

## Digital Input/Output Subsystems

### INTRODUCTION

The DB-16 and DB-24 are 16- and 24-channel digital I/O subsystems providing a reliable, solid state, optically isolated interface between data acquisition boards, such as the Analog Devices' RTI-800 series, or distributed I/O signal conditioning subsystems such as the Analog Devices' Model 6B50, and discrete high level I/O.

The DB-16 is a manifold card that accepts up to 16 single-channel digital input and output modules. These solid state relay modules can be mixed and matched to provide an interface to ac inputs, ac outputs, dc inputs and dc outputs. Each I/O module is individually controlled or sensed by the digital I/O of the data acquisition board or the 6B50 subsystem.

The DB-24 is a manifold card that can accept up to six 4-channel (quad) digital input and output modules. These modules can be mixed and matched as well. Each module handles four channels of identical levels, and the state of each input or output can be observed via the four LEDs on each module.

The DB-16 and DB-24 share the same pinout and 50-pin card edge connector and can be used interchangeably. However, only the 16 channels are addressable on the DB-16. An external +5 V dc power supply at 300 mA maximum is required for operation.

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### DB-16 Digital I/O Subsystem

Use the DB-16 Digital I/O Backplane, shown in Figure 1, and its associated ac and dc single-channel I/O modules to measure and/or control high level ac and dc signals or if isolation of the digital I/O is required.

### Single-Channel Solid State Relays

The DB-16 supports the installation of up to 16 single-channel, solid-state relay modules, which provide 2500 V peak of optical isolation. You should install the modules in their appropriate positions in the backplane and secure them with one screw each.

All output modules can switch up to three amps. AC output modules provide zero voltage turn-on and have an RC (resistor-capacitor) snubber network for increased capability with inductive loads. AC and dc input modules are designed with filtering on the input and hysteresis for high noise rejection and transient-free "clean" switching. They are designed so that high voltage transients on the input do not cause damage to the module.

Each module operates by negative true logic, in which a low digital voltage turns on current to the module. Individual LED status indicators monitor module activity and light when the current is ACTIVE.

Each I/O module position on the DB-16 backplane has a 5 amp, 250 V rms pico-fuse (Littelfuse® Part Number 251 005) protecting the module and wiring from short circuits.

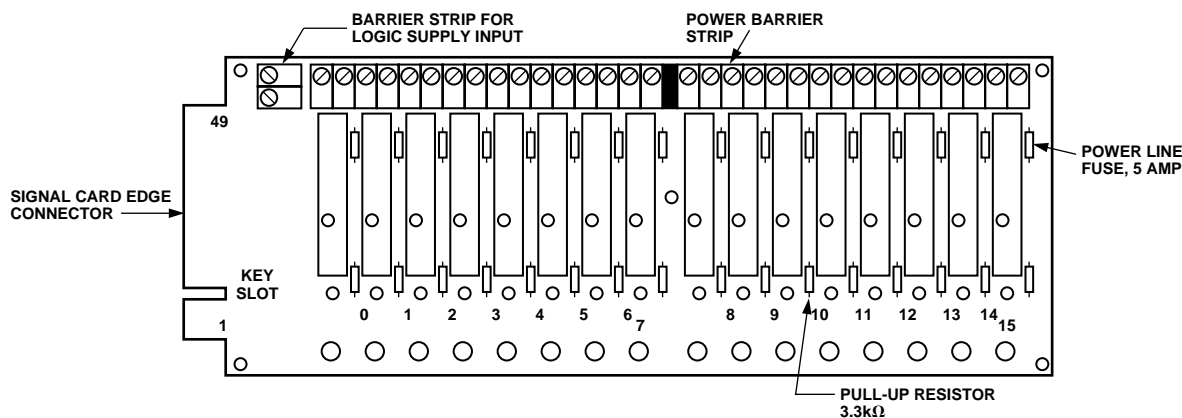


Figure 1. DB-16 Digital I/O Backplane

Table I lists the input and output modules available for use with the DB-16 backplane.

