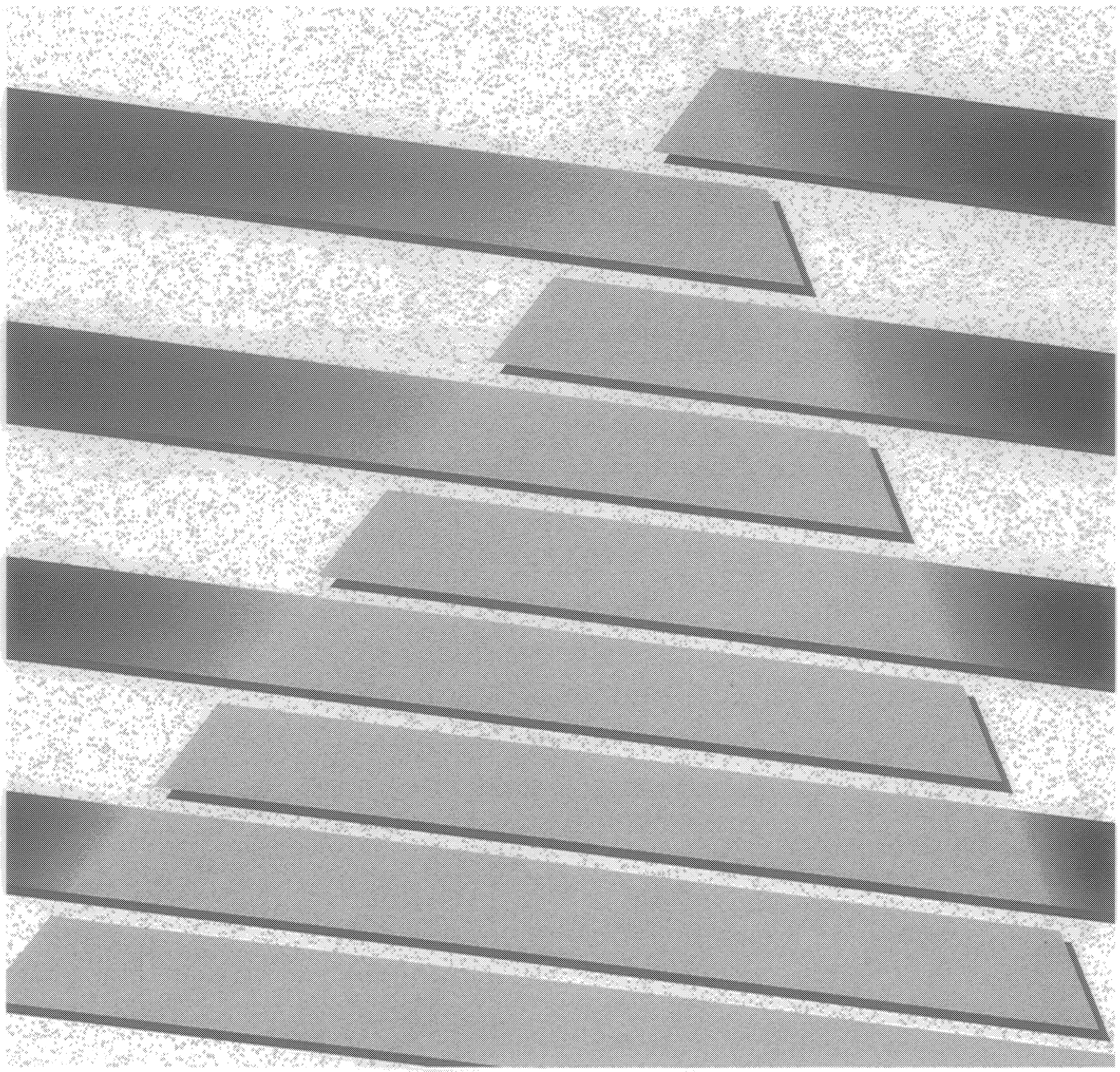
ALLEN-BRADLEY

IMC 110 Motion Control System
(Cat. No. 1746-HS)

Installation Manual



Example of Calculations for Backplane Current Requirements

Our example system includes:

- one 7-slot modular rack
- one 1747-L511 CPU module
- one 1746-IB8 dc input module with 8 inputs @ +24 V
- one 1746-OV8 dc output module with 8 outputs @ +24 V
- one 1747-PIC interface module
- an IMC 110 system which includes:
  - 2 control modules
  - 2 termination panels
  - 2 Allen-Bradley 845H encoders
  - 6 fast inputs
  - 2 fast outputs

Table 1.B lists the current requirements of the devices that use backplane power. Those devices that are not included in the backplane calculations are included in the user-side example calculations.

