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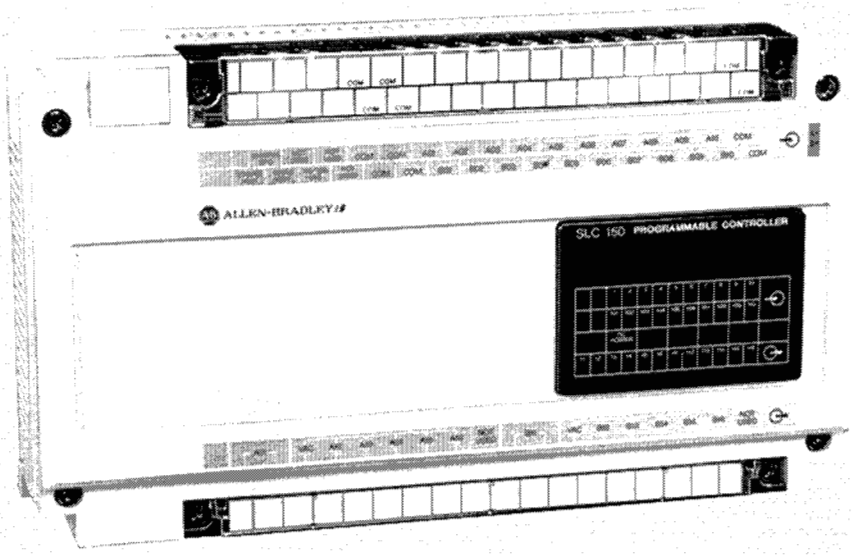
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SLC™ 150 I/O Expansion Unit

Catalog Nos. 1745-E151, -E152, -E153, -E154, -E156, -E157



SLC 150 expansion unit

The Expansion Unit

The SLC 150 expansion unit can be used with either the SLC 150 processor unit or SLC 100 processor unit to expand the number of I/O circuits to a maximum of 112. This is explained in "Addressing I/O" on Page 4.

The SLC 150 expansion unit has the same construction as the SLC 150 processor unit. Like the processor unit, it has 20 inputs and 12 outputs. Outputs include triac, hard contact, and transistor.

The unit is available in six versions to meet various application requirements. See "General Specifications", Page 16.

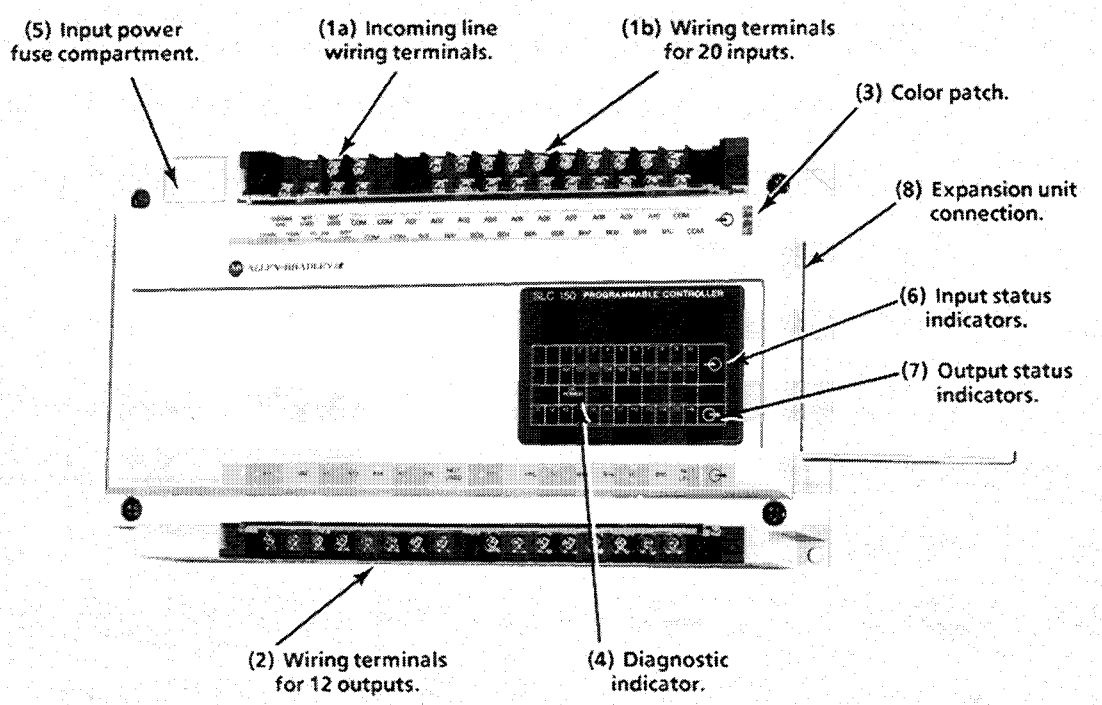
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Expansion Unit Features

The following features are pointed out in the illustration above.

1. a) Incoming line wiring terminals. b) Wiring terminals for 20 inputs. Self-lifting pressure plates allow for easy wire insertion and secure connections. Terminals accept two #14 AWG wires. The hinged cover (shown in the open position) has write-on areas for identification of external circuits. The terminal block is removable for easy expansion unit replacement. Terminal Block Removal: See Page 20.
2. Wiring terminals for 12 outputs. The removable terminal block has the same construction as the line-input terminal block. Hinged cover (shown in the open position) has write-on areas.
3. Color patch. Red, black, blue, green, purple, or yellow. Identifies the 6 expansion unit versions. See General Specifications, Page 16.
4. Diagnostic indicator: **DC POWER** – Indicates that the expansion unit is energized and DC power is being supplied.
5. Input power fuse compartment. If line terminal voltage is present but the DC POWER LED is not lit, the fuse may be blown. Refer to Page 20 for fuse replacement procedure.
6. Input status indicators. Twenty red LEDs, identified with address numbers A01 thru A10 and B01 thru B10, corresponding to numbers below the input wiring terminals. When an input circuit is energized, the corresponding status indicator will be lit.

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Expansion Unit Features *(continued)*

7. Output status indicators. Twelve red LEDs, identified with address numbers A11 thru A16 and B11 thru B16, corresponding to numbers above the output wiring terminals. When a programmed output instruction is TRUE, the corresponding output status indicator will be lit, and the corresponding output circuit will be energized.
8. Expansion unit connection. Hinged cover is shown open. The expansion unit is interconnected with the processor unit and other expansion units via ribbon cable. See Connection Cables, Page 8.

Installation Considerations

Refer to the SLC Programmable Controller User's Manual for details on the following important installation considerations:

- The enclosure should be adequate (NEMA approved) for the environmental conditions of the particular application.
- The processor unit, expansion units, and input/output device circuits should have the same power source. The processor and expansion units should be properly grounded.
- Include an electrical disconnect in the enclosure. An isolation transformer may also be required.
- A master control relay circuit should be included to permit disabling of the I/O devices independent of the processor and expansion unit power supply circuit. One or more emergency-stop switches should also be included.
- Follow the recommendations for component spacing within the enclosure, to help keep the controller temperature within the specified limits.
- Wiring should be routed to minimize electrical noise effects. Surge suppressors should be used for inductive loads in series with hard contacts and for other noise-generating equipment.
- Fusing should be provided to protect loads and wiring from short circuits or overloading.

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Addressing I/O

To obtain the I/O combination best suited to your application, you can use various combinations of SLC 150 expansion units and SLC 100 expansion units. Assigning addresses is simple, once you understand how processor "address blocks" are allocated.

