

INSTALLATION, WIRING AND SPECIFICATIONS



In This Chapter:

- Safety Guidelines2-2
- Mounting Guidelines2-5
- Installing DL205 Bases2-10
- Installing Components in the Base2-12
- Base Wiring Guidelines2-13

Safety Guidelines

2



NOTE: Products with CE marks perform their required functions safely and adhere to relevant standards as specified by CE directives, provided they are used according to their intended purpose and that the instructions in this manual are adhered to. The protection provided by the equipment may be impaired if this equipment is used in a manner not specified in this manual. A listing of our international affiliates is available on our Web site: <http://www.automationdirect.com>



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 and/or damage equipment. Do not rely on the automation system alone to provide a safe operating environment. Sufficient emergency circuits should be provided to stop either partially or totally the operation of the PLC or the controlled machine or process. These circuits should be routed outside the PLC in the event of controller failure, so that independent and rapid shutdown are available. Devices, such as “mushroom” switches or end of travel limit switches, should operate motor starter, solenoids, or other devices without being processed by the PLC. These emergency circuits should be designed using simple logic with a minimum number of highly reliable electromechanical components. Every automation application is different, so there may be special requirements for your particular application. Make sure all national, state, and local government requirements are followed 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.

Three Levels of Protection

The publications mentioned provide many ideas and requirements for system safety. At a minimum, you should follow these regulations. Also, you should use the following techniques, which provide three levels of system control:

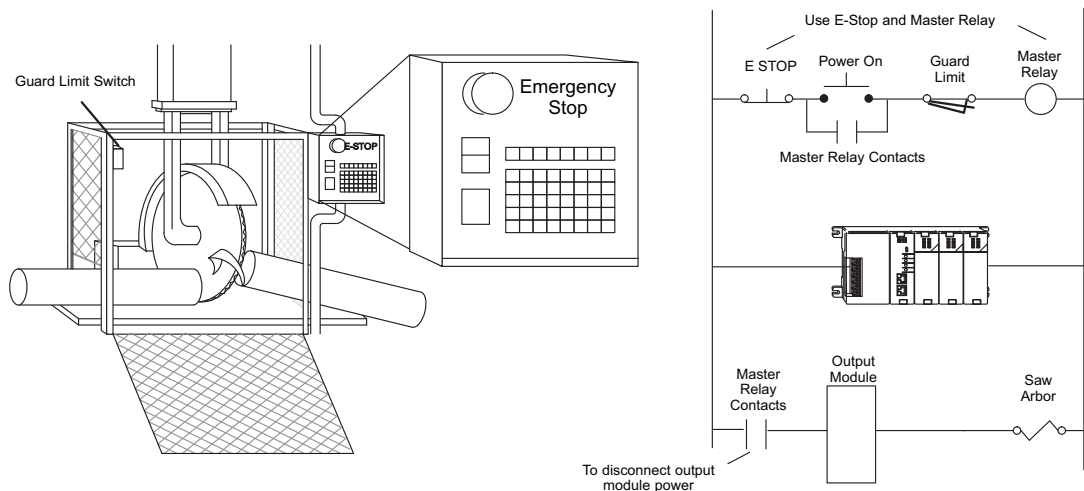
- Emergency stop switch for disconnecting system power
- Mechanical disconnect for output module power
- Orderly system shutdown sequence in the PLC control program

Emergency Stops

It is recommended that emergency stop circuits be incorporated into the system for every machine controlled by a PLC. For maximum safety in a PLC system, these circuits must not be wired into the controller, but should be hardwired external to the PLC. The emergency stop switches should be easily accessed by the operator and are generally wired into a master control relay (MCR) or a safety control relay (SCR) that will remove power from the PLC I/O system in an emergency.

MCRs and SCRs provide a convenient means for removing power from the I/O system during an emergency situation. By de-energizing an MCR (or SCR) coil, power to the input (optional) and output devices is removed. This event occurs when any emergency stop switch opens. However, the PLC continues to receive power and operate even though all its inputs and outputs are disabled.