Table 1.B
Current Requirements for the Backplane of the Example System

Device	+5V	+ 24V
1747-L511	.350 A	.104 A (when using handheld pendant)
control module	.300 A	.104 A (when using interface module)
control module	.300 A	0
1746-IB8	.040 A	0
1746-OV8	.125 A	0
	Total +5V	**Total +24V**
	1.115 A	.208 A

Given the current requirements of this system, you can use the power supply included in the fixed-style SLC 500, the 1746-P1 or the 1746-P2 to power the backplane. Table 1.C lists the power supplies Allen-Bradley recommends for the backplane.

Chapter 2

Planning Hardware Installation

Chapter Objectives

Now that you have selected your system, you should plan your system layout. In this chapter we discuss:

- general wiring practices
- routing wires
- classifying your conductors
- placing your modules in the modular chassis

When you plan the installation of the hardware you must also consider:

- noise suppression
- environment
- grounding
- space requirements

Refer to your SLC 500 documentation for more information on these topics.

General Wiring Practices

In this section we discuss:

- connecting different level power conductors to terminals
- using shielded cables

Using Shielded Cables

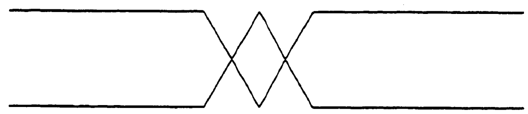
For many connections, we tell you to use shielded cable. Using shielded cables and properly connecting their shields to ground protects against electromagnetic noise interfering with the signals transmitted through the cables.

WARNING: Use shielded cable as directed in this manual. If you do not, the axis motion in your system could be unpredictable. This could result in damage to equipment and/or injury to personnel.

Within a cable, pairs of wires are twisted together. Using a twisted pair for a signal and its return path provides further protection against noise.

We show a twisted pair like this:

Twisted Pair



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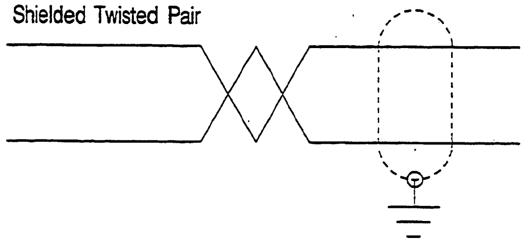
We show a shielded twisted pair like this:

Shielded Twisted Pair



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Shield wires, in general, should connect to ground at one and only one end. The termination panel provides a convenient place to connect all shield wires while providing the necessary ground connection, EGND.

At the other end, cut the shield foil and drain wire short and cover them with tape to protect against their accidentally touching ground. Keep the length of leads extending beyond the shield as short as possible.

In high noise environments, the user may want to connect shield wires at both ends of the cable in an attempt to improve the noise immunity of the system. If this must be done, terminate one end of the shield to ground through a 0.1 μf capacitor to avoid ground loops in the system.

Routing Wires

When planning your wire routing, you must classify all wires and cables connecting your IMC 110 system.

Table 2.A tells you how to classify conductors and route cables. Remember to keep low-level signal conductors separate from high-level power conductors. This is particularly important for cable connections to encoders.

Follow the practices outlined in publication 1770-4.1, entitled "Programmable Controller Wiring and Grounding Guidelines" to learn how to route other conductor categories.

Table 2.A lists:

- the categories
- the cables included in each category
- guidelines for routing the wires and cables

Table 2.A
Categories for Classifying Wires and Cables

These wires and cables:	Are in this category:	Follow these guidleines for routing: (inside or outside an enclcsure)
• ac power lines • High-power ac I/O lines — Connect to ac I/O modules that are rated for high power and high noise immunity. • High-power dc I/O lines — Connect to dc I/O modules that are rated for high power or have input circuits with long time constant filters for high noise rejection. They typically connect to devices such as hard-contact switches, relays, and solenoids.	1	• Route with machine power conductors of up to 600V ac (feeding up to 100 hp devices) if this does not violate local codes. • Article 300-3 of the National Electrical Code requires that all conductors (AC and/or DC) in the same raceway must be insulated for the highest voltage applied to any one of the conductors in the raceway.
• IMC 110 cable (1746-HCA) and termination panel wiring • Serial communication cables — Connect to programming terminals, data terminals, and from the scanner to remote I/O adapter modules, or PLC processors. • Low-power ac/dc I/O lines — Connect to I/O modules that are rated for low power such as low-power contact-output modules. • Low-power dc I/O lines — Connect to dc I/O modules that are rated for low power and have input circuits with short time constant filters to detect short pulses. They typically connect to devices such as proximity switches, photo-electric sensors, TTL devices, encoders, motion control devices, analog devices.	2	• Properly shield conductors, where applicable, and route them in separate raceways. If conductors must cross power feed lines, they should do so at a right angle. • Route at least 1 foot from 110V ac power lines, 2 feet from 240V ac power lines, and 3 feet from 480V ac power lines. • Route at least 3 feet from any electric motors, transformers, rectifiers, generators, arc welders, induction furnaces, or sources of microwave radiation. • If conductor is in a metal raceway or conduit, that raceway or conduit must be well grounded along its entire length.

