Programmable Logic Controllers

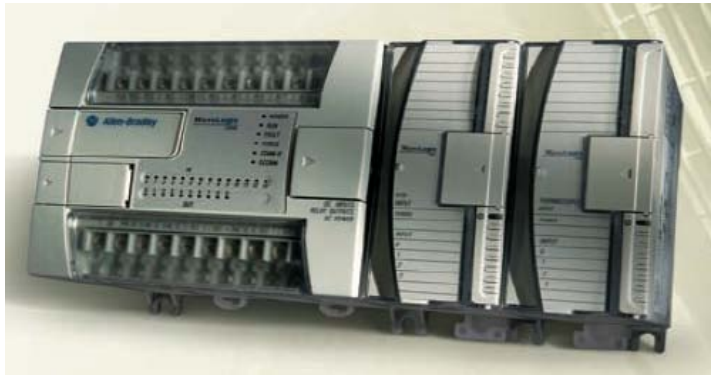
Lab 2

PLC Hardware

PLC Hardware Lab

Micrologix 1000

Micrologix 1100



Micrologix 1200

Micrologix 1500

PLC Hardware Lab

Allen-Bradley

System Overview

MicroLogix™ 1500 Programmable Controller with Compact™ I/O for Expansion

(Bulletins 1764 and 1769)

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Micrologix 1500 with Data Access Tool and 3 extended I/O modules

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Processor Units

The processor units are the "brains" of the system. They provide the logic processing and the interface to the DAT, real-time clock and memory modules, trim potentiometers, mode switch, and (using the 1764-LRP processor) an electrically isolated RS-232 port (channel 1). The two processor units currently available are described below.

1764-LSP Processor

- The 1764-LSP processor provides you with large memory size (greater than 7K user program capacity) to solve a variety of applications. Configurable user data allows data elements to be selected according to the individual application requirements. 100% retentative data ensures data integrity even during power loss.
- Communications are extremely flexible with support for a variety of protocols including DF1 Full-Duplex and Half-Duplex Slave, DH-485, Modbus RTU Slave and ASCII. The RS-232 port on the base unit allows for direct connection of programming and operator interface devices, remote programming, peer-to-peer communications, and SCADA/RTU networking. Modbus RTU Slave allows for easy integration with existing SCADA/RTU installation utilizing Modbus protocol.

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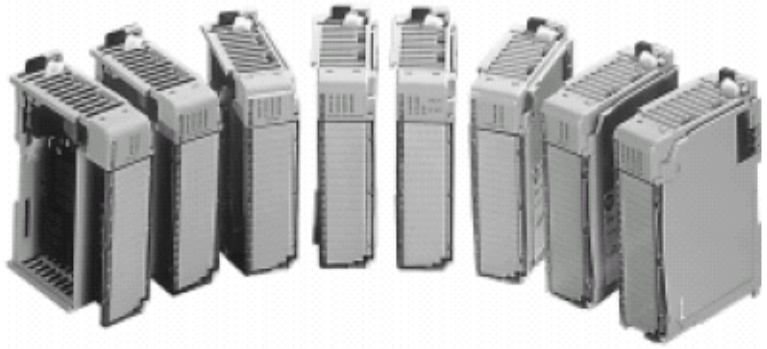
Expansion I/O Modules

High-density Bulletin 1769 Compact I/O rackless expansion modules offer superior functionality and high value at a competitive price. With a variety of modules, they complement and extend the capabilities of the MicroLogix 1500 controller by maximizing flexibility of the I/O count and type. (Up to eight expansion Compact I/O modules can be connected to a MicroLogix 1500 controller dependent on power requirements.) Compact I/O provides an excellent platform for future enhancements, so you can easily choose the level of control as your application needs grow.

Compact I/O's analog modules provide 14-bit plus sign maximum resolution, making them an excellent choice in applications where the need to detect small changes is vital.

Similarly, Compact I/O analog modules can be used in applications where accuracy is crucial. The modules share a high accuracy rating of ±0.35% of full-scale accuracy in the current mode. In the voltage mode, the 1769-IF4 provides ±0.2 and the 1769-OF2 ±0.5% of full-scale accuracy at 25°C.



Features

- Modular system, modules to suit the application
- Feature-rich I/O to address a wide range of applications
- Rackless design, reduces system components
- Small footprint, shrinks panel space requirements
- Front insertion and removal, reducing assembly and replacement time
- Unique tongue-and-groove interlocking case design, ensures a strong, mechanical connection between modules
- Software keying, prevents incorrect module placement within a system
- Discrete, analog and relay output modules

Currently available modules include:

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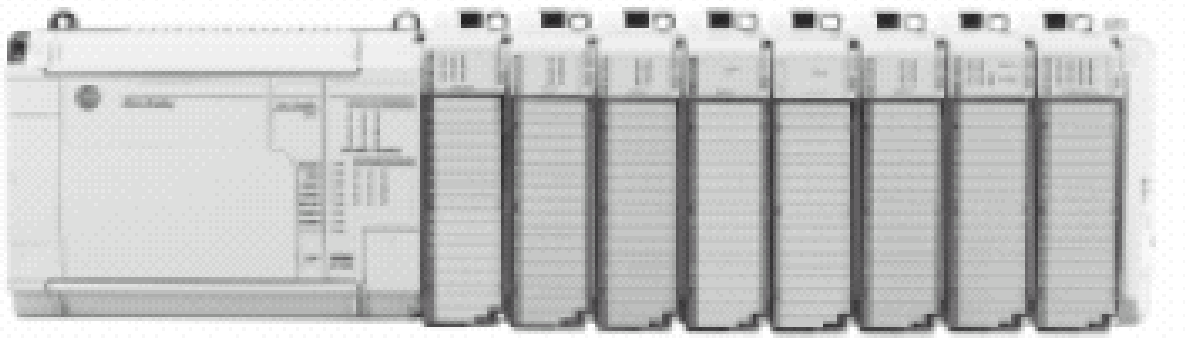

Micrologix 1500 with expansion I/O Modules

Modules can be placed in any order

<u>Typical Modules:</u>

24VDC or 120 VAC Input Modules
24 VDC or 120 VAC Output Modules
Relay Output module for any voltage up to 120VAC
Analog Input s and Analog Output sModules
DeviceNet scanner (must be in slot 1)

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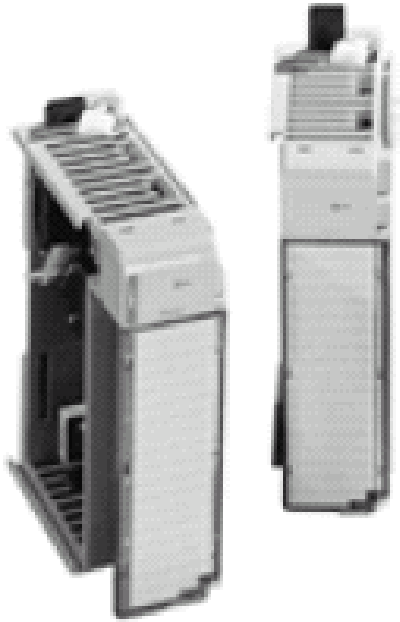
Analog I/O Modules

Compact I/O offers two analog I/O choices:

- 1769-IF4 - 4-channel current or voltage input
- 1769-OF2 - 2-channel current or voltage output

Each channel on both the 1769-IF4 and 1769-OF2 modules has the ability to be individually configured for either current (4 to 20 mA or 0 to 20 mA) or voltage (±10V dc, 0 to 10V dc, 0 to 5V dc or 1 to 5V dc) input/output. This provides application flexibility, reduces stock inventory and lessens the learning curve.



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Data Access Tool (1764-DAT)

- Direct access to 48 bit elements
- Direct access to 48 integer elements
- Two function keys
- Display of controller faults
- Removal/Insertion under power

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Memory and Real-Time Clock Modules (1764-MM1, -MM2, -MM1RTC, -MM2RTC, 1764-RTC)

- Availability allows for time/date scheduling applications to be easily solved.
- Memory backup and real-time clock/memory module
- User Program and Data Back-up
- Program Compare
- Data File Protection
- Memory Module Write Protection
- Removal/Insertion Under Power

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Micrologix 1500 Features:

- Three base options, including a choice of electrical configurations featuring: 120V ac or 24V dc inputs
- Relay and high-speed MOSFET outputs
- 120-240V ac or 24V dc power
- Expandable to over 512 points of I/O
- Broad application coverage through embedded I/O and up to 16 Compact I/O modules
- Typical scan time is less than 1 millisecond per 1K of user program
- Terminal blocks are finger-safe, removable NEMA-style blocks
- Broad application coverage through embedded I/O and up to 16 Compact I/O modules