The MCR circuit could be extended by placing a PLC fault relay (closed during normal PLC operation) in series with any other emergency stop conditions. This would cause the MCR circuit to drop the PLC I/O power in case of a PLC failure (memory error, I/O communications error, etc.).



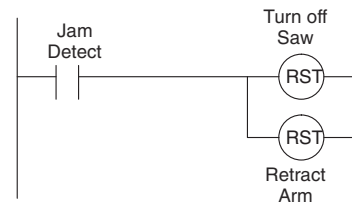
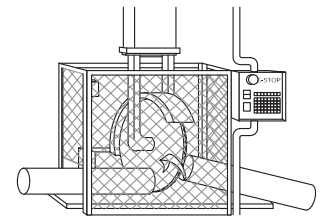
Emergency Power Disconnect

A properly rated emergency power disconnect should be used to power the PLC controlled system as a means of removing the power from the entire control system. It may be necessary to install a capacitor across the disconnect to protect against a condition known as “outrush”. This condition occurs when the output Triacs are turned off by powering off the disconnect, thus causing the energy stored in the inductive loads to seek the shortest distance to ground, which is often through the Triacs.

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 insure a known starting point.

Orderly System Shutdown

Ideally, the first level of fault detection is the PLC control program, which can identify machine problems. Certain shutdown sequences should be performed. The types of problems are usually things such as jammed parts, 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.

Class 1, Division 2, Approval

This equipment is suitable for use in Class 1, Division 2, Zone 2, groups A, B, C and D or non-hazardous locations only.

WARNING: Explosion Hazard! Substitution of components may impair suitability for Class 1, Division 2, Zone 2.



WARNING: Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

WARNING: All DL205 products used with connector accessories must use R/C (ECBT2) mating plugs. All mating plugs must have suitable ratings for the devices.

Mounting Guidelines

Before installing the PLC system you will need to know the dimensions of the components considered. The diagrams on the following pages provide the component dimensions to use in defining your enclosure specifications. Remember to leave room for potential expansion.

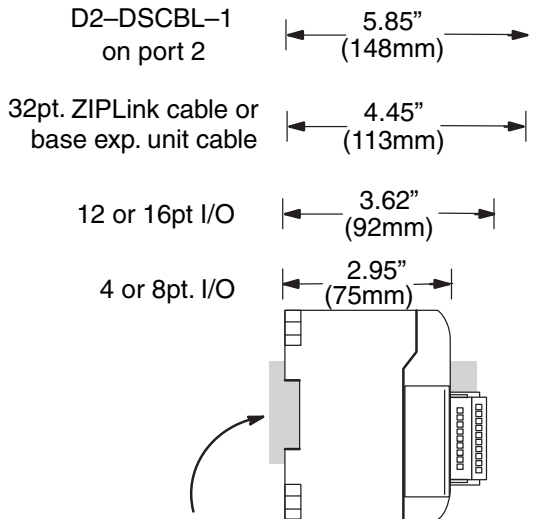


NOTE: If you are using other components in your system, refer to the appropriate manual to determine how those units can affect mounting dimensions.

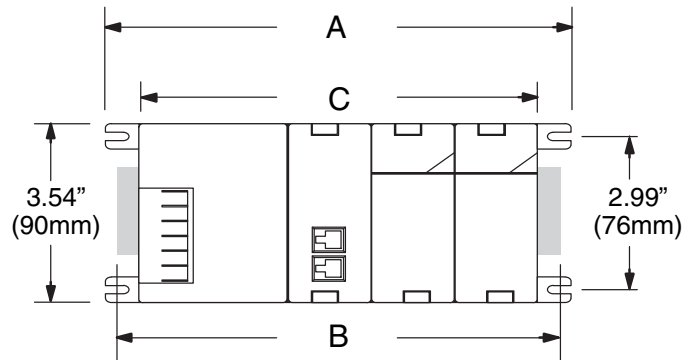
Base Dimensions

The following information shows the proper mounting dimensions. The height dimension is the same for all bases. The depth varies depending on your choice of I/O module. The length varies as the number of slots increase. Make sure you have followed the installation guidelines for proper spacing.