Address Blocks – The I/O image table of the SLC 150 and SLC 100 processor unit consists of 112 I/O, divided into 7 address blocks (10 input addresses and 6 output addresses per block). The SLC 150 processor unit uses blocks 1 and 2. The SLC 100 processor unit uses block 1. In either case, the remaining blocks are available to you for adding I/O expansion units. The figure below identifies the address blocks and summarizes the address block requirements for the various processor and expansion units.

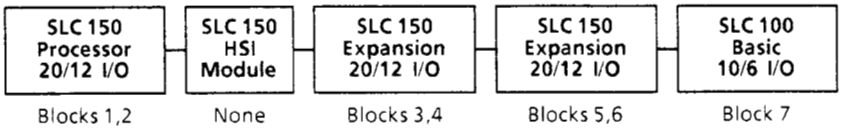
The 7 address blocks are identified in the table to the right. Address block requirements for the various processor and expansion units are shown below.

Address Block Number	Input Addresses (10)	Output Addresses (6)
1	1–10	11–16
2	101–110	111–116
3	201–210	211–216
4	301–310	311–316
5	401–410	411–416
6	501–510	511–516
7	601–610	611–616

ADDRESS BLOCKS REQUIRED FOR PROCESSOR AND EXPANSION UNITS

Type of Unit	I/O	Address Blocks Required	Addresses Used
SLC 150 Processor Unit	20/12	2	Block 1 and 2 addresses are used. Inputs: 1-10, 101-110. Outputs: 11-16, 111-116.
SLC 150 Expansion Unit	20/12	2	All addresses of 2 consecutive blocks are used.
SLC 150 High Speed Input Module	1/0	None	An internal SQO address is associated with the HSI module.
SLC 100 Processor Unit	10/6	1	Block 1 addresses are used. Inputs: 1-10. Outputs: 11-16.
SLC 100 Basic Expansion Unit	10/6	1	All addresses of the block are used.
SLC 100 Relay Output Expansion Unit	0/12	2	Output addresses of 2 consecutive blocks are used. Input addresses of the 2 blocks are bypassed.
SLC 100 Analog Input Expansion Unit	8/0	1	Upper two input addresses (_9, _10) are bypassed. All output addresses of the block are bypassed.

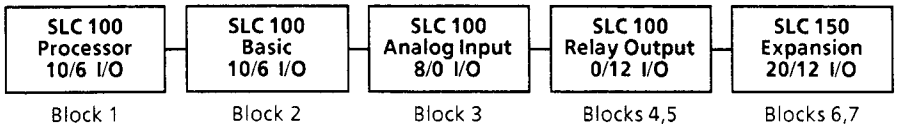
Connection Examples – The following examples indicate how you might interconnect expansion units with an SLC 150 processor unit and an SLC 100 processor unit. Note that example 1 includes an HSI module.



EXAMPLE 1: All input and output addresses of all 7 address blocks are used. The configuration provides 112 I/O (70 inputs, 42 outputs). It also provides 1 high speed input circuit.

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Addressing I/O
(continued)



EXAMPLE 2: All 7 address blocks are used. The configuration provides 84 I/O: 40 digital inputs (blocks 1, 2, 6, 7 – addresses 1-10, 101-110, 501-510, 601-610); 8 analog set points (block 3 – addresses 201-208); and 36 outputs (blocks 1, 2, 4, 5, 6, 7 – addresses 11-16, 111-116, 311-316, 411-416, 511-516, 611-616).

I/O Terminal Identification – Assume you are adding one of the 4 types of expansion units to an SLC 150 processor unit. Address blocks 1 and 2 apply to the processor unit. Address blocks 3 and 4 (or just 3) apply to the expansion unit. I/O terminals are assigned addresses as follows:

Expansion Unit	I/O Terminal Identification	Corresponding Addresses
SLC 150	Inputs: A01-A10 and B01-B10. Outputs: A11-A16 and B11-B16.	Blocks 3 and 4 are used. A = 2 and B = 3. Input addresses: 201-210 and 301-310. Output addresses: 211-216 and 311-316.
SLC 100 Basic	Inputs: 1E-10E. Outputs: 11E-16E.	Block 3 is used. Input addresses: 201-210. Output addresses: 211-216.
SLC 100 Relay Output	Upper terminals (A): 11E-16E. Lower terminals (A + 1): 11E -16E.	Blocks 3 and 4 are used. A = 2 and A + 1 = 3. Upper addresses: 211-216. Lower addresses: 311-316. Input addresses of blocks 3 and 4 are bypassed.
SLC 100 Analog Input	Set points of the 4 input circuits: 1E-8E.	Block 3 is used. Set point addresses: 201-208. Output addresses of block 3 are bypassed.

Maximum I/O Configuration – The maximum I/O configuration is 112, using all addresses of the image table. If you use SLC 100 relay output or analog input expansion units, the maximum configuration will be less, and varies with the particular combination of expansion units used. Keep in mind that when you've used all 7 address blocks, you've reached the maximum.

Internal Addresses Associated with I/O Address Blocks – The table below lists relay-type instruction addresses associated with I/O address blocks. You can use these addresses in your program, but *only if expansion units using the associated address blocks are connected to the processor unit.*

If you are using the SLC 100 processor unit, addresses 17 and 18 (address block 1) can always be used. If you are using the SLC 150 processor unit, addresses 17, 18, 117, and 118 (address blocks 1 and 2) can always be used.

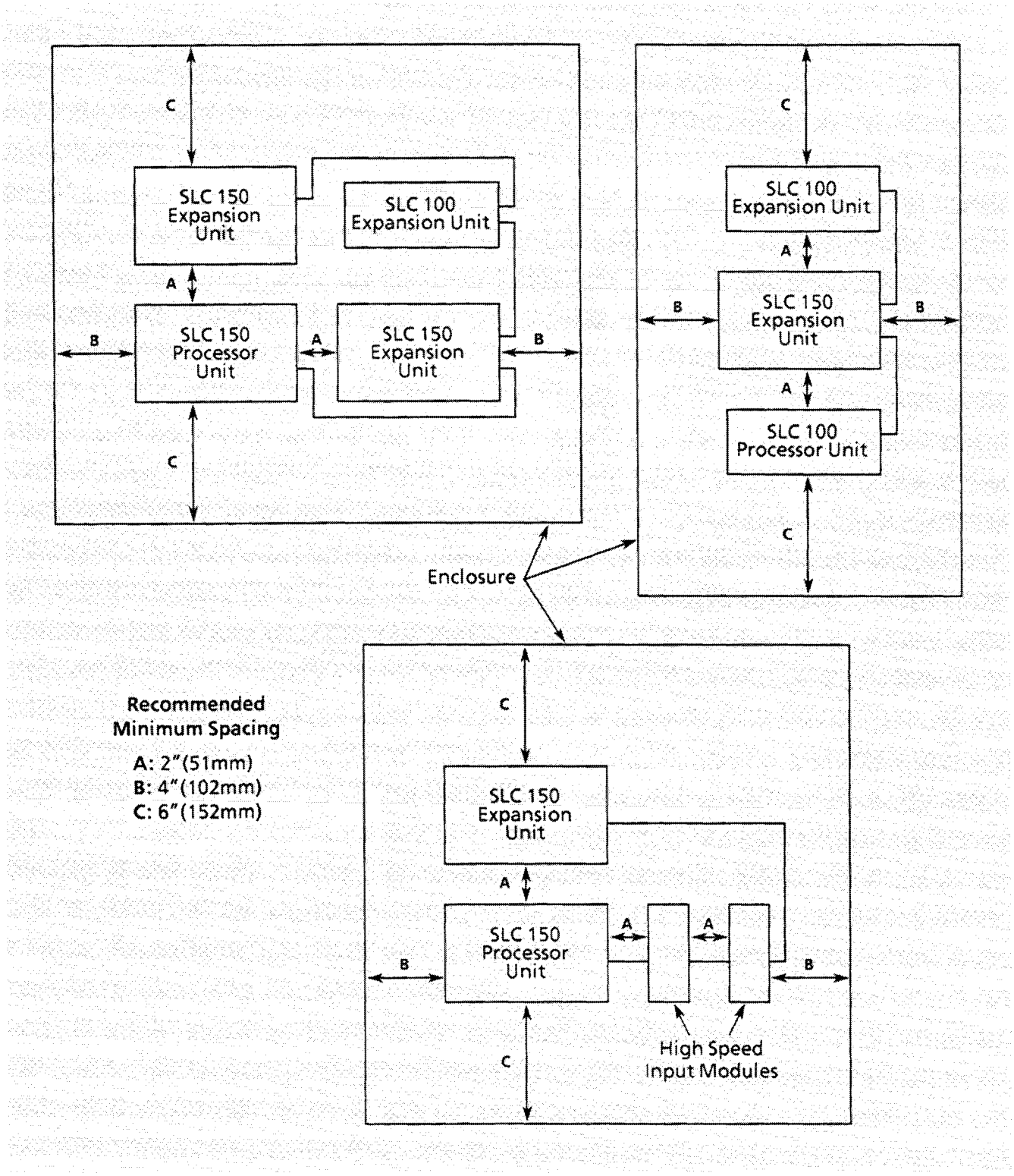
Relay-Type Instruction Addresses	Associated Address Block Number
17, 18	1
117, 118	2
217, 218	3
317, 318	4
417, 418	5
517, 518	6
617, 618	7

