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SLC™ 100 Programmable Controller

Processor Unit – Catalog Nos. 1745-LP101, -LP102, -LP103, -LP104

The SLC 100 Programmable Controller

The SLC 100 Programmable Controller is easy to program, using the familiar ladder diagram format. Functional capabilities include relay logic, timers, counters, sequencers, and shift registers. The controller can be used in a wide variety of applications, including:

- Machine tools
- Material handling
- Assembly machines
- Molding and casting machines

The Processor Unit

Contains the processor (CPU and battery-backed CMOS RAM memory), a power supply, and 16 I/O circuits. It is available in four versions to meet various application requirements. Peripheral devices:

EEPROM Memory Module – Plugs into the processor unit for program loading and storage.

Pocket Programmer – Connect the programmer to the processor unit to program, monitor, edit, and troubleshoot. The nine operating modes selected with the programmer:

1: Clear Memory	**4**: Test–Single Scan	**7**: Load Program from EEPROM
2: Program	**5**: Test–Continuous Scan	**8**: Enter/Change Access Code
3: Run	**6**: Store Program in EEPROM	**9**: Diagnostic Test–Programmer

Personal Computer Software – Allows you to use an IBM or IBM-compatible personal computer in place of the pocket programmer. With the software, you can select functions equivalent to the modes defined above. Additional capabilities: off-line programming and program library development; ladder diagram display and enhancements; data display and cross reference table generation; program print-out. An RS-232-C/RS-422 interface converter is required for communication between the processor and computer.

Timer Counter Access Terminal (TCAT) – Allows production, supervisory, and maintenance people to monitor programmed timer, counter, and sequencer data "on-line". Connected by cable to the processor unit.

I/O Expansion Units – There are three SLC 100 I/O expansion units – the basic expansion unit, the relay output expansion unit, and the analog input expansion unit. These units can be interconnected with the processor unit to expand the number and type of I/O circuits. You can also connect the SLC 150 I/O expansion unit to the SLC 100 processor unit. The maximum number of I/O circuits is 112.

Publication 1745-2.1 – October, 1987
Supersedes Publication 1745-2.1 Dated August, 1985

40065-230-01(D)

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Features

The following features are pointed out in the illustration on Page 3.

1. Incoming line wiring terminals. Self-lifting pressure plates allow for easy wire insertion and secure connections. Terminals accept two #14 AWG wires. A hinged cover is provided (but not illustrated). The cover needn't be removed to gain access to the terminals.
2. Wiring terminals for 10 inputs. Same construction as line terminals. The hinged cover (not illustrated) has write-on areas for identification of external circuits. Cover is color-coded to identify the circuit voltage level. The cover needn't be removed to gain access to the terminals.
3. Wiring terminals for 6 outputs. Same construction as line terminals. Hinged cover (not illustrated) has write-on areas to identify external circuits. The cover needn't be removed to gain access to the terminals.

   The processor unit has relay (hard contact) output circuits.
4. Five LED diagnostic indicators:

   DC POWER (green) – Indicates that the processor unit is energized and DC power is being supplied.

   PC RUN (green) – Indicates the processor unit is in the Run mode.

   CPU FAULT (red) – Indicates the processor has detected an error in either the CPU or memory. Operation is automatically stopped.