Module Placement

Your control module should be kept as far away as possible from all dc and ac I/O modules. Place the control module on the left side of the chassis along with other intelligent I/O modules and the CPU. Then place any dc and ac I/O modules on the right side of the chassis, leaving any empty slots between these two groups. This placement protects the intelligent (CPU based) modules from the heat and electrical noise of the dc and ac I/O modules.

When planning your module placement you must:

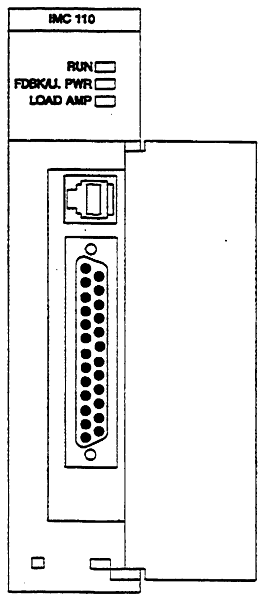
- Classify the modules that you are using into their conductor categories and follow the guidelines stated in Table 2.A.
- You should divide modules, as much as possible, into the following types:
  - ac
  - high level dc
  - low level digital dc (TTL, encoder, pulse output)
  - analog I/O
  - intelligent I/O modules (i.e. the IMC 110 control module)

If a complete I/O chassis cannot be reserved for one of these types of modules, one end of an I/O chassis can be reserved for one type of modules, and the other end for another type. If there is to be a blank I/O slot, choose a slot between two groups of different types of modules to further separate them.

IMC 110 Motion Control Module

To familiarize yourself with the control module, see Figure 3.1. It shows the control module (with door open) and its LED's and connectors.

Figure 3.1
Motion Control Module with Door Open



Chapter 4

Wiring Fast I/O and E-stop

Chapter Overview

Now that you have mounted and connected the termination panel you can wire your fast inputs and outputs and your E-stop string to the termination panel. This chapter discusses:

- wiring fast inputs and outputs
- wiring E-stop connections

Wiring Fast Inputs and Outputs

On the termination panel, the +24V dc fast inputs and outputs of the control module are routed from its connector (37 pin D-shell) to the FAST I/O connector (7 pin pluggable) on the termination panel.

The fast I/O consists of:

- fast inputs FI1-FI3
- fast output FO.1
- +24V dc and +24V dc return signals

We recommend 18 AWG wire for wiring fast I/O. This allows 2 wires for each connection point. The termination panel accepts 12 AWG wire, but this allows only one wire per point.

Figure 4.1 shows a diagram of typical fast I/O connections. Figure 4.2 shows equivalent fast input and fast output circuits.

Important: All fast inputs are +24V dc referenced (i.e. the input device always connects between +24V dc and the appropriate fast input). The fast output is ground-referenced (i.e. the output load always connects between the fast output and ground).