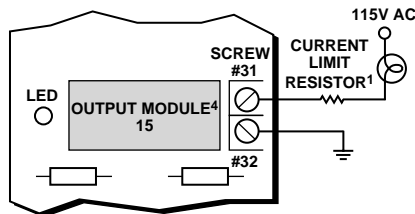
**Table I. Single-Channel Input/Output Module Summary**

Type	Model	Range	Output Current	Input Current
Input	ID016	4 V–16 V dc		68 mA
	ID032	10 V–32 V dc		34 mA
	IA140A	90 V–140 V ac		5 mA
	IA280A	180 V–280 V dc 180 V–280 V ac		5 mA
Output	OD060	5 V–60 V dc	3.0 A rms	
	OA140A	12 V–140 V ac	3.5 A rms	
	OA280A	24 V–280 V ac	3.5 A rms	

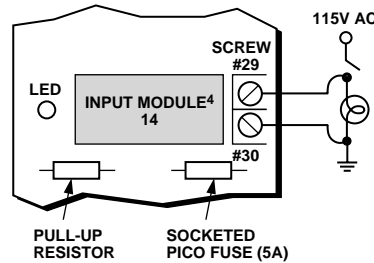
## Attaching Digital I/O Applications to the DB-16 Backplane

The DB-16 backplane is powered through an external +5 V dc power supply. Applications to the DB-16 backplane are connected through the screw terminal barrier strip, which contains 32 standard slot-head screw terminals (screw terminals 1 and 2 are associated with channel 0 on the backplane; screw terminals 3 and 4 are associated with channel 1 on the backplane, and so on). Use the odd-numbered screw terminal for the high input; use the even-numbered screw terminal for the low input.

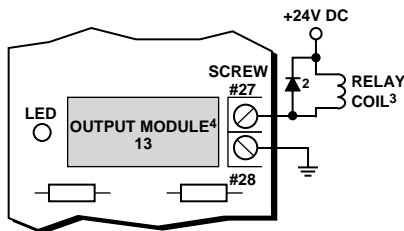
Figure 2 illustrates high level ac and dc digital wiring using input and output modules on the DB-16 backplane. Example 2a illustrates turning a lamp on or off; example 2b illustrates monitoring whether the lamp is on or off; example 2c illustrates turning a relay coil on and off; and example 2d illustrates monitoring whether or not a relay coil is energized.



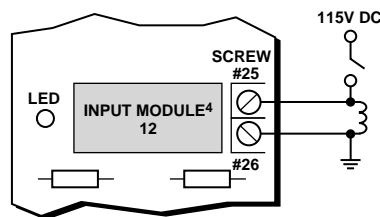
a. AC Output



b. AC Input



c. DC Output



d. DC Input

**NOTES:**

<sup>1</sup>SHOULD NOT EXCEED 3A.

<sup>2</sup>USER SUPPLIED DIODE NECESSARY FOR INDUCTIVE SPIKE DAMPING.

<sup>3</sup>RELAY COIL AMPERAGE SHOULD NOT EXCEED OUTPUT MODULE RATING.

<sup>4</sup>MODULES ARE COLOR CODED: AC INPUT – YELLOW  
AC OUTPUT – BLACK  
DC INPUT – WHITE  
DC OUTPUT – RED

Figure 2. Typical High-Level Digital I/O Wiring Examples Using the DB-16 Backplane

