

Figure 1 - E10-Relay+ PLC Wiring Diagram

1. Introduction

The E10-Relay+ PLC has 10 digital I/O, including 6 PNP type inputs and 4 mechanical relay outputs, and is packaged as a single board controller in an extremely compact form factor.

This PLC features a built-in RS485 port and supports a full set of host link commands compatible with those used on the H-series or any Super PLC (FMD, Nano-10, and F-series PLCs). These features allow it to be used as a local slave or as an intelligent, distributed I/O board for a host PC or any Super PLC.

It can be interfaced to the PC using the Opto232 programmer transfer adapter or via RS485 using an "U-485" or equivalent USB-to-RS485 converter.

2. Physical Mounting & Wiring

The E10-Relay+ PLC can be easily installed in many kinds of plastic or metal enclosures. You need to use 4 PCB standoffs (or screws and nuts) to support the controller and fasten it to a console box. Alternatively, you can mount it on the optional "DIN-KIT 1B" and clip it onto the standard DIN rail.

CAUTION: DO NOT install the E10-Relay+ with the mechanical relays in the vertical position as shown in the following two diagrams.

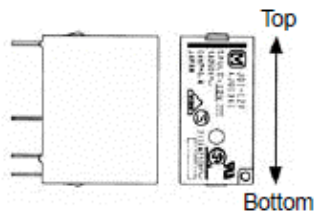


Figure 2 - Incorrect Relay Position

The manufacturer of the mechanical relays currently used on the E10-Relay+ (part # JQ1a-24V-F) is now specifying that the relay not be installed in the vertical position or it could fail to actuate on occasion, typically after many previous switches. However, the results may vary and it should be assumed that the relay can potentially fail at any time when installed in the specified vertical position.

According to the relay manufacturers revised documentation: "When installing with the relay terminals parallel to the ground, the contact terminals at the bottom and the coil terminals at the top, component friction will occur after numerous switching actions or due to vibration in the non-excitation state. Since this may cause the relay to stop functioning when the pick-up voltage increases even if the nominal voltage is applied, please do not install using this orientation." This is demonstrated in Figure 2 above.

On the E10-Relay+, the relays will be orientated this way when the PLC is installed in the following position demonstrated in figure 3. This position should be avoided when the relays are being used.

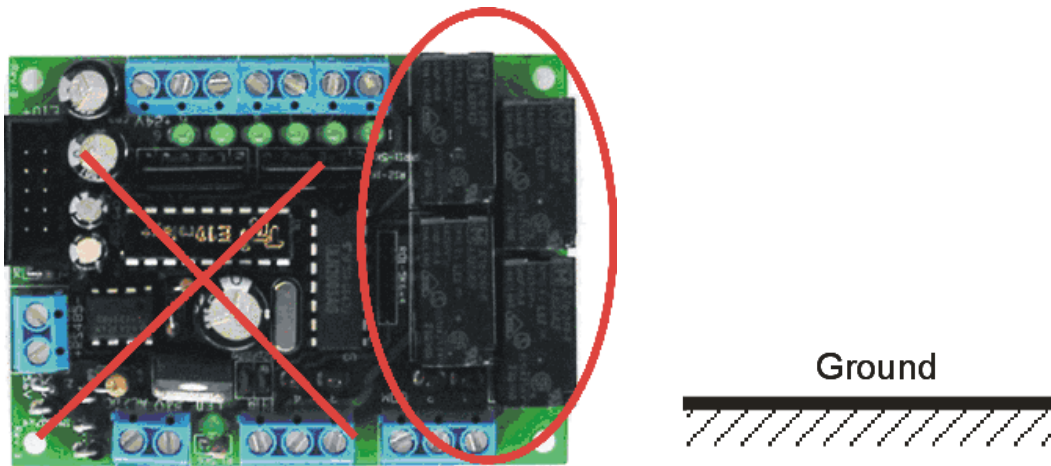


Figure 3 - Incorrect E10-Relay+ Orientation

Digital I/O Ports: Screw terminals are provided for quick connection to all digital inputs, outputs and power supply wires.

Although you can connect a single or multi strand wire directly to the screw terminal, we strongly recommend using the insulated crimp ferrules to provide a good end termination to multi-stranded wires. Using ferrules reduces the possibility of stray wire-strands short-circuiting adjacent terminals and their use is therefore highly recommended.

3. Power Supply

The E10-Relay+ PLC has a built-in power supply unit, hence requiring only a small 24V AC transformer to power it. The power supply also provides a 24V DC output for connection to sensors. Up to 0.1A current is available for sensors when using a 0.2A transformer.