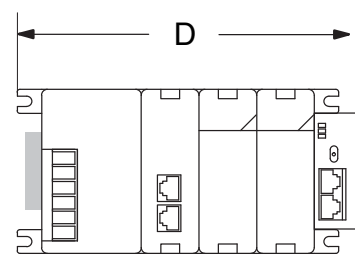
Mounting depths with:



DIN Rail slot. Use rail conforming to DIN EN 50022.



with D2-EM Expansion Unit

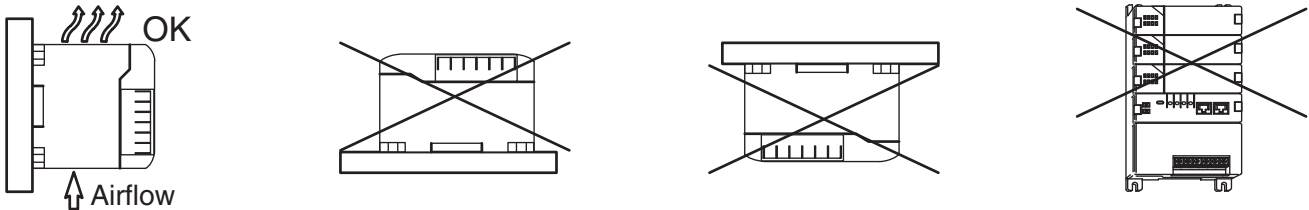


Base	A (Base Total Width)		B (Mounting Hole)		C (Component Width)		D (Width with Exp. Unit)	
	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters
3-slot	6.77"	172mm	6.41"	163mm	5.8"	148mm	7.24"	184mm
4-slot	7.99"	203mm	7.63"	194mm	7.04"	179mm	8.46"	215mm
6-slot	10.43"	265mm	10.07"	256mm	9.48"	241mm	10.90"	277mm
9-slot	14.09"	358mm	13.74"	349mm	13.14"	334mm	14.56"	370mm

Panel Mounting and Layout

It is important to design your panel properly to help ensure the DL205 products operate within their environmental and electrical limits. The system installation should comply with all appropriate electrical codes and standards. It is important the system also conforms to the operating standards for the application to insure proper performance. The diagrams below reference the items in the following list.