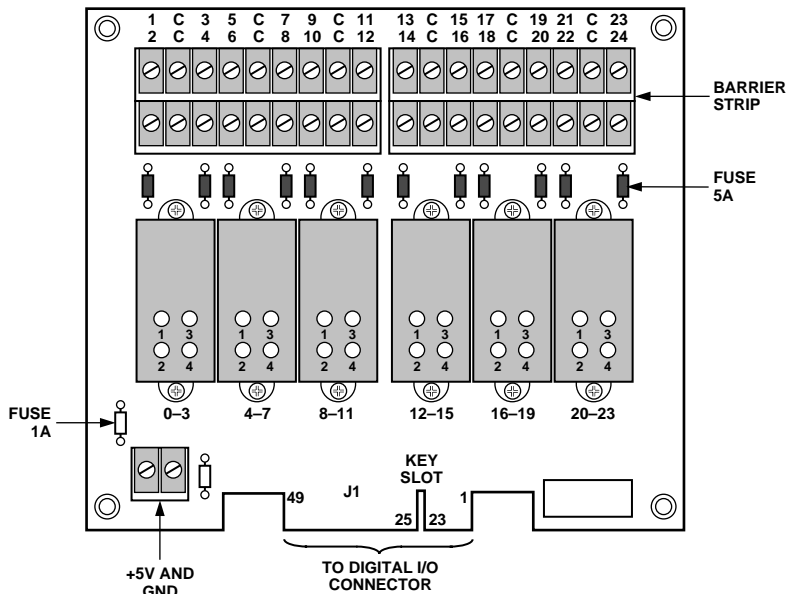


Figure 3. DB-24 Digital I/O Backplane

**DB-24 Digital I/O Subsystem**

Use the DB-24 Digital I/O manifold card, shown in Figure 3, and its associated dc and ac 4-channel I/O modules to measure and/or control high level ac and dc signals or if isolation of the digital I/O is required.

**4-Channel Solid State Relays**

The DB-24 is a 24-channel I/O backplane that supports the installation of up to six 4-channel, high-density modules to perform ac input, dc input, dc output, and dc output functions. You install each module into a socketed position on the DB-24 backplane, where each module is held in place with two screws, provided with the module.

All output modules are able to switch up to 3 amps. AC output modules provide zero voltage turn-on and have an RC snubber network for increased capability with inductive loads. AC and dc input modules are designed with filtering on the input and hysteresis for high noise rejection and transient free “clean” switching. They are designed so that high voltage transients on the input will not cause damage to the module. Optical isolation for the ac and dc input and output module is rated at 4000 V rms input-to-output.

Each module is color-coded by function and the model number is clearly marked on the module itself. The channel numbers associated with the module are printed below the module on the panel and spaces are

provided to apply colored stick-on dots (supplied) to match the color coding of the modules (yellow = ac input, black = ac output, white = dc input, and red = dc output). Note that the four channels corresponding to one quad module must be configured with either all input channels or all output channels.

Each module on the DB-24 Digital I/O Backplane operates by negative true logic, in which a low digital voltage turns on current to the module. Four LEDs on each module indicate the status of the I/O channels (the LED lights when current is turned on).

Each I/O module position has two 5 amp, 250 V rms pico-fuses protecting the module and wiring from short circuits. Table II lists the input and output 4-channel modules available for use with the DB-24 backplane.

**Table II. Quad Input/Output Module Summary**

Type	Model	Range	Output Current	Input Current
Input	ID16FQ	4 V–32 V dc		68 mA
	ID32Q	10 V–60 V dc		34 mA
	IA120QA	90 V–140 V ac		5 mA
	IA240QA	180 V–280 V dc 180 V–280 V ac		5 mA
Output	OA240QA	24 V–280 V ac	3.5 A rms	
	OD60Q	3 V–60 V ac	3.5 A rms	

## Powering the DB-24 Backplane

You can power the DB-24 Digital I/O Backplane internally for some boards, or you can use an external +5 V power supply. Before you attach the DB-24 backplane to the board, you must configure it for internal or external power.

To configure the DB-24 for internal power, remove the socketed 1 amp fuse from the left of the +5 V dc and GND screw terminals. Install this fuse in the socketed position to the right of the +5 V dc and GND screw terminals on the DB-24 backplane.

To configure the DB-24 backplane for external power, ensure that the socketed 1 amp fuse is installed to the left of the +5 V dc and GND screw terminals. Refer to Figure 4.

## Attaching the DB-24 Digital I/O Backplane

To attach the DB-24 backplane to a data acquisition or 6B50 board, use a 50-pin cable, such as the AC1585-9 cable or the CAB-03 cable (available from Analog Devices). Attach one end of the cable to the digital I/O connector on the board and attach the other end of the cable to the digital I/O connector (J1) on the DB-24 backplane. Make sure that Pin 1 on the cable corresponds to Pin 1 on the connector. Refer to Figure 5.