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System Layout

The figure below shows acceptable layouts. Follow the recommended minimum spacing to allow for convection cooling within the enclosure. Cooling air in the enclosure must be kept within a range of 0° to 60°C.

Note that SLC 150 and SLC 100 expansion units can be interconnected with either an SLC 150 or an SLC 100 processor unit. High speed input modules can be used with the SLC 150 processor unit only.



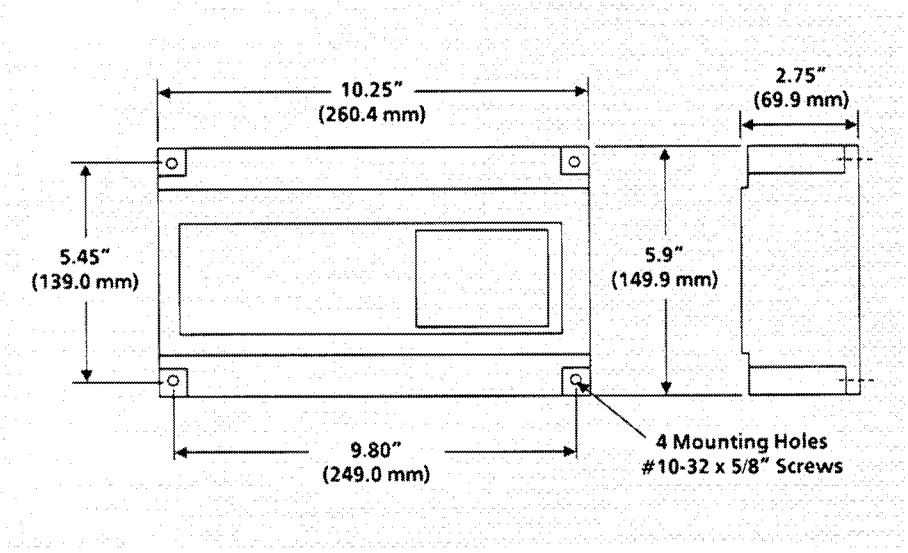
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Mounting

The expansion unit should be mounted directly to the back panel of your enclosure using four #10 screws. Hole locations are shown in the dimension drawing below.

IMPORTANT: Mount the unit on a smooth metal back panel to provide good thermal conductivity. Back panel temperature specification: 60°C maximum.

SLC 150 processor and expansion units utilize the mounting back panel as a heat sink for dissipating excess heat generated during operation. In high ambient temperature applications (60°C), sub panels not exposed to air outside the enclosure could heat up beyond 60°C. In these situations, the sub panel temperature can be reduced by removing other heat generating equipment from the enclosure or by providing auxiliary equipment for cooling, such as fans or air conditioning.

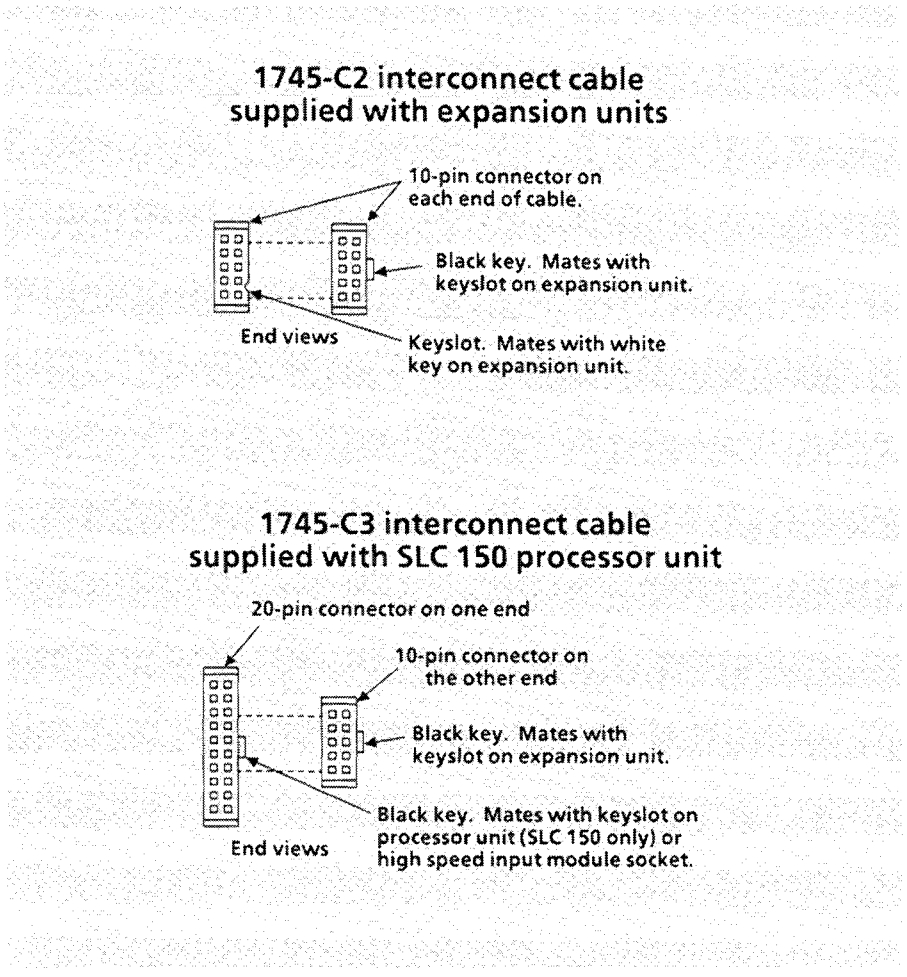


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Connection Cables

Two cables are used for interconnecting processor and expansion units: Interconnect cable 1745-C3 is a 20-pin to 10-pin cable supplied with the SLC 150 processor unit. Interconnect cable 1745-C2 is a 10-pin to 10-pin cable supplied with each expansion unit. Both cables are 18.5 inches (47 cm) long. See the figure below for cable connector details.