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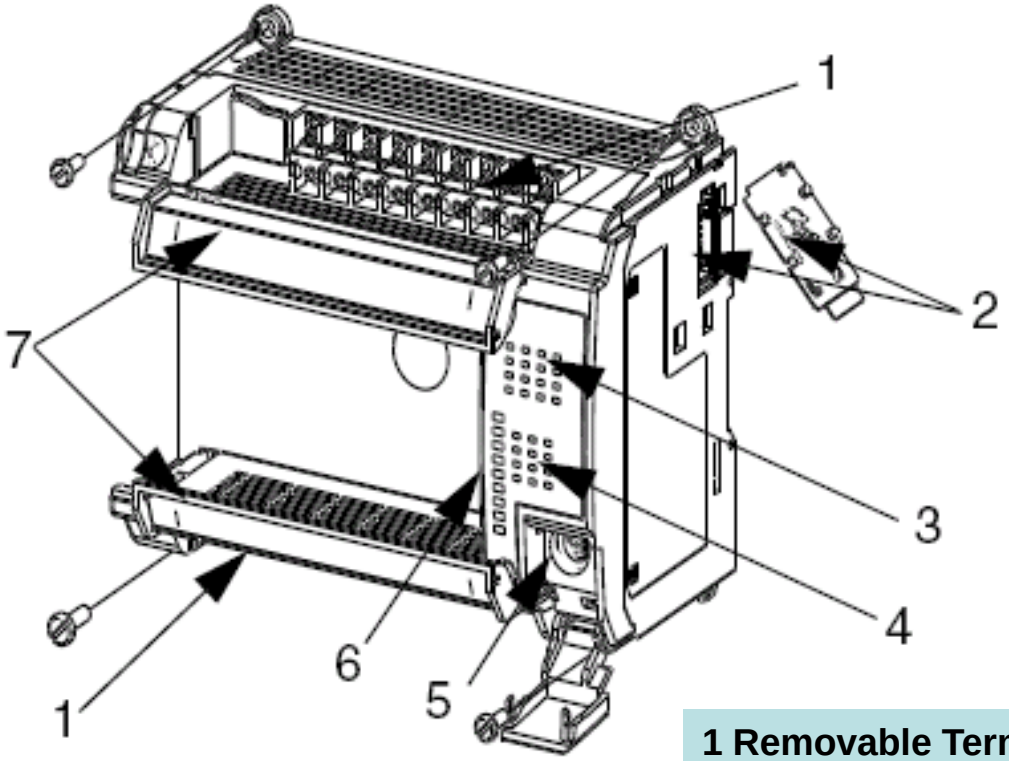

Micrologic 1500
Base Unit

“The Brick”

1 Removable Terminal Blocks
2 Interface to Expansion I/O, Removable ESD Sticker
3 Input LEDs
4 Output LEDs
5 RS-232 Communication Port (CH0)
6 Status LEDs
7 Terminal Doors and Label

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PLC Concept of I/O Control

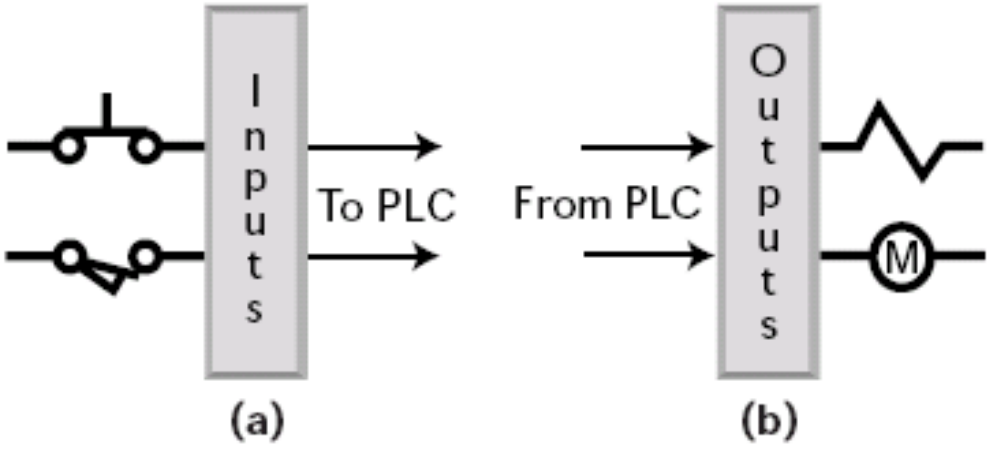

Figure 1-3. **(a)** A PLC's input interface interprets the data from the input devices and then sends it to the CPU. **(b)** A PLC's output interface interprets the data from the CPU and sends it to the output devices.

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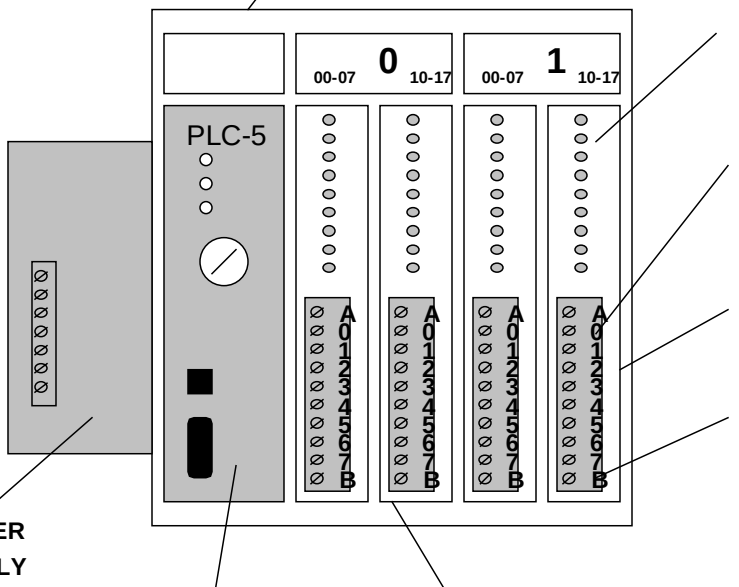
4 Characteristics of PLC Interfacing (Wiring)



INDICATION

LEDS OR LIGHTS

TERMINATION

TERMINALS FOR EASH CONNECTION

ISOLATION

OPTO-ISOLATORS

SIGNAL CONDITIONING

FIELD WIRING VOLTAGE
(5 AND 12 VDC IN COMPUTERS)

PLC PROCESSOR

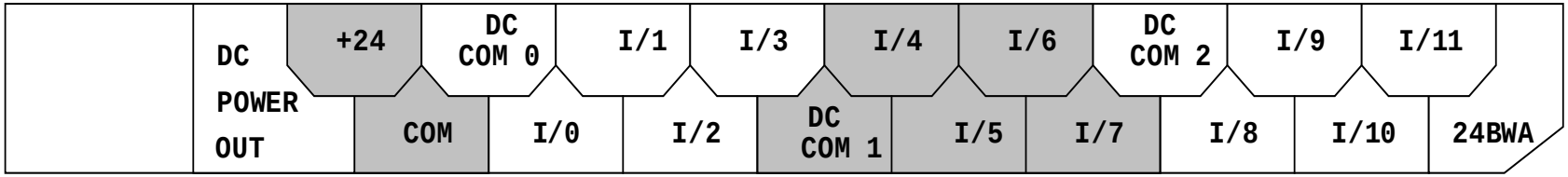
CPU, RAM, ROM, ETC

I/O MODULES

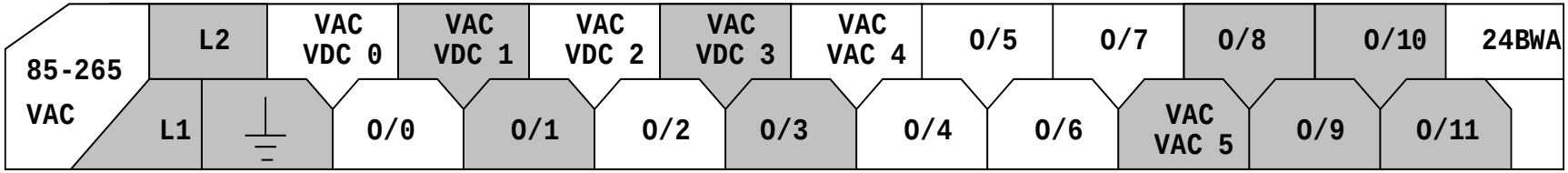
8, 16, OR 32 DIGITAL , 24VDC, 24VAC, 120VAC
ANALOG INPUT & OUTPUT MODULES
THERMOCOUPLE MODULES
BAR CODE READERS
STEPPER MOTOR MODULES
SERVO MODULE

PLC Hardware Lab

Micrologix 1500 Terminal Blocks on the “Brick”

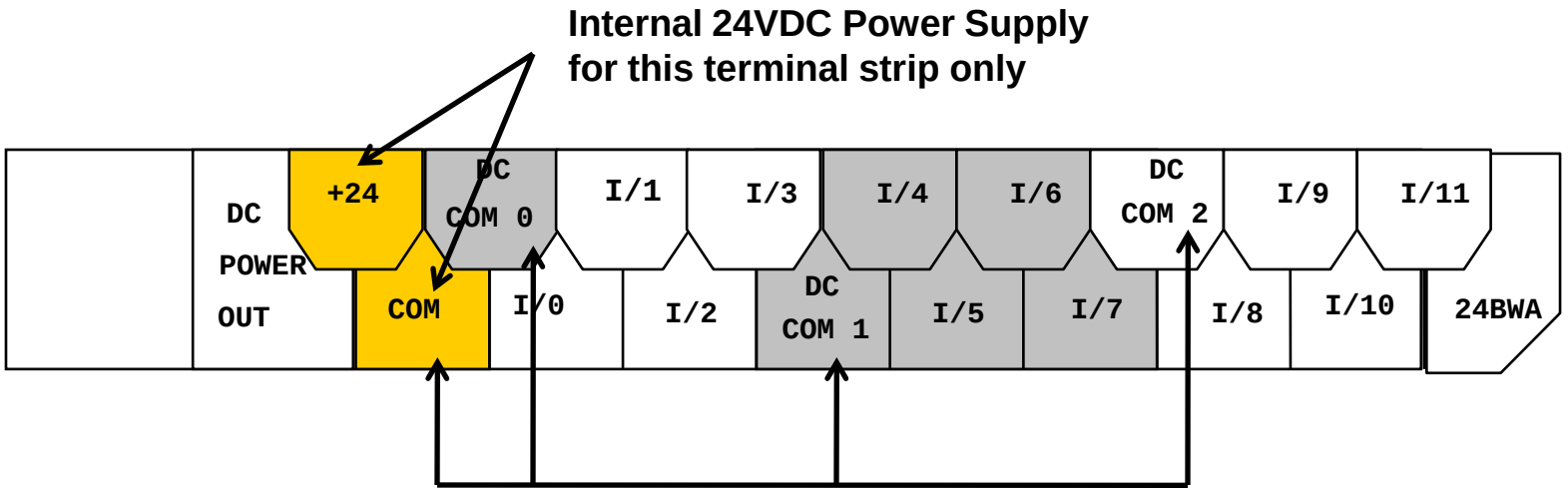


1764-24BWA LSP SERIES C



PLC Hardware Lab

Micrologic 1500
Input terminal strip on the “Brick”



Inputs are in groups so different supply voltages may be used. Example DC Com 0 is for Inputs 0, 1,2,& 3. It you are to use the 24VDC internal supply for all inputs, all common grounds must be connected as shown.