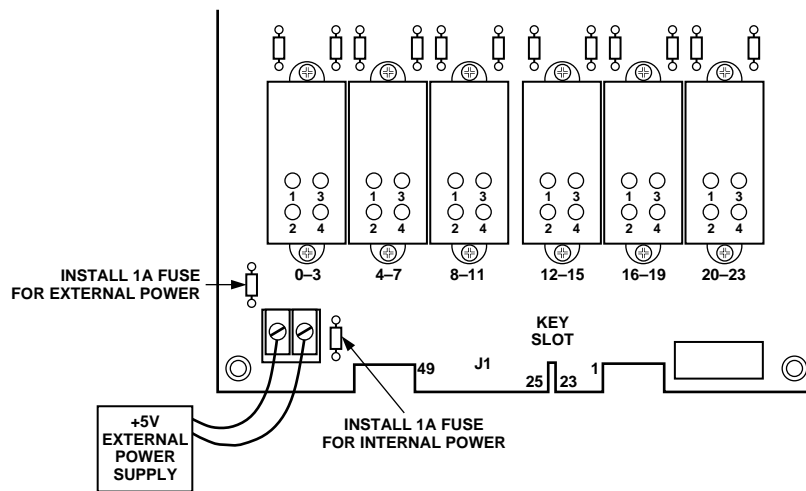


Figure 4. Positioning Fuse for Internal or External Power on the DB-24 Backplane

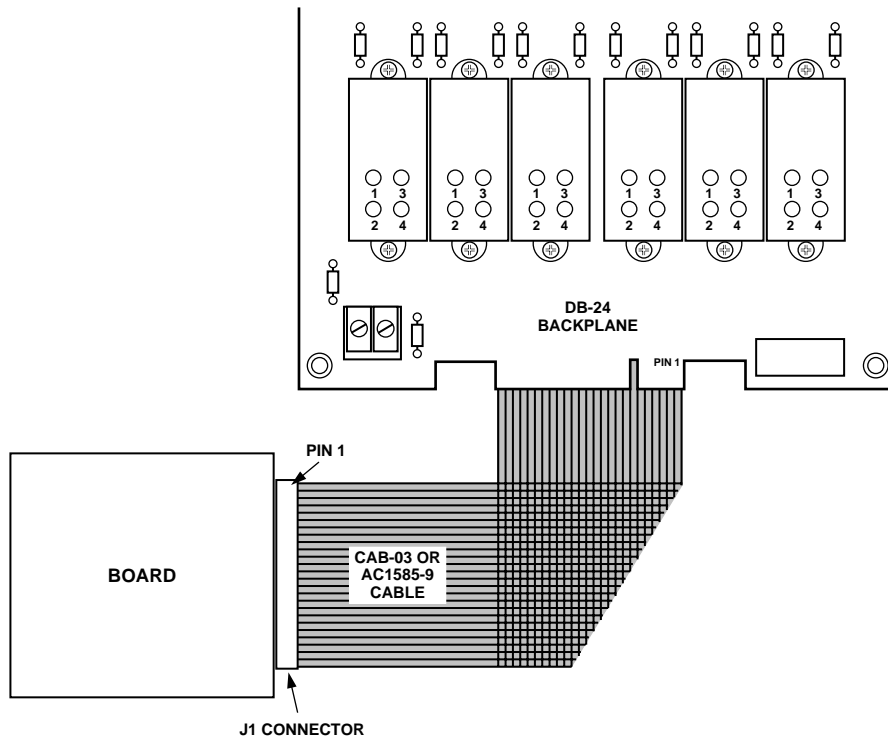


Figure 5. Attaching the DB-24 Digital I/O Backplane

### Attaching Digital I/O Applications to the DB-24 I/O Backplane

Use the DB-24 Digital I/O Backplane for high level ac or dc signals. Connect applications to the backplane through the barrier strip. The barrier strip contains standard slot-head screw terminals, six screws for each 4-channel (quad) I/O module. Use 22-14 AWG twisted-pair wire, and strip the wire back approximately 0.25-inch (6.3 mm). Four consecutive input or output applications are attached to a single quad module, with two channels sharing the same common in the module.

The two common connections for each module are connected to one another on the DB-24 backplane. Therefore, each of the four individual channels on the module can use either of its two common connections. Since the commons are connected, you must make sure that all of the applications attached to a 4-channel module share the same common voltage reference. If two applications use different common voltage references, the applications must be attached to two different modules. Figure 6 illustrates how the channels and their commons are connected.