Important: Do not use cables longer than those provided. Longer cables could affect the integrity of data communications between the processor and expansion units, possibly causing unsafe operation.

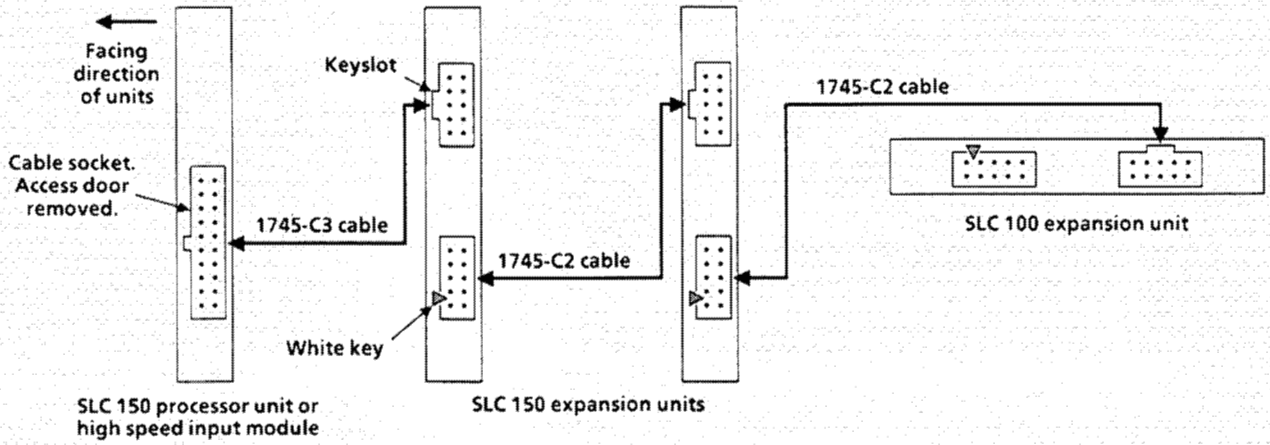


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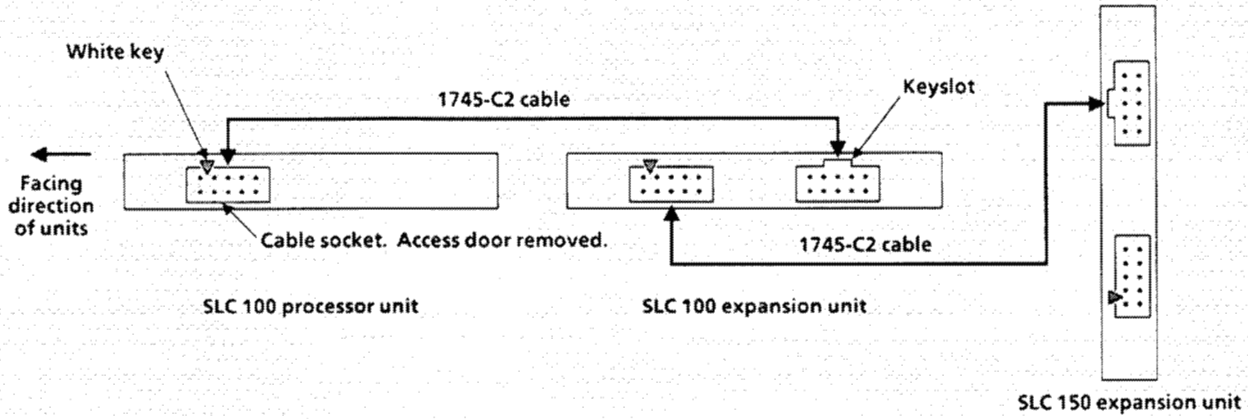
Connection Cables *(continued)*

The figure below explains how to install the interconnect cables.

A – Connecting expansion units to an SLC 150 processor unit



B – Connecting expansion units to an SLC 100 processor unit



Connecting an expansion unit to an SLC 150 processor unit:

Use cable 1745-C3, supplied with the SLC 150 processor unit.

1. Open the access doors.
2. Refer to illustration A. Align the 20-pin cable connector with the socket on the processor unit . Push gently; tabs will lock the connector in place.
3. Align the 10-pin connector with the expansion unit socket having the keyslot. Push gently; tabs will lock the connector in place.
4. Close the access doors.

Connecting an expansion unit to a high speed input module:

Same as above, but remove the plug from the high speed input module socket.

Connecting an expansion unit to an SLC 100 processor unit:

Use cable 1745-C2, supplied with the expansion unit.

1. Open the access doors.
2. Refer to illustration B. Align the cable connector having the keyslot with the socket on the processor unit. Push gently; tabs will lock the connector in place.
3. Align the connector having the black key with the expansion unit socket having the keyslot . Push gently; tabs will lock the connector in place.
4. Close the access doors.

Connecting one expansion unit to another:

Use cable 1745-C2, supplied with the expansion unit.

1. Open the access doors.
2. Refer to illustrations A and B. On the expansion unit already connected to another unit: Align the cable connector having the keyslot with the socket. Push gently; tabs will lock the connector in place.
3. On the other expansion unit: Align the connector having the black key with the socket having the keyslot. Push gently; tabs will lock the connector in place.
4. Close the access doors.

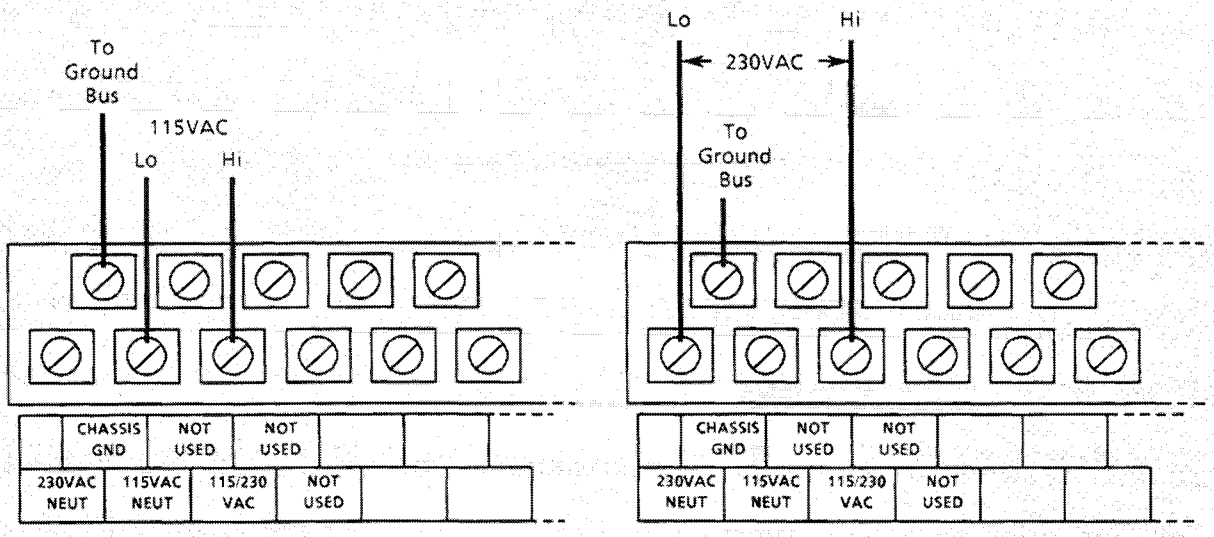
To remove cable: Move tabs on socket outward; connector will pop out.