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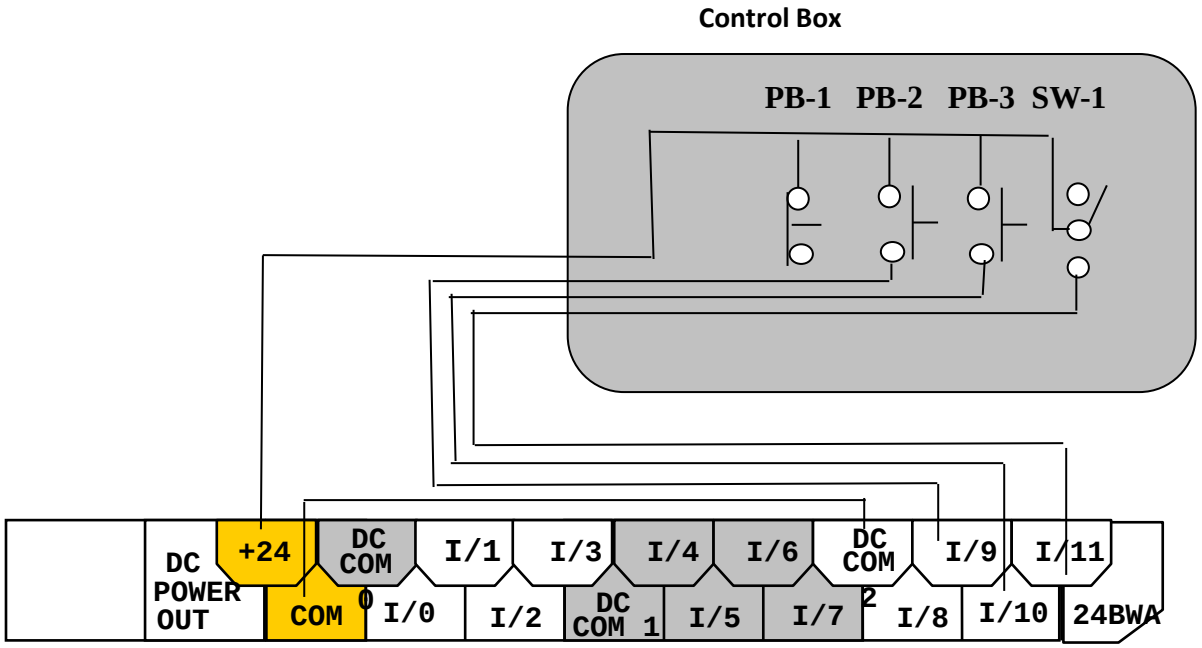
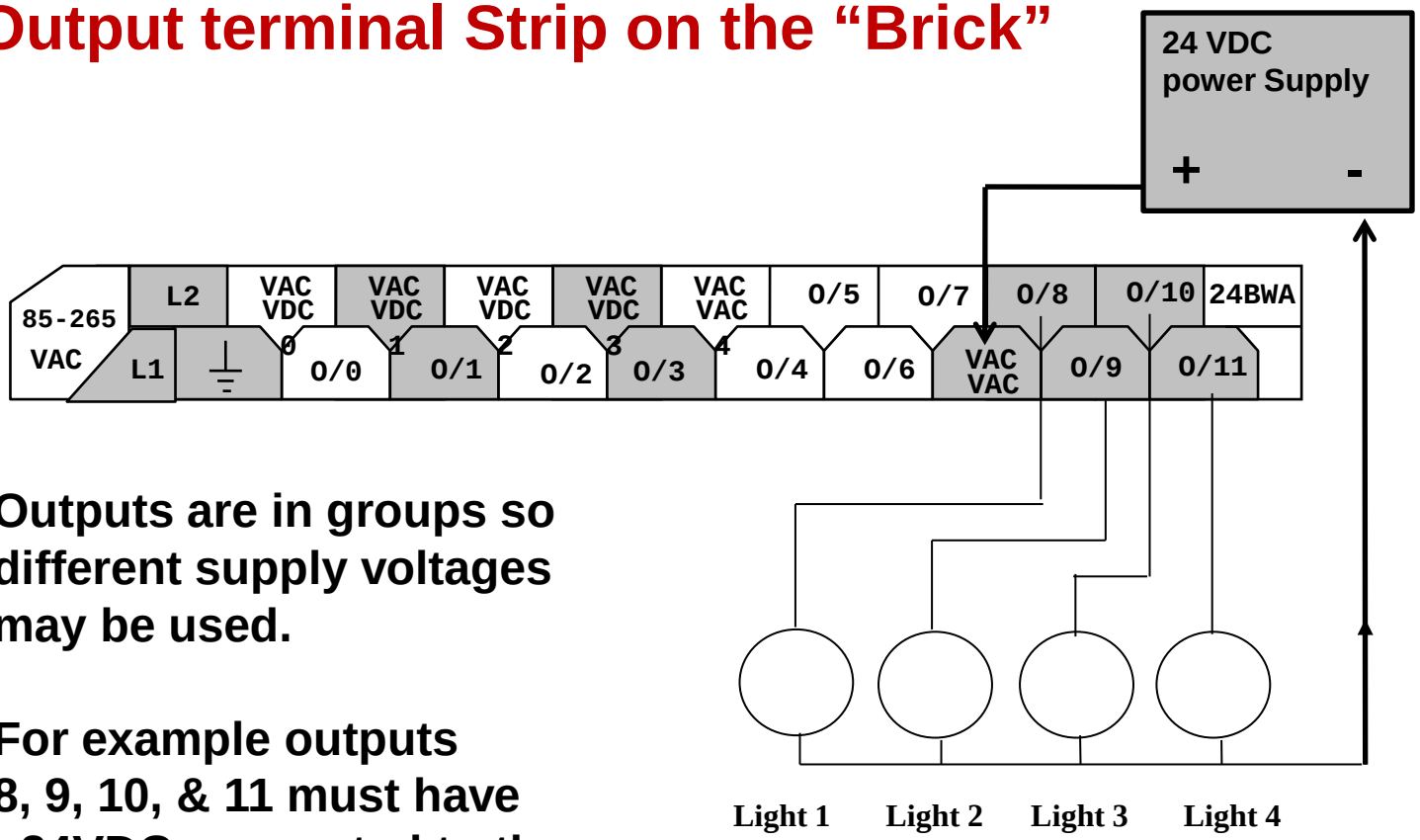
Switches wired to the PLC “Brick” input terminals



Notice PB-1 is not wired. Since this is a normally closed button. Inputs to PLCs should be wired to normally open devices.

PLC Hardware Lab

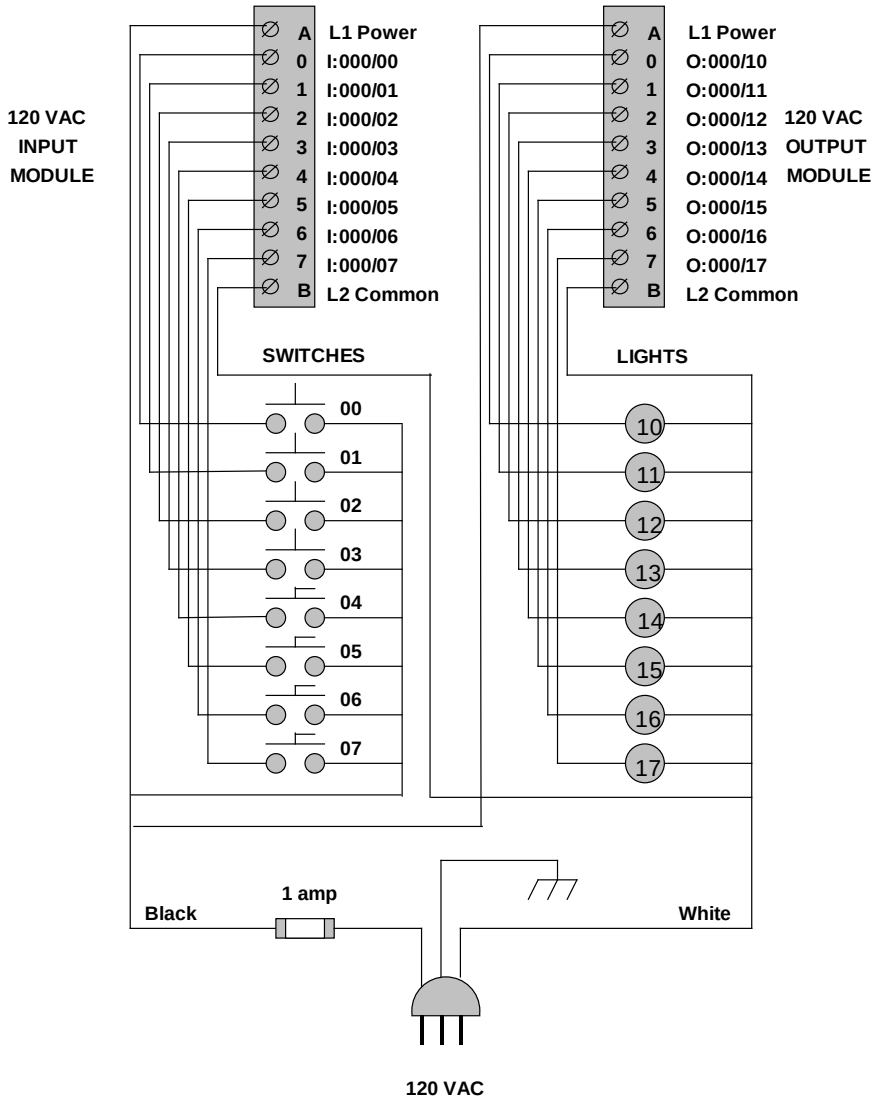
Micrologic 1500
Output terminal Strip on the “Brick”



Outputs are in groups so different supply voltages may be used.

