

Installation and Wiring

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Safety Guidelines



WARNING: Providing a safe operating environment for personnel and equipment is your responsibility and should be your primary goal during system planning and installation. Automation systems can fail and may result in situations that can cause serious injury to personnel or damage to equipment. Do not rely on the automation system alone to provide a safe operating environment. You should use external electromechanical devices, such as relays or limit switches, that are independent of the PLC system to provide protection for any part of the system that may cause personal injury or damage.

Every automation application is different, so there may be special requirements for your particular application. Make sure you follow all National, State, and local government requirements for the proper installation and use of your equipment.

Plan for Safety

The best way to provide a safe operating environment is to make personnel and equipment safety part of the planning process. You should examine *every* aspect of the system to determine which areas are critical to operator or machine safety.

If you are not familiar with PLC system installation practices, or your company does not have established installation guidelines, you should obtain additional information from the following sources.

- NEMA — The National Electrical Manufacturers Association, located in Washington, D.C., publishes many different documents that discuss standards for industrial control systems. You can order these publications directly from NEMA. Some of these include:
ICS 1, General Standards for Industrial Control and Systems
ICS 3, Industrial Systems
ICS 6, Enclosures for Industrial Control Systems
- NEC — The National Electrical Code provides regulations concerning the installation and use of various types of electrical equipment. Copies of the NEC Handbook can often be obtained from your local electrical equipment distributor or your local library.
- Local and State Agencies — many local governments and state governments have additional requirements above and beyond those described in the NEC Handbook. Check with your local Electrical Inspector or Fire Marshall office for information.

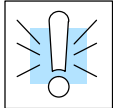
Safety Techniques

The publications mentioned provide many ideas and requirements for system safety. We recommend following these regulations as a minimum. Using the techniques listed below will further help reduce the risk of safety problems.

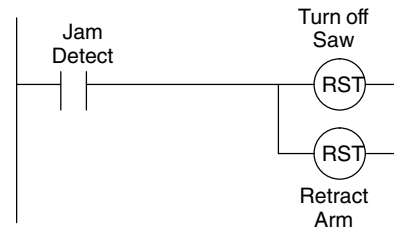
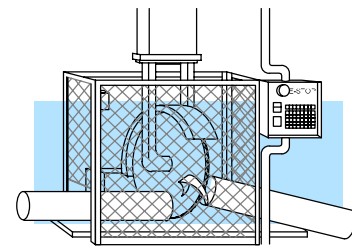
- Orderly system shutdown sequence in the PLC control program.
- System power disconnects (guard limits, emergency stop switches, etc.).

Orderly System Shutdown

The PLC control program can provide the first level of protection when used to identify machine problems. After analyzing your application, identify any shutdown sequences that must be performed. Typical problems include part jams, empty bins, etc. that do not pose a risk of personal injury or equipment damage.



WARNING: The control program *must not* be the only form of protection for any problems that may result in a risk of personal injury or equipment damage.

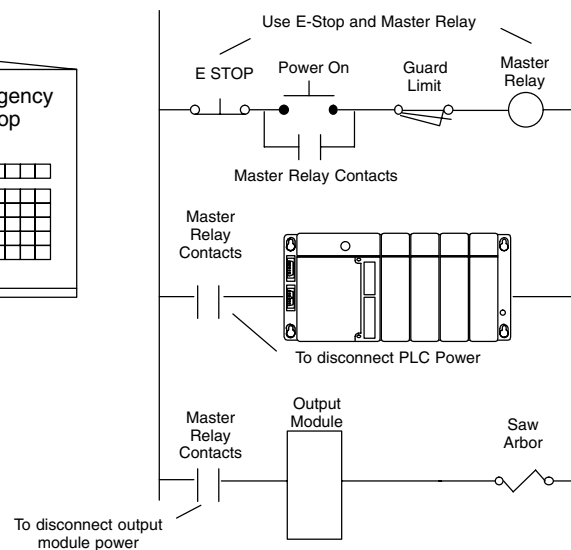
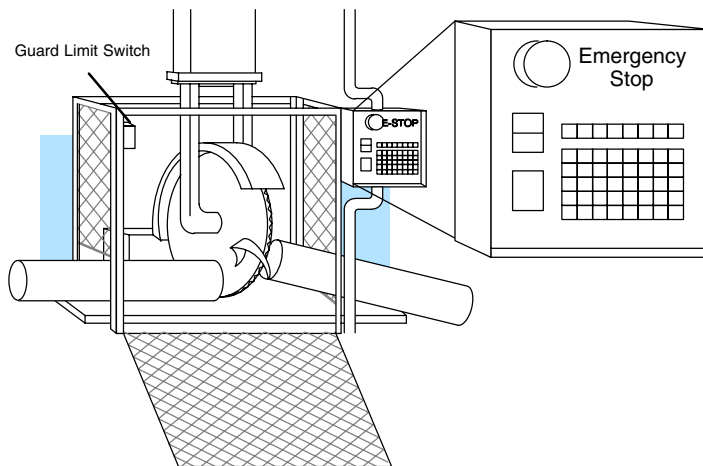


System Power Disconnect

By using electro-mechanical devices such as master control relays and/or limit switches, you can prevent accidental equipment startup. When installed properly, these devices will prevent *any* machine operation from occurring.