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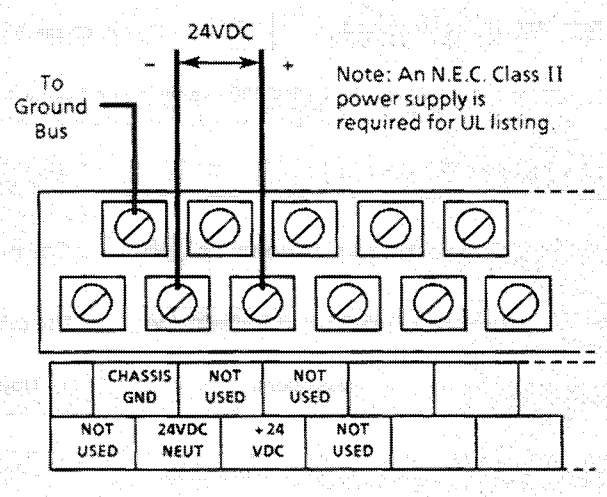
Line Wiring Connections

Make line connections to the expansion unit as follows.

CAUTION: Incorrect wire connections can cause damage to the expansion unit power supply. **Do not** jumper 115VAC NEUT and 230VAC NEUT together. **Do not** jumper unused 115VAC NEUT or unused 230VAC NEUT to the CHASSIS GND terminal.



Catalog Nos. 1745-E151, -E152, -E153, -E156



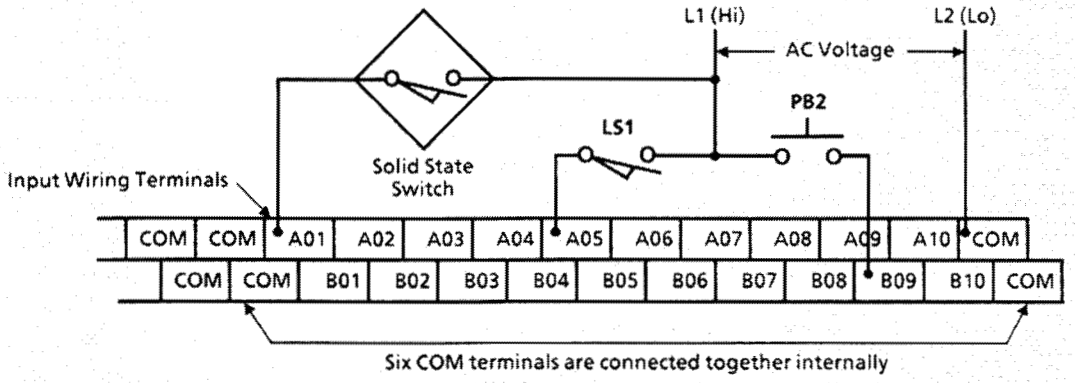
Catalog No. 1745-E154, -E157

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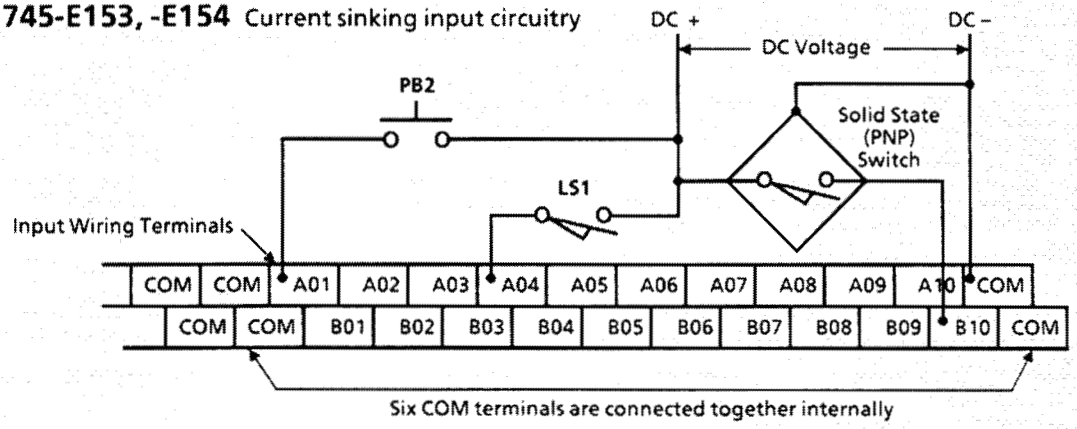
Input Wiring Connections

The diagrams below show typical input devices connected to the expansion unit wiring terminals.

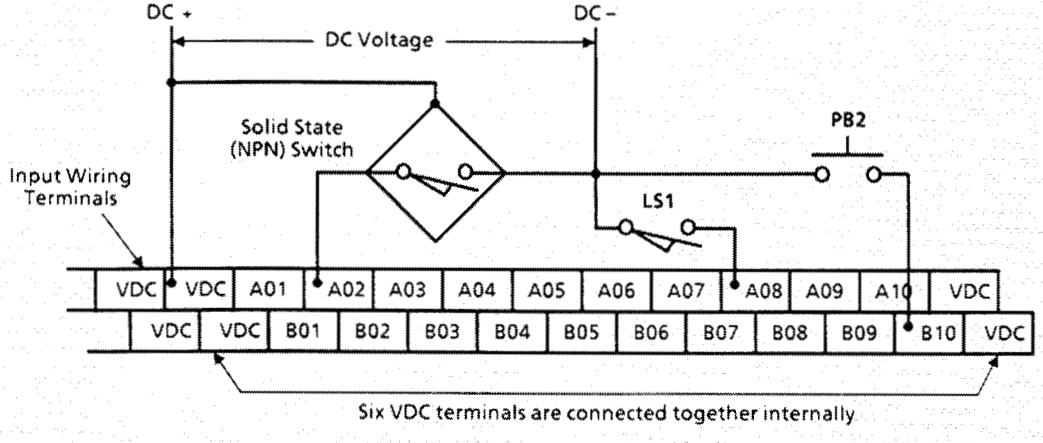
1745-E151, -E152 Current sinking input circuitry



1745-E153, -E154 Current sinking input circuitry



1745-E156, -E157 Current sourcing input circuitry



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Output Wiring Connections

Wiring connections are shown on Pages 13 and 14. Note that each expansion unit has two isolated groups of outputs plus two additional isolated hard contact relay outputs.

Triac Outputs: Triac outputs include optical isolation as well as MOV protection to guard against possible damage by transients from external outputs. Triac output firing can be synchronized with the AC line to accomplish zero-cross turn-on and minimize noise generated when switching loads. This is accomplished by making instruction –(866)– TRUE in the user program. If this feature is used, your scan time will be 8.3 msec (or some multiple) at 60 Hz and 10 msec (or some multiple) at 50 Hz. A common power source **must be used** for the processor unit power supply and output circuits to achieve zero-cross turn on.

Since triacs turn off at AC line zero cross, it is not necessary to use external surge suppression when switching inductive loads. However, if hard contacts are connected with triacs to switch an inductive load, we recommend using varistors for external surge suppression. Do not use suppressors having RC networks, since damage to triacs could occur. Refer to Page 15 for further discussion on surge suppression.

Hard Contact Relay Outputs: Outputs at terminals A12-A16 and B12-B16 include arc suppression circuitry (RC networks) which protects contacts when switching inductive loads. We recommend that you also connect external surge suppression to protect the contacts from high transient voltage which occurs when an inductive device is switched off.