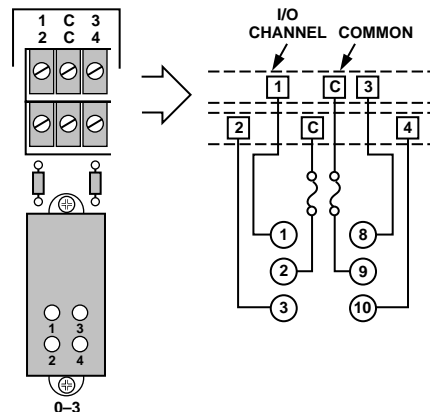
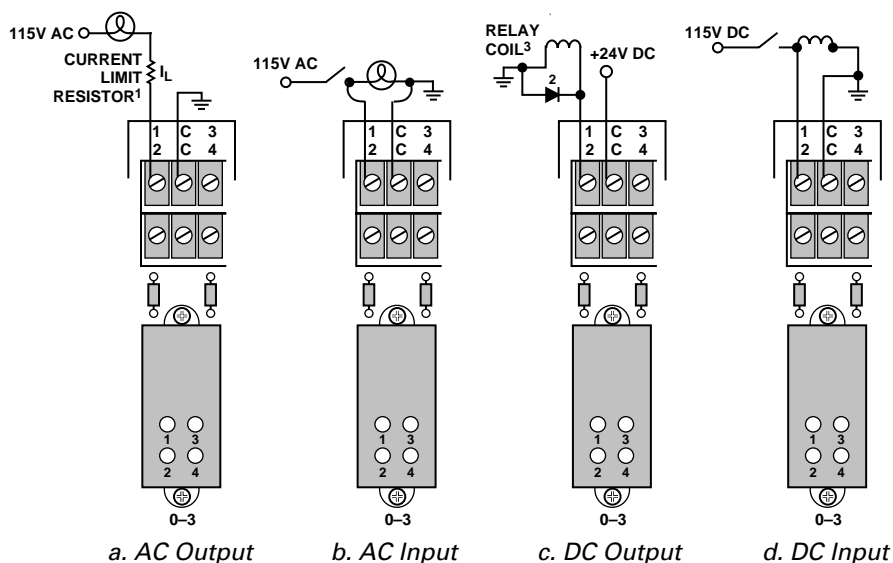


Figure 6. DB-24 Backplane Common Connections

Figure 7 illustrates high level ac and dc digital wiring using input and output modules on the DB-24 backplane. Example 7a illustrates turning a lamp on and off, and example 7b illustrates monitoring whether the lamp is on or off. Example 7c illustrates turning a relay coil on and off, and example 7d illustrates monitoring whether or not the relay coil is being energized.

**NOTE:**

The channels on the screw terminals on the DB-24 backplane are labeled from 1–24, while the channels for the I/O modules are labeled 0–23. Keep this distinction in mind when installing your field wiring applications.



- NOTES:  
<sup>1</sup>SHOULD NOT EXCEED 3A.  
<sup>2</sup>USER SUPPLIED DIODE NECESSARY FOR INDUCTIVE SPIKE DAMPING.  
<sup>3</sup>RELAY COIL AMPERAGE SHOULD NOT EXCEED OUTPUT MODULE RATING.  
<sup>4</sup>MODULES ARE COLOR CODED: AC INPUT – YELLOW  
 AC OUTPUT – BLACK  
 DC INPUT – WHITE  
 DC OUTPUT – RED

Figure 7. Typical High Level Digital I/O Wiring Using the DB-24 and 4-Channel Solid State Relay Modules