For example, if the machine has a jammed part the PLC control program can turn off the saw blade and retract the arbor. However, since the operator must open the guard to remove the part, you must include a disconnect switch that removes *all* system power any time the guard is opened.

The machine operator must also have a quick and easy method of manually disconnecting *all* system power. This is accomplished with a mechanical device that is clearly labeled as an **Emergency Stop** switch.



After an Emergency shutdown or any other type of power interruption, there may be requirements that must be met before the PLC control program can be restarted. For example, there may be specific register values that must be established (or maintained from the state prior to the shutdown) before operations can resume. In this case, you may want to use retentive memory locations, or include constants in the control program to ensure a known starting point.

I/O Wiring Strategies

Wiring Guidelines



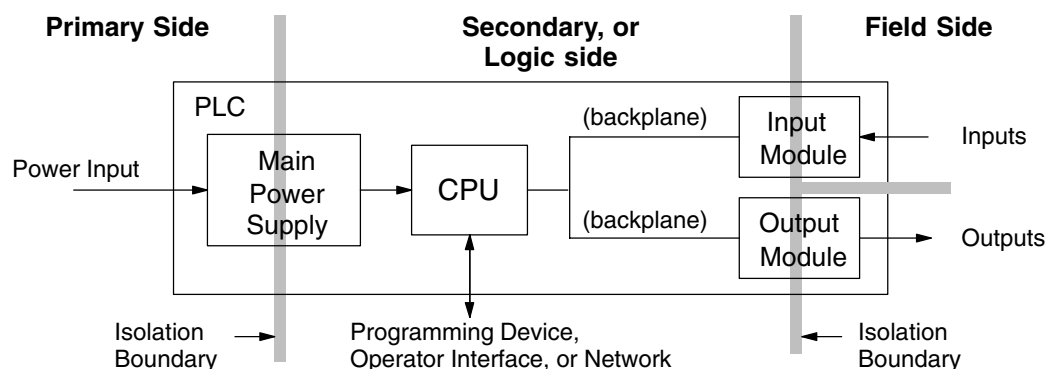
The DL405 PLC system is very flexible and will work in many different wiring configurations. By studying this section before actual installation, you can probably find the best wiring strategy for your application. This will help to lower system cost, reduce wiring errors, and avoid safety problems.

Your company may have guidelines for wiring and cable installation. If so, you should check those before you begin installation. Here are some general things to consider.

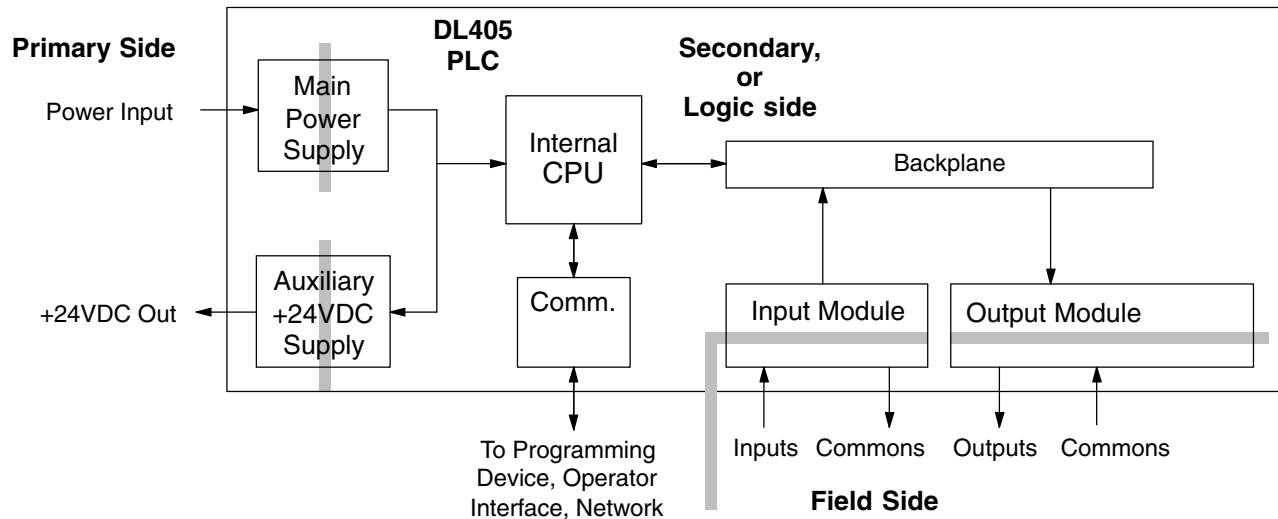
NOTE: See the DL405 User Manual for more detailed wiring information.