Hard contact relay outputs at terminals A11 and B11 do *not* include internal arc suppression. Contact protection/surge suppression: See Page 15.

Transistor Outputs: Expansion unit 1745-E154 has current sourcing (PNP) transistor outputs. Expansion unit 1745-E157 has current sinking (NPN) transistor outputs.

We recommend that you connect external surge suppression to protect transistors from the high transient voltage which occurs when an inductive device is turned off. An IN4004 diode is acceptable for most applications. Refer to Page 15 for further discussion on surge suppression.

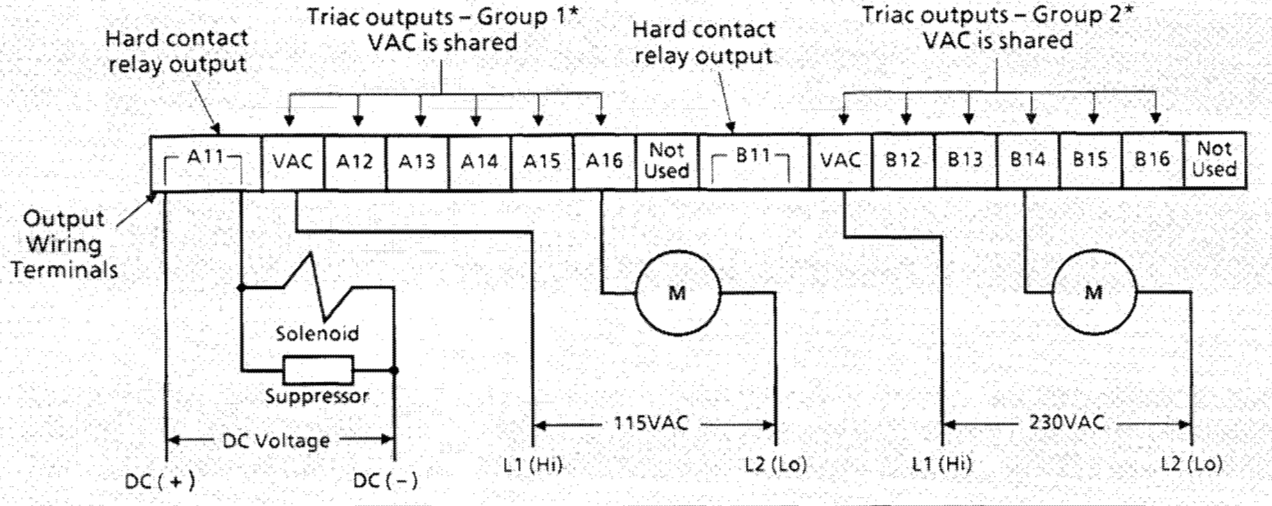
Fusing: You should provide appropriate fusing to protect output devices and wiring from short circuits and overload conditions. Refer to Pages 18 and 19 for recommended fusing.

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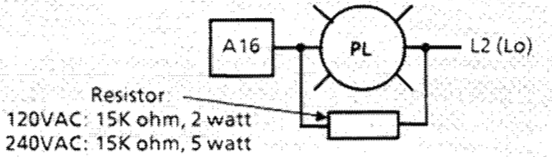
Output Wiring Connections (continued)

Wiring connections for expansion unit catalog numbers 1745-E151, 1745-E152, and 1745-E154 are shown below.

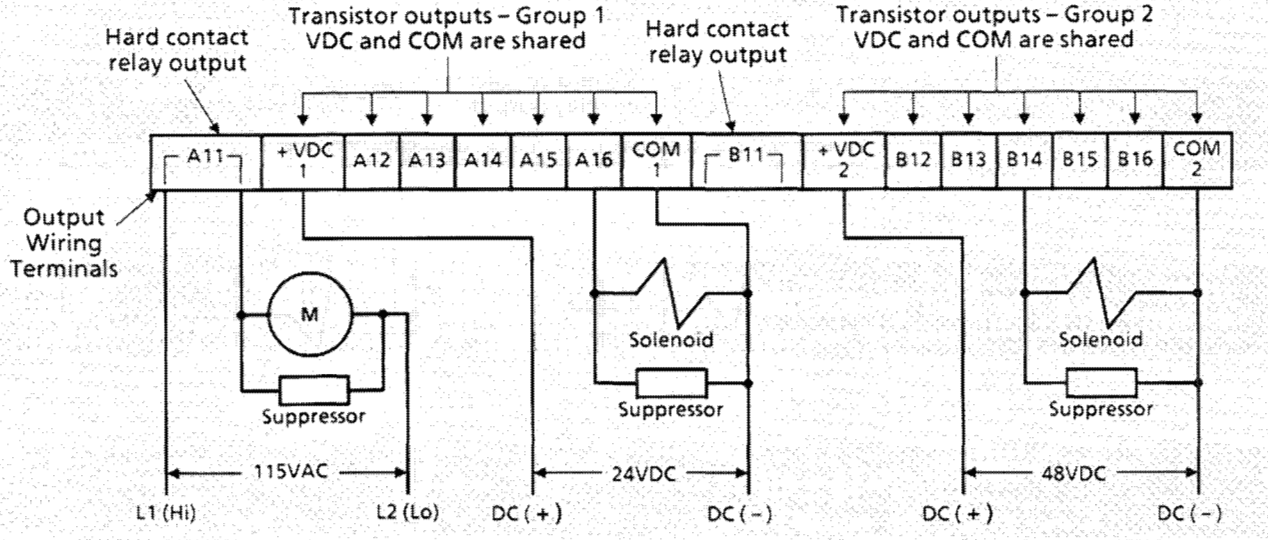
1745-E151, -E152



* To limit the effects of leakage current thru triac outputs, use a loading resistor across the load as shown at the right.



1745-E154 Current sourcing (PNP) transistor outputs

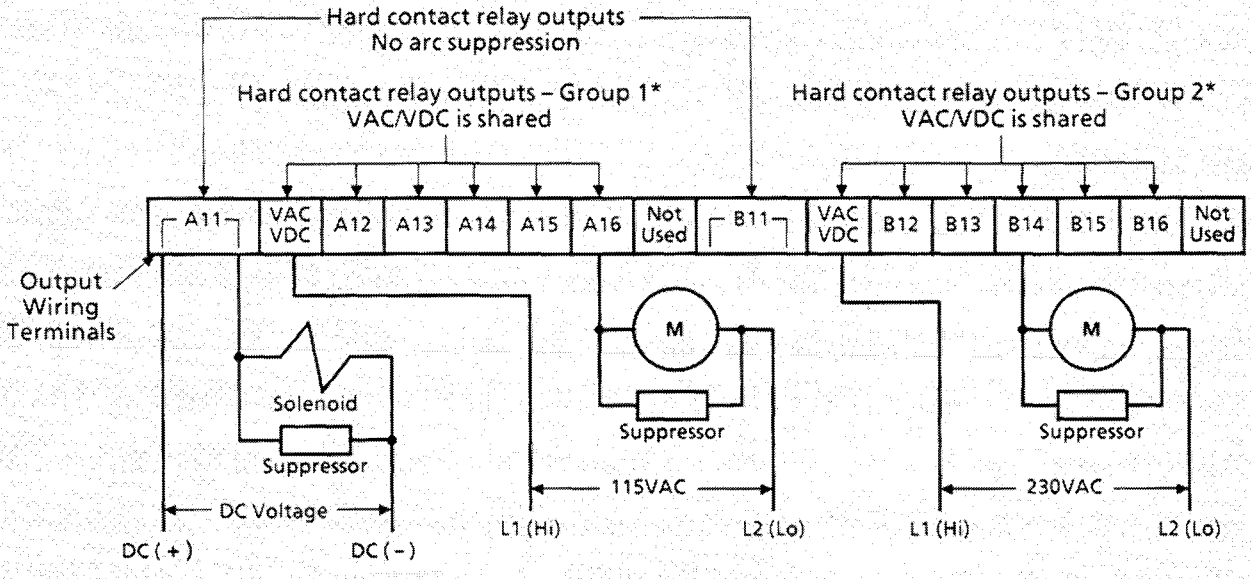


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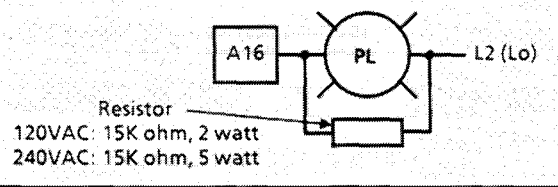
Output Wiring Connections *(continued)*

