Installation, Wiring, and Specifications

In This Chapter...

Safety Guidelines

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 or damage to equipment. Do not rely on the automation system alone to provide a safe operating environment. You should use external electro-mechanical devices, such as relays or limit switches, that are independent of the PLC application 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.

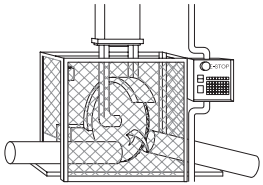
Three Levels of Protection

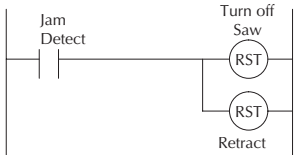
The publications mentioned provide many ideas and requirements for system safety. At a minimum, you should follow these regulations. Also, you should use the following techniques, which provide three levels of system control.

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

Orderly System Shutdown

The first level of fault detection is ideally the PLC control program, which can identify machine problems. You must shutdown sequences that must be performed. These 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.

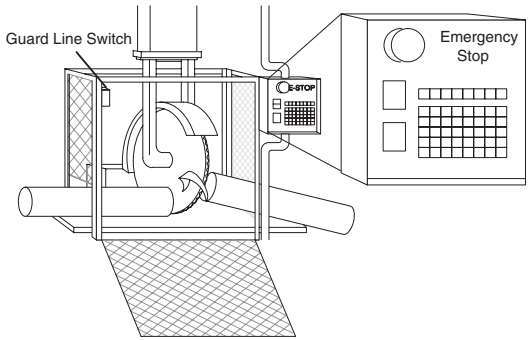
System Power Disconnect

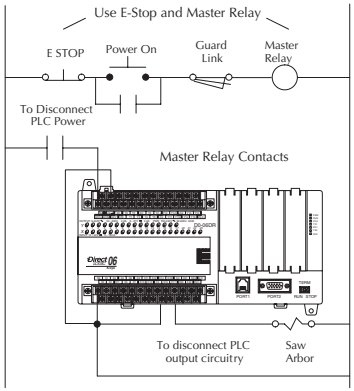
You should also use electro-mechanical devices, such as master control relays and/or limit switches, to prevent accidental equipment startup at an unexpected time. These devices should be installed in such a manner to prevent any machine operations from occurring.

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 should also include a bypass switch that disconnects all system power any time the guard is opened.

Emergency Stop

The machinery must provide a quick manual method of disconnecting all system power. The disconnect device or switch must be clearly labeled "**Emergency Stop**".





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.

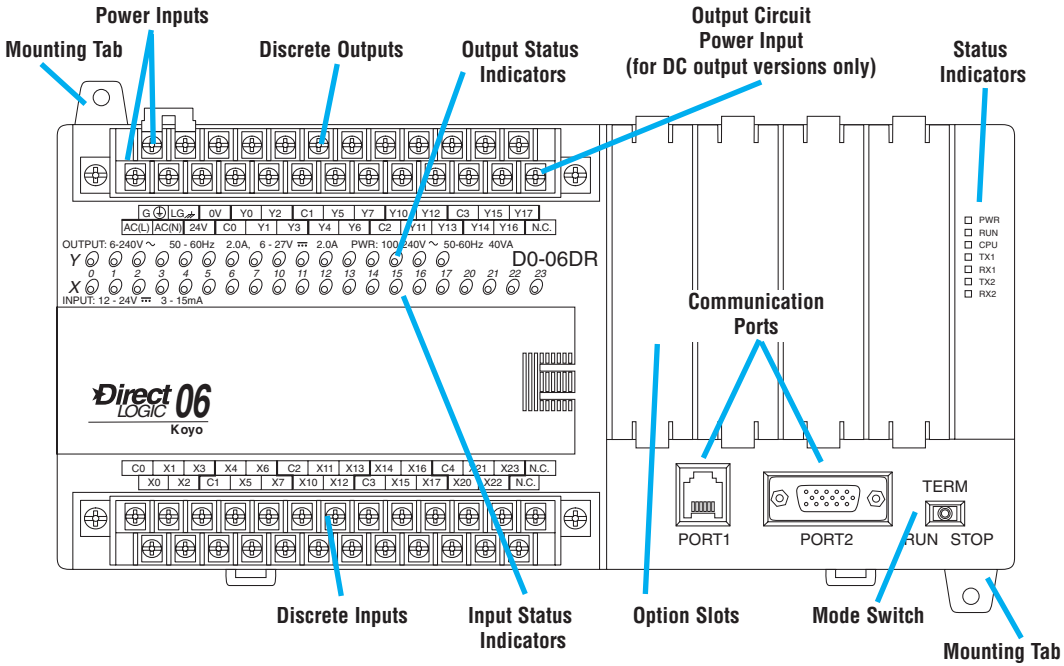
Class 1, Division 2 Approval

This equipment is suitable for use in Class 1, Division 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. Do not disconnect equipment unless power has been switched off or area is known to be non-hazardous.

Orientation to DL06 Front Panel

Most connections, indicators, and labels on the DL06 Micro PLCs are located on its front panel. The communication ports are located on front of the PLC as are the option card slots and the mode selector switch. Please refer to the drawing below.



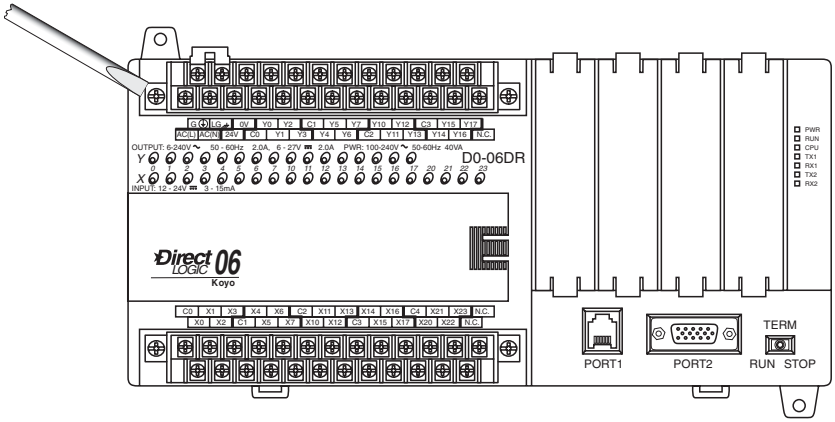
The output and power connector accepts external power and logic and chassis ground connections on the indicated terminals. The remaining terminals are for connecting commons and output connections Y0 through Y17. The sixteen output terminals are numbered in octal, Y0-Y7 and Y10-Y17. On DC output units, the end terminal on the right accepts power for the output stage. The input side connector provides the location for connecting the inputs X0 and X23 and the associated commons.

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

Terminal Block Removal

The DL06 terminals are divided into two groups. Each group has its own terminal block. The outputs and power wiring are on one block, and the input wiring is on the other. In some instances, it may be desirable to remove the terminal block for easy wiring. The terminal block is designed for easy removal with just a small screwdriver. The drawing below shows the procedure for removing one of the terminal blocks.

1. Loosen the retention screws on each end of the connector block.



2. From the center of the connector block, pry upward with the screwdriver until the connector is loose.

The terminal blocks on DL06 PLCs have regular (m3 size) screw terminals, which will accept either standard blade-type or #1 Philips screwdriver tips. You can insert one 16 AWG wire under a terminal, or two 18 AWG wires (one on each side of the screw). Be careful not to over-tighten; maximum torque is 6 inch/ounces.

Spare terminal blocks are available in an accessory kit. Please refer to part number D0-ACC-2. You can find this and other accessories on our web site.

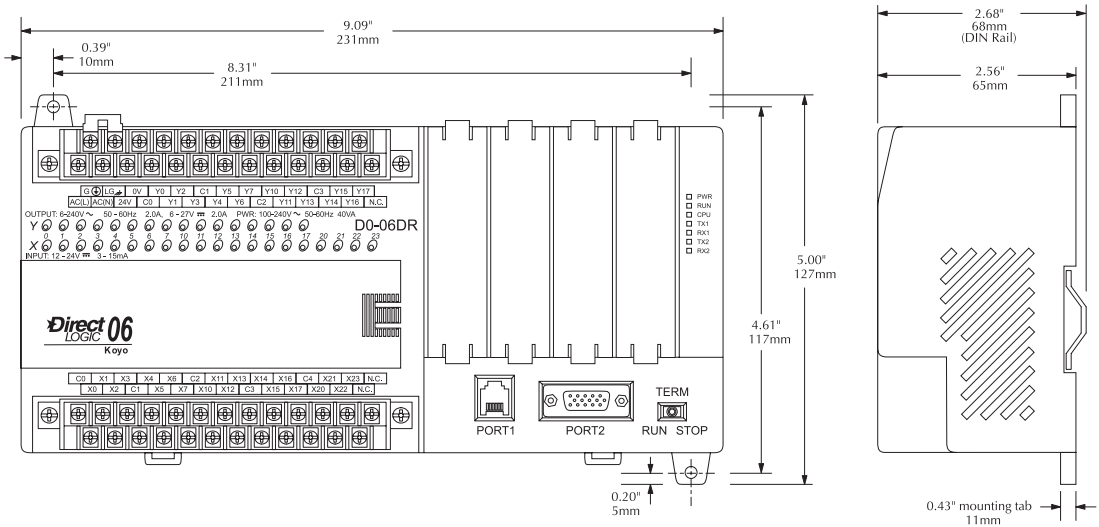
Mounting Guidelines

In addition to the panel layout guidelines, other specifications can affect the installation of a PLC system. Always consider the following:

- Environmental Specifications
- Power Requirements
- Agency Approvals
- Enclosure Selection and Component Dimensions

Unit Dimensions

The following diagram shows the outside dimensions and mounting hole locations for all versions of the DL06. Make sure you follow the installation guidelines to allow proper spacing from other components.



Enclosures

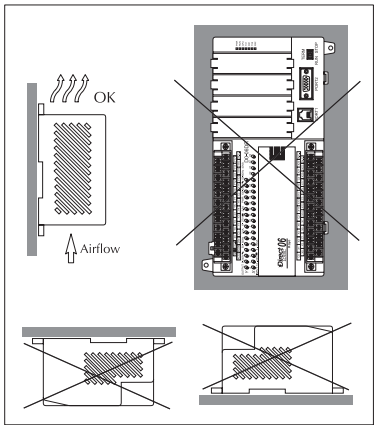
Your selection of a proper enclosure is important to ensure safe and proper operation of your DL06 system. Applications of DL06 systems vary and may require additional features. The minimum considerations for enclosures include:

- 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

Panel Layout & Clearances

There are many things to consider when designing the panel layout. The following items correspond to the diagram shown. Note: there may be additional requirements, depending on your application and use of other components in the cabinet.

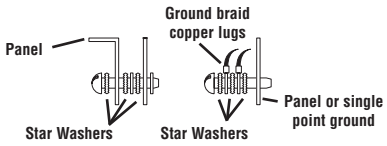
1. Mount the PLCs horizontally as shown below to provide proper ventilation. You ***cannot*** mount the DL06 units vertically, upside down, or on a flat horizontal surface. If you place more than one unit in a cabinet, there must be a minimum of 7.2" (183mm) between the units.

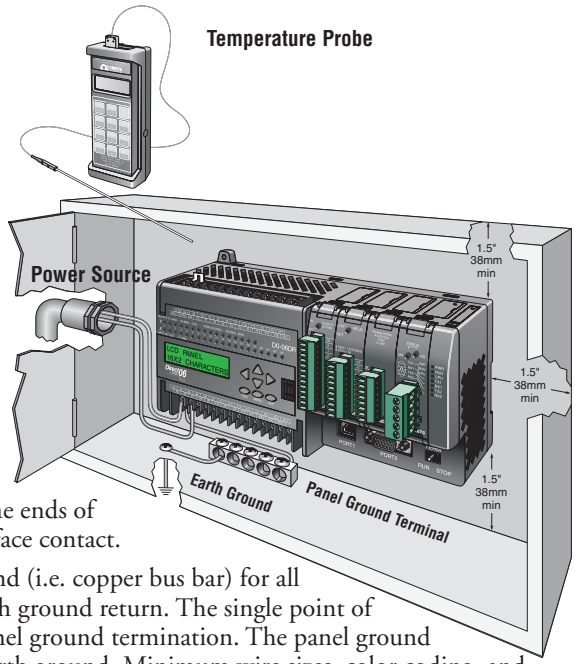


2. Provide a minimum clearance of 1.5" (39mm) between the unit and all sides of the cabinet. Note, remember to allow for any operator panels or other items mounted in the door.

3. There should also be at least 3" (78mm) of clearance between the unit and any wiring ducts that run parallel to the terminals.

Note: There is a minimum clearance requirement of 1.5" (38mm) between the panel door (or any devices mounted in the panel door) and the nearest DL06 component.





4. The ground terminal on the DL06 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.

5. 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. Minimum wire sizes, color coding, and general safety practices should comply with appropriate electrical codes and standards for your area.

6. A good common ground reference (Earth ground) is essential for proper operation of the DL06. One side of all control and power circuits and the ground lead on flexible shielded cable must be properly connected to Earth ground. 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.