Figure 4.1
Typical Fast I/O Connections

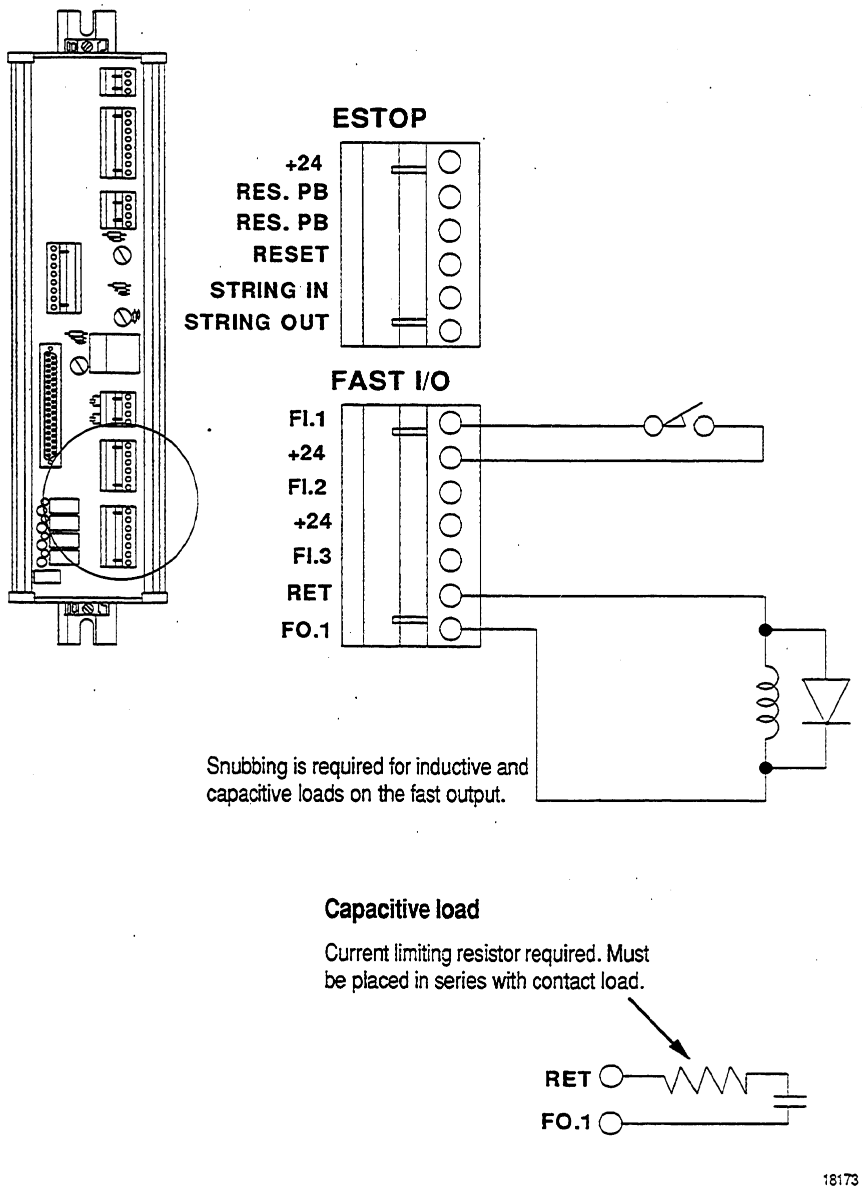
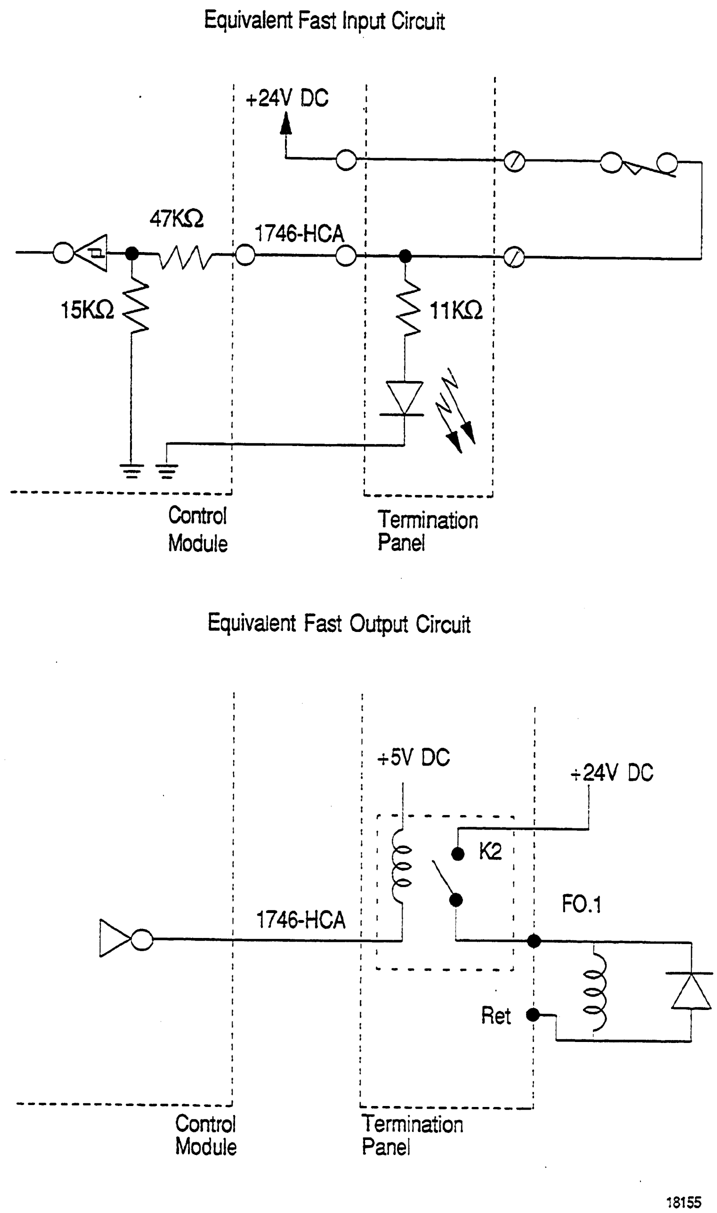


