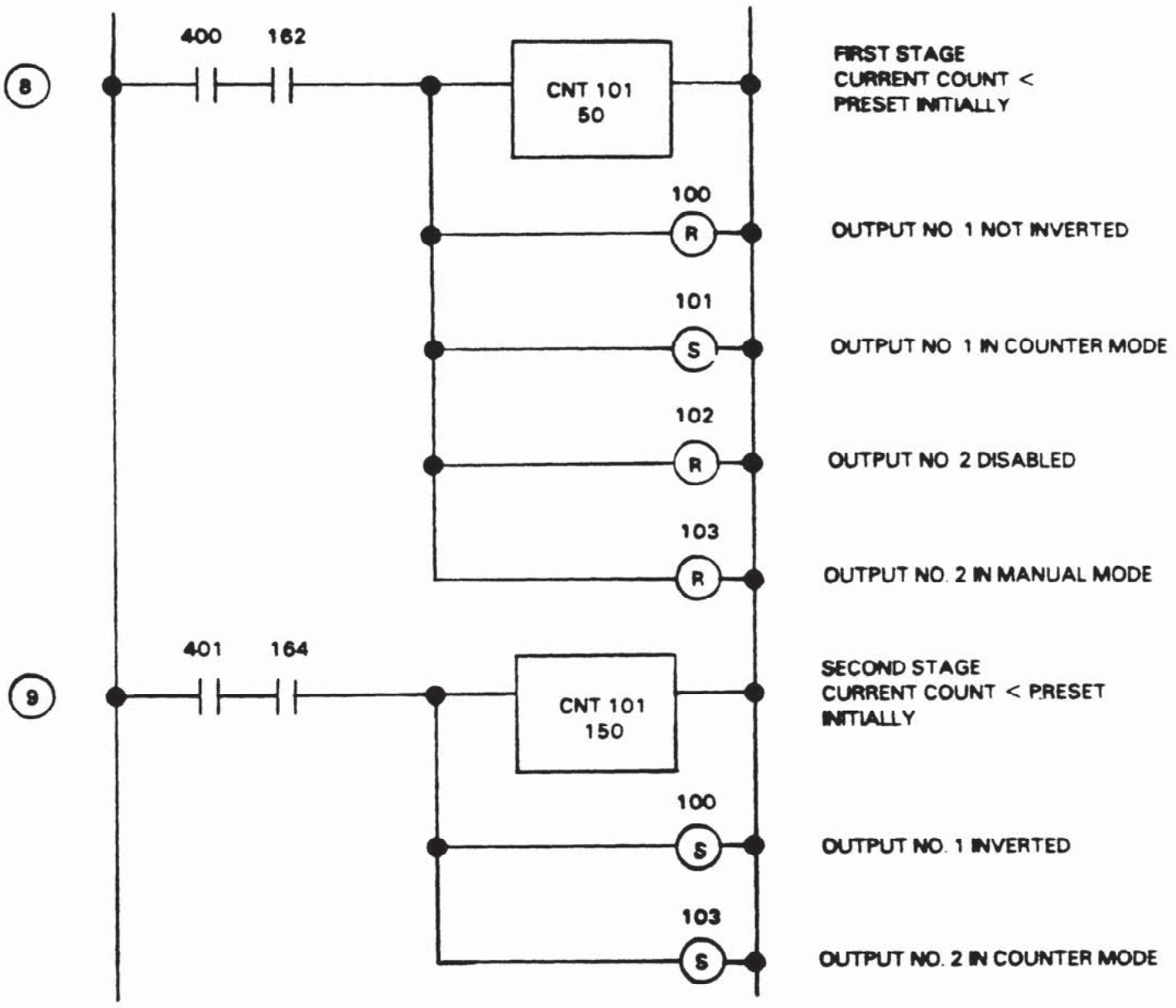

Figure 8-15 Programmable CAM Switch (Continued)