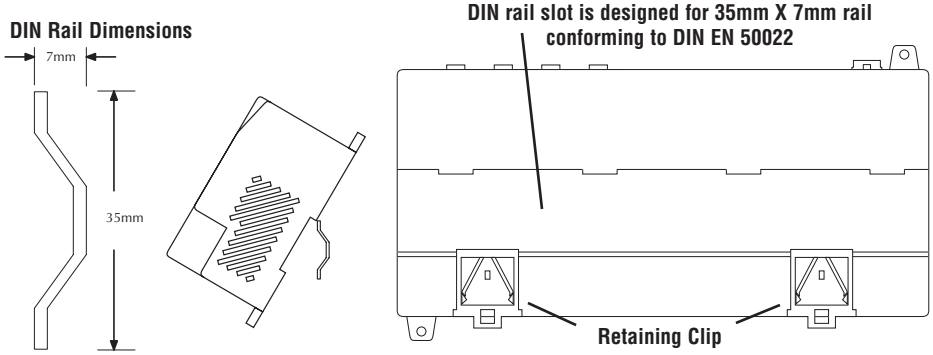
7. Evaluate any installations where the ambient temperature may approach the lower or upper limits of the specifications. If you suspect the ambient temperature will not be within the operating specification for the DL06 system, measures such as installing a cooling/heating source must be taken to get the ambient temperature within the range of specifications.

8. The DL06 systems are designed to be powered by 95-240 VAC or 12–24 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 DL06 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 (locate at www.automationdirect.com), however, you can use a filter of your choice. These units install easily between the power source and the PLC.

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

Using Mounting Rails

DL06 Micro PLCs can be secured to a panel by using mounting rails. We recommend rails that conform to DIN EN standard 50 022. They are approximately 35mm high, with a depth of 7mm. If you mount the Micro PLC on a rail, do consider using end brackets on each side of the PLC. The end bracket helps keep the PLC from sliding horizontally along the rail, reducing the possibility of accidentally pulling the wiring loose. On the bottom of the PLC are two small retaining clips. To secure the PLC to a DIN rail, place it onto the rail and gently push up on the clips to lock it onto the rail. To remove the PLC, pull down on the retaining clips, lift up on the PLC slightly, then pull it away from the rail.



NOTE: *Refer to our catalog or web site for a complete listing of* ***DINnector*** *connection systems.*

Environmental Specifications

The following table lists the environmental specifications that generally apply to DL06 Micro PLCs. The ranges that vary for the Handheld Programmer are noted at the bottom of this chart. Certain output circuit types may have derating curves, depending on the ambient temperature and the number of outputs ON. Please refer to the appropriate section in this chapter pertaining to your particular DL06 PLC.

Environmental Specifications	
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**	5% – 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
Agency approvals	UL, CE (C1D2), FCC class A

* 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° to70° C).

**Equipment will operate down to 5% relative humidity. However, static electricity problems occur much more frequently at low humidity levels (below 30%). 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.

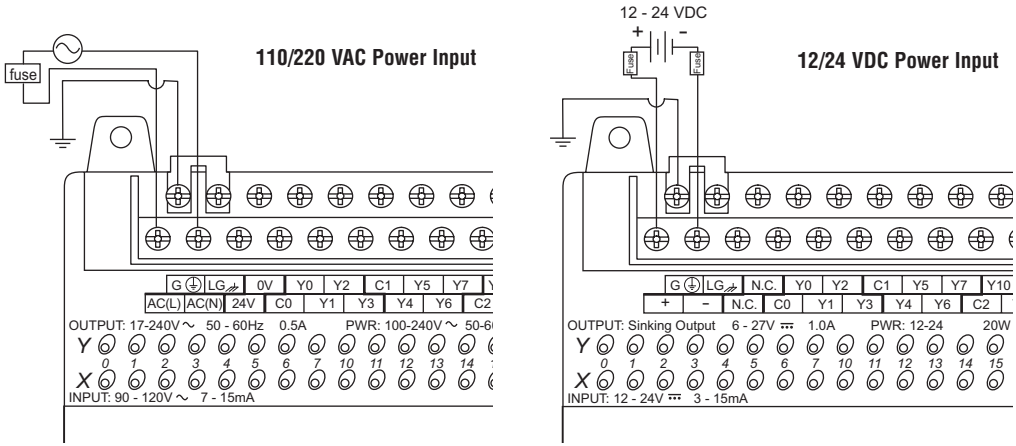
Agency Approvals

Some applications require agency approvals for particular components. The DL06 Micro PLC agency approvals are listed below:

- UL (Underwriters' Laboratories, Inc.)
- CUL (Canadian Underwriters' Laboratories, Inc.)
- CE (European Economic Union)

Wiring Guidelines

Connect the power input wiring for the DL06. Observe all precautions stated earlier in this manual. For more details on wiring, see Chapter 2 on Installation, Wiring, and Specifications. When the wiring is complete, close the connector covers. Do not apply power at this time.



WARNING: Once the power wiring is connected, secure the terminal block cover in the closed position. When the cover is open there is a risk of electrical shock if you accidentally touch the connection terminals or power wiring.

Fuse Protection for Input Power

There are no internal fuses for the input power circuits, so external circuit protection is needed to ensure the safety of service personnel and the safe operation of the equipment itself. To meet UL/CUL specifications, the input power must be fused. Depending on the type of input power being used, follow these fuse protection recommendations:

208/240 VAC Operation

When operating the unit from 208/240 VAC, whether the voltage source is a step-down transformer or from two phases, fuse both the line (L) and neutral (N) leads. The recommended fuse size is 1.0A (fast blow).

110/125 VAC Operation

When operating the unit from 110/125 VAC, it is only necessary to fuse the line (L) lead; it is not necessary to fuse the neutral (N) lead. The recommended fuse size is 1.0A (fast blow).

12/24 VDC Operation

When operating at these lower DC voltages, wire gauge size is just as important as proper fusing techniques. Using large conductors minimizes the voltage drop in the conductor. Each DL06 input power terminal can accommodate one 16 AWG wire or two 18 AWG wires. A DC failure can maintain an arc for much longer time and distance than AC failures. Typically, the main bus is fused at a higher level than the branch device, which in this case is the DL06. The recommended fuse size for the branch circuit to the DL06 is 1.5A (for example, a Littlefuse 312.001 or equivalent).

External Power Source

The power source must be capable of suppling voltage and current complying with individual Micro PLC specifications, according to the following specifications:

Power Source Specifications		
Item	**DL06 VAC Powered Units**	**DL06 VDC Powered Units**
Input Voltage Range	110/220 VAC (95–240 VAC)	12–24 VDC (10.8–26.4 VDC)
Maximum Inrush Current	13 A, 1ms (95–240 VAC) 15 A, 1ms (240–264 VAC)	10A
Maximum Power	30 VA	20 W
Voltage Withstand (dielectric)	1 minute @ 1500 VAC between primary, secondary, field ground	
Insulation Resistance	> 10 MΩ at 500 VDC	

NOTE: *The rating between all internal circuits is BASIC INSULATION ONLY.*

Planning the Wiring Routes

The following guidelines provide general information on how to wire the I/O connections to DL06 Micro PLCs. For specific information on wiring a particular PLC refer to the corresponding specification sheet which appears later in this chapter.

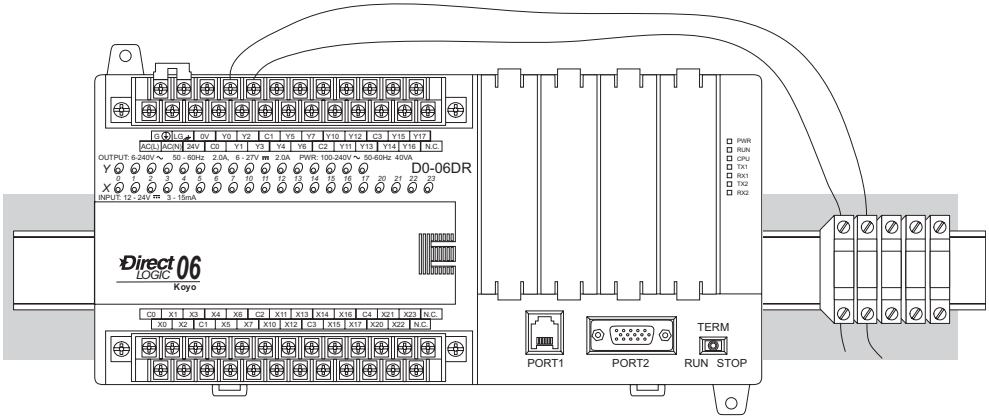
1. Each terminal connection of the DL06 PLC can accept one 16 AWG wire or two 18 AWG size wires. Do not exceed this recommended capacity.

NOTE: *Recommended wire size for field devices is 16 - 22 AWG solid/stranded. Tighten terminal screws to 7.81 lb-in (0.882 N*m) to 9.03 lb-in (1.02 N*m).*

2. Always use a continuous length of wire. Do not splice wires to attain a needed length.
3. Use the shortest possible wire length.
4. Use wire trays for routing where possible.
5. Avoid running wires near high energy wiring.
6. Avoid running input wiring close to output wiring where possible.
7. To minimize voltage drops when wires must run a long distance , consider using multiple wires for the return line.
8. Avoid running DC wiring in close proximity to AC wiring where possible.
9. Avoid creating sharp bends in the wires.
10. Install the recommended powerline filter to reduce power surges and EMI/RFI noise.

Fuse Protection for Input and Output Circuits

Input and Output circuits on DL06 Micro PLCs do not have internal fuses. In order to protect your Micro PLC, we suggest you add external fuses to your I/O wiring. A fast-blow fuse, with a lower current rating than the I/O bank's common current rating can be wired to each common. Or, a fuse with a rating of slightly less than the maximum current per output point can be added to each output. Refer to the Micro PLC specification sheets further in this chapter to find the maximum current per output point or per output common. Adding the external fuse does not guarantee the prevention of Micro PLC damage, but it will provide added protection.



I/O Point Numbering

All DL06 Micro PLCs have a fixed I/O configuration. It follows the same octal numbering system used on other ***Direct***Logic family PLCs, starting at X0 and Y0. The letter X is always used to indicate inputs and the letter Y is always used for outputs.

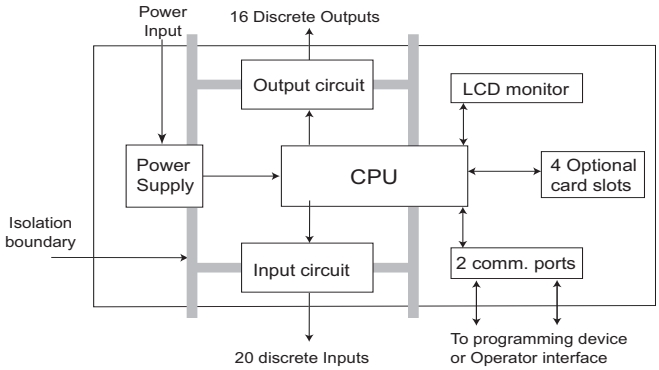
The I/O numbering always starts at zero and does not include the digits 8 or 9. The addresses are typically assigned in groups of 8 or 16, depending on the number of points in an I/O group. For the DL06 the twenty inputs use reference numbers X0 – X23. The sixteen output points use references Y0 – Y17.

System Wiring Strategies

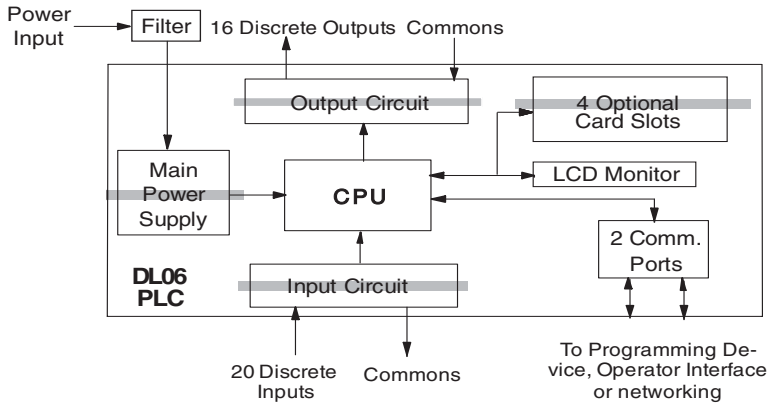
The DL06 Micro PLC is very flexible and will work in many different wiring configurations. By studying this section before actual installation, you can probably find the best wiring strategy for your application. This will help to lower system cost, wiring errors, and avoid safety problems.

PLC Isolation Boundaries

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. A powerline filter will provide isolation between the power source and the power supply. A transformer in the power supply provides magnetic isolation between the primary and secondary sides. Opto-couplers provide optical isolation in Input and Output circuits. This isolates logic circuitry from the field side, where factory machinery connects. Note that the discrete inputs are isolated from the discrete outputs, because each is isolated from the logic side. Isolation boundaries protect the operator interface (and the operator) from power input faults or field wiring faults. *When wiring a PLC, it is extremely important to avoid making external connections that connect logic side circuits to any other.*



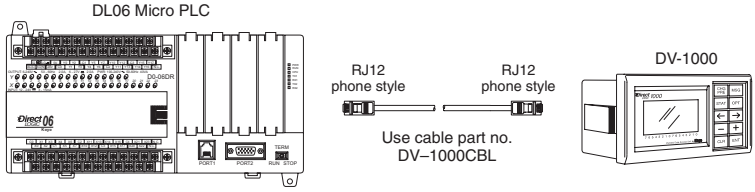
The next figure shows the internal layout of DL06 PLCs, as viewed from the front panel.



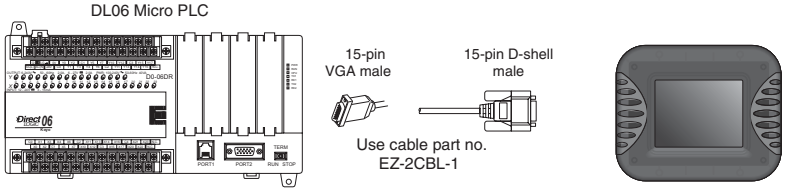
Connecting Operator Interface Devices

Operator interfaces require data and power connections. Operator interfaces with a large CRT usually require separate AC power. However, small operator interface devices like the popular DV-1000 Data Access Unit may be powered directly from the DL06 Micro PLC.