Figure 4.2
Equivalent Fast Input and Output Circuits



Wiring Hardware Overtravels

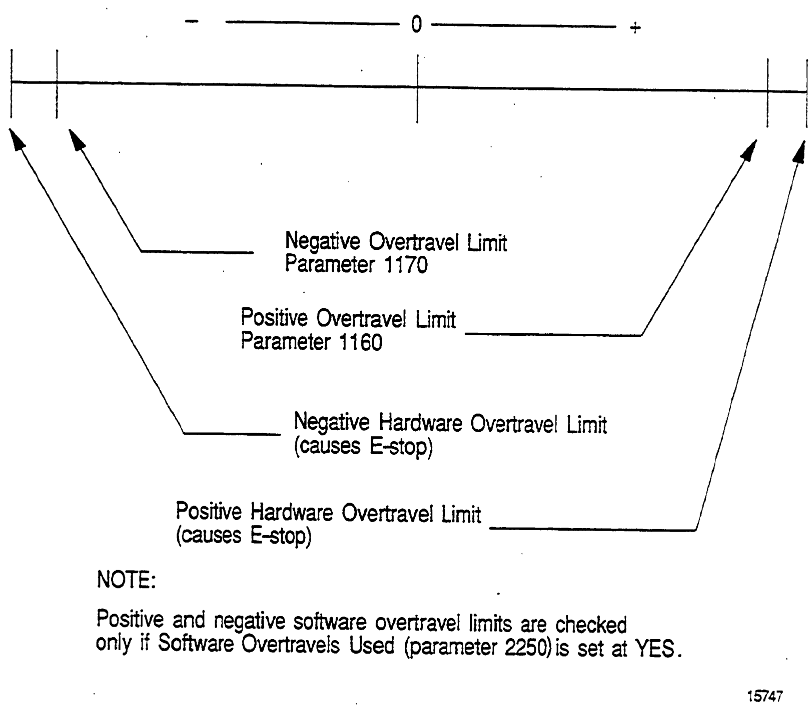
Hardware overtravel limit switches for each axis should be:

- wired into the customer E-stop string
- positioned outside software overtravels as shown in Figure 4.3.

The system should go into E-stop when a hardware overtravel is tripped.

Refer to the AMP Reference Manual (publication 1746-ND003) to read more about software overtravels.

Figure 4.3
Overtravel Limits



Connecting Home Limit Switch as a Fast Input

You can establish any one of the fast inputs as the home limit switch through AMP parameter 2360, SOURCE OF SWITCH INPUT. Refer to the AMP Reference Manual (Publication 1746-ND003) to read more about this AMP parameter.

The exact position of home is not important. It is important that the home position is:

- a repeatable resting place for the axis when it is not in use
- free of obstruction from any other axis that is in motion

To connect a home limit switch, follow these steps:

1. Place the limit switch near the approximate desired home position.

2. Adjust the encoder so that the marker is about 1/2 revolution from the limit switch closure.

If step 2 is not done, home may occasionally be off by one revolution of the encoder.

E-stop Operation

The control module detects and controls E-stop conditions. Each control module has a separate and independent E-stop circuit. Refer to customer wiring documentation for recommendations on how to correctly wire your external E-stop string.

The following events cause a hardware E-stop to occur:

- broken wire in the user power cable
- powerfail (signal from chassis backplane)
- watch-dog time out on control module
- software E-stop conditions
- a contact in the external E-stop string or a broken/missing wire opens the string (someone pushes the E-stop pushbutton)

Table 4.A shows the specifications for E-stop relay on the control module.

Table 4.A
Specifications for the E-stop Relay on the Control Module

Specification	Rating
Max. Contact Voltage Rating	80V dc max
Operate time	500μs average
Contact bounce	less than 200μs average
Contact resistance	150 milliohms average
Contact rating	5.0 VA @ 0.35 A max

Wiring the E-stop for a One Axis System

Wiring the E-stop for one axis system consists of connecting:

- Drive Enable
- E-stop Reset pushbutton (RES PB, RES PB, and RESET)
- customer E-stop string (STRING IN and STRING OUT)