- Use the shortest wiring route whenever possible.
- Use shielded wiring and ground the shield at the transmitter source. *Do not* ground the shield at both the module and the source.
- Don't run the signal wiring next to large motors, high current switches, or transformers. This may cause noise problems.
- Route wiring through an approved cable housing to minimize the risk of accidental damage. Check local and national codes to choose the correct method for your application.
- When using thermocouple wire always use the same type of composition for thermocouple extensions. For example, do not use copper wire and expect the thermocouple to function correctly.
- When using RTDs, three-wire RTDs are preferred. The three wires connecting the RTD to the module must be the same type and length. Do not use the shield or drain wire for one of the connections.
- There are many different types of analog modules and there are slight wiring differences between modules. Please refer to your specific module type for the recommended sensors/sources wiring.

PLC circuitry is divided into three main regions separated by isolation boundaries, shown in the drawing below. Electrical isolation provides safety, so that a fault in one area does not damage another area.

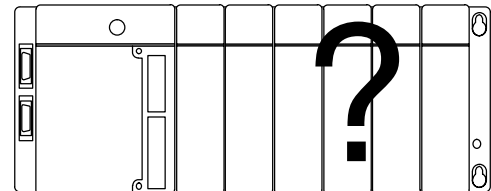


The next figure shows the physical layout of a DL405 PLC system as viewed from the front. In addition to the basic circuits, AC-powered CPUs include an auxiliary +24VDC power supply with its own isolation boundary. Since the supply output is isolated from the other three circuits, it can power input and/or output circuits.



I/O Module Placement and Wiring

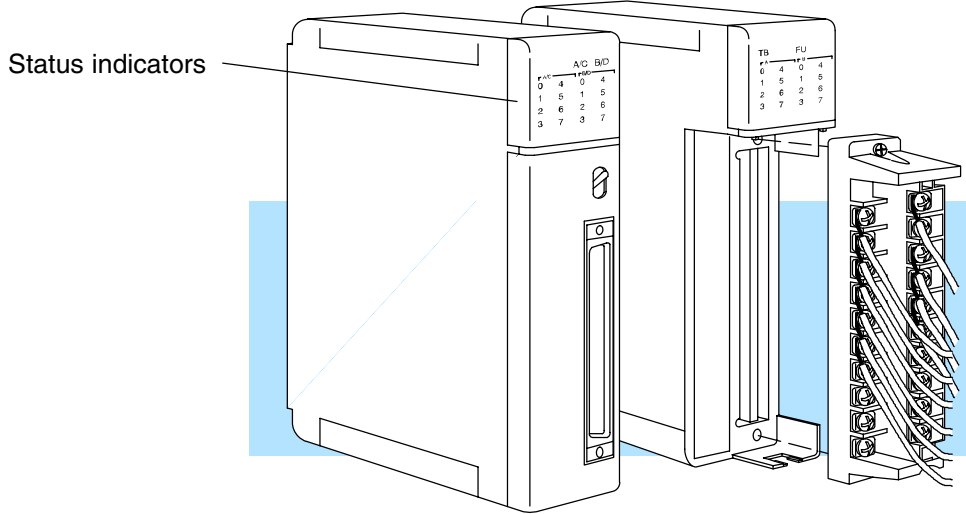
Module Placement Before wiring the I/O modules in your system to field devices, it's very important to make sure each I/O module is in the right slot and base in the system. Costly wiring errors may be avoided by doing the following:



- Do the power budget calculations for each base to verify the base power supply can power all the modules in the base. Information on how to do this is in the DL405 User Manual.
- Some specialty I/O modules may only be installed in particular slots or they will not function properly. Check the corresponding manuals before installation and wiring.
- Whenever possible, keep modules with high voltage and current wiring away from sensitive analog modules.

I/O Module Status Indicators

The diagram below shows the status indicator location for common I/O modules. The actual status indicators vary from one module to another, and some modules do not have status indicators.

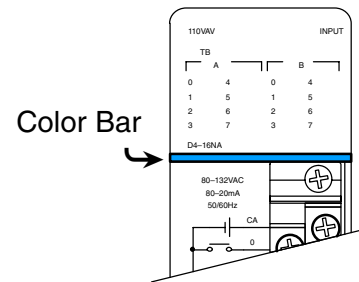


Installation and Wiring

Color Coding of I/O Modules

The DL405 family of I/O modules have a color-coded stripe on the front bezel to help identify whether the module type is input, output, or special module. The color code meaning is listed below:

<u>Module Type</u>	<u>Color Code</u>
Discrete/Analog Output	Red
Discrete/Analog Input	Blue
Other	White



Wiring a Module with a Terminal Block

You must first remove the front cover of the module prior to wiring. To remove the cover press the bottom tab of the cover and tilt the cover up to loosen from the module.

All DL405 I/O module terminal blocks are removable for your convenience. To remove the terminal block loosen the retaining screws and lift the terminal block away from the module. When you return the terminal block to the module make sure the terminal block is tightly seated. Be sure to tighten the retaining screws. If your module has a loose-terminal-block-LED (TB), you should also verify that it is off when system power is applied.



WARNING: For some modules, field device power may still be present on the terminal block even though the PLC system is turned off. To minimize the risk of electrical shock, check all field device power *before* you remove the connector.