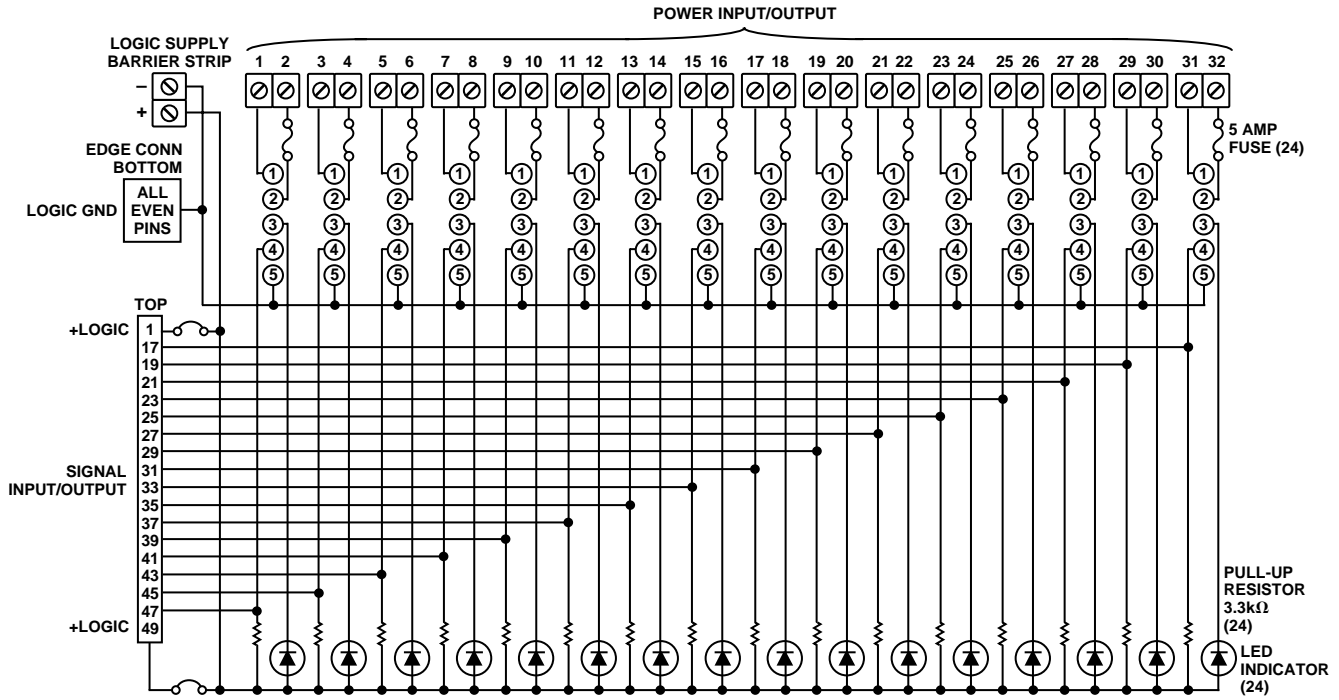


Figure 8. Schematic Diagram Model DB-16

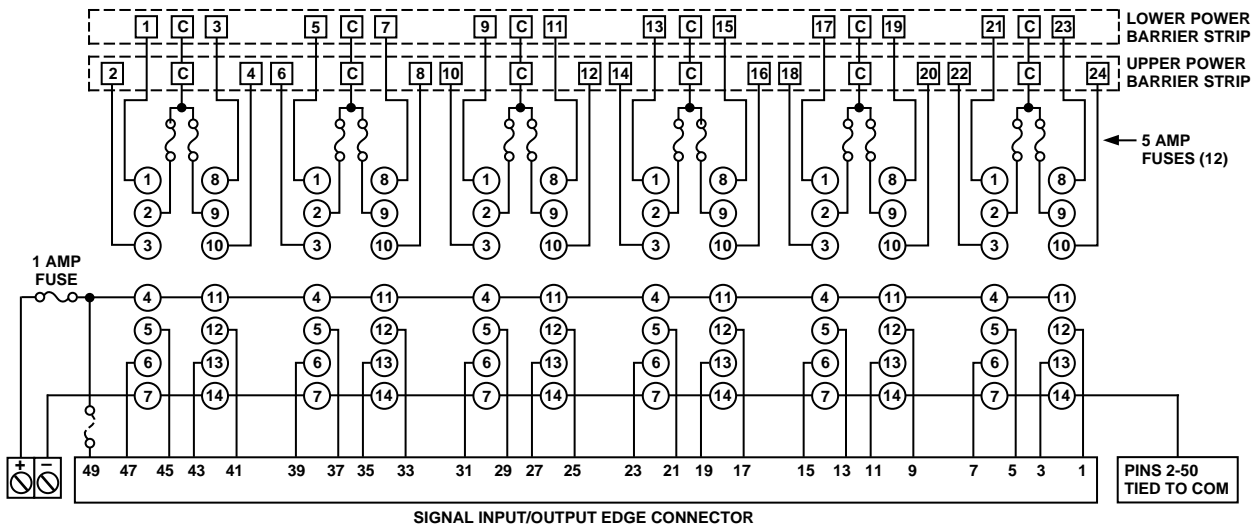


Figure 9. Schematic Diagram Model DB-24