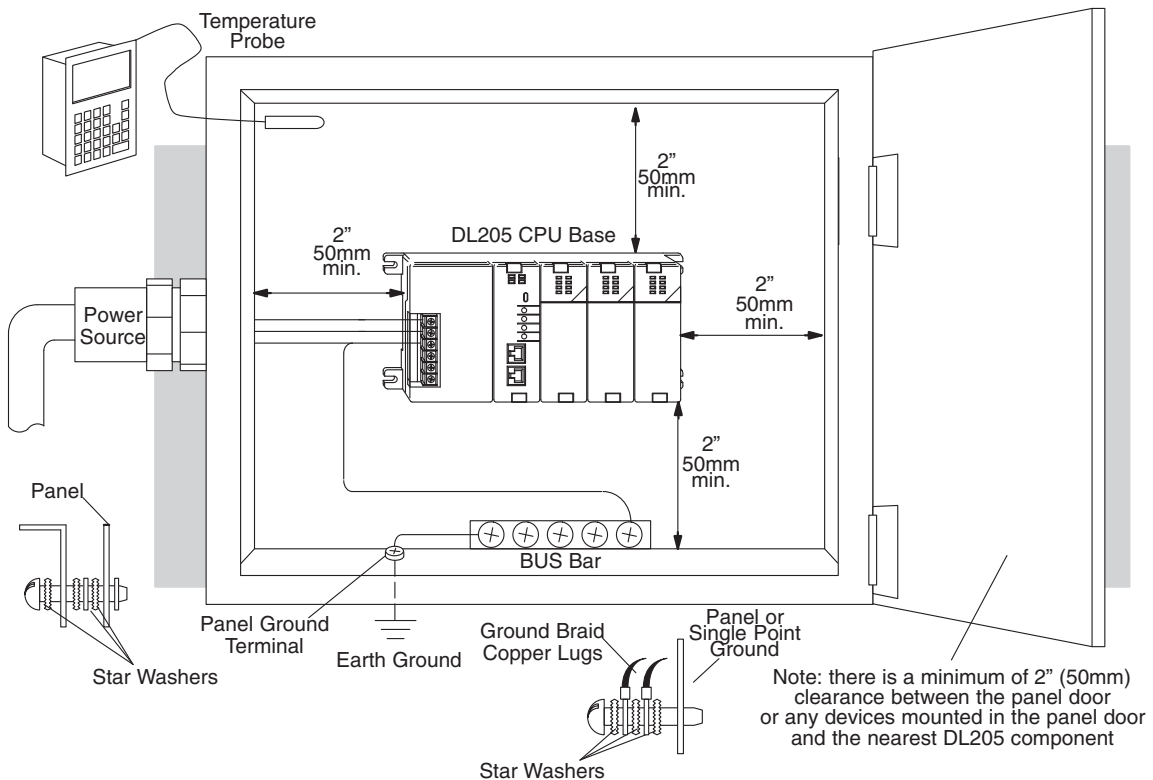
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1. Mount the bases horizontally to provide proper ventilation.
2. If you place more than one base in a cabinet, there should be a minimum of 7.2" (183mm) between bases.
3. Provide a minimum clearance of 2" (50mm) between the base and all sides of the cabinet. There should also be at least 1.2" (30mm) of clearance between the base and any wiring ducts.
4. There must be a minimum of 2" (50mm) clearance between the panel door and the nearest DL205 component.



NOTE: The cabinet configuration below is not suitable for EU installations. Refer to Appendix I European Union Directives.



5. The ground terminal on the DL205 base must be connected to a single point ground. Use copper stranded wire to achieve a low impedance. Copper eye lugs should be crimped and soldered to the ends of the stranded wire to ensure good surface contact. Remove anodized finishes and use copper lugs and star washers at termination points. A general rule is to achieve a 0.1 ohm of DC resistance between the DL205 base and the single point ground.
6. There must be a single point ground (i.e. copper bus bar) for all devices in the panel requiring an earth ground return. The single point of ground must be connected to the panel ground termination. The panel ground termination must be connected to earth ground. For this connection you should use #12 AWG stranded copper wire as a minimum. Minimum wire sizes, color coding, and general safety practices should comply with appropriate electrical codes and standards for your region. A good common ground reference (Earth ground) is essential for proper operation of the DL205. There are several methods of providing an adequate common ground reference, including:
 - a) Installing a ground rod as close to the panel as possible.
 - b) Connection to incoming power system ground.
7. Properly evaluate any installations where the ambient temperature may approach the lower or upper limits of the specifications. Place a temperature probe in the panel, close the door and operate the system until the ambient temperature has stabilized. If the ambient temperature is not within the operating specification for the DL205 system, measures such as installing a cooling/heating source must be taken to get the ambient temperature within the DL205 operating specifications.
8. Device mounting bolts and ground braid termination bolts should be #10 copper bolts or equivalent. Tapped holes instead of nut-bolt arrangements should be used whenever possible. To ensure good contact on termination areas impediments such as paint, coating or corrosion should be removed in the area of contact.
9. The DL205 system is designed to be powered by 110/220 VAC, 24 VDC, or 125 VDC normally available throughout an industrial environment. Electrical power in some areas where the PLCs are installed is not always stable and storms can cause power surges. Due to this, powerline filters are recommended for protecting the DL205 PLCs from power surges and EMI/RFI noise. The Automation Powerline Filter, for use with 120 VAC and 240 VAC, 1–5 Amps, is an excellent choice (can be located at www.automationdirect.com), however, you can use a filter of your choice. These units install easily between the power source and the PLC.