DC ground (0V) may be tapped from the heatsink tab of the 7805 voltage regulator. The input is triggered by connecting a switch to the +24VDC output. PNP type sensor can be interfaced directly. With a pull up resistor NPN sensors may also be used, although the logic state for the input contact in the ladder program should be inverted

Always place the power supply as near to the PLC and the expansion board as possible and use separate wires to connect the power to I/Os. Keep the power supply wire as short as possible and avoid running it along side high current cable in the same cable conduit.

4. Digital Input Circuits

There are a total of 6 physical inputs in the E10-Relay+ PLC. These inputs are numbered from 1 to 6. These numbers correspond directly to the first 6 entries in the WinTRILOGI's™ Input Table. Input interfacing to the E10-Relay+ controller is different from that of the E10-npn+ controller, as follow:

	E10-Relay+ (PNP Type Inputs)	E10-NPN+ (NPN Type Inputs)
Input Voltage for Logic 0:	Open circuit or 0V to +3.5V	Open Circuit or +8V to +30V DC
Input Voltage for Logic 1:	+8V to +30V	0V to +3.5V

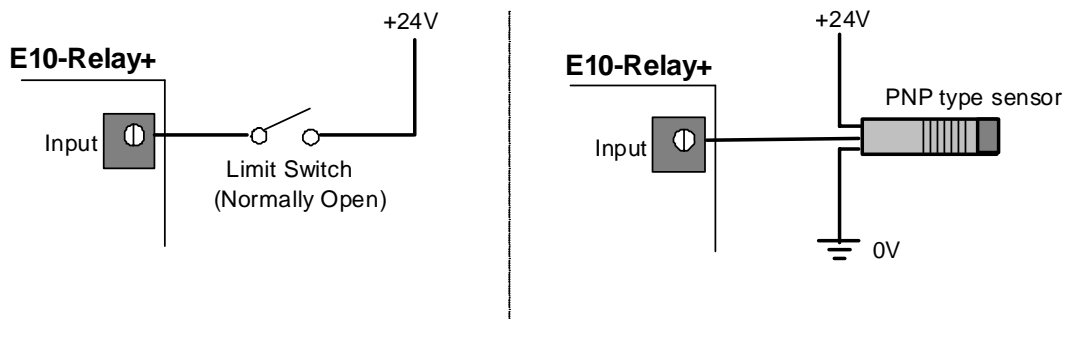


Figure 5 - E10-Relay+ Input Wirings

All these inputs have green color LED indicators. All 6 inputs are grouped together into a single strip of permanent screw terminal along with a single 24V sensor power terminal (marked as "24V"). The input numbers are marked on their screw terminals.

5. Relay Output Circuits

Each E10-Relay+ PLC features 4 normally-open, voltage-free relay outputs. Every 2 outputs share a common terminal ("COM"). Each output has an LED indicator adjacent to its terminal that lights up when the output is turned ON.

Relay Outputs Electrical Specifications:

Current Ratings @30V DC : 5A (Electrical life = 2×10^5 cycles)
 (resistive load) @125V AC : 5A (Electrical life = 2×10^5 cycles)
 @250V AC : 2A (Electrical life = 2×10^5 cycles)

Maximum total current : 10A (per block of 2 outputs)

