

Figure 1 - E10-npn+ PLC Wiring Diagram

## 1. Introduction

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

This PLC features a jumper-selectable **RS232 / 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 a standard DB9 RS232 cable (and a USB to RS232 adapter if your PC does not have a 9-pin RS232 port), or via RS485 using an "U-485" or equivalent USB-to-RS485 converter.

## 2. Physical Mounting & Wiring

The E10-npn+ 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.

**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-npn+ controller requires a single +12V to +24V (+/- 10%) DC regulated supply connected to the upper-right screw terminal block as shown in Figures 1 and 2. Use only industrial grade switching or linear regulated power supply from established manufacturers for best results. Using a poorly-made power supply can give rise to some problems if the output voltage of the supply fluctuates widely when the load is turned ON/OFF. If the AC main is affected by nearby machines drawing large currents (such as large three-phase motors), use a surge-suppressor to prevent any unwanted noise voltage from being coupled into the T44H power supply.

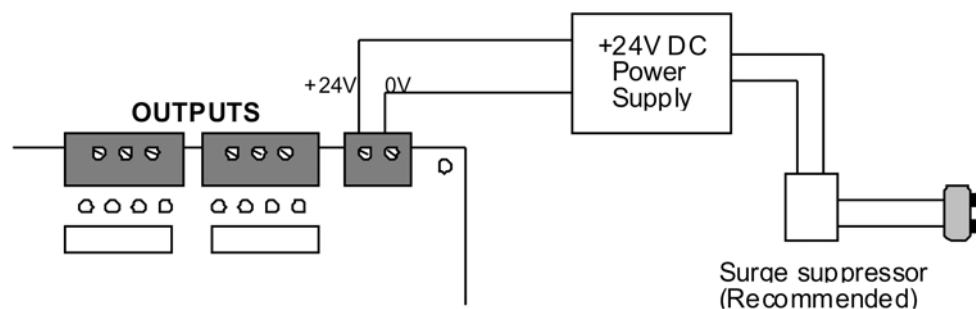


Figure 2 - E10-npn+ PLC Power Supply wiring

The E10-npn+ controller consumes less than 100mA of current when all its inputs/outputs are off, and each LED indicator on the input and output consumes only about 5mA. Thus the required current rating for the power supply depends mainly on the total average load current, taking into consideration the peak current demand and duty cycle of the operation. Normally, a 12-24V, 1-2A DC power supply is quite sufficient for most of the E10-npn+ applications.

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

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

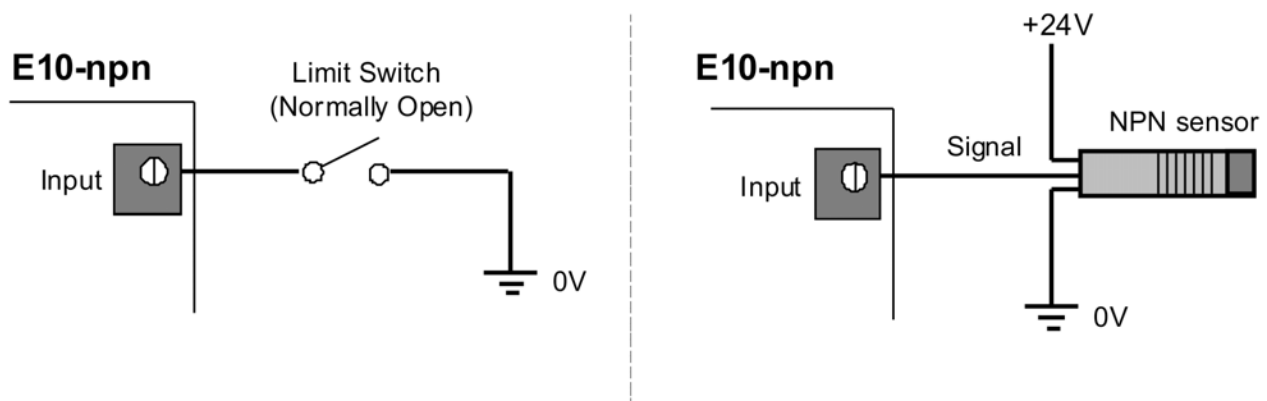


Figure 3 - E10-npn+ Input Wirings

All these inputs have green color LED indicators. All 6 inputs are grouped together into a single strip of permanent screw. The input numbers are marked on their screw terminals.

## 5. Output Circuits

Each E10-npn+ PLC features 4 digital outputs that use “sinking” (NPN) type power transistors that turn ON by sinking current from the load to the 0V terminal. All outputs have red colored LED indicators and are grouped together into a single strip of detachable screw terminal. Figure 4 shows the wiring diagram of the digital outputs.