Enclosures

Selection of a proper enclosure is important to ensure safe and proper operation of your DL205 system. Applications of DL205 systems vary and may require additional features. The minimum considerations for enclosures include:

- Conformance to electrical standards
- Protection from the elements in an industrial environment
- Common ground reference
- Maintenance of specified ambient temperature
- Access to equipment
- Security or restricted access
- Sufficient space for proper installation and maintenance of equipment

Environmental Specifications

The following table lists the environmental specifications that generally apply to the DL205 system (CPU, Bases, I/O Modules). The ranges that vary for the Handheld Programmer are noted at the bottom of this chart. I/O module operation may fluctuate depending on the ambient temperature and your application. Please refer to the appropriate I/O module specifications for the temperature derating curves applying to specific modules.

Specification	Rating
Storage temperature	-4° F to 158° F (-20° C to 70° C)
Ambient operating temperature*	32° F to 131° F (0° C to 55° C)
Ambient humidity**	30% – 95% relative humidity (non-condensing)
Vibration resistance	MIL STD 810C, Method 514.2
Shock resistance	MIL STD 810C, Method 516.2
Noise immunity	NEMA (ICS3-304)
Atmosphere	No corrosive gases

* Operating temperature for the Handheld Programmer and the DV-1000 is 32° to 122° F (0° to 50° C) Storage temperature for the Handheld Programmer and the DV-1000 is - 4° to 158° F (- 20° to 70° C).

** Equipment will operate below 30% humidity. However, static electricity problems occur much more frequently at lower humidity levels. Make sure you take adequate precautions when you touch the equipment. Consider using ground straps, anti-static floor coverings, etc., if you use the equipment in low humidity environments.

Power

The power source must be capable of supplying voltage and current complying with the base power supply specifications.

Specification	AC Powered Bases	24 VDC Powered Bases	125 VDC Powered Bases
Part Numbers	D2-03B-1 D2-04B-1 D2-06B-1 D2-09B-1	D2-03BDC1-1 D2-04BDC1-1 D2-06BDC1-1 D2-09BDC1-1	D2-06BDC2-1 D2-09BDC2-1
Input Voltage Range	100-240 VAC (+10%/ -15%) 50/60 Hz	10.2 – 28.8VDC (24VDC) with less than 10% ripple	104-240 VDC +10% -15%
Maximum Inrush Current	30A	10A	20A
Maximum Power	80VA	25W	30W
Voltage Withstand (dielectric)	1 minute @ 1500 VAC between primary, secondary, and field ground		
Insulation Resistance	> 10 MΩ at 500 VDC		
Auxiliary 24 VDC Output	20-28 VDC, less than 1V p-p 300mA max.	None	20-28 VDC, less than 1V p-p 300mA max.
Fusing (internal to base power supply)	non-replaceable 2A @ 250V slow blow fuse; external fusing recommended	non-replaceable 3.15A @ 250V slow blow fuse; external fusing recommended	non-replaceable 2A @ 250V slow blow fuse; external fusing recommended

Marine Use

American Bureau of Shipping (ABS) certification requires flame-retarding insulation as per 4-8-3/5.3.6(a). ABS will accept Navy low smoke cables, cable qualified to NEC “Plenum rated” (fire resistant level 4), or other similar flammability resistant rated cables. Use cable specifications for your system that meet a recognized flame retardant standard (i.e. UL, IEEE, etc.), including evidence of cable test certification (i.e. tests certificate, UL file number, etc.).



NOTE: Wiring needs to be “low smoke” per the above paragraph. Teflon coated wire is also recommended.