For example outputs 8, 9, 10, & 11 must have +24VDC connected to the group as shown.

PLC Hardware Lab



Typical PLC Control Panel

Using 120 VAC

4 Pushbuttons
4 Switches
8 Lights

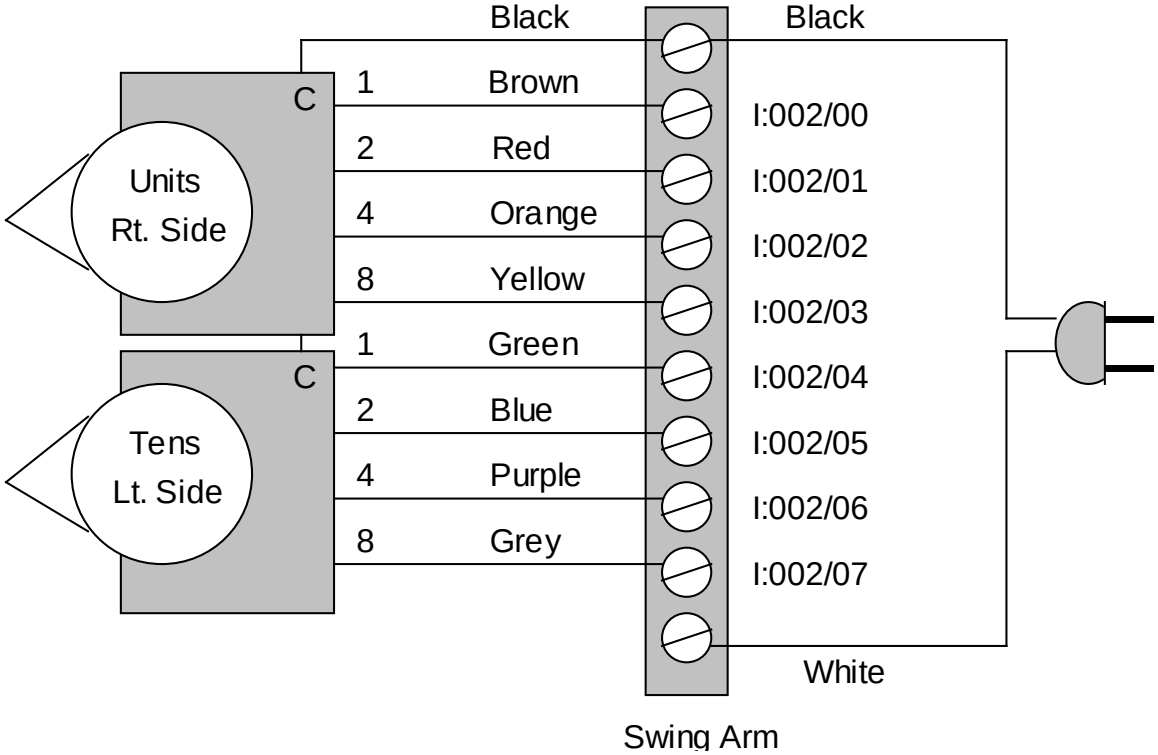
All programmable

Most panels today are 24VDC for safety

PLC Hardware Lab

Thumbwheel Switches

for operator data input



Two Units:

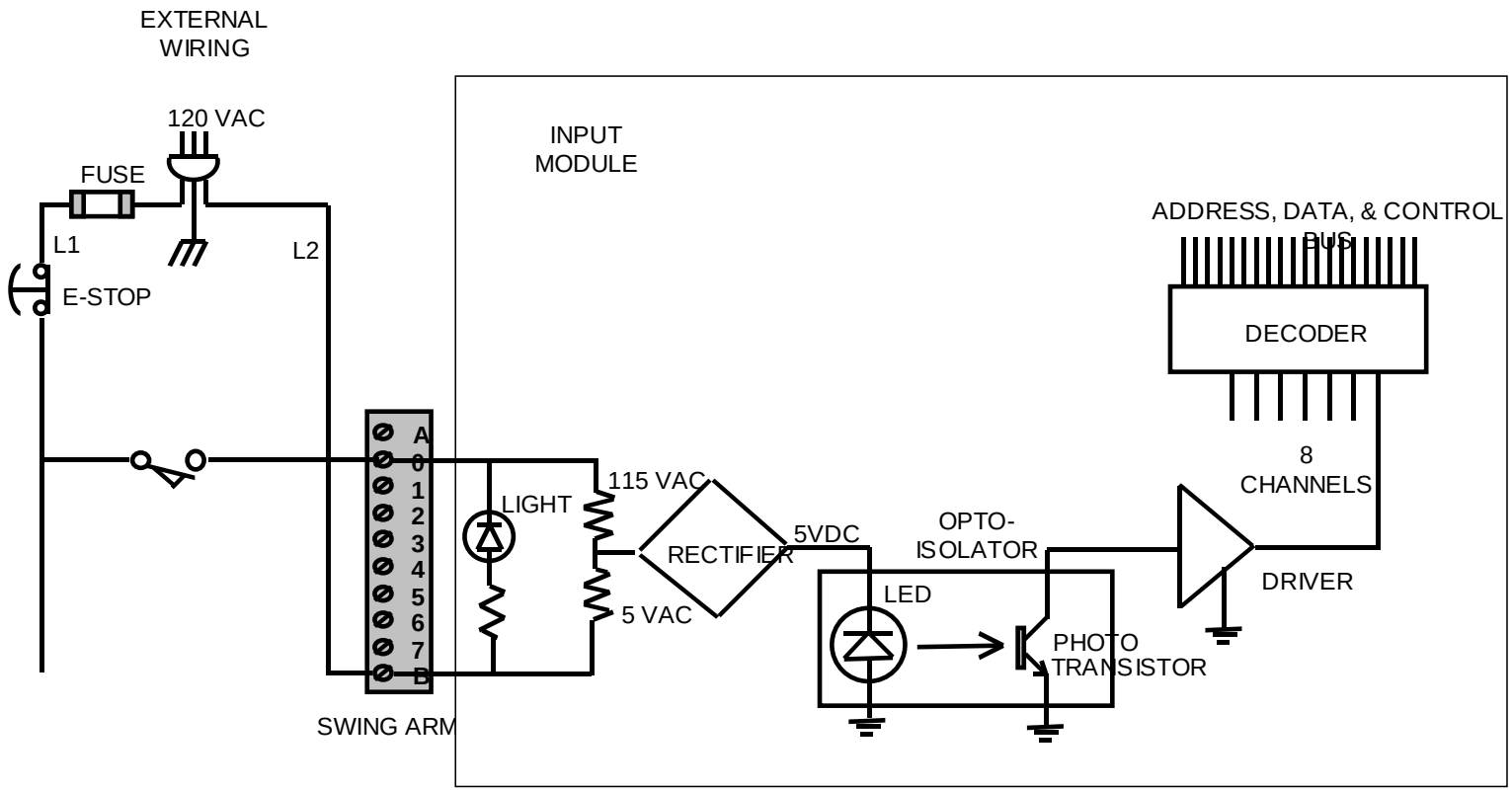
Enter numbers 0-99

Inputs data in BCD Format

PLC Hardware Lab

Input Module: 120VAC Inputs

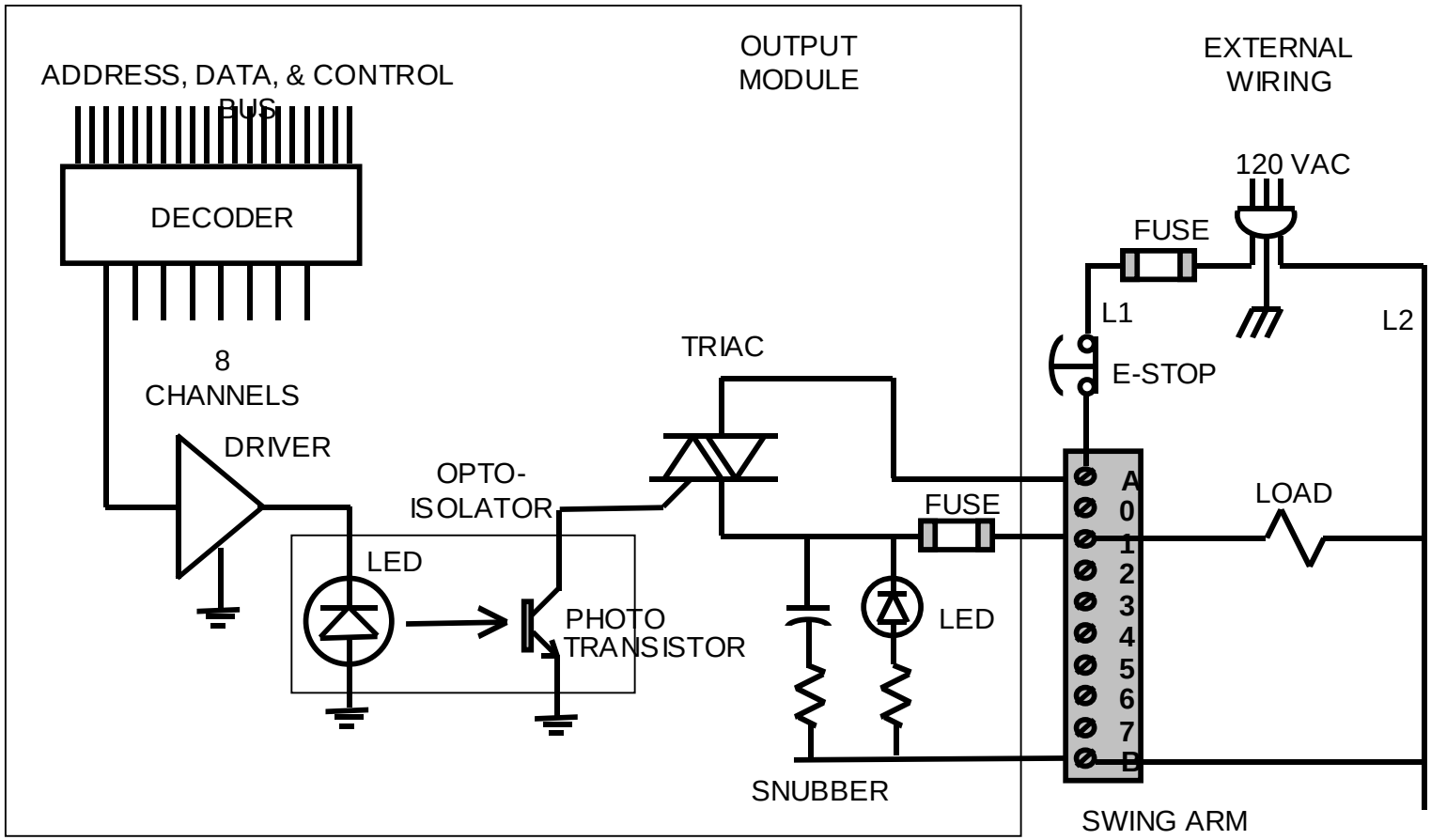
Provides: indication, Termination, Signal Conditioning, & Isolation



PLC Hardware Lab

Output Module: 120VAC Outputs

Provides: indication, Termination, Signal Conditioning, & Isolation



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Picture on inside 24VDC output module

Show arrows point to all the parts.

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Rules for PLC wiring:

1. **Only one output device to one output terminal**
2. **Outputs can output only 1 amp.** ***Use a relay to control more current***
3. **Inputs are common to +24 VDC**
4. **Outputs are common to ground**
5. **Inputs are wired to normally open devices.**
6. **Wire only one input to each input terminal**
7. **Input and output voltage must match the I/O module**
8. **Some input devices such as proxs require a pull up resistor**

PLC Hardware Lab

Wiring Methods and Standards

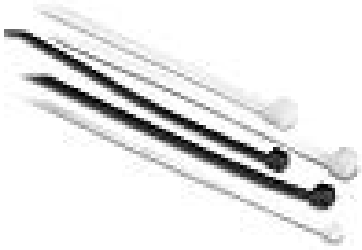
http://ecmweb.com/mag/electric_wiring_methods_industrial/

Wire Marker Tape

Wire Marker Labeler

Spade Lugs

DIN Terminal Blocks



Cable &Wire Ties

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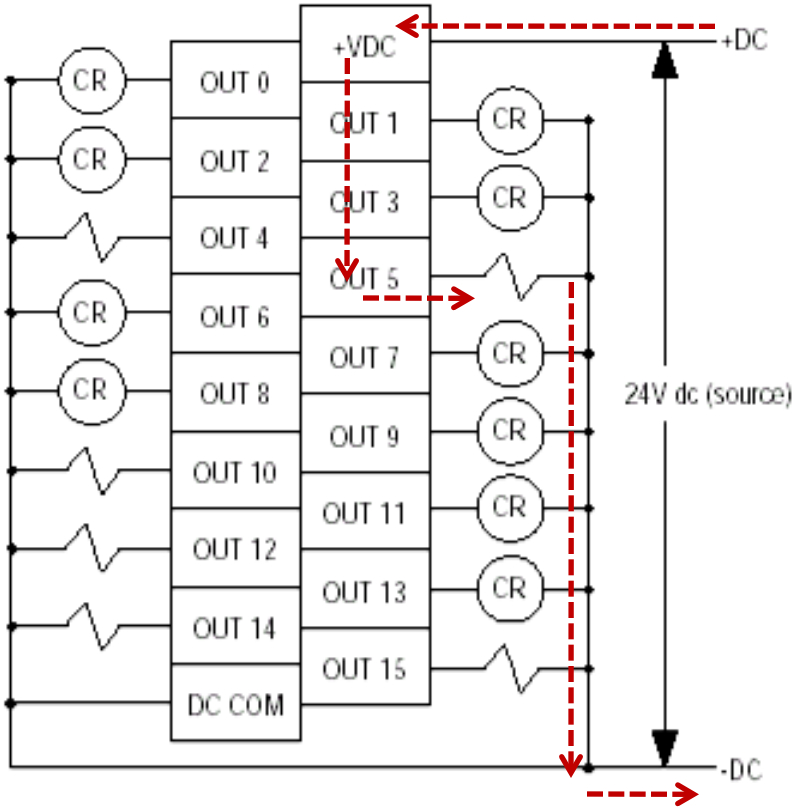
Source Output