Connect the DV-1000 to communication port 1 on the DL06 Micro PLC using the cable shown below. A single cable contains transmit/receive data wires and +5V power.

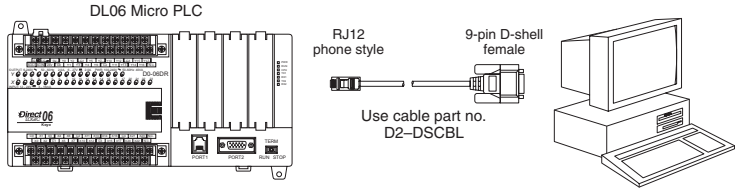


EZ-Touch and EZ-Text operator interface panels require separate power and communications connections. Connect the DL06 to the proper D-shell connector on the rear of the operator panel using the cable shown below. These panels require 8–30VDC power.

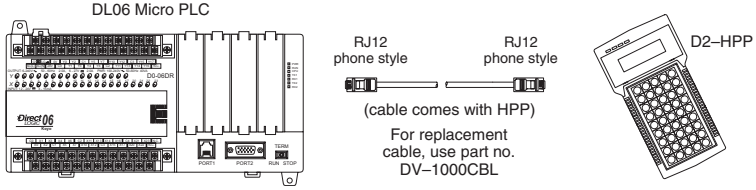


Connecting Programming Devices

DL06 Micro PLCs can be programmed with either a handheld programmer or with *Direct*SOFT32 on a PC. Connect the DL06 to a PC using the cable shown below.



The D2-HPP Handheld Programmer comes with a communications cable. For a replacement part, use the cable shown below.



Sinking / Sourcing Concepts

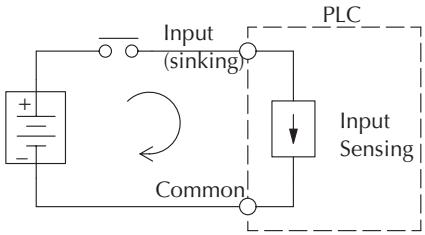
Before going further in our presentation of wiring strategies, we need to introduce the concepts of "sinking" and "sourcing." These terms apply to typical input or output circuits. It is the goal of this section to make these concepts easy to understand. First we give the following short definitions, followed by practical applications.

Sinking = Path to supply ground (–)

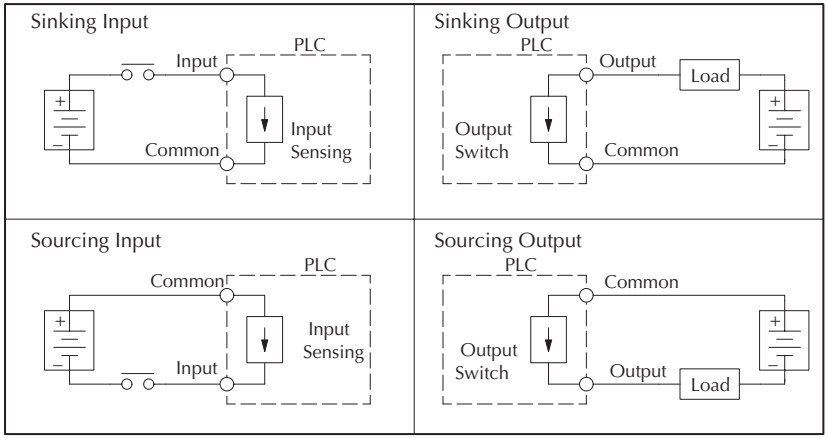
Sourcing = Path to supply source (+)

Notice the reference to (+) and (–) polarities. S*inking and sourcing terminology applies only to DC input and output circuits.* Input and output points that are either sinking or sourcing can conduct current in only one direction. This means it is possible to connect the external supply and field device to the I/O point with current trying to flow in the wrong direction, and the circuit will not operate. However, we can successfully connect the supply and field device every time by understanding "sourcing" and "sinking."

For example, the figure to the right depicts a "sinking" input. To properly connect the external supply, we just have to connect it so the the input *provides a path to ground (–)*. So, we start at the PLC input terminal, follow through the input sensing circuit, exit at the common terminal, and connect the supply (–) to the common terminal. By adding the switch, between the supply (+) and the input, we have completed the circuit. Current flows in the direction of the arrow when the switch is closed.

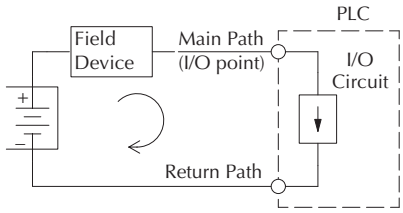


By applying the circuit principle above to the four possible combinations of input/output sinking/sourcing types, we have the four circuits as shown below. The DC-powered DL06 Micro PLCs have selectable sinking or sourcing inputs and either sinking or sourcing outputs. Any pair of input/output circuits shown below is possible with one of the DL06 models.

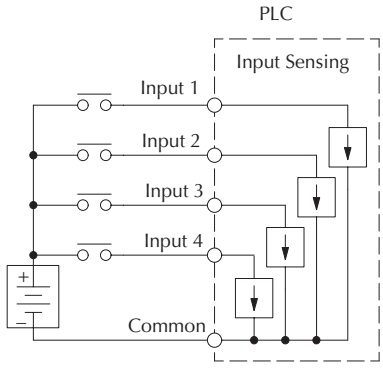


I/O "Common" Terminal Concepts

In order for a PLC I/O circuit to operate, current must enter at one terminal and exit at another. This means at least two terminals are associated with every I/O point. In the figure to the right, the input or output terminal is the *main path* for the current. One additional terminal must provide the *return path* to the power supply.

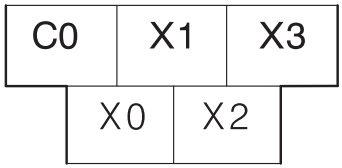


Most input or output point groups on PLCs share the return path among two or more I/O points. The figure to the right shows a group (*or bank*) of 4 input points which share a common return path. In this way, the four inputs require only five terminals instead of eight.



Note: *In the circuit to the right, the current in the common path is 4 times any channel's input current when all inputs are energized. This is especially important in output circuits, where heavier gauge wire is sometimes necessary on commons.*

Most DL06 input and output circuits are grouped into banks that share a common return path. The best indication of I/O common grouping is on the wiring label. The I/O common groups are separated by a bold line. A thinner line separates the inputs associated with that common. To the right, notice that X0, X1, X2, and X3 share the common terminal C0, located to the left of X1.



The following complete set of labels shows five banks of four inputs and four banks of four outputs. One common is provided for each bank.

G ⏚	LG	0V	Y0	Y2	C1	Y5	Y7	Y10	Y12	C3	Y15	Y17
AC(L)	AC(N)	24V	C0	Y1	Y3	Y4	Y6	C2	Y11	Y13	Y14	Y16	N.C.

C0	X1	X3	X4	X6	C2	X11	X13	X14	X16	C4	X21	X23	N.C.
X0	X2	C1	X5	X7	X10	X12	C3	X15	X17	X20	X22	N.C.

This set of labels is for DC (sinking) output versions such as the D0-06DD1 and D0-06DD1-D. One common is provided for each group of four outputs, and one designated terminal on the output side accepts power for the output stage.

G ⏚	LG	0V	Y0	Y2	C1	Y5	Y7	Y10	Y12	C3	Y15	Y17
AC(L)	AC(N)	24V	C0	Y1	Y3	Y4	Y6	C2	Y11	Y13	Y14	Y16	+V

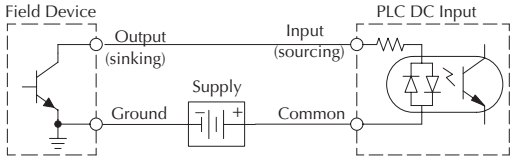
C0	X1	X3	X4	X6	C2	X11	X13	X14	X16	C4	X21	X23	N.C.
X0	X2	C1	X5	X7	X10	X12	C3	X15	X17	X20	X22	N.C.

Connecting DC I/O to "Solid State" Field Devices

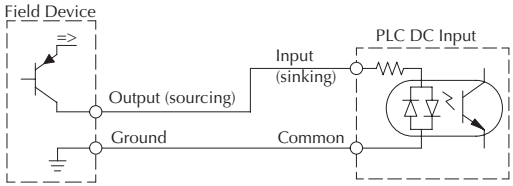
In the previous section on sinking and sourcing concepts, we discussed DC I/O circuits that only allow current to flow one way. This is also true for many of the field devices which have solid-state (transistor) interfaces. In other words, field devices can also be sourcing or sinking. *When connecting two devices in a series DC circuit (as is the case when wiring a field device to a PLC DC input or output), one must be wired as sourcing and the other as sinking.*

Solid State Input Sensors

The DL06's DC inputs are flexible in that they detect current flow in either direction, so they can be wired as either sourcing or sinking. In the following circuit, a field device has an open-collector NPN transistor output. It sinks current from the PLC input point, which sources current. The power supply can be the included auxiliary 24 VDC power supply or another supply (+12 VDC or +24VDC), as long as the input specifications are met.



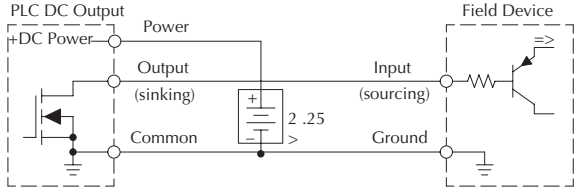
In the next circuit, a field device has an open-emitter PNP transistor output. It sources current to the PLC input point, which sinks the current back to ground. Since the field device is sourcing current, no additional power supply is required between the device and the PLC DC Input.



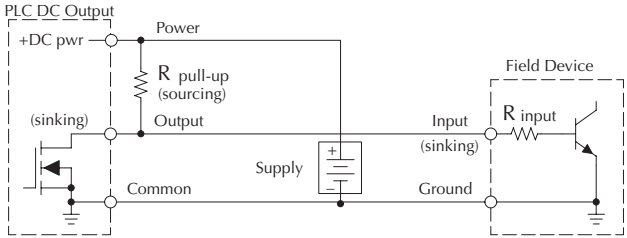
Solid State Output Loads

Sometimes an application requires connecting a PLC output point to a solid state input on a device. This type of connection is usually made to carry a low-level signal, not to send DC power to an actuator.

The DL06 PLC family offers DC outputs that are sinking only or DC outputs that are sourcing. All sixteen outputs have the same electrical common, even though there are four common terminal screws. In the following circuit, the PLC output point sinks current to the output common when energized. It is connected to a sourcing input of a field device input.



In the next example we connect a PLC DC output point to the sinking input of a field device. This is a bit tricky, because both the PLC output and field device input are sinking type. Since the circuit must have one sourcing and one sinking device, we add sourcing capability to the PLC output by using a pull-up resistor. In the circuit below, we connect Rpull-up from the output to the DC output circuit power input.



NOTE: *DO NOT attempt to drive a heavy load (>25 mA) with this pull-up method.*

NOTE 2: *Using the pull-up resistor to implement a sourcing output has the effect of inverting the output point logic. In other words, the field device input is energized when the PLC output is OFF, from a ladder logic point-of-view. Your ladder program must comprehend this and generate an inverted output. Or, you may choose to cancel the effect of the inversion elsewhere, such as in the field device.*

It is important to choose the correct value of R pull-up. In order to do so, we need to know the nominal input current to the field device (I input) when the input is energized. If this value is not known, it can be calculated as shown (a typical value is 15 mA). Then use I input and the voltage of the external supply to compute R pull-up. Then calculate the power Ppull-up (in watts), in order to size R pull-up properly.

$$I_{input} = \frac{V_{input\ (turn\text{–}on)}}{R_{input}}$$

$$R_{pull\text{-}up} = \frac{V_{supply} - 0.7}{I_{input}} - R_{input} \qquad P_{pull\text{-}up} = \frac{V_{supply}^2}{R_{pullup}}$$

Relay Output Wiring Methods

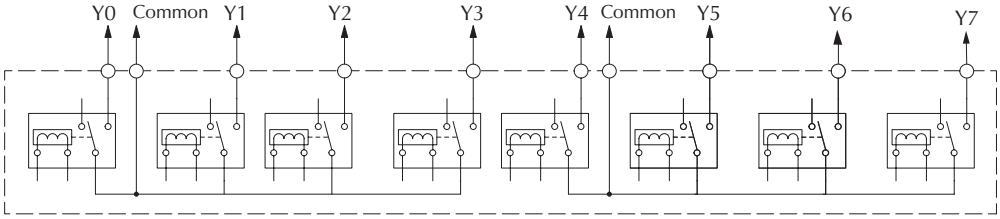
The D0–06AR and the D0–06DR models feature relay outputs. Relays are best for the following applications:

- Loads that require higher currents than the solid-state DL06 outputs can deliver
- Cost-sensitive applications
- Some output channels need isolation from other outputs (such as when some loads require AC while others require DC)

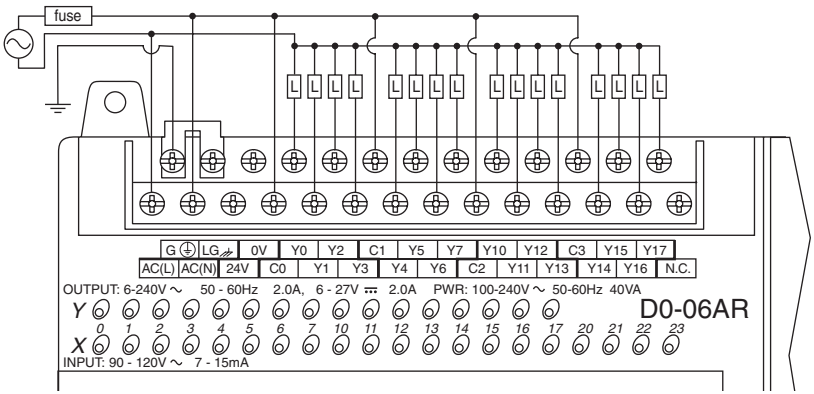
Some applications in which NOT to use relays:

- Loads that require currents under 10 mA
- Loads which must be switched at high speed and duty cycle

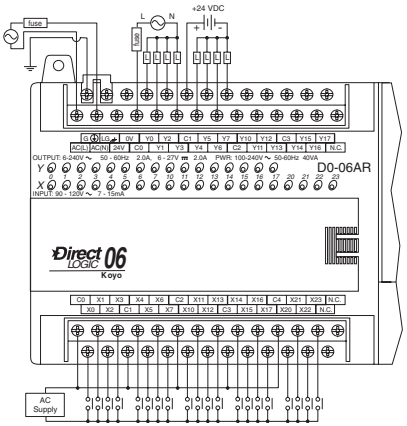
This section presents various ways to wire relay outputs to the loads. The relay output DL06s have sixteen normally-open SPST relays available. They are organized with four relays per common. The figure below shows the relays and the internal wiring of the PLC. Note that each group is isolated from the other group of outputs.