Agency Approvals

Some applications require agency approvals. Typical agency approvals which your application may require are:

- UL (Underwriters’ Laboratories, Inc.)
- CSA (Canadian Standards Association)
- FM (Factory Mutual Research Corporation)
- CUL (Canadian Underwriters’ Laboratories, Inc.)

24 VDC Power Bases

Follow these additional installation guidelines when installing D2-03BDC1-1, D2-04BDC1-1, D2-06BDC1-1 and D2-09BDC1-1 bases:

- Install these bases in compliance with the enclosure, mounting, spacing, and segregation requirements of the ultimate application.
- These bases must be used within their marked ratings.
- These bases are intended to be installed within an enclosure rated at least IP54.
- provisions should be made to prevent the rated voltage being exceeded by transient disturbances of more than 40%.

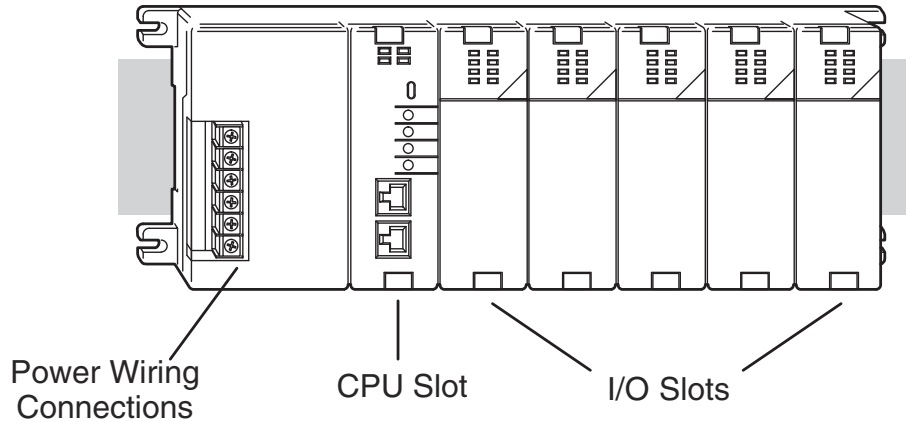
Installing DL205 Bases

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Choosing the Base Type

The DL205 system offers four different sizes of bases and three different power supply options.

The following diagram shows an example of a 6-slot base.

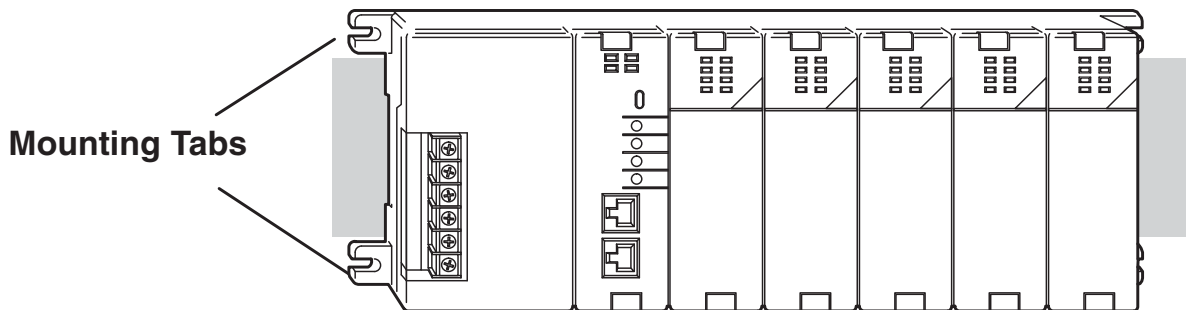


Your choice of base depends on three things:

- Number of I/O modules required
- Input power requirement (AC or DC power)
- Available power budget

Mounting the Base

All I/O configurations of the DL205 may use any of the base configurations. The bases are secured to the equipment panel or mounting location using four M4 screws in the corner tabs of the base. The full mounting dimensions are given in the previous section on Mounting Guidelines.



WARNING: To minimize the risk of electrical shock, personal injury, or equipment damage, always disconnect the system power before installing or removing any system component.