Transistor Output Electrical Specifications:

	Output #1 to 4
Output Driver type	NPN Darlington Transistors
Maximum Breakdown Voltage	50V
Maximum Output Current:	1A (pulse)
Continuous Output Current	350mA
Output Voltage when OFF	Resistor pulled up to 24V power rail
Output Voltage when ON:	0.7V @1A
Inductive Back EMF Bypass	Yes (Built-in diode)

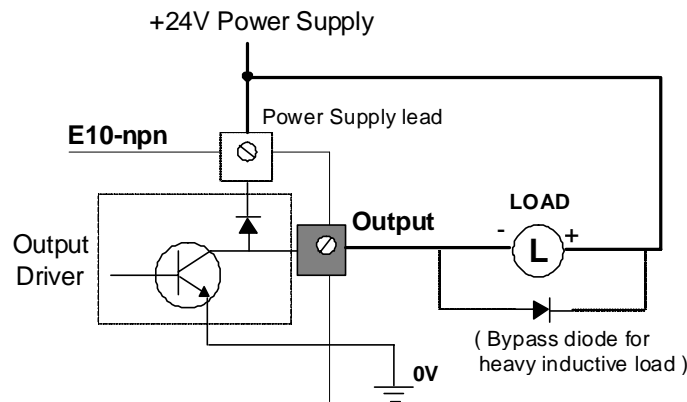


Figure 4 - Relay Output interfacing to load

When switching inductive loads such as a solenoid or a motor, always ensure that a bypass diode is connected to absorb inductive kicks, which will occur whenever the output driver is turned OFF. Although all the PLC digital outputs already incorporate either internal diodes or intrinsic Zener bypass diodes to protect the driver, some may only activate when the inductive kick voltage rises well above 50V DC. This can result in a large dose of noise being introduced into the system and may have undesirable effects. We recommend using a fast recovery diode such as UF4001 to UF4007 connected as shown in the following diagram to absorb the inductive noise:

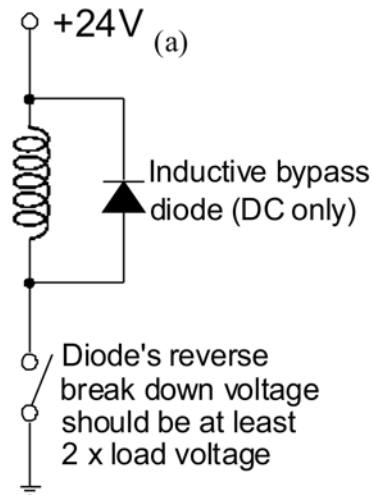


Figure 5 - (a) Inductive snubber circuit

## 6. Programming E10-npn+ 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.

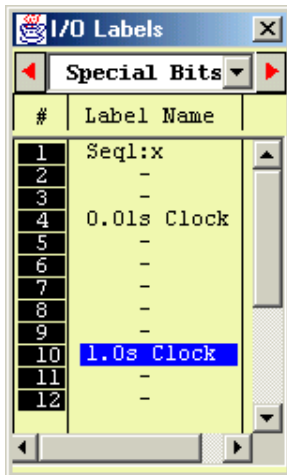
As mentioned in the introduction, the E10-npn+ PLC also features a jumper-selectable **RS232 / RS485** port and supports a full set of host link commands compatible with those used on the H-series or any Super PLC (FMD, Nano-10, and F-series PLCs).

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

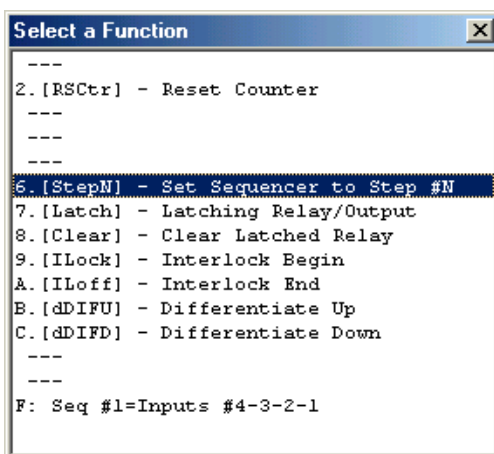


Unlike the H-series PLC which supports 8 sequencers, the E10+ PLC only supports 1 sequencer and two clock pulses.

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

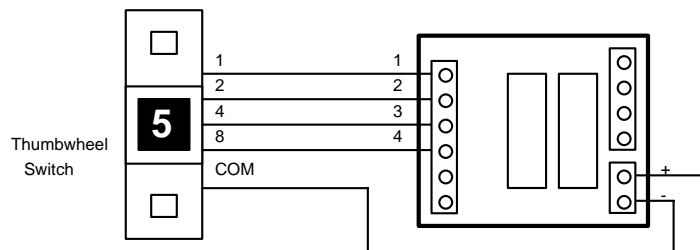
Since E10+ mode does not support [AVseq] & [Upctr] functions, you can use the normal down counter coil "-----[Ctr]" to decrement the value of Counter #1, which is also used as the step counter of Sequencer #1.

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.

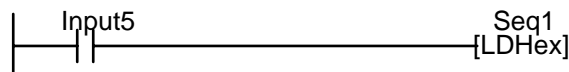
As the process progresses from one step to another, decrement the sequencer using the normal counter coil. As described in the TRiLOGI Programmer's Reference, each step of the sequencer such as "Seq1:5", "Seq1:29" can be used as a contact in the ladder diagram. When the sequencer reaches the final step (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:




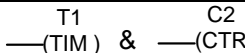
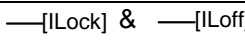
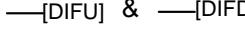
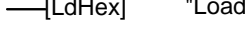
Note that Input #4 is the most significant bit and Input #1 the least significant bit. Next construct a ladder diagram using the [LDHex] function as follow:



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	ENDLOGIC - Always used at the end of each program	2

## 10. Host Link Commands

The E10-npn+ 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>