In the circuit below, all loads use the same AC power supply which powers the DL06 PLC. In this example, all commons are connected together.



In the circuit on the following page, loads for Y0 – Y3 use the same AC power supply which powers the DL06 PLC. Loads for Y4 – Y7 use a separate DC supply. In this example, the commons are separated according to which supply powers the associated load.



Surge Suppression For Inductive Loads

Inductive load devices (devices with a coil) generate transient voltages when de-energized with a relay contact. When a relay contact is closed it "bounces", which energizes and de-energizes the coil until the "bouncing" stops. The transient voltages generated are much larger in amplitude than the supply voltage, especially with a DC supply voltage.

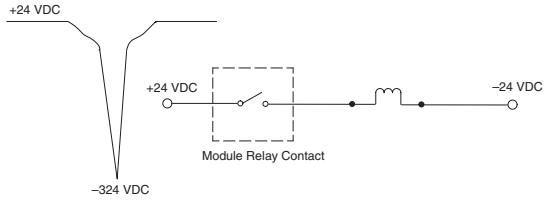
When switching a DC-supplied inductive load the full supply voltage is always present when the relay contact opens (or "bounces"). When switching an AC-supplied inductive load there is one chance in 60 (60 Hz) or 50 (50 Hz) that the relay contact will open (or "bounce") when the AC sine wave is zero crossing. If the voltage is not zero when the relay contact opens there is energy stored in the inductor that is released when the voltage to the inductor is suddenly removed. This release of energy is the cause of the transient voltages.

When inductive load devices (motors, motor starters, interposing relays, solenoids, valves, etc.) are controlled with relay contacts, it is recommended that a surge suppression device be connected directly across the coil of the field device. If the inductive device has plug-type connectors, the suppression device can be installed on the terminal block of the relay output.

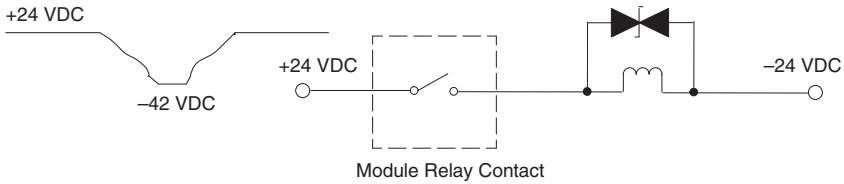
Transient Voltage Suppressors (TVS or transorb) provide the best surge and transient suppression of AC and DC powered coils, providing the fastest response with the smallest overshoot.

Metal Oxide Varistors (MOV) provide the next best surge and transient suppression of AC and DC powered coils.

For example, the waveform in the figure below shows the energy released when opening a contact switching a 24 VDC solenoid. Notice the large voltage spike.



This figure shows the same circuit with a transorb (TVS) across the coil. Notice that the voltage spike is significantly reduced.



Use the following table to help select a TVS or MOV suppressor for your application based on the inductive load voltage.

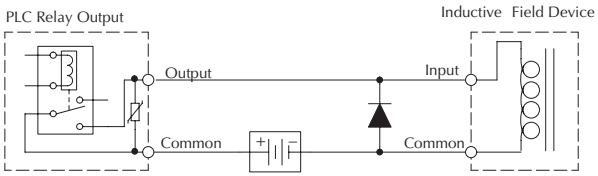
Surge Suppressors			
Vendor / Catalog	**Type**	**Inductive Load Voltage**	**Part Number**
Automationdirect	TVS	110/120 VAC	ZL-TD8-120
	TVS	24 VDC	ZL-TD8-24
General Instrument	TVS	110/120 VAC	P6KE180CAGICT–ND
Transient Voltage Suppressors,	TVS	220/240 VDC	P6KE350CA
LiteOn Diodes; from DigiKey	TVS	12/24 VDC or VAC	P6K30CAGICT–ND
Catalog; Phone: 1-800-344-4539	Diode	12/24 VDC or VAC	1N4004CT–ND
Harris Metal Oxide Varistors;|	MOV	110/120 VAC	V150LA20C
from Newark Catalog:	MOV	220/240 VAC	V250LA20C
Phone 1-800-463-9275			

Prolonging Relay Contact Life

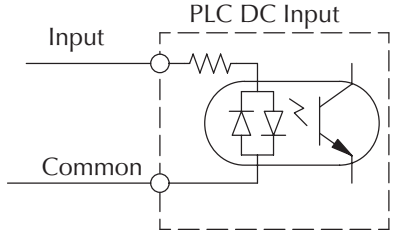
Relay contacts wear according to the amount of relay switching, amount of spark created at the time of open or closure, and presence of airborne contaminants. There are some steps you can take to help prolong the life of relay contacts, such as switching the relay on or off only when it is necessary, and if possible, switching the load on or off at a time when it will draw the least current. Also, take measures to suppress inductive voltage spikes from inductive DC loads such as contactors and solenoids.

For inductive loads in DC circuits we recommend using a suppression diode as shown in the following diagram (DO NOT use this circuit with an AC power supply). When the load is energized the diode is reverse-biased (high impedance). When the load is turned off, energy stored in its coil is released in the form of a negative-going voltage spike. At this moment the diode is forward-biased (low impedance) and shunts the energy to ground. This protects the relay contacts from the high voltage arc that would occur just as the contacts are opening.

Place the diode as close to the inductive field device as possible. Use a diode with a peak inverse voltage rating (PIV) at least 100 PIV, 3A forward current or larger. Use a fast-recovery type (such as Schottky type). DO NOT use a small-signal diode such as 1N914, 1N941, etc. Be sure the diode is in the circuit correctly before operation. If installed backwards, it short-circuits the supply when the relay energizes.

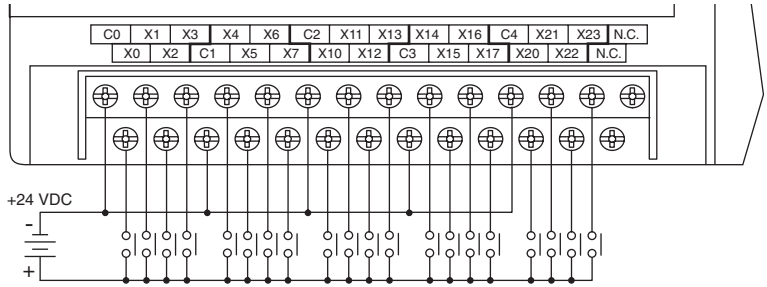


DC Input Wiring Methods

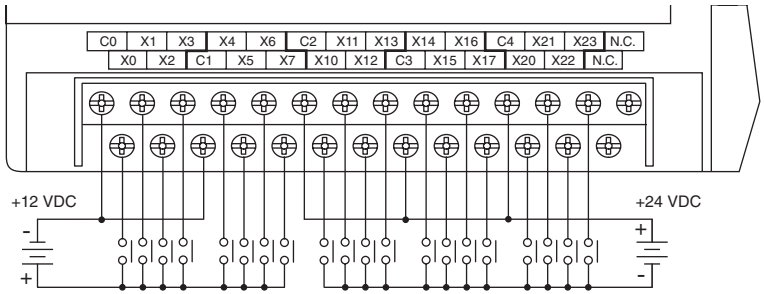


DL06 Micro PLCs with DC inputs are particularly flexible because they can be wired as either sinking or sourcing. The dual diodes (shown to the right) allow 10.8 – 26.4 VDC. The target applications are +12 VDC and +24 VDC. You can actually wire each group of inputs associated common group of inputs as DC sinking and the other half as DC sourcing. Inputs grouped by a common must be all sinking or all sourcing.

In the first and simplest example below, all commons are connected together and all inputs are sinking.



In the next example, the first eight inputs are sinking, and the last twelve are sourcing.

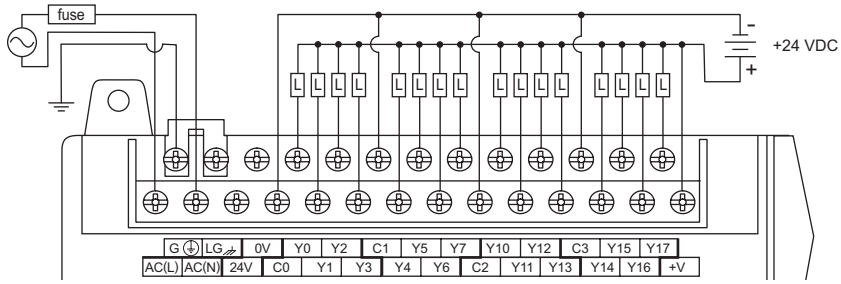


DC Output Wiring Methods

DL06 DC output circuits are high-performance transistor switches with low on-resistance and fast switching times. Please note the following characteristics which are unique to the DC output type:

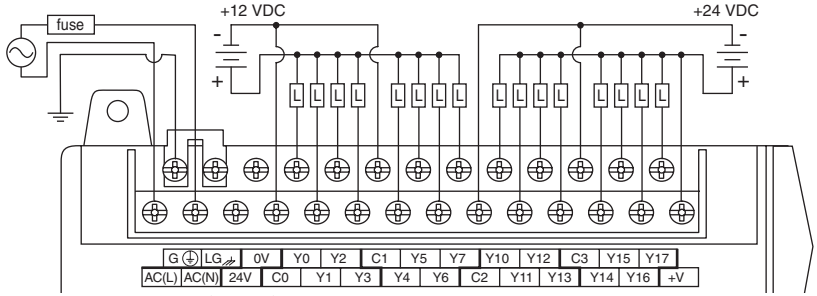
- There is only one electrical common for all sixteen outputs. All sixteen outputs belong to one bank.
- The output switches are current-sinking only or current sourcing only. ***Refer to the detailed specifications in this manual to determine which type output is present on a particular model.***
- The output circuit inside the PLC requires external power. The supply (–) must be connected to a common terminal, and the supply (+) connects the the right-most terminal on the upper connector (+V).

In the example below, all sixteen outputs share a common supply.



In the next example below, the outputs have "split" supplies. The first eight outputs are using a +12 VDC supply, and the last eight are using a +24 VDC supply. However, you can split the outputs among any number of supplies, as long as:

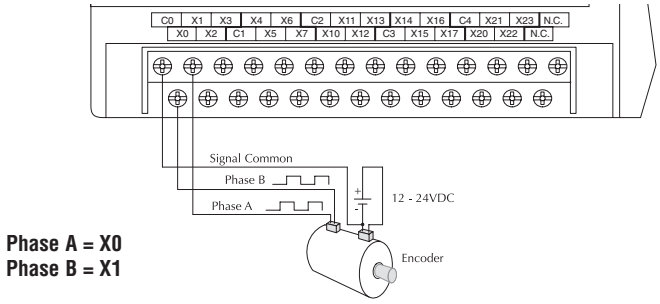
- all supply voltages are within the specified range



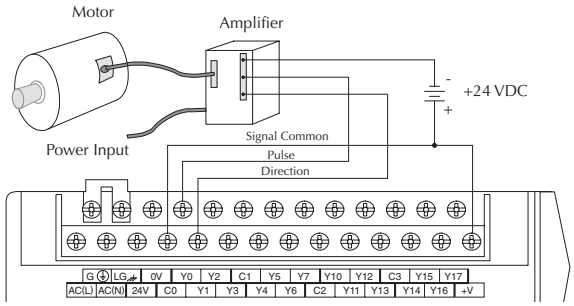
- all output points are wired as sinking
- all source (–) terminals are connected together

High-Speed I/O Wiring Methods

DL06 versions with DC type input or output points contain a dedicated High-Speed I/O circuit (HSIO). The circuit configuration is programmable, and it processes specific I/O points independently from the CPU scan. Chapter 3 discusses the programming options for HSIO. While the HSIO circuit has six modes, we show wiring diagrams for two of the most popular modes in this chapter. The high-speed input interfaces to points X0 – X3. Properly configured, the DL06 can count quadrature pulses at up to 7 kHz from an incremental encoder as shown below.



DL06 versions with DC type output points can use the High Speed I/O Pulse Output feature. It can generate high-speed pulses at up to 10 kHz for specialized control such as stepper motor / intelligent drive systems. Output Y0 and Y1 can generate pulse and direction signals, or it can generate CCW and CW pulse signals respectively. See Chapter 3 on high-speed input and pulse output options.



Glossary of Specification Terms

Discrete Input
One of twenty input connections to the PLC which converts an electrical signal from a field device to a binary status (off or on), which is read by the internal CPU each PLC scan.