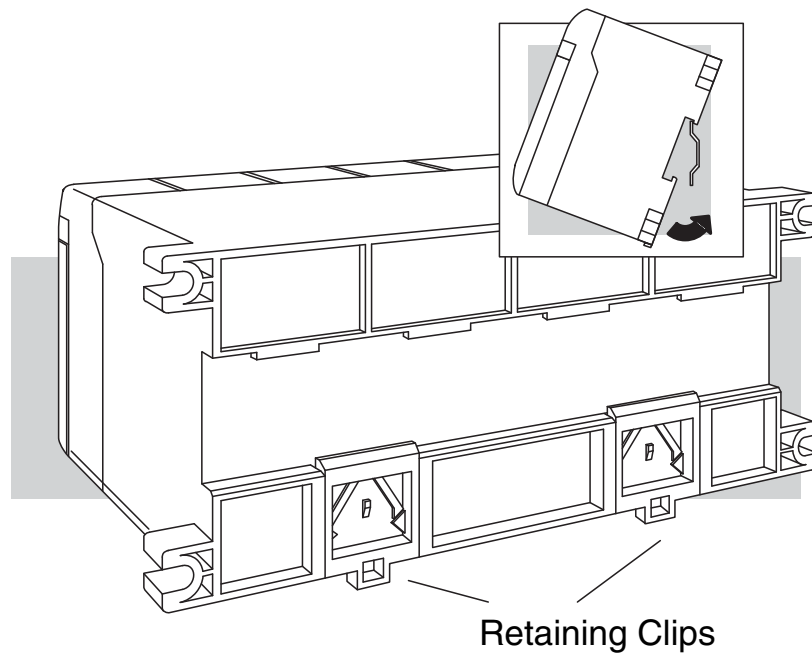
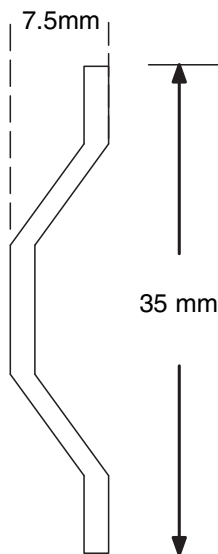
Using Mounting Rails

The DL205 bases can also be secured to the cabinet by using mounting rails. You should use rails that conform to DIN EN standard 50 022. Refer to our catalog for a complete line of DIN rail, DINnectors and DIN rail mounted apparatus. These rails are approximately 35mm high, with a depth of 7.5mm. If you mount the base on a rail, you should also consider using end brackets on each end of the rail. The end brackets help keep the base from sliding horizontally along the rail. This helps minimize the possibility of accidentally pulling the wiring loose.

If you examine the bottom of the base, you'll notice small retaining clips. To secure the base to a DIN rail, place the base onto the rail and gently push up on the retaining clips. The clips lock the base onto the rail.

To remove the base, pull down on the retaining clips, lift up on the base slightly, and pull it away from the rail.