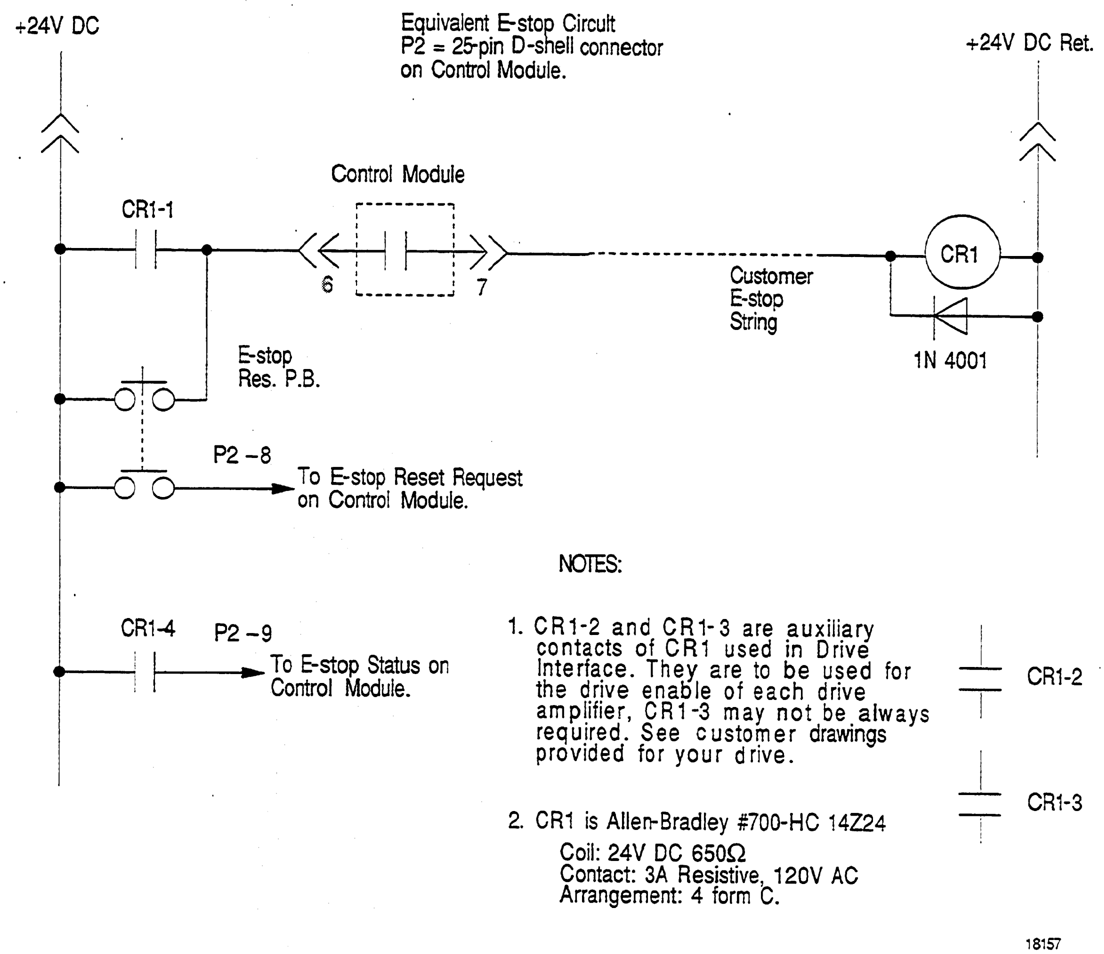
WARNING: It is responsibility of the user to develop a failsafe wiring design for his customer E-stop string. You must wire a remote E-stop pushbutton near where the handheld pendant is connected to the control module.

The elements of the E-stop string consist of the following connections in series:

- axis hardware overtravels
- remote E-stop
- motor thermal switch
- transformer thermal switch
- drive fault

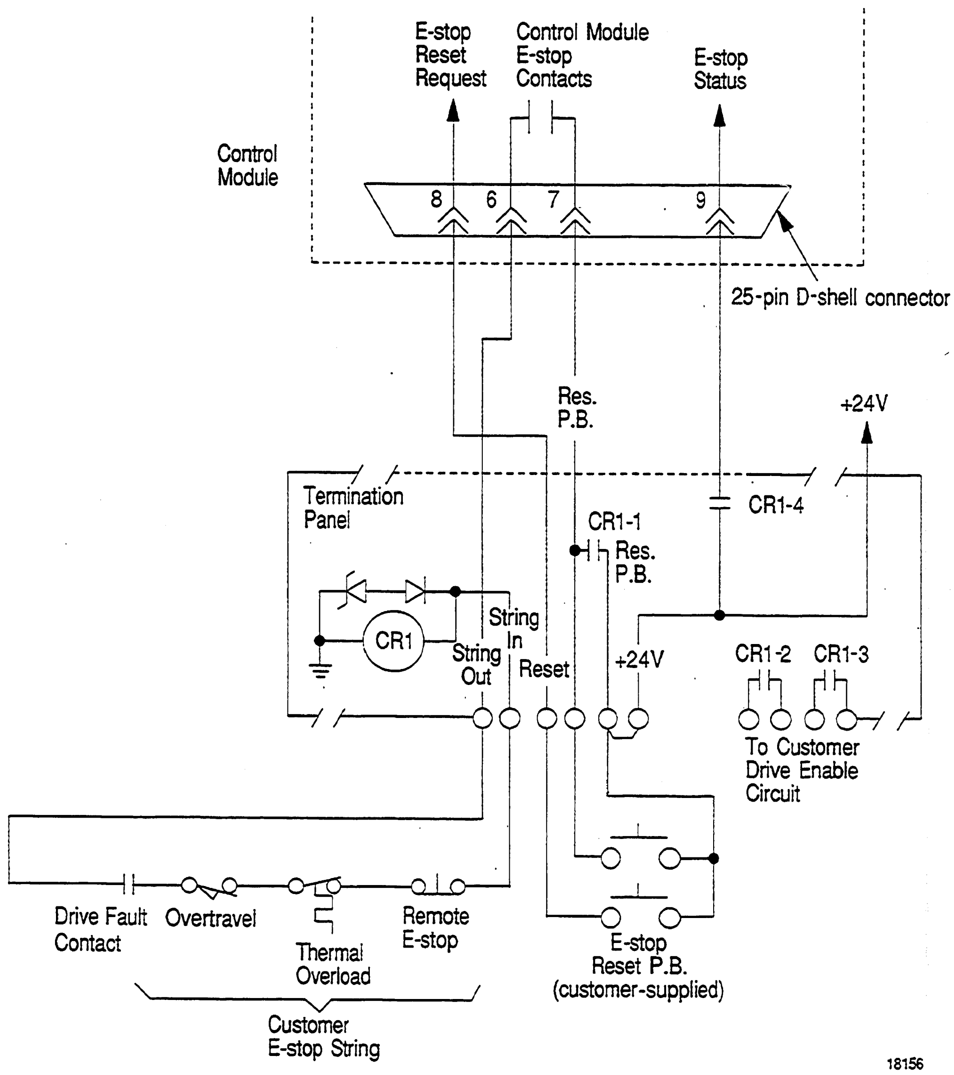
Figure 4.4 shows the ladder diagram for a system with one axis. Figure 4.5 shows the E-stop diagram for a system with one axis.