Discrete Output
One of sixteen output connections from the PLC which converts an internal ladder program result (0 or 1) to turn On or Off an output switching device. This enables the program to turn on and off large field loads.

I/O Common
A connection in the input or output terminals which is shared by multiple I/O circuits. It usually is in the return path to the power supply of the I/O circuit.

Input Voltage Range
The operating voltage range of the input circuit.

Maximum Voltage
Maximum voltage allowed for the input circuit.

ON Voltage Level
The minimum voltage level at which the input point will turn ON.

OFF Voltage Level
The maximum voltage level at which the input point will turn OFF

Input Impedance
Input impedance can be used to calculate input current for a particular operating voltage.

Input Current
Typical operating current for an active (ON) input.

Minimum ON Current
The minimum current for the input circuit to operate reliably in the ON state.

Maximum OFF Current
The maximum current for the input circuit to operate reliably in the OFF state.

OFF to ON Response
The time the module requires to process an OFF to ON state transition.

ON to OFF Response
The time the module requires to process an ON to OFF state transition.

Status Indicators
The LEDs that indicate the ON/OFF status of an input or output point. All LEDs on DL06 Micro PLCs are electrically located on the logic side of the input or output circuit.

Wiring Diagrams and Specifications

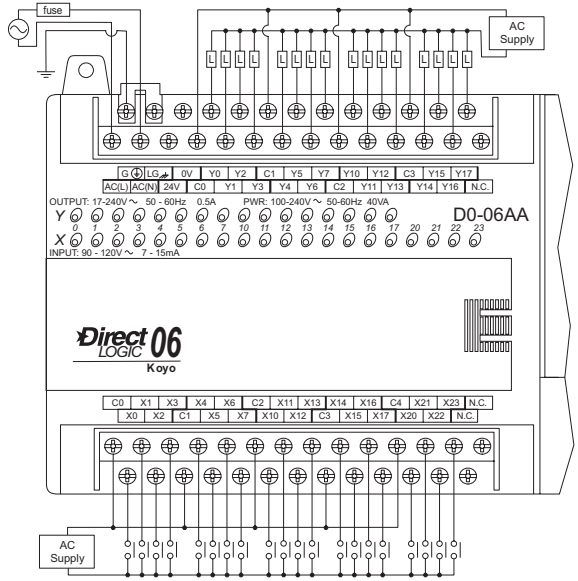
The remainder of this chapter provides detailed technical information for the DL06 PLCs. A basic wiring diagram, equivalent I/O circuits, and specification tables are laid out for each PLC.

D0–06AA I/O Wiring Diagram

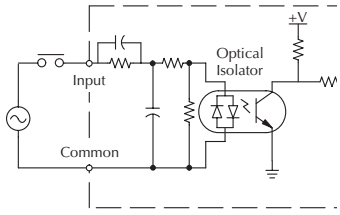
The D0–06AA PLC has twenty AC inputs and sixteen AC outputs. The following diagram shows a typical field wiring example. The AC external power connection uses four terminals as shown.

Inputs are organized into five banks of four. Each bank has an isolated common terminal. The wiring example below shows all commons connected together, but separate supplies and common circuits may be used. The equivalent input circuit shows one channel of a typical bank.

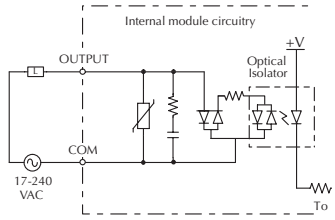
Outputs are organized into four banks of four triac switches. Each bank has a common terminal. The wiring example below shows all commons connected together, but separate supplies and common circuits may be used. The equivalent output circuit shows one channel of a typical bank.



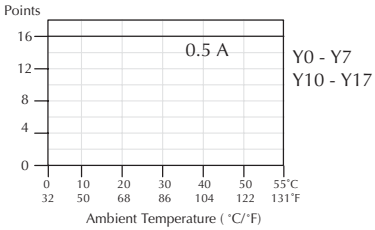
Equivalent Input Circuit



Equivalent Output Circuit



Derating Chart for AC Outputs



D0-06AA General Specifications	
External Power Requirements	100– 240 VAC, 40 VA maximum,
Communication Port 1 9600 baud (Fixed), 8 data bits, 1 stop bit odd parity	K–Sequence (Slave), DirectNET (Slave), MODBUS (Slave)
Communication Port 2 9600 baud (default) 8 data bits, 1 stop bit odd parity	K–Sequence (Slave),DirectNET (Master/Slave), MODBUS (Master/Slave), Non-sequence / print, ASCII in/out
Programming cable type	D2–DSCBL
Operating Temperature	32 to 131° F (0 to 55 C)
Storage Temperature	–4 to 158° F (–20 to 70 C)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3–304
Terminal Type	Removable
Wire Gauge	One AWG16 or two AWG18, AWG24 minimum

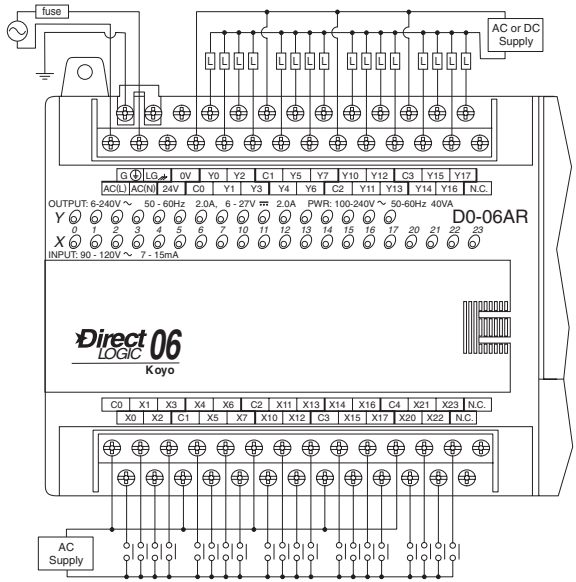
AC Input Specifications	
Input Voltage Range (Min. - Max.)	80 – 132 VAC, 47 - 63 Hz
Operating Voltage Range	90 – 120 VAC, 47 - 63 Hz
Input Current	8 mA @100 VAC at 50 Hz 10 mA @100 VAC at 60 Hz
Max. Input Current	12 mA @132 VAC at 50 Hz 15 mA @132 VAC at 60 Hz
Input Impedance	14KΩ @50 Hz, 12KΩ @60Hz
ON Current/Voltage	> 6 mA @ 75 VAC
OFF Current/Voltage	< 2 mA @ 20 VAC
OFF to ON Response	< 40 mS
ON to OFF Response	< 40 mS
Status Indicators	Logic Side
Commons	4 channels / common x 5 banks (isolated)

AC Output Specifications	
Output Voltage Range (Min. - Max.)	15 – 264 VAC, 47 – 63 Hz
Operating Voltage	17 – 240 VAC, 47 – 63 Hz
On Voltage Drop	1.5 VAC (>50mA) 4.0 VAC (<50mA)
Max Current	0.5 A / point, 1.5 A / common
Max leakage current	<4 mA @ 264 VAC
Max inrush current	10 A for 10 mS
Minimum Load	10 mA
OFF to ON Response	1 mS
ON to OFF Response	1 mS +1/2 cycle
Status Indicators	Logic Side
Commons	4channels / common x 4 banks (isolated)
Fuses	None (external recommended)

D0–06AR I/O Wiring Diagram

The D0–06AR PLC has twenty AC inputs and sixteen relay contact outputs. The following diagram shows a typical field wiring example. The AC external power connection uses four terminals at the left as shown.

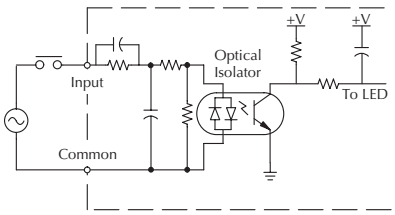
The twenty AC input channels use terminals on the bottom of the connector. Inputs are organized into five banks of four. Each bank has a common terminal. The wiring example below shows all commons connected together, but separate supplies and common circuits may be used. The equivalent input circuit shows one channel of a typical bank.



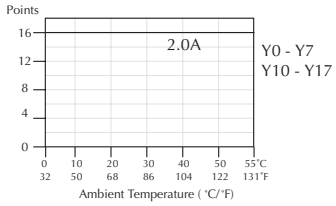
Typical Relay Life (Operations) at Room Temperature

Voltage & Load Type	Load Current	
	At 1A	At 2A
24VDC Resistive	500K	250K
24VDC Resistive	100K	50K
110VAC Resistive	500K	250K
110VAC Resistive	200K	100K
220VAC Resistive	350K	200K
220VAC Resistive	100K	50K

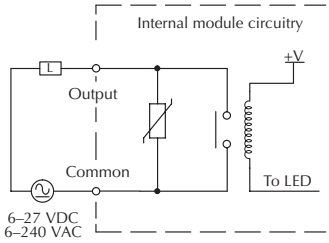
Equivalent Input Circuit



Derating Chart for Relay Outputs



Equivalent Output Circuit



The sixteen relay output channels use terminals on the right side top connector. Outputs are organized into four banks of four normally-open relay contacts. Each bank has a common terminal. The wiring example on the last page shows all commons connected together, but separate supplies and common circuits may be used. The equivalent output circuit shows one channel of a typical bank. The relay contacts can switch AC or DC voltages.

D0-06AR General Specifications	
External Power Requirements	100 – 240 VAC, 40 VA maximum,
Communication Port 1 9600 baud (Fixed), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Slave), MODBUS (Slave)
Communication Port 2 9600 baud (default), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Master/Slave), MODBUS (Master/Slave), Non-sequence / print, ASCII in/out
Programming cable type	D2–DSCBL
Operating Temperature	32 to 131° F (0 to 55 C)
Storage Temperature	–4 to 158° F (–20 to 70 C)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3–304
Terminal Type	Removable
Wire Gauge	One AWG16 or two AWG18, AWG24 minimum

AC Input Specifications X0-X23	
Input Voltage Range (Min. - Max.)	80 – 132 VAC, 47 - 63 Hz
Operating Voltage Range	90 – 120 VAC, 47 -63 Hz
Input Current	8 mA @ 100 VAC at 50 Hz 10 mA @ 100 VAC at 60 Hz
Max. Input Current	12 mA @ 132 VAC at 50 Hz 15 mA @ 132 VAC at 60 Hz
Input Impedance	14KΩ @50 Hz, 12KΩ @60 Hz
ON Current/Voltage	>6 mA @ 75 VAC
OFF Current/Voltage	<2 mA @ 20 VAC
OFF to ON Response	< 40 mS
ON to OFF Response	< 40 mS
Status Indicators	Logic Side
Commons	4 channels / common x 5 banks (isolated)

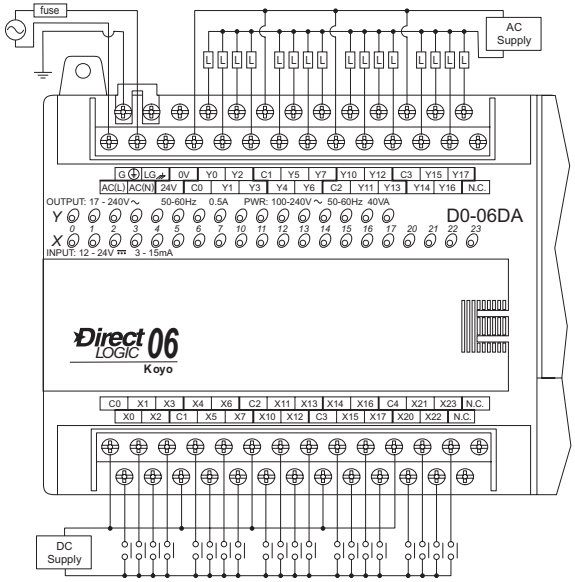
Relay Output Specifications Y0-Y17	
Output Voltage Range	(Min. – Max.) 5 – 264 VAC (47 -63 Hz), 5 – 30 VDC
Operating Voltage Range	6 – 240 VAC (47 -63 Hz), 6 – 27 VDC
Output Current	2A / point, 6A / common
Max. leakage current	0.1 mA @264VAC
Smallest Recommended Load	5 mA @5 VDC
OFF to ON Response	< 15 mS
ON to OFF Response	< 10 mS
Status Indicators	Logic Side
Commons	4 channels / common x 4 banks (isolated)
Fuses	None (external recommended)

D0–06DA I/O Wiring Diagram

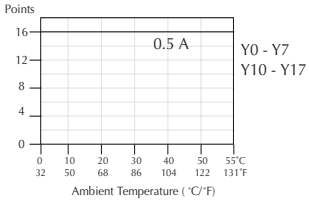
The D0–06DA PLC has twenty DC inputs and sixteen AC outputs. The following diagram shows a typical field wiring example. The AC external power connection uses four terminals as shown.

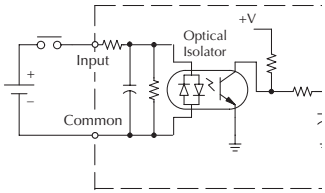
Inputs are organized into five banks of four. Each bank has an isolated common terminal, and may be wired as sinking or sourcing. The wiring example below shows all commons connected together, but separate supplies and common circuits may be used. The equivalent circuit for standard inputs is shown below, and the high-speed input circuit is shown to the left.

Outputs are organized into four banks of four triac switches. Each bank has a common terminal. The wiring example below shows all commons connected together, but separate supplies and common circuits may be used. The equivalent output circuit shows one channel of a typical bank.