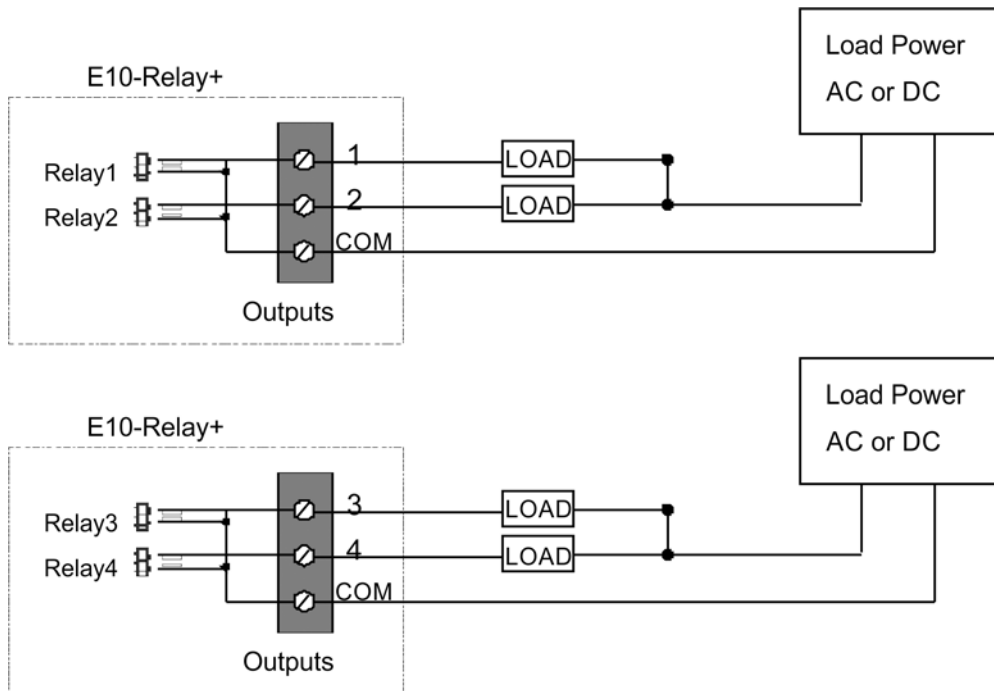


Figure 6 - Relay Output interfacing to load

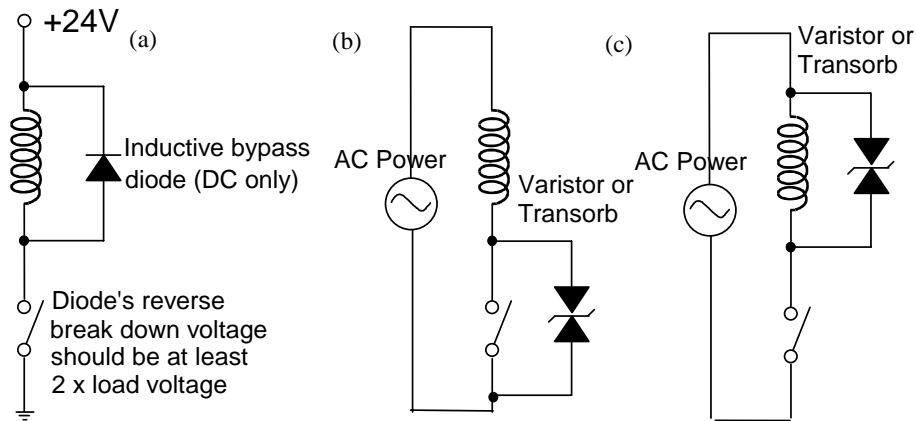


Figure 7 - (a) Inductive snubber circuit - DC load only.
 (b), (c) Inductive snubber circuit - AC/DC load.

Note: When switching inductive load, always ensure that either a varistor or bypass diode is connected to absorb inductive kick that occurs when the relay contact opens. If left unchecked, the inductive kick causes an electric arc to form across the contact, which will wear out the contact material and severely shorten the contact life of the relay.

6. Programming E10-Relay+ using WinTRiLOGI 3.5

When the WinTRiLOGI program is first started, you will be prompted to select the PLC model type. Please select "E10+" and click the OK button to enter into E10+ mode. The E10+ PLCs are subject to the following I/O limitations:

Inputs	8
Outputs	6
Internal Relays	8
Timers	4
Counters	4
Sequencer	1
Maximum Program Steps	216

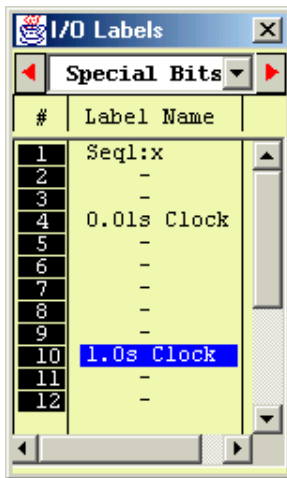
All timers and counters in the E10+ support the full range of set values from 0-9999, and the maximum program steps is 216 steps. The E10+ PLCs can be programmed by the WinTRiLOGI version 3.5x software which runs under Windows 95/98/ME/NT/2000, XP, Vista, 7, and 8.

As mentioned in the introduction, the E10-Relay+ PLC also features a built-in RS485 port that is automatically enabled when the Opto232 adapter is unplugged from the 10-pin PTA box header.

In addition, the E10+ PLCs supports only one sequencer, two clock pulses, and a limited number of special bits and special functions. To better differentiate program files created for the E10+ and the H-series, all files created in E10+ mode will be assigned the ".PE3" as the default file extension, whereas files created in H-series mode will be assigned the default extension ".PC3". The WinTRiLOGI program will also automatically use the corresponding default extension for the selected PLC mode when you attempt to open a file or create a new file.

The next few sections describe the special bits and special functions supported by the E10+ PLCs.

7. Special Bits Menu

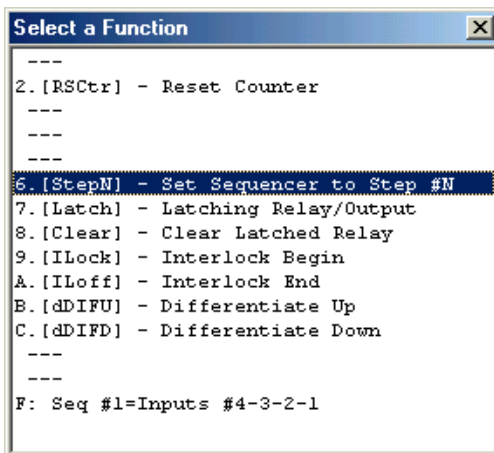


Unlike the H-series PLC which supports 8 sequencers, the E10+ PLC only supports 1 sequencer and two clock pulses.