Figure 4.4
Ladder Diagram for a One Axis System



CAUTION: If the above relay is not used, be sure that replacement relay has a coil resistance greater than or equal to 650Ω.

Figure 4.5
E-stop Circuitry Diagram for a One Axis System



To wire E-stop connections you must refer to wiring diagrams for the drive you are using. Table 4.B lists the figures that show wiring for four different Allen-Bradley compatible drives.

Table 4.B
Figure Numbers of the Wiring Diagrams for Compatible Allen-Bradley Drives

Figure	Wiring Diagram for
5.6	1386 DC Servo Drive
5.7	1388 DC PWM Servo Control
5.8	1389 AC Servo Amplifier
5.9	1391 AC Servo Control Module Amplifier
5.10	1392 AC Servo Amplifier

The 1389 servo drives requires a 115 V ac power contactor (K1) to supply main power to the drive amplifier. See the 1389 Servo Amplifier Installation Manual for details.

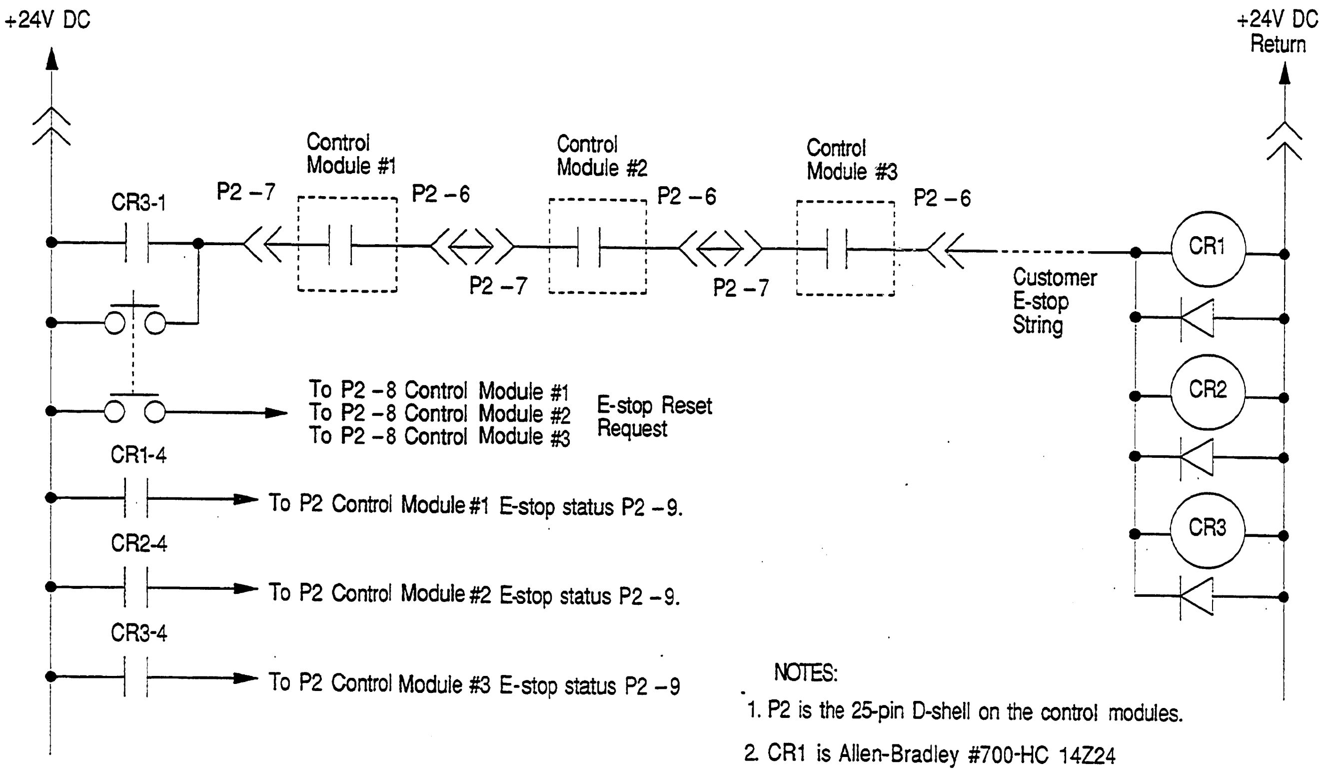
Wiring the E-stop for System with Two or More Axes

For a system with two or more axes you need a termination panel and a servo control module for each axis. Refer to Figure 4.6 and Figure 4.7 for the ladder diagram and E-stop circuitry diagram for a system with two or more axes. This type of system will have these E-stop characteristics:

- all of the control modules must be up and running before the system comes out of E-stop
- if any one axis drops into E-stop, the whole system drops into E-stop.