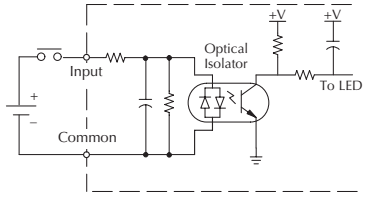


Derating Chart for AC Outputs

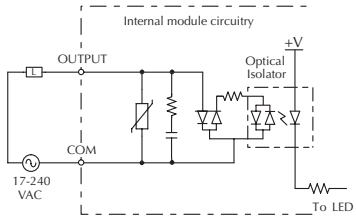




High Speed Inputs (X0-X3)



Standard Inputs (X4-X23)



Equivalent Output Circuit

D0-06DA General Specifications	
External Power Requirements	100 – 240 VAC, 40 VA maximum,
Communication Port 1 9600 baud (Fixed), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Slave), MODBUS (Slave)
Communication Port 2 9600 baud (default), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Master/Slave), MODBUS (Master/Slave), Non-sequence/print, ASCII in/out
Programming cable type	D2–DSCBL
Operating Temperature	32 to 131° F (0 to 55 C)
Storage Temperature	–4 to 158° F (–20 to 70 C)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3–304
Terminal Type	Removable
Wire Gauge	One AWG16 or two AWG18, AWG24 minimum

DC Input Specifications		
Parameter	**High–Speed Inputs, X0 – X3**	**Standard DC Inputs X4 – X23**
Input Voltage Range	10.8 – 26.4 VDC	10.8 – 26.4 VDC
Operating Voltage Range	12 – 24 VDC	12 – 24 VDC
Maximum Voltage	30 VDC (7 kHz maximum frequency)	30 VDC
Minimum Pulse Width	70 µS	N/A
ON Voltage Level	> 10 VDC	> 10 VDC
OFF Voltage Level	< 2.0 VDC	< 2.0 VDC
Input Impedance	1.8 kΩ @ 12 – 24 VDC	2.8 kΩ @ 12 – 24 VDC
Minimum ON Current	>5 mA	>4 mA
Maximum OFF Current	< 0.5 mA	<0.5 mA
OFF to ON Response	<70 µS	2 – 8 mS, 4 mS typical
ON to OFF Response	<70 µS	2 – 8 mS, 4 mS typical
Status Indicators	Logic side	Logic side
Commons	4 channels / common x 5 bank (isolated)	

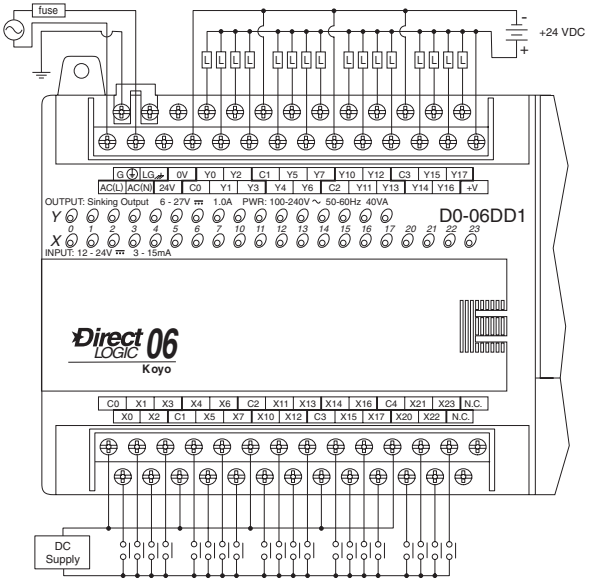
AC Output Specifications	
Output Voltage Range (Min. - Max.)	15 – 264 VAC, 47 – 63 Hz
Operating Voltage	17 – 240 VAC, 47 – 63 Hz
On Voltage Drop	1.5 VAC @> 50mA, 4 VAC @< 50mA
Max Current	0.5 A / point, 1.5 A / common
Max leakage current	< 4 mA @ 264 VAC, 60Hz
Max inrush current	10 A for 10 mS
Minimum Load	10 mA
OFF to ON Response	1 mS
ON to OFF Response	1 mS +1/2 cycle
Status Indicators	Logic Side
Commons	4 channels / common x 4 banks (isolated)
Fuses	None (external recommended)

D0–06DD1 I/O Wiring Diagram

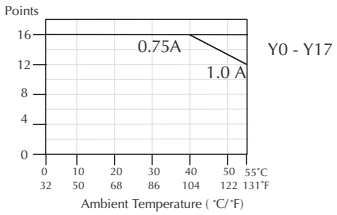
The D0-06DD1 PLC has twenty DC inputs and sixteen DC outputs. The following diagram shows a typical field wiring example. The AC external power connection uses four terminals as shown.

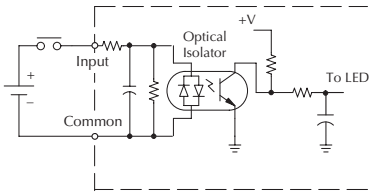
Inputs are organized into five banks of four. Each bank has an isolated common terminal, and may be wired as either sinking or sourcing inputs. The wiring example below shows all commons connected together, but separate supplies and common circuits may be used.

Outputs all share the same common. Note the requirement for external power.

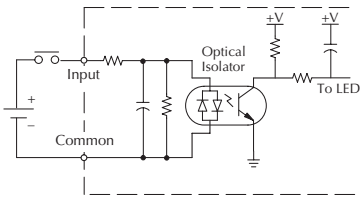


Derating Chart for DC Outputs

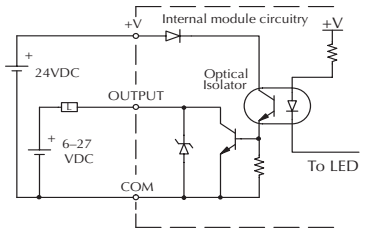




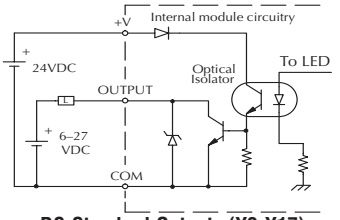
High Speed Inputs (X0-X3)



DC Standard Inputs (X4-X23)



DC Pulse Outputs (Y0-Y1)



DC Standard Outputs (Y2-Y17)

D0-06DD1 General Specifications	
External Power Requirements	100 – 240 VAC, 40 VA maximum,
Communication Port 1 9600 baud (Fixed), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Slave), MODBUS (Slave)
Communication Port 2 9600 baud (default), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Master/Slave), MODBUS (Master/Slave), Non-sequence / print, ASCII in/out
Programming cable type	D2–DSCBL
Operating Temperature	32 to 131° F (0 to 55 C)
Storage Temperature	–4 to 158° F (–20 to 70 C)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3–304
Terminal Type	Removable
Wire Gauge	One AWG16 or two AWG18, AWG24 minimum

DC Input Specifications		
Parameter	**High–Speed Inputs, X0 – X3**	**Standard DC Inputs X4 – X23**
Min. - Max. Voltage Range	10.8 – 26.4 VDC	10.8 – 26.4 VDC
Operating Voltage Range	12 – 24 VDC	12 – 24 VDC
Peak Voltage	30 VDC (7 kHz maximum frequency)	30 VDC
Minimum Pulse Width	100 µs	N/A
ON Voltage Level	> 10.0 VDC	> 10.0 VDC
OFF Voltage Level	< 2.0 VDC	< 2.0 VDC
Max. Input Current	6mA @12VDC, 13mA @24VDC	4mA @12VDC, 8.5mA @24VDC
Input Impedance	1.8 Ωk @ 12 – 24 VDC	2.8 Ωk @ 12 – 24 VDC
Minimum ON Current	>5 mA	>4 mA
Maximum OFF Current	< 0.5 mA	<0.5 mA
OFF to ON Response	<70 µS	2 – 8 mS, 4 mS typical
ON to OFF Response	<70 µS	2 – 8 mS, 4 mS typical
Status Indicators	Logic side	Logic side
Commons	4 channels / common x 5 banks isolated	

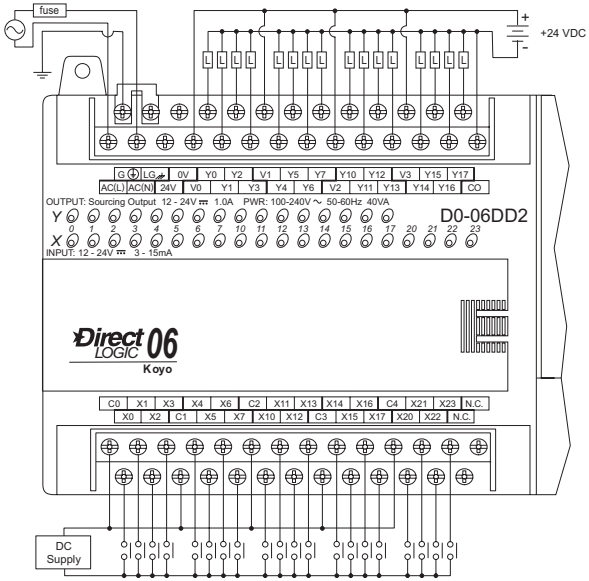
DC Output Specifications		
Parameter	**Pulse Outputs Y0 – Y1**	**Standard Outputs Y2 – Y17**
Min. - Max. Voltage Range	5 – 30 VDC	5 – 30 VDC
Operating Voltage	6 – 27 VDC	6 – 27 VDC
Peak Voltage	< 50 VDC (10 kHz max. frequency)	< 50 VDC
On Voltage Drop	0.3 VDC @ 1 A	0.3 VDC @ 1 A
Max Current (resistive)	0.5 A / pt., 1A / pt. as standard pt.	1.0 A / point
Max leakage current	15µA @ 30 VDC	15µA @ 30 VDC
Max inrush current	2 A for 100 mS	2 A for 100 mS
External DC power required	20 - 28 VDC Max 150mA	20 - 28 VDC Max 280mA (Aux. 24VDC powers V+ terminal (sinking outputs)
OFF to ON Response	< 10µ s	< 10 µs
ON to OFF Response	< 20 µs	< 60 µs
Status Indicators	Logic Side	Logic Side
Commons	4 channels / common x 4 banks non-isolated	
Fuses	None (external recommended)	

D0–06DD2 I/O Wiring Diagram

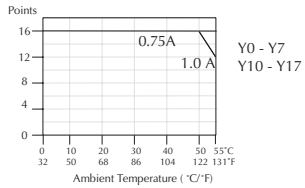
The D0–06DD2 PLC has twenty DC inputs and sixteen sourcing DC outputs. The following diagram shows a typical field wiring example. The AC external power connection uses four terminals as shown.

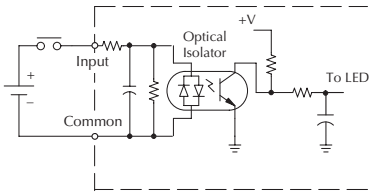
Inputs are organized into four banks of four. Each bank has an isolated common terminal, and may be wired as either sinking or sourcing inputs. The wiring example below shows all commons connected together, but separate supplies and common circuits may be used.

All outputs share the same common. Note the requirement for external power.

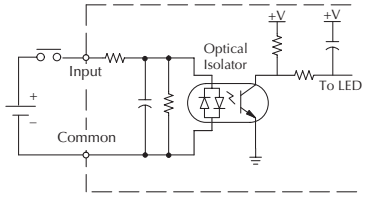


Derating Chart for DC Outputs

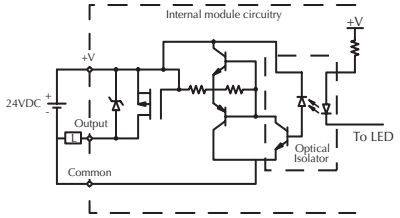




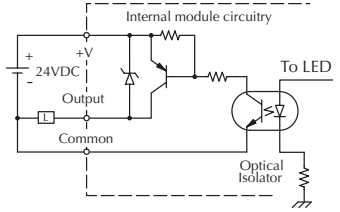
High Speed Inputs (X0-X3)



DC Standard Inputs (X4-X23)



DC Pulse Outputs (Y0-Y1)



DC Standard Outputs (Y2-Y17)

D0-06DD2 General Specifications	
External Power Requirements	100 – 240 VAC, 40 VA maximum,
Communication Port 1 9600 baud (Fixed), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Slave), MODBUS (Slave)
Communication Port 2 9600 baud (default), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Master/Slave), MODBUS (Master/Slave), Non-sequence / print, ASCII in/out
Programming cable type	D2–DSCBL
Operating Temperature	32 to 131° F (0 to 55 C)
Storage Temperature	–4 to 158° F (–20 to 70 C)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3–304
Terminal Type	Removable
Wire Gauge	One AWG16 or two AWG18, AWG24 minimum

DC Input Specifications		
Parameter	**High–Speed Inputs, X0 – X3**	**Standard DC Inputs X4 – X23**
Min. - Max. Voltage Range	10.8 – 26.4 VDC	10.8 – 26.4 VDC
Operating Voltage Range	12 – 24 VDC	12 – 24 VDC
Peak Voltage	30 VDC (7 kHz maximum frequency)	30 VDC
Minimum Pulse Width	70 µs	N/A
ON Voltage Level	> 10.0 VDC	> 10.0 VDC
OFF Voltage Level	< 2.0 VDC	< 2.0 VDC
Max. Input Current	6mA @12VDC, 13mA @24VDC	4mA @12VDC, 8.5mA @24VDC
Input Impedance	1.8 Ωk @ 12 – 24 VDC	2.8 Ωk @ 12 – 24 VDC
Minimum ON Current	>5 mA	>4 mA
Maximum OFF Current	< 0.5 mA	<0.5 mA
OFF to ON Response	<70 µS	2 – 8 mS, 4 mS typical
ON to OFF Response	<70 µS	2 – 8 mS, 4 mS typical
Status Indicators	Logic side	Logic side
Commons	4 channels/common x 5 banks (isolated)	