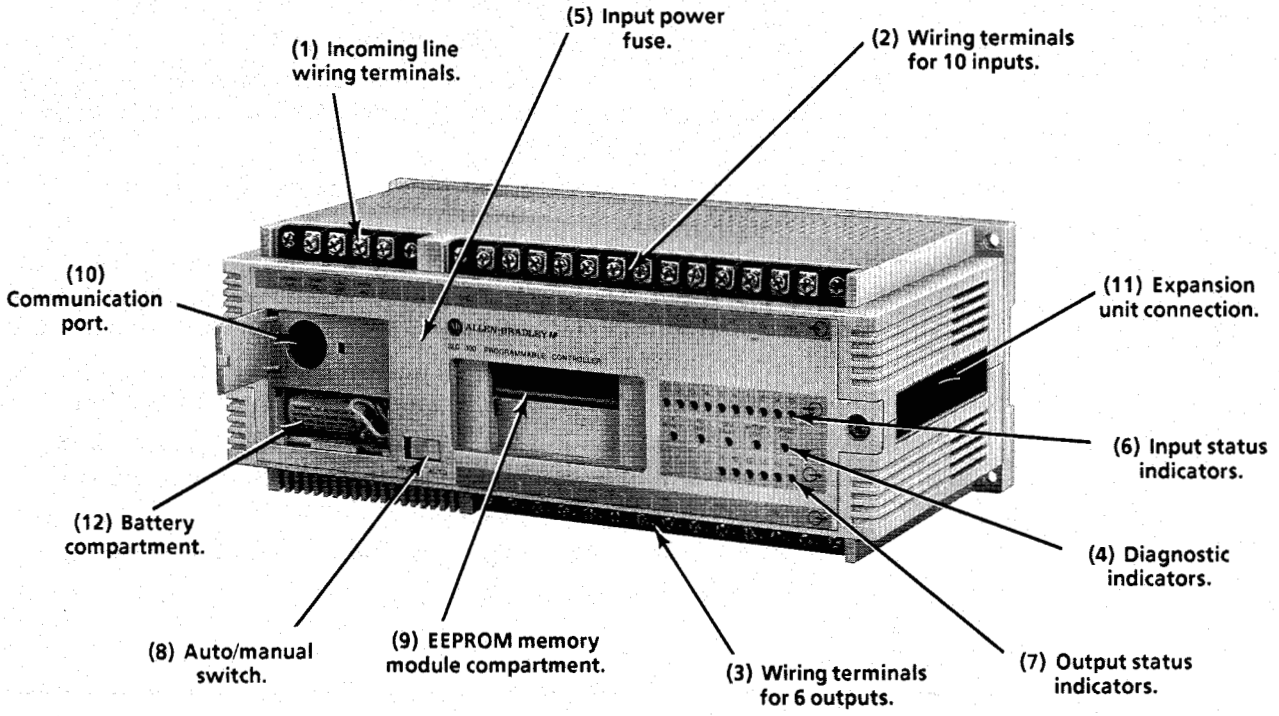
   BATTERY LOW (red) – A battery provides back-up power for the CMOS RAM memory. This LED alerts you when the battery voltage level has fallen below a threshold level.

   FORCED I/O (amber) – Indicates that one or more input or output addresses have been forced to an ON or OFF state.
5. Input power fuse (behind front cover). If line terminal voltage is present but the DC POWER LED is not lit, the fuse may be blown. Refer to the User's Manual for fuse replacement procedure.
6. Input status indicators. Ten red LEDs, identified with address numbers 1 thru 10, corresponding to numbers 1 thru 10 on the input device wiring terminals. When an input circuit is energized, the corresponding status indicator will be lit.
7. Output status indicators. Six red LEDs, identified with address numbers 11 thru 16, corresponding to numbers 11 thru 16 on the output contact wiring terminals. When a programmed output instruction is TRUE, the corresponding output status indicator will be lit, and the corresponding output contact will close.
8. Auto/Manual switch. This switch controls restarting of the processor unit after a power loss, brown-out, or correction of a CPU fault.

   Auto – On power-up, the processor runs thru its normal diagnostic tests and then automatically enters the Run mode (if it was in the Run mode at the last power-down).

   Manual – On power-up, the processor runs thru its diagnostic tests but will not enter the Run mode. To enter the Run mode, you must move the switch to the auto position or use the pocket programmer (or personal computer).

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Features (continued)

9. EEPROM memory module compartment. The optional memory module can be plugged into the processor. The pocket programmer or personal computer software allows you to store your processor RAM program in the EEPROM. You can also load a program from the EEPROM into the processor RAM.

> **We recommend that you install an EEPROM memory module.** This will provide maximum protection against user program loss or program alteration due to battery back-up drain, processor malfunction, or excessive noise.

10. Communication port. The pocket programmer, interface converter, or TCAT cable is plugged into this socket.
11. Expansion unit connection. The expansion unit cable is plugged in this socket. SLC 100 and SLC 150 expansion units can be interconnected to increase the I/O capacity of the controller.
12. Battery compartment. Back-up power for the CMOS RAM is provided by a replaceable battery assembly, accessible from the front of the processor unit. The lithium battery provides back-up power for approx. 2-3 years. Battery replacement: See the User's Manual.