SINGLE-CHANNEL SOLID STATE RELAYS

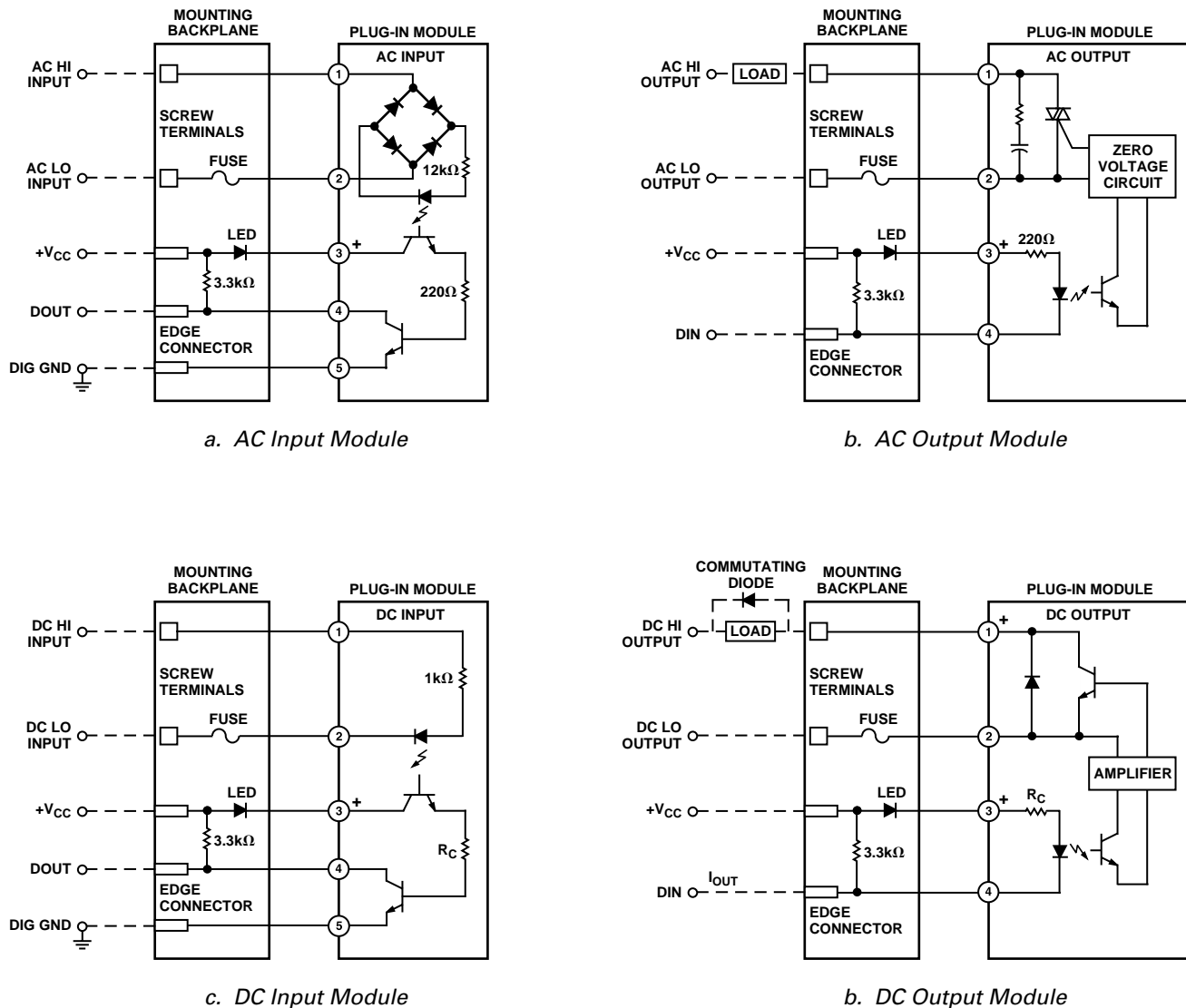
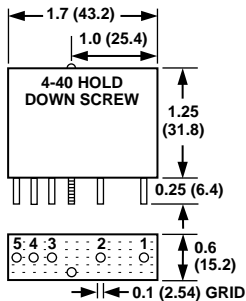


Figure 10.

OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).



## SCHEMATIC DRAWINGS

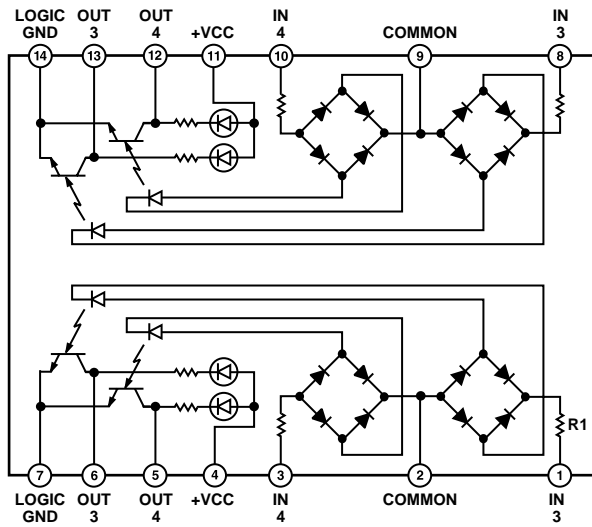


Figure 11. Input Modules, ID16FQ, ID32Q, IA120QA, IA24QA

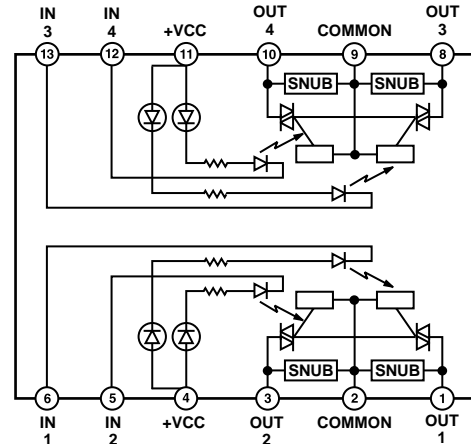


Figure 12. AC Output Module, OA240QA

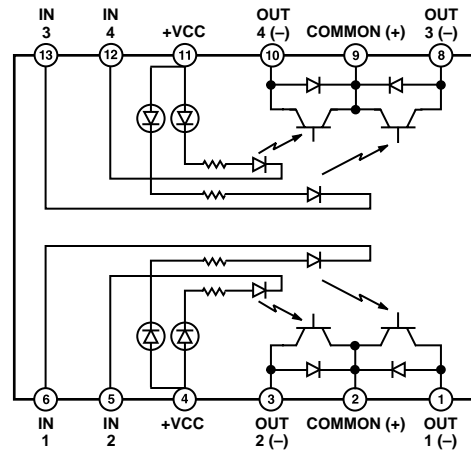
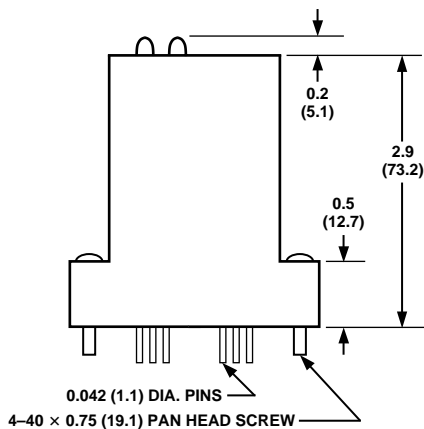


Figure 13. DC Output Module, OD60Q

## OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).  
Tolerance:  $\pm 0.020$  ( $\pm 0.50$ )



CASE COLORS:  
INPUT MODULES: AC: YELLOW  
DC: WHITE

OUTPUT MODULES: AC: BLACK  
DC: RED