Wiring connections for expansion unit catalog numbers 1745-E153, 1745-E156, and 1745-E157 are shown below.

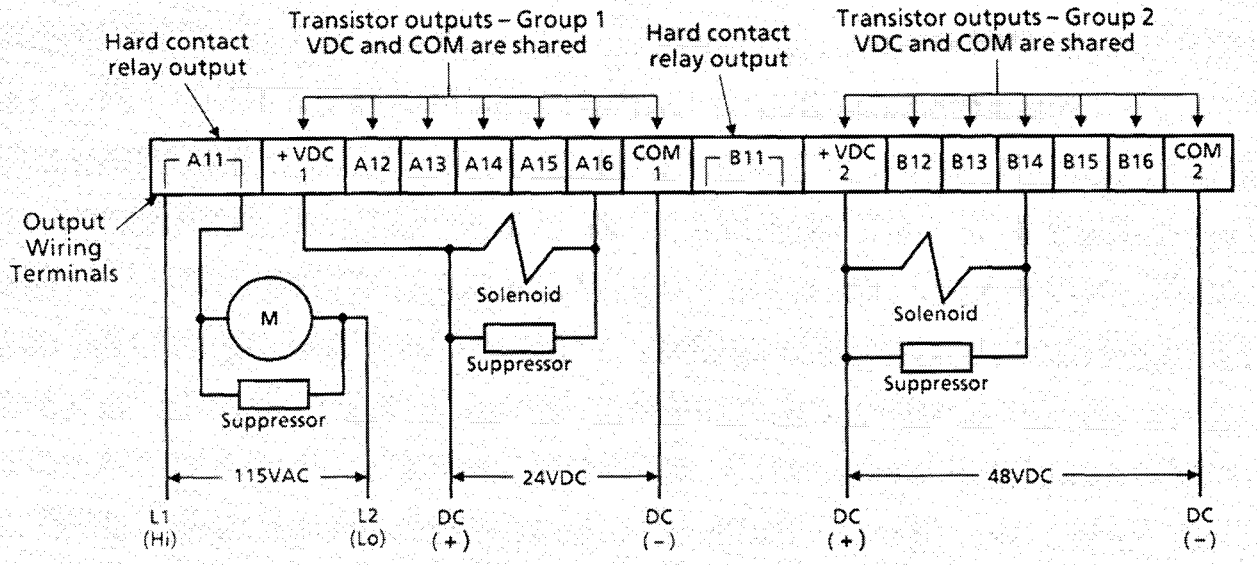
1745-E153, -E156



* Group 1 and 2 hard contact relay outputs have built-in arc suppression (R = 120 ohms, C = 0.022 microfarad). To limit the effects of leakage current, use a loading resistor across the load as shown at the right.



1745-E157 Current sinking (NPN) transistor outputs



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Surge Suppression

Inductive output devices such as motor starters and solenoids may require that you use some type of surge suppression to protect output contacts and minimize noise generation. Examples are shown below.

These surge suppression circuits are connected directly across the output device. The effect is to reduce arcing of the output contacts (arcing can be caused by the high transient voltage which occurs when an inductive device is switched off).

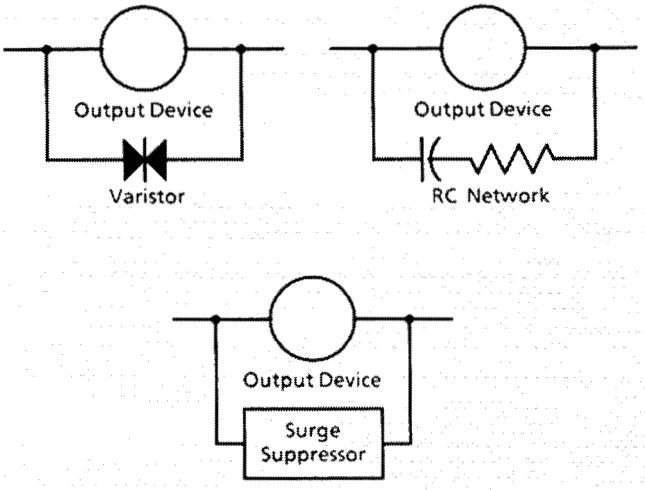
Suitable surge suppression methods for inductive AC output devices include a varistor, an RC network, and an Allen-Bradley surge suppressor. These components must be appropriately rated to suppress the switching transient characteristic of the particular inductive device.

For inductive DC output devices, a diode is suitable. A 1N4004 diode is acceptable for most applications. A surge suppressor can also be used (Refer to the SLC Programmable Controller User's Manual).

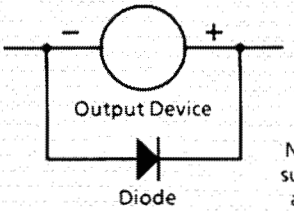
We recommend that you locate the suppression device as close as possible to the output device.

Suppressors recommended for use with Allen-Bradley relays, contactors, and motor starters are listed in the SLC Programmable Controller User's Manual.

Surge Suppression for Inductive AC Output Devices



Surge Suppression for Inductive DC Output Devices



Note: A surge suppressor can also be used.

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General Specifications

General specifications for the expansion unit are shown below.

Voltage Ranges (Incoming Power, Input Circuits, Output Circuits):

Catalog Number	Voltage Ranges (Incoming Power Connections)	External I/O		
		Input Circuits – 20	Output Circuits – 12	Color Patch*
1745-E151	85-132/170-265 VAC 50/60 Hz	85-132 VAC 50/60Hz Current Sinking	10 Triac – 85-265 VAC 50/60 Hz 2 Hard Contact – 10-250VAC/10-125VDC	Red
1745-E152	85-132/170-265 VAC 50/60 Hz	170-265 VAC 50/60Hz Current Sinking	10 Triac – 85-265 VAC 50/60 Hz 2 Hard Contact – 10-250VAC/10-125VDC	Black
1745-E153	85-132/170-265 VAC 50/60 Hz	10-30 VDC Current Sinking	12 Hard Contact – 10-250VAC/10-125VDC	Blue
1745-E154	18-30 VDC	10-30 VDC Current Sinking	10 PNP Transistor – 10-50 VDC 2 Hard Contact – 10-250VAC/10-125VDC	Green
1745-E156	85-132/170-265 VAC 50/60 Hz	10-30 VDC Current Sourcing	12 Hard Contact – 10-250VAC/10-125VDC	Purple
1745-E157	18-30 VDC	10-30 VDC Current Sourcing	10 NPN Transistor – 10-50 VDC 2 Hard Contact – 10-250VAC/10-125VDC	Yellow

* Color patch appears in the upper right corner of the unit, above the cluster of LED status indicators.