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Installation Considerations

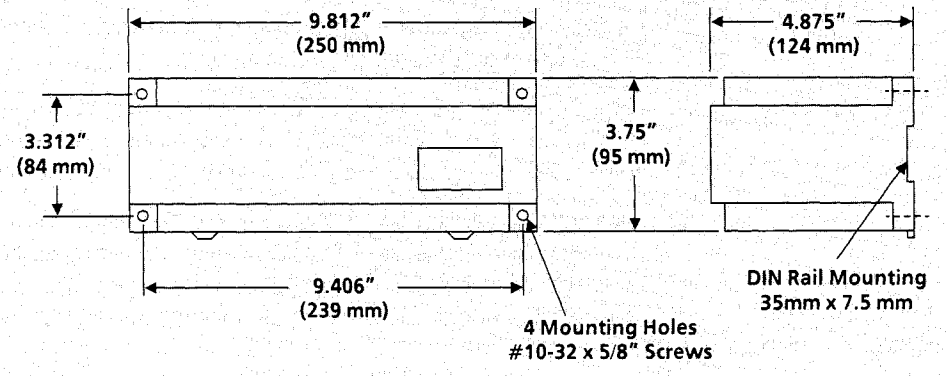
Refer to the User's Manual for details on the following important installation considerations:

- 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 circuit. One or more emergency-stop switches should also be included.
- Follow 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.

Mounting

1. Screw mounting: The processor unit can be mounted directly to the back panel of your enclosure using four #10 screws. Hole locations are shown in the dimension drawing below.
2. DIN rail mounting: The processor unit can be mounted in your enclosure on a 35 mm by 7.5 mm DIN mounting rail (Catalog No. 199-1DR). Two DIN rail fasteners are provided on the processor unit.

   The DIN rail can be screwed, bolted, or welded to the enclosure back panel. Install the processor unit by hanging the unit on the top edge of the DIN rail, then pressing the unit toward the rail until it snaps into place. To remove the processor unit, pry open the fasteners.

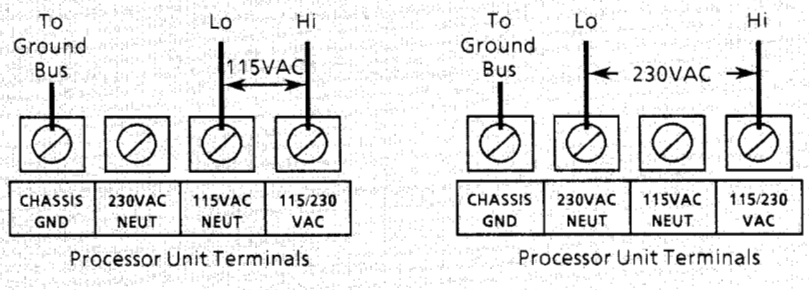


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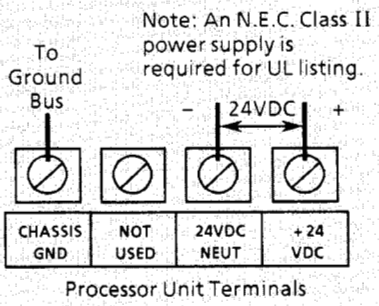
Line Wiring Connections

Make line connections as follows:

> **CAUTION:** Incorrect wire connections can cause damage to the processor 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-LP101, -LP102, -LP103



Catalog No. 1745-LP104

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Input Wiring Connections

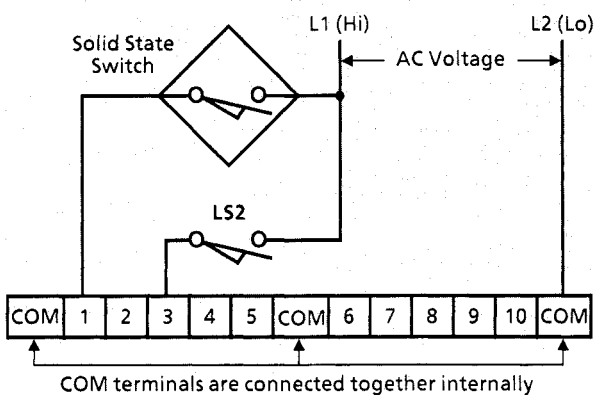
SLC 100 input circuitry is current sinking, compatible with current sourcing (PNP) input devices. Circuitry includes optical isolation and surge suppression to guard against damage by transients from user input devices.