Allen-Bradley 24VDC OutputModule1769-OB16



+ 24VDC SOURCE is supplied to the power terminal

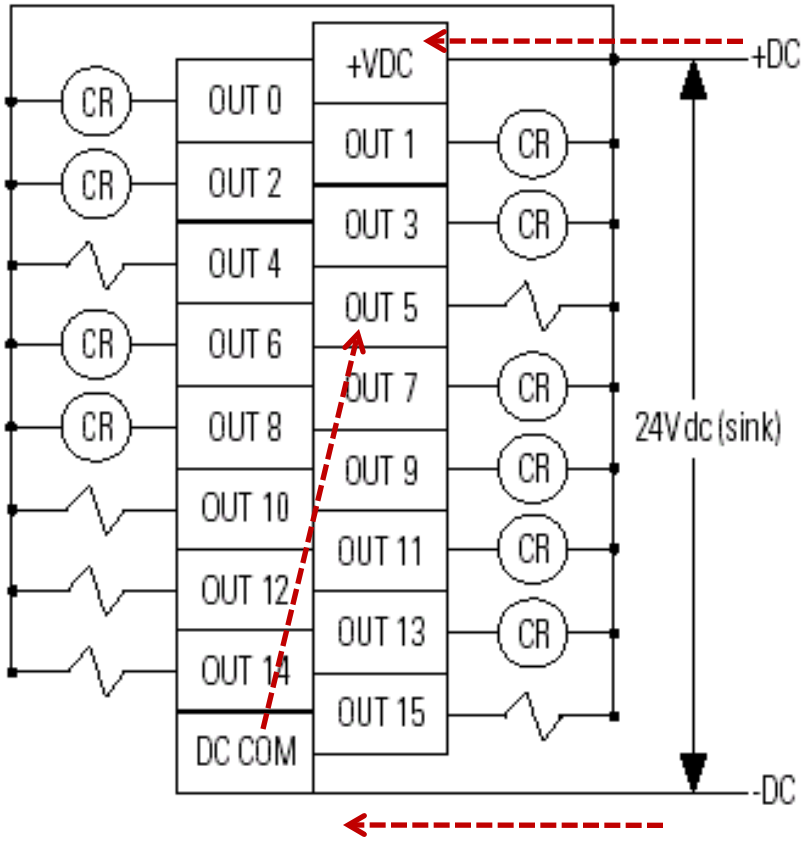
All outputs are grounded

Output Terminals are LOW until the PLC program switches the +24VDC to the output

PLC Hardware Lab

Sink Output

Allen-Bradley 24VDC Output Module 1769-OV16



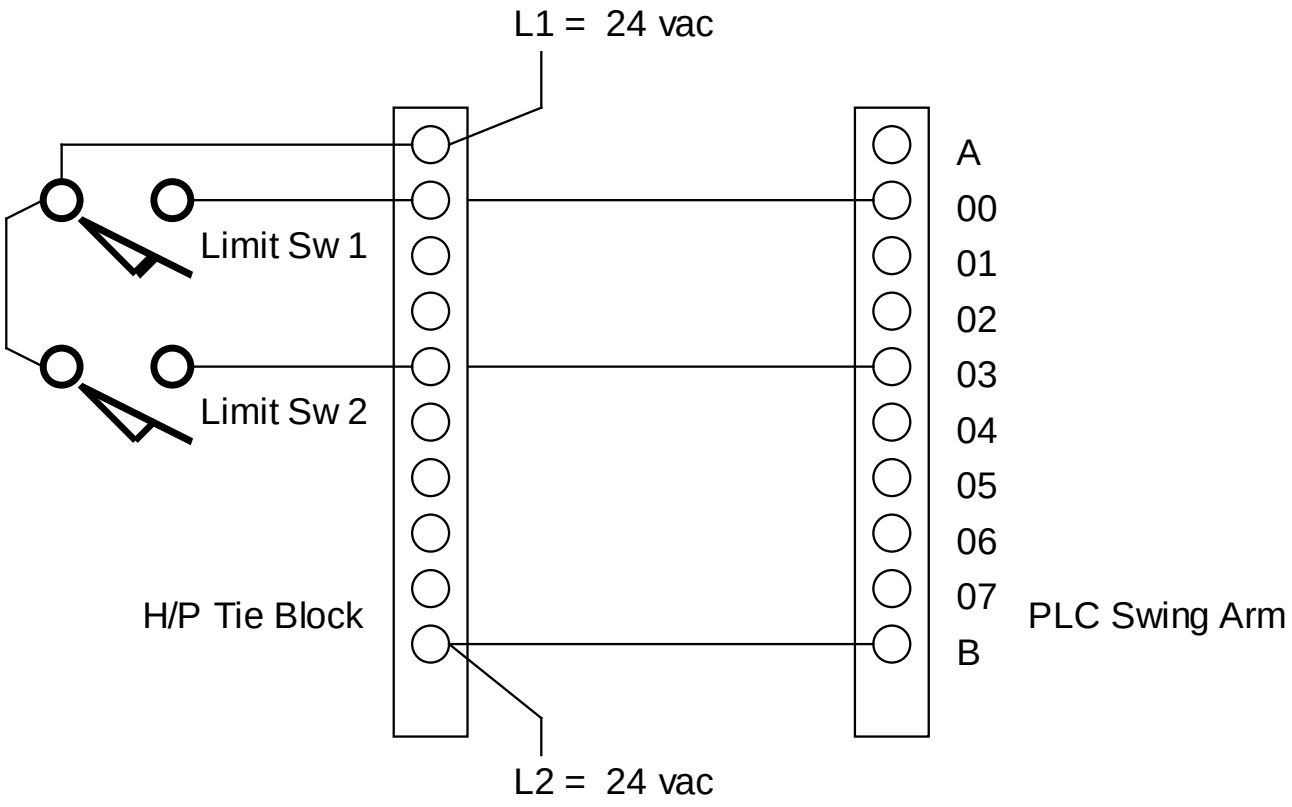
+ 24VDC SOURCE is supplied to the power terminal

All outputs are wired to the +24vdc, not ground

Output Terminals are HIGH until the PLC program switches and grounds the output. (sinks to ground)

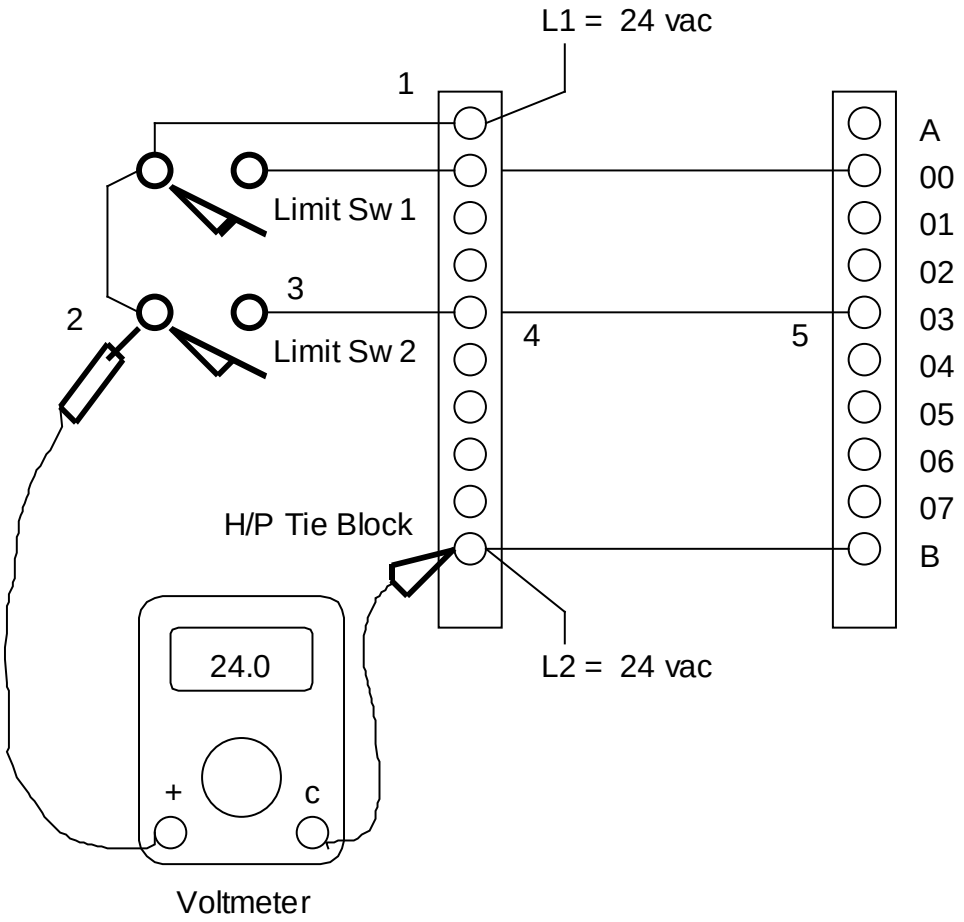
PLC Hardware Lab

TESTING INPUTS: No program is needed.
Activate switch and the LED on the input module will light indicating connection



PLC Hardware Lab

TESTING INPUTS

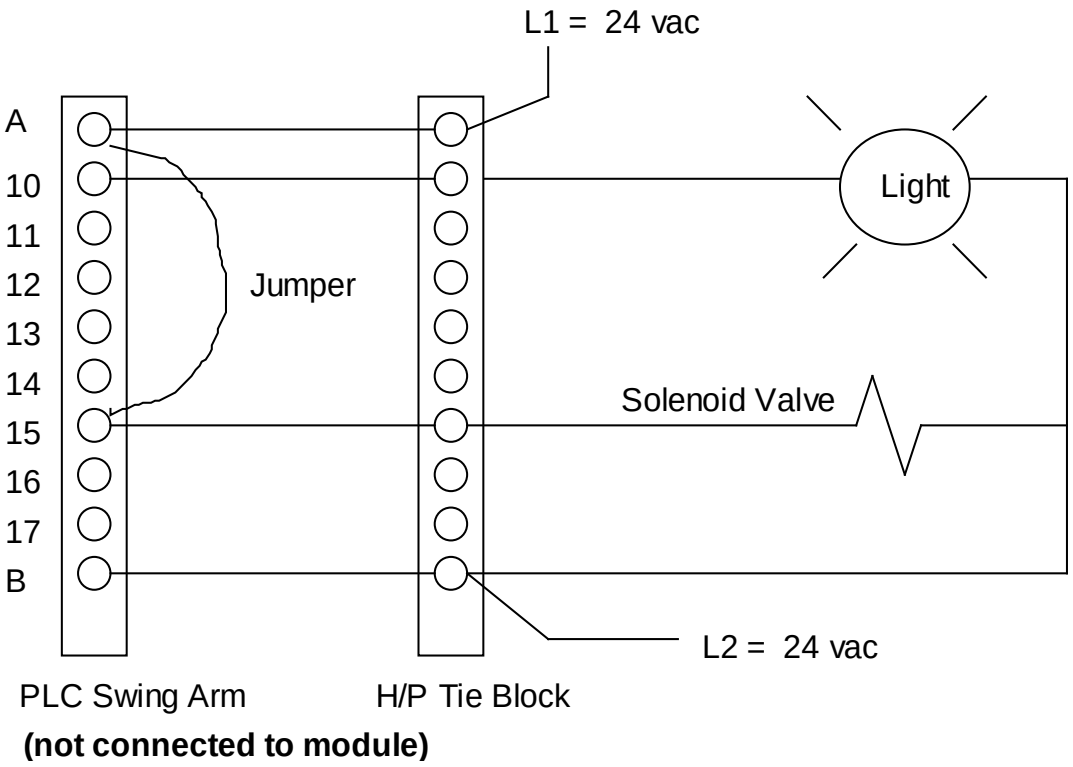


To check wiring, use a voltmeter and check for power to the switch or input device. Manually activate the switch and trace voltage to the PLC terminal checking for breaks or bad conection.

PLC Hardware Lab

TESTING OUTPUTS:

No program is needed for this test.