Maximum Power Requirement:
1745-E151, -E152, -E153, -E156: 15 VA.
1745-E154, -E157: 9 VA.

Input Power Fuse Protection:
1745-E151, -E152, -E153: 315mA/250V.
1745-E154: 1.6A/250V.
Fuse Types: SAN-O: SOC SD4.
Bussman: MDL, or GDC (miniature).

I/O Capacity:
20 inputs and 12 outputs. See table above.
Input specifications: Page 17.
Output specifications: Pages 18 and 19.

Specifications applying to all Catalog Numbers

Noise Immunity: NEMA Standard ICS 2-230.

Vibration:
0.015 inch peak to peak displacement, 2.5g peak(max) acceleration, 1 Hr/axis.

Ambient Temperature Rating:
0° to 60° C (operating).
– 40° to 85° C (storage).

Humidity Rating:
5 to 95% (without condensation).

Wiring: #14 - #24 AWG stranded.
3/64" insulation (max).

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Input Specifications

Input specifications are shown below. All input circuits include optical isolation as well as filtering to guard against high voltage transients from external input devices.

ON State Voltage Range and Frequency:
1745-E151: 85-132 VAC, 47-63 Hz.
1745-E152: 170-265 VAC, 47-63 Hz.
1745-E153, -E154, -E156, -E157: 10-30VDC.

Maximum OFF State Voltage:
1745-E151: 30V.
1745-E152: 50V.
1745-E153, -E154, -E156, -E157: 4V.

Maximum OFF State Leakage Current:
1745-E151, -E152: 2 mA.
1745-E153, -E154, -E156, -E157: 1mA.

Nominal Input Current:
1745-E151, -E152: 8 mA.
1745-E153, -E154, -E156, -E157: 4 mA at 12VDC, 8 mA at 24VDC.

Input Filter Time ON Delay:
1745-E151, -E152: 3 to 13 msec.
1745-E153, -E154, -E156, -E157: 4 to 8 msec.

Input Filter Time OFF Delay:
1745-E151, -E152: 9 to 18 msec.
1745-E153, -E154, -E156, -E157: 4 to 8 msec.

Electrical-Optical Isolation:
1500 volts between input voltage and control logic. Applies to all catalog numbers.

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Output Specifications

TRIAC OUTPUTS, 1745-E151, -E152
(Hard contact relay outputs: Page 19)

Output Voltage Range: 85-265 VAC.

Continuous Output Current per Circuit:
1A at 30°C, linearly derated to 0.5A at 60°C.

Continuous Output Current per Chassis:
10A at 30°C, linearly derated to 5A at 60°C.

Surge Current:
10A for 25 msec. Repeat once each second at 30°C, or once each 2 seconds at 60°C.

Minimum Load Current: 10 mA.

Maximum OFF State Leakage Current: 2 mA.

OFF to ON Response Time (non-zero cross): 0.1 msec (max).

Zero-Cross Turn-on Timing Accuracy: ± 500 microseconds.

Saturation Voltage Drop: 1.5 volts at 1.0A.

Electrical-Optical Isolation:
1500 volts between output voltage and control logic.

Recommended Output Fusing for Short Circuit Protection:
San-O SOC ST4-3A or equivalent.

TRANSISTOR OUTPUTS, 1745-E154, -E157
(Hard contact relay outputs: Page 19)

Output Voltage Range: 10-50 VDC.

Continuous Output Current per Circuit:
1A at 30°C, linearly derated to 0.5A at 60°C.

Continuous Output Current per Chassis: 10A at 30°C. 5A at 60°C.

Surge Current:
3A for 20 msec. Repeat once each second at 30°C, or once each 2 seconds at 60°C.

Minimum Load Current: 1.0 mA.

Maximum OFF State Leakage Current: 0.1 mA.

OFF to ON Response Time: 100 microseconds.

Maximum ON State Voltage Drop:
1.5 volts at 1.0A. 0.8 volts at 0.5A.

Electrical-Optical Isolation:
1500 volts between output voltage and control logic.

Recommended Output Fusing for Short Circuit Protection:
San-O SOC 5T4-2A or equivalent.

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Output Specifications *(continued)*

Specifications for hard contact relay outputs are shown below. We recommend that you use some type of surge suppression when switching inductive load devices with hard contact outputs. Refer to Page 15.

HARD CONTACT RELAY OUTPUTS

Wiring Terminals, Internal Arc Suppression:

Catalog Number	Hard Contact Relay Outputs
1745-E151 1745-E152 1745-E154 1745-E157	Units have 2 hard contact relay outputs, at terminals A11 and B11. These outputs do *not* have internal arc suppression circuitry.
1745-E153 1745-E156	Units have 12 hard contact relay outputs. Relay outputs at terminals A12 thru A16 and B12 thru B16 have internal arc suppression circuitry. Relay outputs at terminals A11 and B11 do *not* have internal arc suppression circuitry.

Voltage Range and Frequency:
10-250 VAC (50/60 Hz), 10-125 VDC.

Contact Ratings:

Maximum Volts	Amperes		Amperes Continuous	Voltamperes	
	Make	Break		Make	Break
240VAC 120VAC	7.5A 15A	0.75A 1.5A	2.5A	1800VA	180VA
125VDC	0.22A		1.0A	28VA	
24VDC	1.2A		2.5A	28VA	

Contact Resistance: 20 mΩ (typical).

Electrical Isolation:
2000 volts between output contacts and control logic.

OFF State Leakage Current:
Outputs at terminals A11 and B11 (all catalog numbers): No leakage current.

Outputs at terminals A12 thru A16 and B12 thru B16 of 1745-E153 and 1745-E156: 2mA (AC voltage only). To limit leakage current, use a loading resistor across the load as shown on Page 14.

Output Fusing for Overload Protection:
Bussman 3A, 250VAC slow blow or equivalent.

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Fuse Replacement

If the power supply fuse of the unit is blown, the DC Power indicator will not illuminate as it does during normal operation. The fuse could be blown because of excessive line voltage or because of an internal power supply malfunction.

After the conditions causing the malfunction have been corrected, the fuse can be replaced. The fuse compartment is located in the upper left corner, next to the incoming power wiring terminals.

> **WARNING:** Contact with AC line potential can cause injury to personnel. Remove system power before removing the fuse compartment cover.

Replacement procedure:

1. Remove the fuse compartment cover.
2. Remove the fuse holder by pushing the handle to the left, then pulling outward.
3. Remove the fuse from its holder and replace it with a recommended replacement fuse.

> **CAUTION:** Use only replacement fuses of the type and rating specified for the unit. Improper fuse selection may result in equipment damage.

4. Place the fuse holder back into its compartment by pushing inward until it locks into place. You may first have to shift the position of the wires.
5. Replace the fuse compartment cover.
6. Restore power. The DC Power indicator should now illuminate.

Terminal Block Removal

The wiring terminal blocks can be removed to allow replacement of an expansion unit without removing power supply, input, or output wiring.

To remove a terminal block, back out the two screws located at the ends of the terminal block. Alternate between the two screws, backing out about five turns at a time. This will help avoid binding. To replace the terminal block, align the terminal block screws with the holes on the chassis. Alternate between the two screws, as you did when removing the terminal block. Press on the center of the terminal block as you tighten the screws to help guard against an improper seat.

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