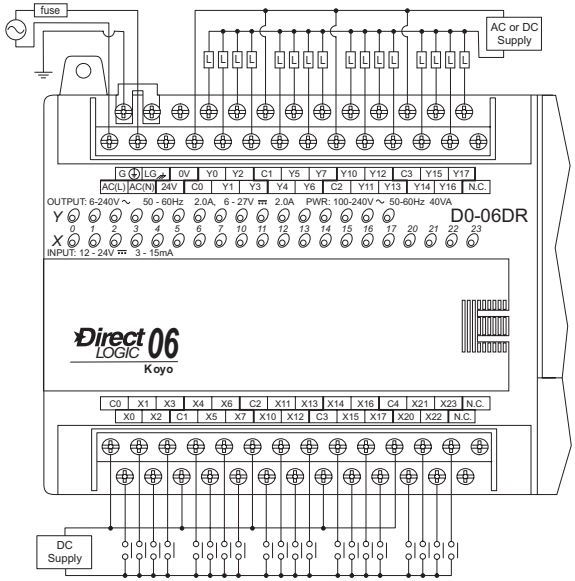
DC Output Specifications		
Parameter	**Pulse Outputs Y0 – Y1**	**Standard Outputs Y2 – Y17**
Min. - Max. Voltage Range	10.8 -26.4 VDC	10.8 -26.4 VDC
Operating Voltage	12-24 VDC	12-24 VDC
Peak Voltage	< 50 VDC (10 kHz max. frequency)	< 50 VDC
On Voltage Drop	0.5VDC @ 1 A	1.2 VDC @ 1 A
Max Current (resistive)	0.5 A / pt., 1A / pt. as standard pt.	1.0 A / point
Max leakage current	15 µA @ 30 VDC	15 µA @ 30 VDC
Max inrush current	2 A for 100 mS	2 A for 100 mS
External DC power required	n/a	n/a
OFF to ON Response	< 10µs	< 10 µs
ON to OFF Response	< 20 µs	< 0.5 µs
Status Indicators	Logic Side	Logic Side
Commons	4 channels / common x 4 banks (non-isolated)	
Fuses	None (external recommended)	

D0–06DR I/O Wiring Diagram

The D0–06DR PLCs feature twenty DC inputs and sixteen relay contact outputs. The following diagram shows a typical field wiring example. The AC external power connection uses four terminals as shown.

Inputs are organized into five banks of four. Each bank has an isolated common terminal, and may be wired as either sinking or sourcing inputs. The wiring example below shows all commons connected together, but separate supplies and common circuits may be used. The equivalent circuit for standard inputs is shown below, and the high-speed input circuit is shown to the left.

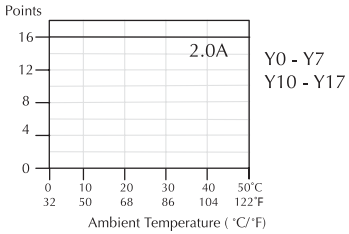
Outputs are organized into four banks of four normally-open relay contacts. Each bank has a common terminal. The wiring example below shows all commons connected together, but separate supplies and common circuits may be used. The equivalent output circuit shows one channel of a typical bank. The relay contacts can switch AC or DC voltages.



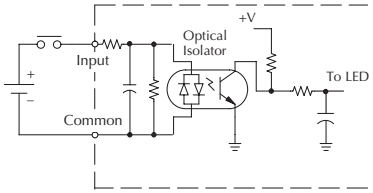
Typical Relay Life (Operations) at Room Temperature

Voltage & Load Type	Load Current	
	At 1A	At 2A
24VDC Resistive	500K	250K
24VDC Resistive	100K	50K
110VAC Resistive	500K	250K
110VAC Resistive	200K	100K
220VAC Resistive	350K	200K
220VAC Resistive	100K	50K

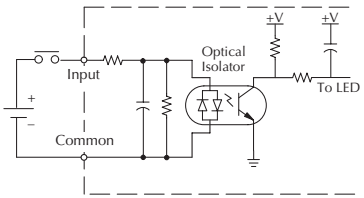
Derating Chart for Relay Outputs



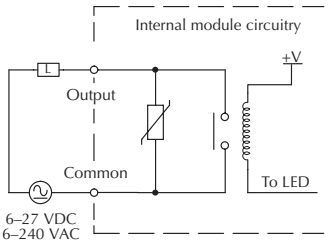
Equivalent Circuit, High-speed Inputs (X0-X3)



Equivalent Circuit, Standard Inputs (X4-X23)



Equivalent Output Circuit



D0-06DR General Specifications	
External Power Requirements	100 – 240 VAC, 40 VA maximum,
Communication Port 1 9600 baud (Fixed), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Slave), MODBUS (Slave)
Communication Port 2 9600 baud (default), 8 data bits, 1 stop bit,odd parity	K–Sequence (Slave), DirectNET (Master/Slave), MODBUS (Master/Slave), Non-sequence /print, ASCII in/out
Programming cable type	D2–DSCBL
Operating Temperature	32 to 131° F (0 to 55 C)
Storage Temperature	–4 to 158° F (–20 to 70 C)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3–304
Terminal Type	Removable
Wire Gauge	One AWG16 or two AWG18, AWG24 minimum

DC Input Specifications		
Parameter	High–Speed Inputs, X0 – X3	Standard DC Inputs X4 – X23
Min. - Max. Voltage Range	10.8 – 26.4 VDC	10.8 – 26.4 VDC
Operating Voltage Range	12 -24 VDC	12 -24 VDC
Peak Voltage	30 VDC (7 kHz maximum frequency)	30 VDC
Minimum Pulse Width	70 µs	N/A
ON Voltage Level	> 10 VDC	> 10 VDC
OFF Voltage Level	< 2.0 VDC	< 2.0 VDC
Input Impedance	1.8 kΩ @ 12 – 24 VDC	2.8 kΩ @ 12 – 24 VDC
Max. Input Current	6mA @12VDC 13mA @24VDC	4mA @12VDC 8.5mA @24VDC
Minimum ON Current	>5 mA	>4 mA
Maximum OFF Current	< 0.5 mA	<0.5 mA
OFF to ON Response	<70 µs	2 – 8 mS, 4 mS typical
ON to OFF Response	<70 µs	2 – 8 mS, 4 mS typical
Status Indicators	Logic side	Logic side
Commons	4 channels / common x 5 banks (isolated)	

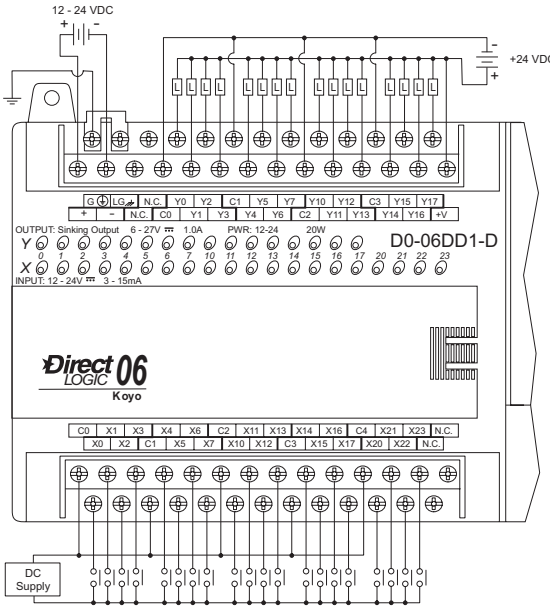
Relay Output Specifications	
Output Voltage Range (Min. - Max.)	5 -264 VAC (47 -63 Hz), 5 - 30 VDC
Operating Voltage	6 -240 VAC (47 -63 Hz), 6 - 27 VDC
Output Current	2A / point 6A / common
Maximum Voltage	264 VAC, 30 VDC
Max leakage current	0.1 mA @264 VAC
Smallest Recommended Load	5 mA
OFF to ON Response	< 15 mS
ON to OFF Response	< 10 mS
Status Indicators	Logic Side
Commons	4 channels / common x 4 banks (isolated)
Fuses	None (external recommended)

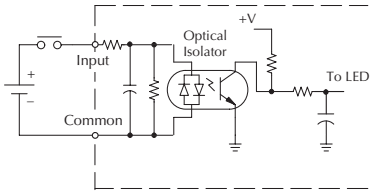
D0–06DD1–D I/O Wiring Diagram

These micro PLCs feature twenty DC inputs and sixteen sinking DC outputs. The following diagram shows a typical field wiring example. The DC external power connection uses four terminals at the left as shown.

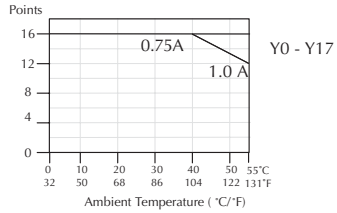
Inputs are organized into five banks of four. Each bank has an isolated common terminal, and may be wired as either sinking or sourcing inputs. The wiring example below shows all commons connected together, but separate supplies and common circuits may be used.

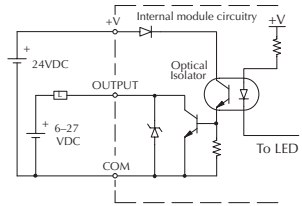
All outputs actually share the same common. Note the requirement for external power.



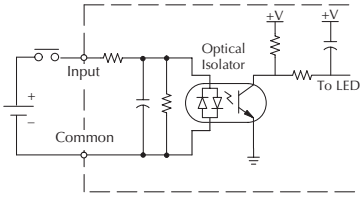


High Speed Inputs (X0-X3)

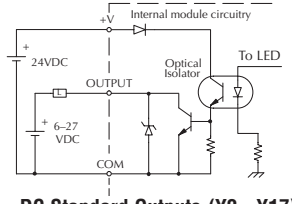




DC Pulse Outputs (Y0 - Y1)



Standard Input Circuit (X4-X23)



DC Standard Outputs (Y2 - Y17)

D0-06DD1-D General Specifications	
External Power Requirements	12 – 24 VDC, 20 W maximum,
Communication Port 1: 9600 baud (Fixed), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Slave), MODBUS (Slave)
Communication Port 2: 9600 baud (default), 8 data bits, 1 stop bit,odd parity	K–Sequence (Slave), DirectNET (Master/Slave), MODBUS (Master/Slave), Non-sequence/print, ASCII in/out
Programming cable type	D2–DSCBL
Operating Temperature	32 to 131° F (0 to 55 C)
Storage Temperature	–4 to 158° F (–20 to 70 C)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3–304
Terminal Type	Removable
Wire Gauge	One AWG16 or two AWG18, AWG24 minimum

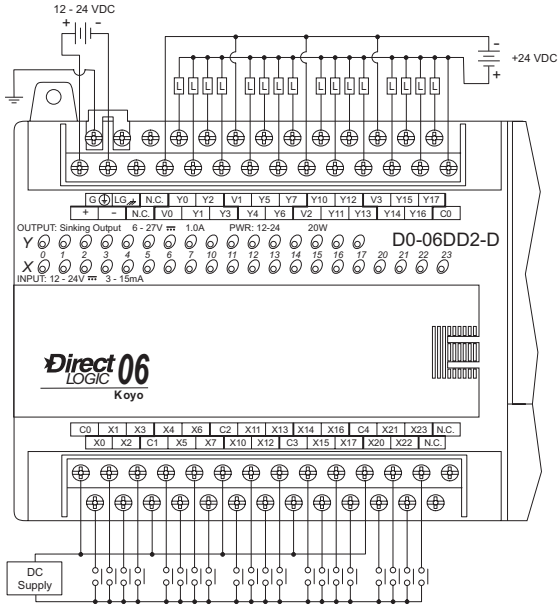
DC Input Specifications		
Parameter	**High–Speed Inputs, X0 – X3**	**Standard DC Inputs X4 – X23**
Min. - Max. Voltage Range	10.8 – 26.4 VDC	10.8 – 26.4 VDC
Operating Voltage Range	12 – 24 VDC	12 – 24 VDC
Peak Voltage	30 VDC (7 kHz maximum frequency)	30 VDC
Minimum Pulse Width	70 µs	N/A
ON Voltage Level	>10.0 VDC	> 10.0 VDC
OFF Voltage Level	< 2.0 VDC	< 2.0 VDC
Max. Input Current	6mA @12VDC, 13mA @24VDC	4mA @12VDC, 8.5mA @24VDC
Input Impedance	1.8 kΩ @ 12 – 24 VDC	2.8 kΩ @ 12 – 24 VDC
Minimum ON Current	>5 mA	>4 mA
Maximum OFF Current	< 0.5 mA	<0.5 mA
OFF to ON Response	<70 µS	2 – 8 mS, 4 mS typical
ON to OFF Response	<70 µS	2 – 8 mS, 4 mS typical
Status Indicators	Logic side	Logic side
	4 channels / common x 5 banks (isolated)	
DC Output Specifications		
Parameter	**Pulse Outputs, Y0 – Y1**	**Standard Outputs, Y2 – Y17**
Min. - Max. Voltage Range	5 – 30 VDC	5 – 30 VDC
Operating Voltage	6 – 27 VDC	6 – 27 VDC
Peak Voltage	< 50 VDC (10 kHz max. frequency)	< 50 VDC
On Voltage Drop	0.3 VDC @ 1 A	0.3 VDC @ 1 A
Max Current (resistive)	0.5 A / pt., 1A / pt. as standard pt.	1.0 A / point
Max leakage current	15 µA @ 30 VDC	15 µA @ 30 VDC
Max inrush current	2 A for 100	mS 2 A for 100 mS
External DC power required	20 - 28 VDC Max 150mA	20 - 28 VDC Max 150mA
OFF to ON Response	< 10 µs	< 10 µs
ON to OFF Response	< 20 µs	< 60 µs
Status Indicators	Logic Side	Logic Side
Commons	4 channels / common x 4 banks (non-isolated)	
Fuses	None (external recommended)	

D0–06DD2–D I/O Wiring Diagram

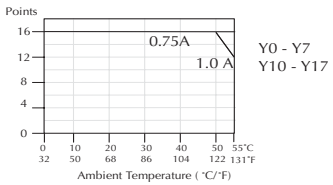
These micro PLCs feature twenty DC inputs and sixteen sinking DC outputs. The following diagram shows a typical field wiring example. The DC external power connection uses four terminals at the left as shown.