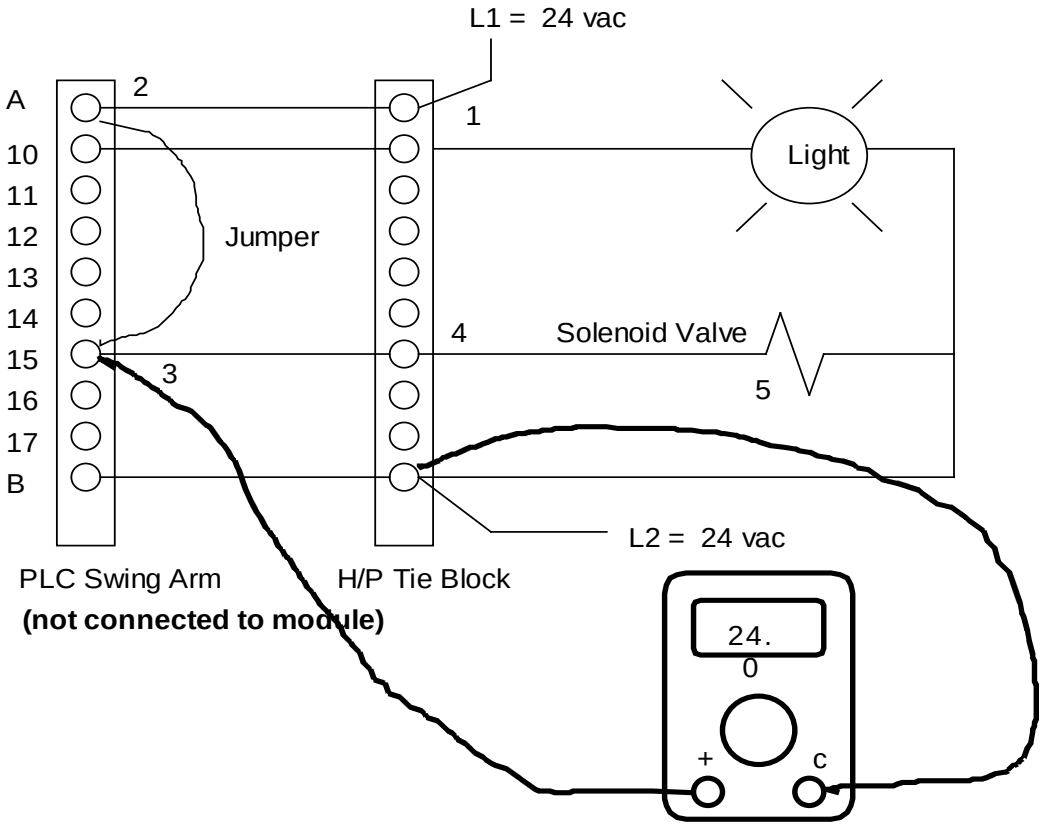


To check the output wiring, place a temporary jumper from the power terminal to the PLC output terminal. CAUTION: the output will be energized at once if the wiring is good.

PLC Hardware Lab

TESTING OUTPUTS:

No program is needed for this test.

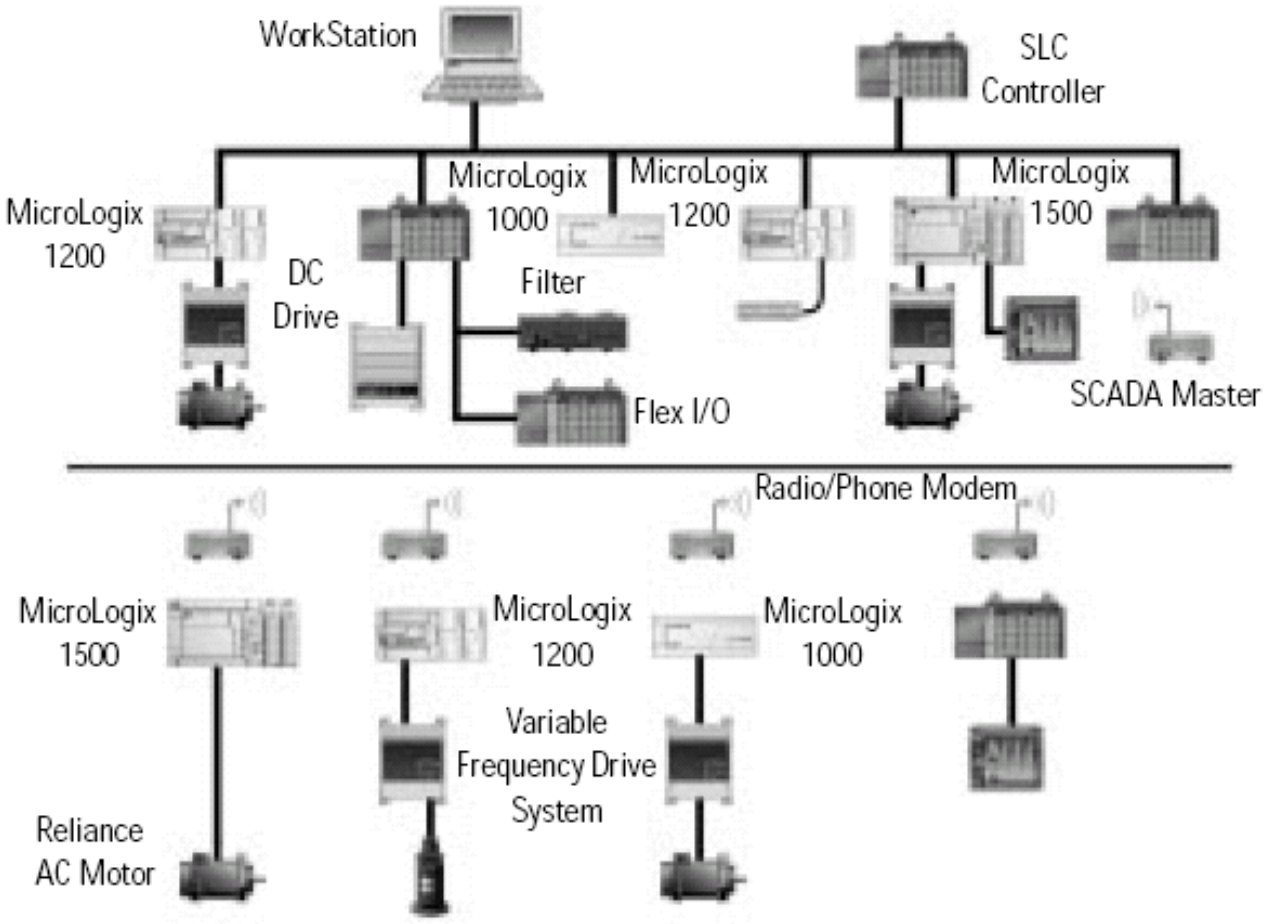


If the jumper does not turn on the power, use a voltmeter to trace the lose of power to the output device.

Connect the ground lead of the meter to ground then use the + probe to trace voltage to the device.