A direct interface to solid state sensing devices and SLC 100 controller output circuits is possible because of the 2 mA OFF state leakage current specification, indicated in the following table. Note that the 2 mA value applies only to inputs 1 and 2 in some units. You can achieve a 2 mA current value for inputs 3 thru 10 by adding a resistor, as indicated.

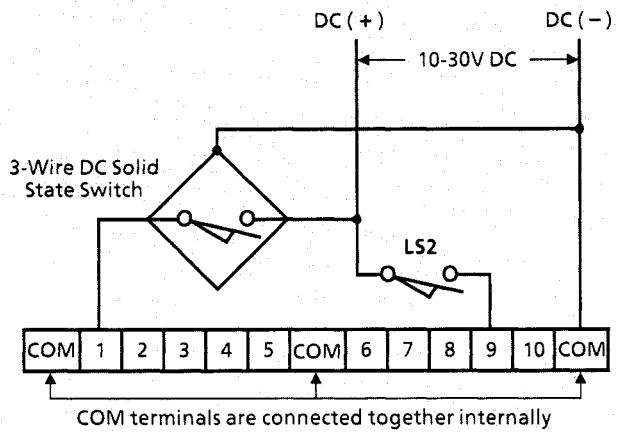
Catalog Number	Maximum OFF State Leakage Current
1745-LP101 1745-LP102	2 mA, all inputs
1745-LP103 1745-LP104	2 mA, inputs 1 and 2 only ①

① To achieve a 2 mA OFF state leakage current for inputs 3 thru 10, connect a resistor from the input terminal to the COM terminal as shown in the wiring diagram.

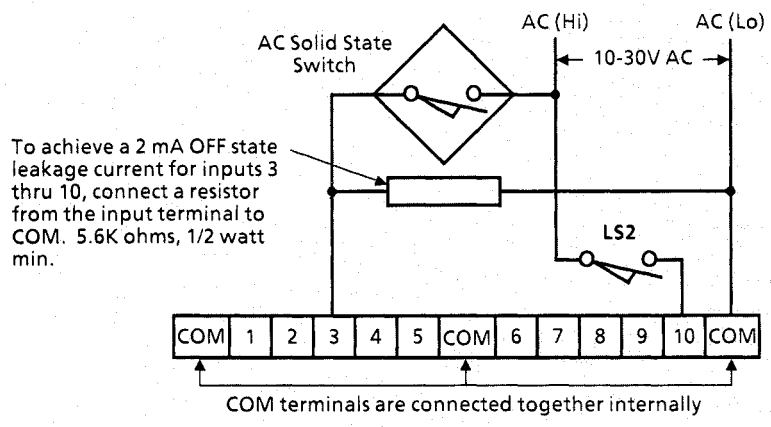
Input terminal coverplates are color coded according to voltage: 115VAC – red, 230VAC – black, 24VDC – blue.



1745-LP101, -LP102



1745-LP103, -LP104 (DC input devices)



1745-LP103, -LP104 (AC input devices)