When creating a contact and when you scroll to the special bits table, only the Seq1:X, the 0.01s clock pulse bit "Clk:.01s" and the 1 second clock pulse bit "Clk:1.0s" are available for selection.

The unavailable items are marked as "-" to indicate that the menu item is only available to the H-series PLC but not to the E10+.

8. Special Functions Menu



The Special Function menu will only show those special functions which are available to E10+ PLC. Those functions that are unavailable are replaced by the "--" symbol.

Note that a unique Special Function: "[LDHex]" is visible only when you are in the E10+ mode. This function can be used to set the present value of the Sequencer #1 to that of the hexadecimal or BCD value formed by Inputs #4, 3, 2 & #1.

a. Using Sequencer #1

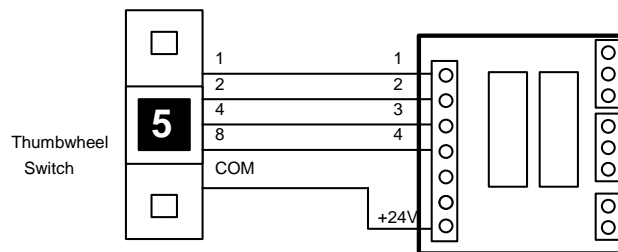
Since E10+ mode does not support [AVseq] & [Upctr] functions, you can use the normal down counter coil "------(Ctr)" to decrement the value of Counter #1, which is also used as the step counter of Sequencer #1.

Define Counter #1 with the name "Seq1", and you can initiate it to any step number between 0 and 31 using the [StepN] function. When you create the [StepN] special function, it will ask you to select the sequencer (only Seq1 available here) as well as the step number N to set it to.

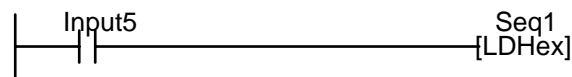
As the process progresses from one step to another, decrement the sequencer using the normal counter coil. As described in the TRiLOGI Programmer's Reference, each step of the sequencer such as "Seq1:5", "Seq1:29" can be used as a contact in the ladder diagram. When the sequencer reaches the final step (usually Step #0), use the [StepN] again to set it back to the initial value. A TRiLOGI sample program "Seqtest.PE3" which demonstrates the use of the sequencer can be found in your WinTRiLOGI installation folder.

b. [LDHex] Function

The [LDHex] function is an extremely convenient feature for applications that require external setting of timer/counter value using a thumbwheel switch. A thumbwheel switch typically has 10 or 16 positions and 4 binary outputs which are used to represent the position of the wheel. Connect the 4 outputs of the thumbwheel switch to the Inputs #4, #3, #2 and #1 of E10+ and the common output of the thumbwheel switch to (-) terminal of the E10+ power supply terminal, as shown in the following diagram:




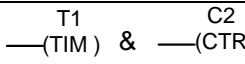
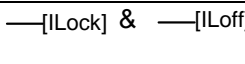
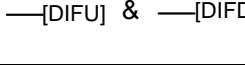
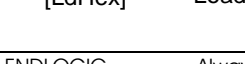
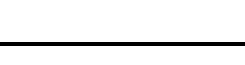
Note that Input #4 is the most significant bit and Input #1 the least significant bit. Next construct a ladder diagram using the [LDHex] function as follow:



When Input #5 is ON, the Counter #1's present value will be loaded with the hexadecimal/BCD number formed by Inputs #4,3,2 & 1. Since Counter #1 is also Sequencer #1, its step number can be used as a decoded signal for decision making purposes.

9. Program Step Size Calculation

For E10+ PLCs, the step sizes occupied by the contacts, coils and special functions are different from that of the H-series. Most program elements occupy only one program step, with the following exceptions occupying two steps each.

	Symbol	Step Size
1	 contacts for Sequencer#1 Step N	2
2	 Coil for Timers & Counters	2
3	 Interlock functions	2
4	 Differentiation functions	2
5	 "Load Seq1 with Hex number" function	2
6	 Always used at the end of each program	2

10. Host Link Commands

The E10-Relay+ PLCs support a full set of point-to-point and multi-point host link commands for communication with a host computer. You normally DO NOT need to know them in order to program the PLC.

Please refer to the "E10+ Host Link Command Reference Manual", which is "HostlinkE10.pdf" on your WinTRiLOGI CD-ROM, or download it from the following webpage:

<http://www.triplc.com/HostlinkE10.pdf>