PLC Hardware Lab

Networking PLCs, Drives, SCADA, Modems, etc



3 types of networks

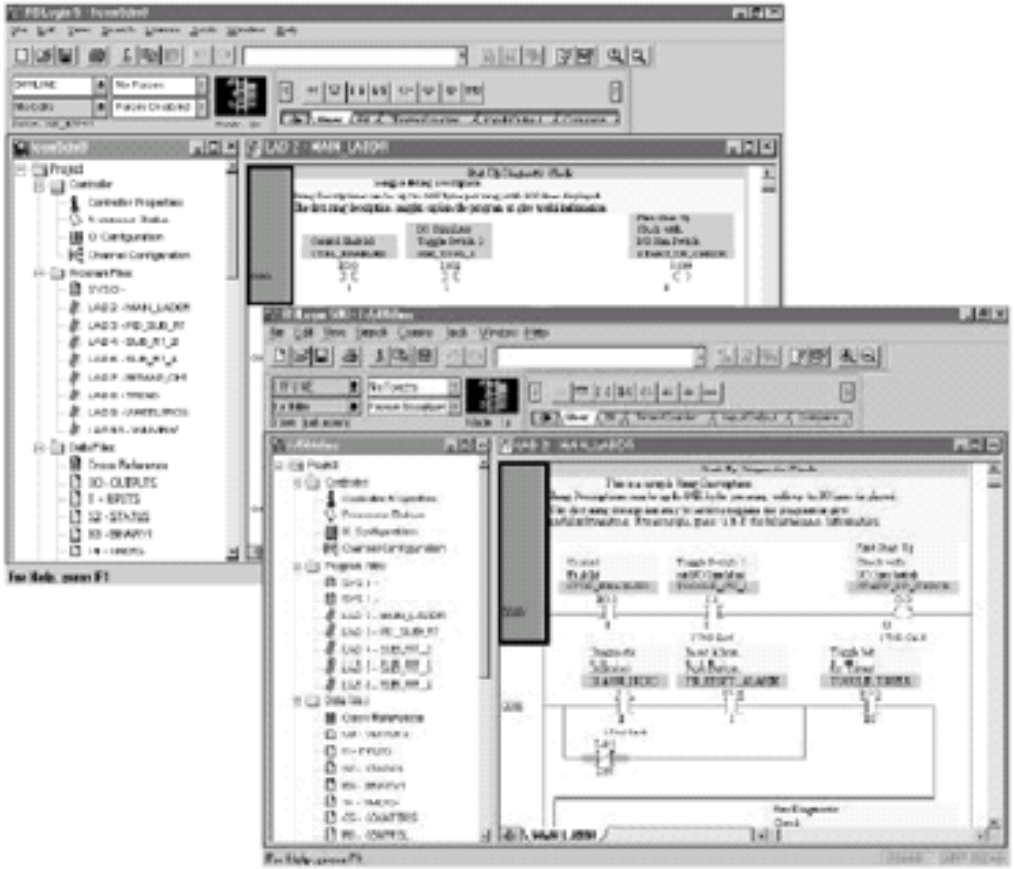
EtherNet

DeviceNet

ControlNet

PLC Hardware Lab

RSLOGIX500 Programming Software



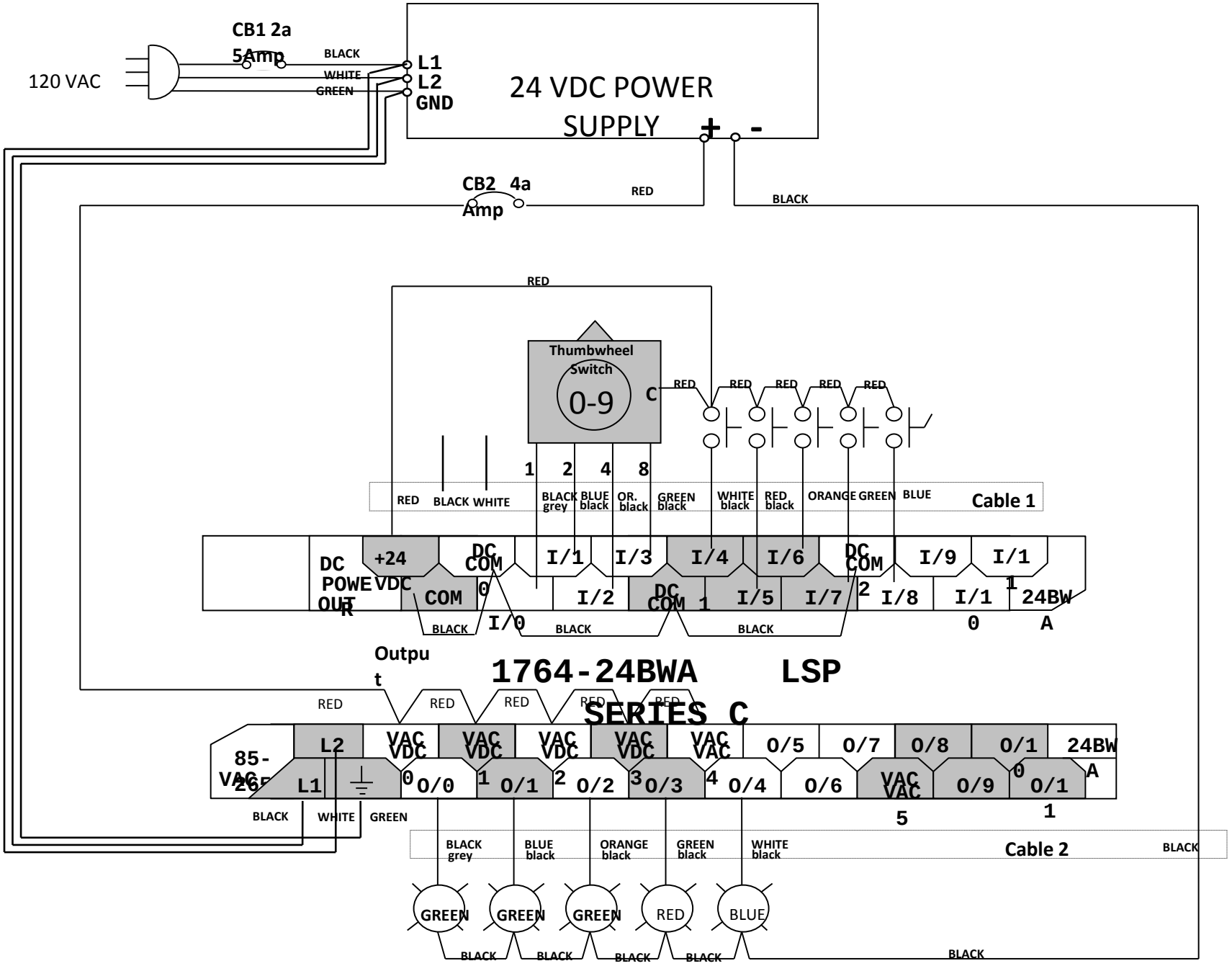
Graphical Programming Language

Called:

“Ladder Logic”
or
“Relay Logic”

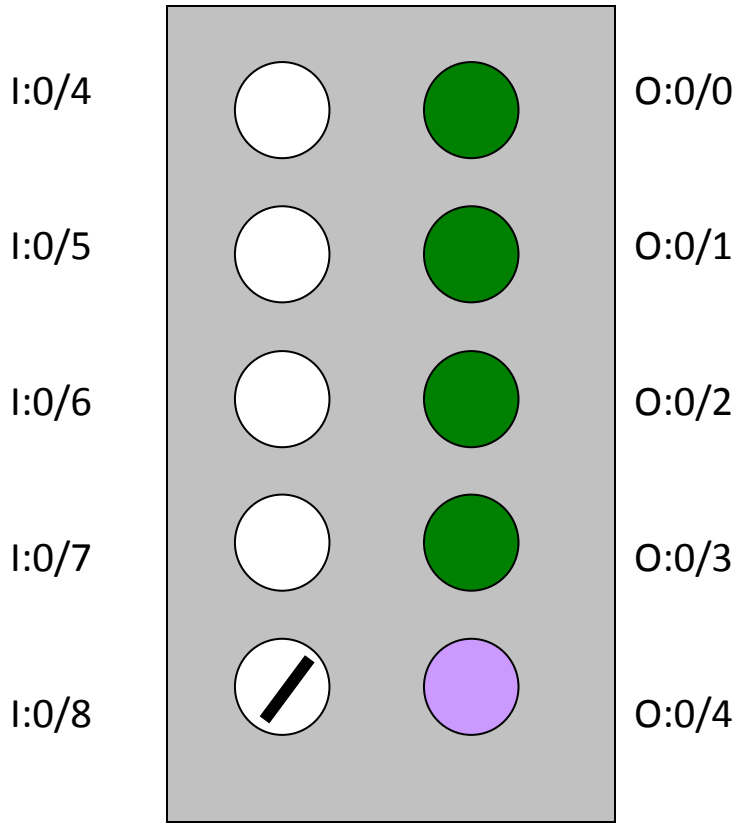
PLC Hardware Lab

PLC Panel
Wiring
at Trane
Panama City


CB1 2a
5Amp
120 VAC
BLACK
WHITE
GREEN
L1
L2
GND
24 VDC POWER SUPPLY
+
-
CB2 4a
Amp
RED
BLACK
RED
Thumbwheel Switch
0-9
C
RED
RED
RED
RED
RED
1
2
4
8
RED
BLACK
WHITE
BLACK grey
BLUE black
OR. black
GREEN black
WHITE black
RED black
ORANGE
GREEN
BLUE
Cable 1
DC POWER OUT
+24 VDC
DC COM
I/1
I/3
I/4
I/6
DC COM
I/9
I/11
COM
0
I/2
DC COM
1
I/5
I/7
2
I/8
I/10
24BWA
BLACK
I/0
BLACK
BLACK
Output
1764-24BWA
LSP
SERIES C
RED
RED
RED
RED
RED
L2
VAC VDC
VAC VDC
VAC VDC
VAC VDC
VAC
0/5
0/7
0/8
0/11
24BWA
85-265 VAC
L1
0/0
0
0/1
1
0/2
2
0/3
3
0/4
4
0/6
VAC
5
0/9
0/10
0/11
1
BLACK
WHITE
GREEN
BLACK grey
BLUE black
ORANGE black
GREEN black
WHITE black
Cable 2
BLACK
GREEN
GREEN
GREEN
RED
BLUE
BLACK
BLACK
BLACK
BLACK
BLACK

PLC Hardware Lab

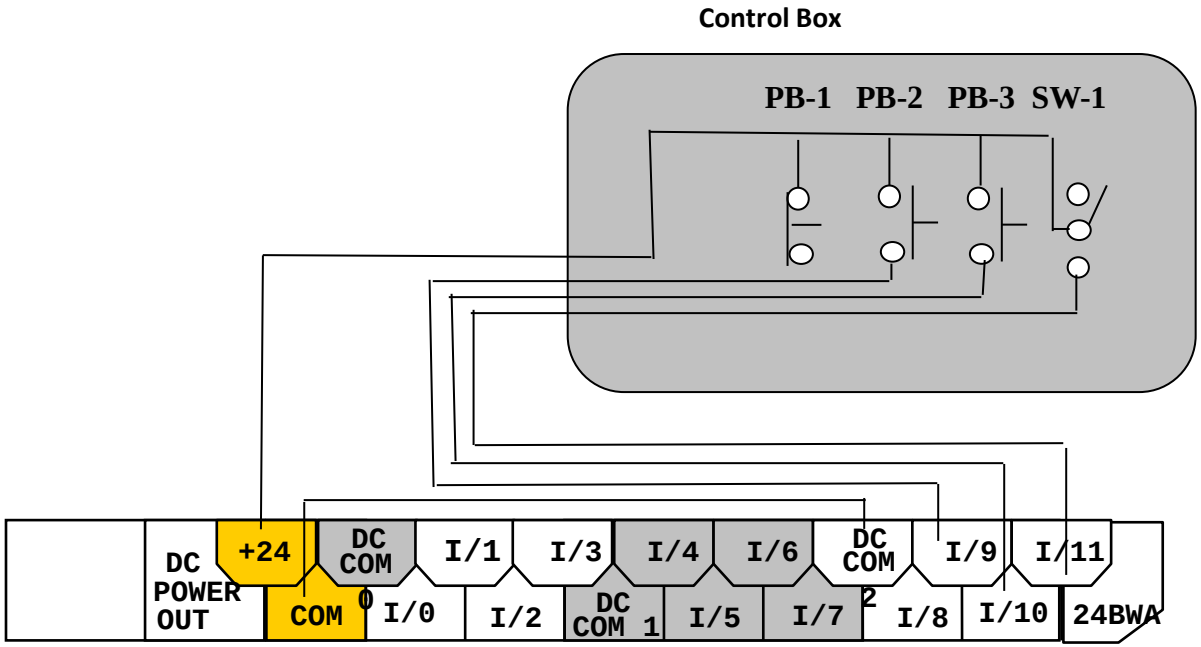
Control Panel on GCCC PLC Trainer



PLC Hardware Lab

Your Lab assignment :

Wire switches to the PLC “Brick” input terminals



Notice PB-1 is not wired. Since this is a normally closed button. Inputs to PLCs should be wired to normally open devices.

PLC Hardware Lab

The End