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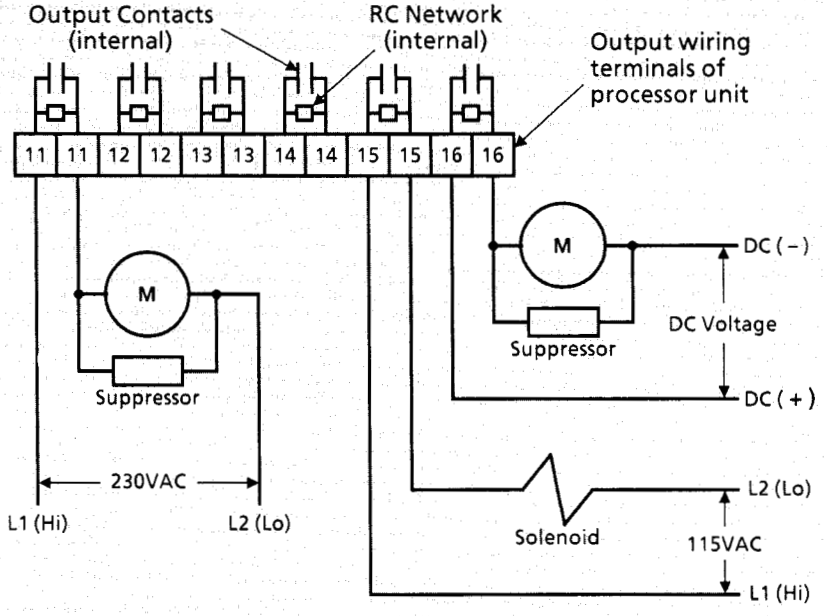
Output Wiring Connections

Wiring connections for output devices are shown below. Note that the diagram shows the internally-connected output contacts and parallel RC networks. The RC networks guard against possible damage by transients from external output devices.

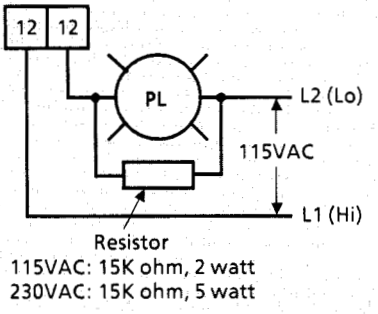
External connections are shown for outputs 11, 15, and 16. We've added a suppressor in parallel with two of the external devices for the purpose of contact protection. Contact protection is discussed on Page 8.

Since the output contacts are isolated from each other, each output circuit can be wired independently, with its own ground return. You can apply a different voltage in each output circuit, as your application might require. Power or ground wires can be jumpered between sets of terminals if desired.

You should provide appropriate fusing to protect the output devices and wiring from short circuits and overload conditions.



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



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Output Contact Protection

Inductive output devices such as motor starters and solenoids may require that you use some type of surge suppression to protect the output contacts. 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).

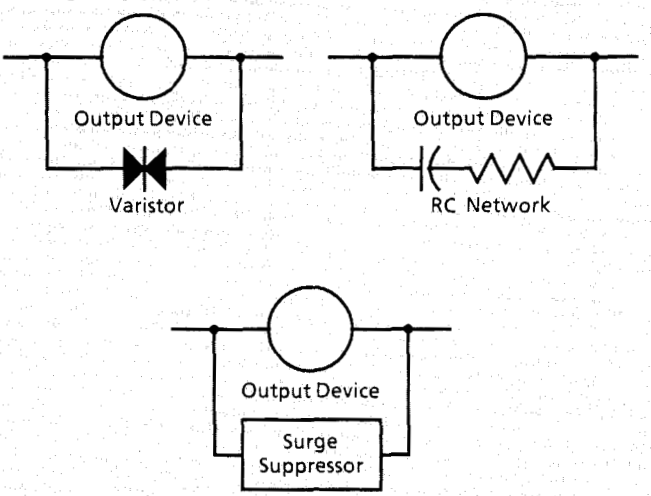
Suitable surge suppression methods for inductive AC output devices include a varistor, an RC network, and an Allen-Bradley surge suppressor. These components must be appropriately rated to suppress the switching transient characteristic of the particular inductive device.

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 User's Manual).

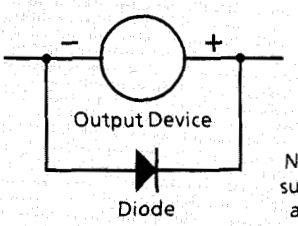
We recommend that you locate the suppression device as close as possible to the output device.