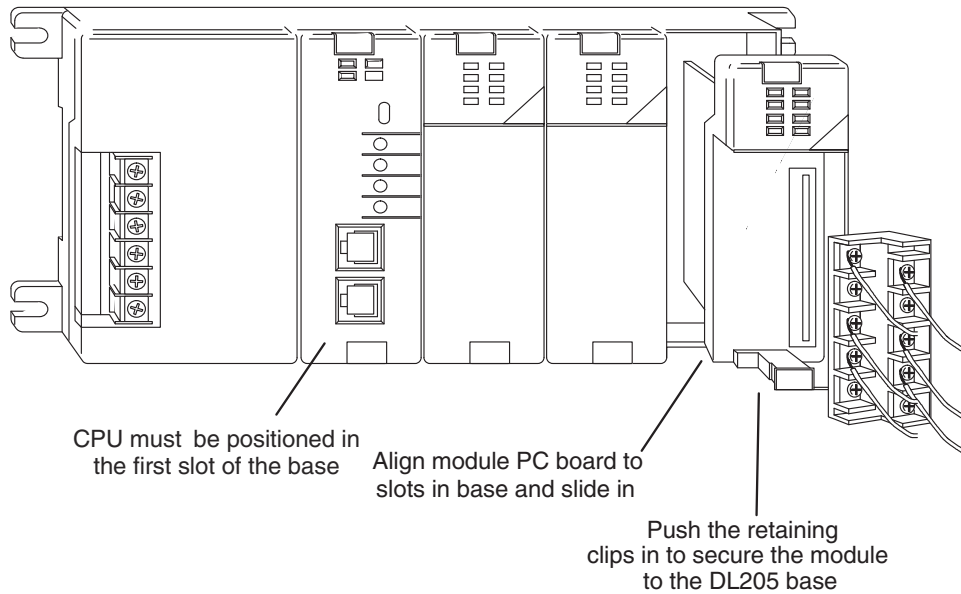
DIN Rail Dimensions



Installing Components in the Base

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To insert components into the base: first slide the module retaining clips to the out position and align the PC board(s) of the module with the grooves on the top and bottom of the base. Push the module straight into the base until it is firmly seated in the backplane connector. Once the module is inserted into the base, push in the retaining clips to firmly secure the module to the base.



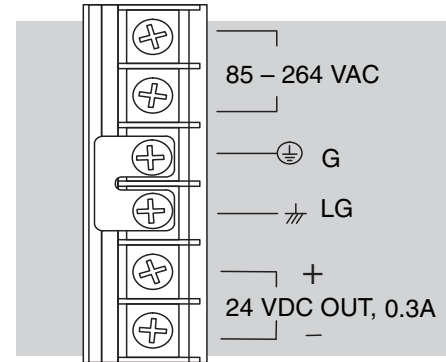
WARNING: Minimize the risk of electrical shock, personal injury, or equipment damage. Always disconnect the system power before installing or removing any system component.

Base Wiring Guidelines

Base Wiring

The diagrams show the terminal connections located on the power supply of the DL205 bases. The base terminals can accept up to 16 AWG. You may be able to use larger wiring depending on the type of wire used, but 16 AWG is the recommended size. Do not overtighten the connector screws; the recommended torque value is 7.81 lb-in (0.882 N•m).

110/220 VAC Base Terminal Strip

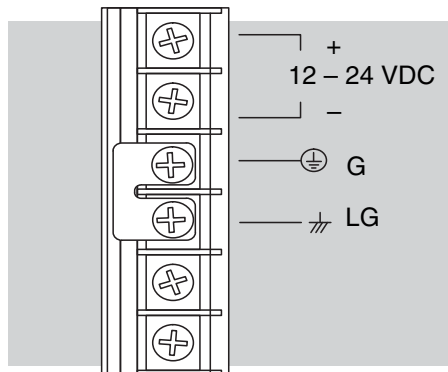


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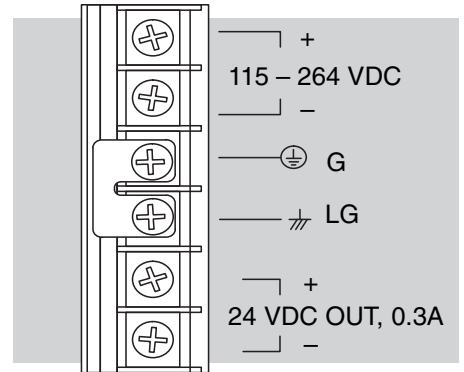


NOTE: You can connect either a 115 VAC or 220 VAC supply to the AC terminals. Special wiring or jumpers are not required as with some of the other **DirectLOGIC** products.

12/24 VDC Base Terminal Strip



125 VDC Base Terminal Strip



WARNING: Once the power wiring is connected, install the plastic protective cover. When the cover is removed, there is a risk of electrical shock if you accidentally touch the wiring or wiring terminals.