The number of axes on one E-stop String is determined by the power capacity of the user-supplied +24V dc power supply. Each E-stop String requires ~ 50 mA of current from the +24V supply.

Figure 4.6
Ladder Diagram for Two or Three Axis System



NOTES:

1. P2 is the 25-pin D-shell on the control modules.
2. CR1 is Allen-Bradley #700-HC 14Z24

   Coil: 24V DC 650Ω
   Contact: 3A Resistive, 120V AC
   Arrangement: 4 form C.
3. CR1, CR2, and CR3 auxiliary contacts to be used for drive enable of each drive amplifier. CR2 and CR3 may not always be required.

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Chapter 5

Wiring Power Supplies, Encoders and Drives

Chapter Objectives

Now that you have wired the E-stop string and fast I/O, you can wire the system power supply(ies), encoders, and drives. This chapter discusses:

- wiring power supplies
- wiring encoders
- wiring A-B drive connections

Wiring Power Supplies

Figure 5.1 shows how to wire a 1770-P1 power supply (for backplane and user-side requirements) and a +24V power supply (for E-stop circuitry) to the termination panel.

Figure 5.1
Wiring a 1770-P1 Power Supply and a +24V Power Supply

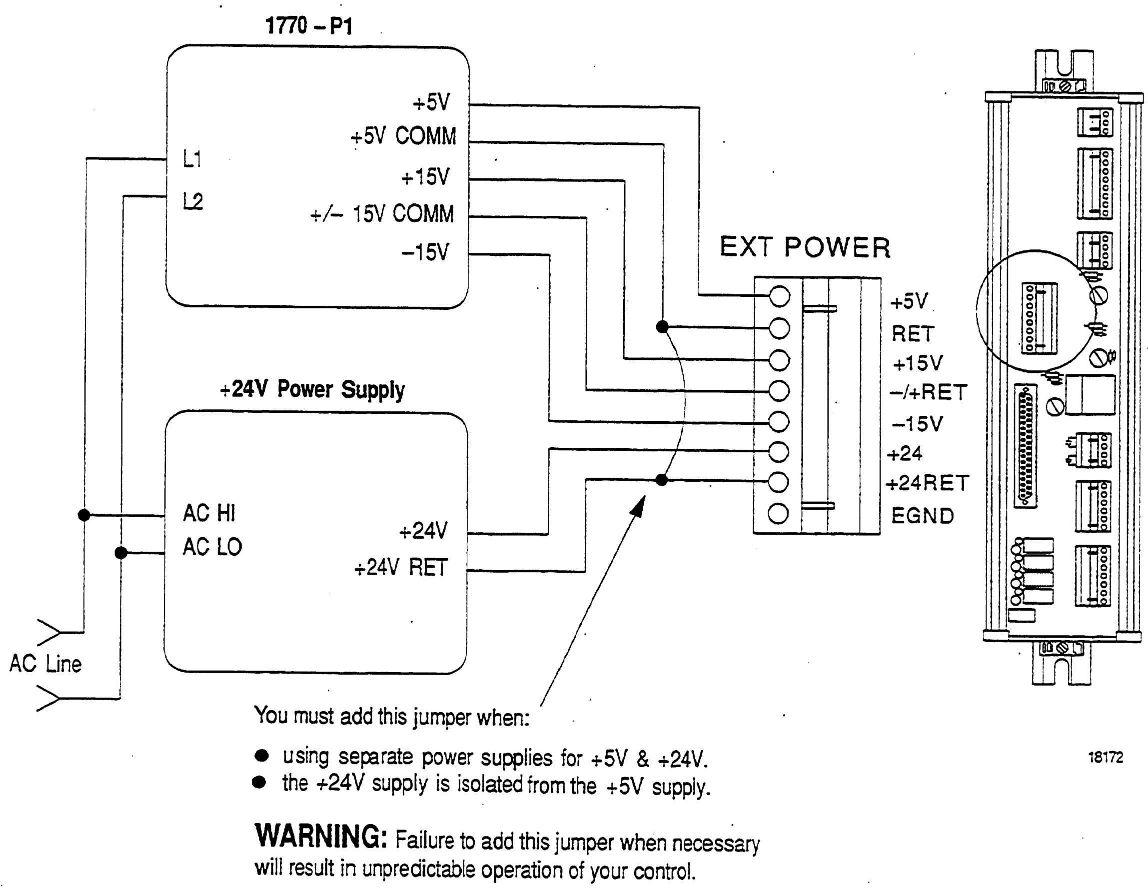

Figure A.1
1746-HCA Cable Specifications and Wiring Diagram