Suppressors recommended for use with Allen-Bradley relays, contactors, and motor starters are listed in the 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

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

Catalog Number	Voltage Ranges (Incoming Power Connections)	External I/O Circuits	
		Input	Output (Hard Contact)
1745-LP101	85-132/170-265 VAC 50/60 Hz	85-132 VAC 50/60 Hz	10-250VAC/ 10-125VDC
1745-LP102	85-132/170-265 VAC 50/60 Hz	170-265 VAC 50/60 Hz	
1745-LP103	85-132/170-265 VAC 50/60 Hz	10-30V AC/DC	
1745-LP104	18-30 VDC	10-30V AC/DC	
	Full wave rectified AC voltage 18V RMS ± 20%, 30V peak		

Input Terminal Cover Color Code	
Volts	Color
85-132 VAC 50/60 Hz	Red
170-265 VAC 50/60 Hz	Black
10-30V AC/DC	Blue

Maximum Power Requirement:
1745-LP101, -LP102, -LP103: 20VA. 1745-LP104: 15VA.

Input Power Fuse Protection:
1745-LP101, -LP102, -LP103: 315mA/250V. 1745-LP104: 1.6 A/250V.
Fuse Types: SAN-O: SOC SD4. Bussman: MDL, or GDC (miniature).

Hold-Up Time: The processor can sustain operation for approx. 300 milliseconds in the event of power interruption or removal. It takes approx. 85 milliseconds for the processor to reach full power from an initial power on condition.

Specifications applying to all Catalog Numbers

Memory Type: CMOS RAM with battery back-up. Provision for optional EEPROM module (Cat. No. 1745-M1).

Battery Back-Up: Lithium battery, non rechargeable, 2-3 year life.

User Memory Size: 885 words maximum. (Most instructions require 1 word.)

Typical Scan Time: 15 msec (depends on program length).

I/O Capacity: 16 I/O (10 inputs, 6 outputs). Expandable to 112 I/O.
Input specifications: Page 10. Output specifications: Page 11.

Internal Relay-Type Instructions: 181 max, regular or latched.

Timers/Counters/Sequencers: 32 max, any combination. Retentive.

Time Base: 0.1 sec. Fine time bases to 0.01 sec can be selected.

Timer Range: 0.1 to 999.9 seconds.

Counter Capacity: 9999 counts.

Sequencer Capacity: 8 bits x 100 steps.

Shift Register: 8-bit groups.

Noise Immunity: NEMA Standard ICS 2-230.

Vibration: DIN Rail Mounting: 0.006 inch peak to peak displacement, 1.0g peak (max) acceleration, 1 Hr/axis. Screw Fastener Mounting: 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 for the various processor unit versions are shown below. The 2 mA OFF state leakage current specification allows direct interface to solid state sensing devices.

Note that the 2 mA OFF state leakage current for 24VAC circuits applies to inputs 1 and 2 only. When required, you can also achieve a 2 mA OFF state leakage current for inputs 3 thru 10, as indicated in the specifications.

All input circuits include optical isolation as well as filtering and surge suppression to guard against damage by transients from external input devices.

ON State Voltage Range and Frequency:
1745-LP101: 85-132 VAC, 50/60 Hz.
1745-LP102: 170-265 VAC, 50/60 Hz.
1745-LP103, -LP104: 10-30V, AC/DC.

Maximum OFF State Voltage:
1745-LP101: 35V.
1745-LP102: 50V.
1745-LP103, -LP104: 5V.

Maximum OFF State Leakage Current:
1745-LP101, -LP102: 2 mA.
1745-LP103, -LP104: 2mA, inputs 1 and 2 only. To achieve a 2 mA OFF state leakage current for inputs 3 thru 10, connect a 5.6KΩ, 1/2 watt (min) resistor from the input terminal to the common terminal.

Nominal Input Current:
1745-LP101, -LP102: 8 mA.
1745-LP103, -LP104: Inputs 1 and 2– 8 mA at 12V, 18 mA at 24V. Inputs 3 thru 10– 6 mA at 12V, 14 mA at 24V.

Specifications applying to all Catalog Numbers:

Input Filter Time Delay: 10-25 msec.

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

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Output Specifications

Output specifications for all versions of the processor unit are shown below.

Internal output circuitry includes surge suppression to guard against possible damage by transients from external output devices. We recommend that you also use some type of contact protection when switching inductive load devices. Refer to Pages 7 and 8.

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.

OFF State Leakage Current: 2 mA (AC voltage only). To limit leakage current use a loading resistor across the load as shown on Page 7.

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

Internal RC Network Values: R = 120 ohms, C = 0.022 microfarad.

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