Inputs are organized into five banks of four. Each bank has an isolated common terminal, and may be wired as either sinking or sourcing inputs. The wiring example below shows all commons connected together, but separate supplies and common circuits may be used.

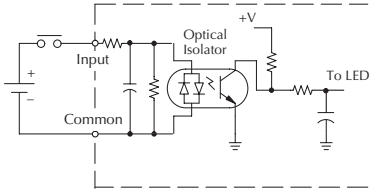
All outputs actually share the same common. Note the requirement for external power.



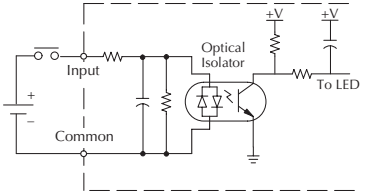
Derating Chart for DC Outputs



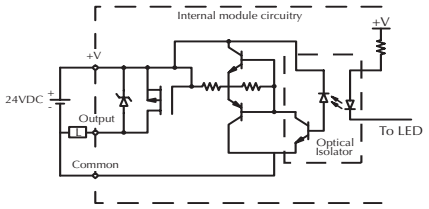
High Speed Inputs (X0-X3)



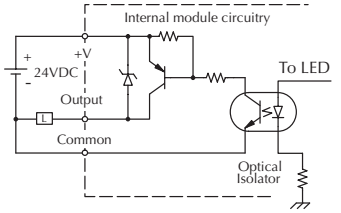
Standard Input Circuit (X4-X23)



DC Pulse Outputs (Y0 - Y1)



DC Standard Outputs (Y2 - Y17)



D0-06DD2-D General Specifications	
External Power Requirements	12 – 24 VDC, 20 W maximum,
Communication Port 1: 9600 baud (Fixed), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Slave), MODBUS (Slave)
Communication Port 2: 9600 baud (default), 8 data bits, 1 stop bit,odd parity	K–Sequence (Slave), DirectNET (Master/Slave), MODBUS (Master/Slave), Non-sequence/print, ASCII in/out
Programming cable type	D2–DSCBL
Operating Temperature	32 to 131° F (0 to 55 C)
Storage Temperature	–4 to 158° F (–20 to 70 C)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3–304
Terminal Type	Removable
Wire Gauge	One AWG16 or two AWG18, AWG24 minimum

DC Input Specifications		
Parameter	**High–Speed Inputs, X0 – X3**	**Standard DC Inputs X4 – X23**
Min. - Max. Voltage Range	10.8 – 26.4 VDC	10.8 – 26.4 VDC
Operating Voltage Range	12 – 24 VDC	12 – 24 VDC
Peak Voltage	30 VDC (7 kHz maximum frequency)	30 VDC
Minimum Pulse Width	70 µs	N/A
ON Voltage Level	>10.0 VDC	> 10.0 VDC
OFF Voltage Level	< 2.0 VDC	< 2.0 VDC
Max. Input Current	15mA @26.4VDC	11mA @26.4VDC
Input Impedance	1.8 kΩ @ 12 – 24 VDC	2.8 kΩ @ 12 – 24 VDC
Minimum ON Current	5 mA	3 mA
Maximum OFF Current	0.5 mA	0.5 mA
OFF to ON Response	<70 µS	2 – 8 mS, 4 mS typical
ON to OFF Response	<70 µS	2 – 8 mS, 4 mS typical
Status Indicators	Logic side	Logic side
Commons	4 channels / common x 5 banks (isolated)	

DC Output Specifications		
Parameter	**Pulse Outputs, Y0 – Y1**	**Standard Outputs, Y2 – Y17**
Min. - Max. Voltage Range	10.8 – 26.4 VDC	10.8 – 26.4 VDC
Operating Voltage	12 – 24 VDC	12 – 24 VDC
Peak Voltage	30 VDC (10 kHz max. frequency)	30 VDC
On Voltage Drop	0.5 VDC @ 1 A	1.2 VDC @ 1 A
Max Current (resistive)	0.5 A / pt., 1A / pt. as standard pt.	1.0 A / point
Max leakage current	15 µA @ 30 VDC	15 µA @ 30 VDC
Max inrush current	2 A for 100	mS 2 A for 100 mS
External DC power required	N/A	N/A
OFF to ON Response	< 10 µS	< 10 µS
ON to OFF Response	< 20 µS	< 0.5 mS
Status Indicators	Logic Side	Logic Side
Commons	4 channels / common x 4 banks (non-isolated)	
Fuses	None (external recommended)	

D0–06DR–D I/O Wiring Diagram

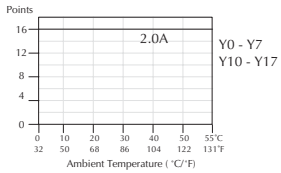
The D0–06DR–D PLC has twenty DC inputs and sixteen relay contact outputs. The following diagram shows a typical field wiring example. The DC external power connection uses three terminals as shown.

Inputs are organized into five banks of four. Each bank has an isolated common terminal, and may be wired as either sinking or sourcing inputs. The wiring example above shows all commons connected together, but separate supplies and common circuits may be used.

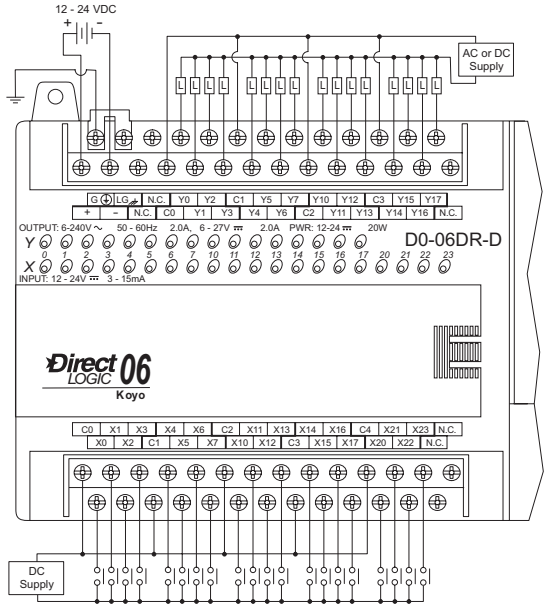
Outputs are organized into four banks of four normally-open relay contacts. Each bank has a common terminal. The wiring example above shows all commons connected together, but separate supplies and common circuits may be used. The equivalent output circuit shows one channel of a typical bank. The relay contacts can switch AC or DC voltages.

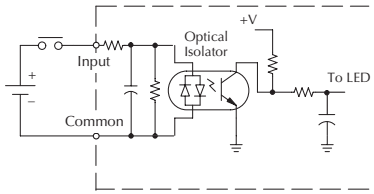
Typical Relay Life (Operations) at Room Temperature

Voltage & Load Type	Load Current	
	At 1A	At 2A
24VDC Resistive	500K	250K
24VDC Resistive	100K	50K
110VAC Resistive	500K	250K
110VAC Resistive	200K	100K
220VAC Resistive	350K	200K
220VAC Resistive	100K	50K

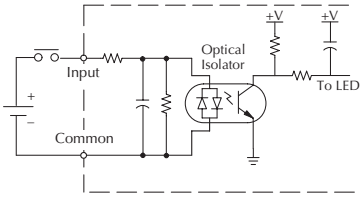


Derating Chart for Relay Outputs

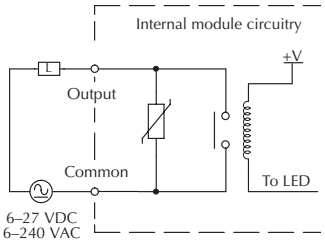




High-speed Input Circuit (X0-X3)



Standard Input Circuit (X4-X23)



Standard Output Circuit

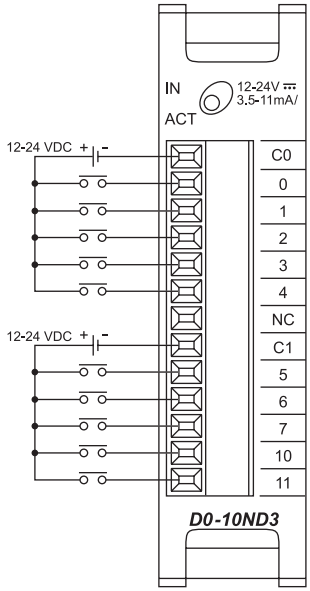
D0-06DR-D General Specifications	
External Power Requirements	12 – 24 VDC, 20 W maximum,
Communication Port 1 9600 baud (Fixed), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Slave), MODBUS (Slave)
Communication Port 2 9600 baud (default), 8 data bits, 1 stop bit, odd parity	K–Sequence (Slave), DirectNET (Master/Slave), MODBUS (Master/Slave),Non-sequence/print, ASCII in/out
Programming cable type	D2–DSCBL
Operating Temperature	32 to 131° F (0 to 55 C)
Storage Temperature	–4 to 158° F (–20 to 70 C)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3–304
Terminal Type	Removable
Wire Gauge	One AWG16 or two AWG18, AWG24 minimum

DC Input Specifications		
Parameter	**High–Speed Inputs, X0 – X3**	**Standard DC Inputs X4 – X23**
Min. - Max. Voltage Range	10.8 – 26.4 VDC	10.8 – 26.4 VDC
Operating Voltage Range	12 -24 VDC	12 -24 VDC
Peak Voltage	30 VDC (7 kHz maximum frequency)	30 VDC
Minimum Pulse Width	70 µs	N/A
ON Voltage Level	> 10 VDC	> 10 VDC
OFF Voltage Level	< 2.0 VDC	< 2.0 VDC
Input Impedance	1.8 kΩ @ 12 – 24 VDC	2.8 kΩ @ 12 – 24 VDC
Max. Input Current	6mA @12VDC 13mA @24VDC	4mA @12VDC 8.5mA @24VDC
Minimum ON Current	>5 mA	>4 mA
Maximum OFF Current	< 0.5 mA	<0.5 mA
OFF to ON Response	<70 µs	2 – 8 mS, 4 mS typical
ON to OFF Response	< 70 µs	2 – 8 mS, 4 mS typical
Status Indicators	Logic side	Logic side
Commons	4 channels / common x 5 banks (isolated)	

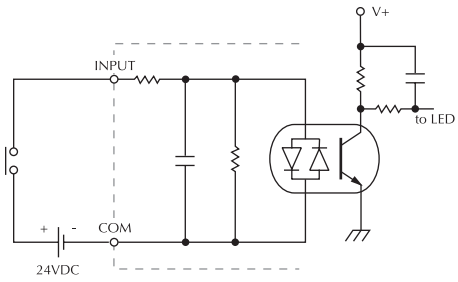
Relay Output Specifications	
Output Voltage Range (Min. - Max.)	5 -264 VAC (47 -63 Hz), 5 - 30 VDC
Operating Voltage	6 -240 VAC (47 -63 Hz), 6 - 27 VDC
Output Current	2A / point 6A / common
Maximum Voltage	264 VAC, 30 VDC
Max leakage current	0.1 mA @264 VAC
Smallest Recommended Load	5 mA
OFF to ON Response	< 15 mS
ON to OFF Response	< 10 mS
Status Indicators	Logic Side
Commons	3 channels / common x 2 banks
Fuses	None (external recommended)

D0-10ND3
10-point DC input module

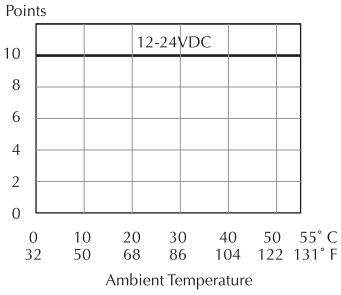
D0-10ND3 Specifications	
Number of Inputs	10 (sink/source)
Input Voltage Range	10.8-26.4VDC
Operating Voltage Range	12-24VDC
Peak Voltage	30.0VDC
Input Current	Typical:4.0mA @ 12VDC 8.5mA @ 24VDC
Maximum Input Current	11mA @ 26.4VDC
Input Impedance	2.8Kq @ 12-24VDC
On Voltage Level	> 10.0 VDC
Off Voltage Level	< 2.0 VDC
Minimum ON Current	3.5mA
Minimum OFF Current	0.5mA
Off to On Response	2-8ms, Typ. 4ms
On to Off Response	2-8ms, Typ. 4ms
Status Indicators	Module activity: one green LED
Commons	2 non-isolated
Fuse	No fuse
Base Power Required	Typical. 35mA (all pts. ON)



Equivalent input circuit



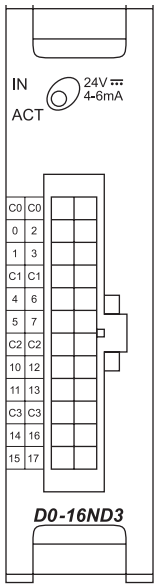
Derating chart



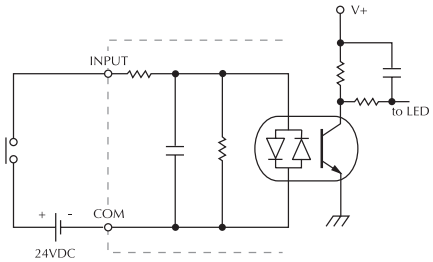
D0-16ND3

16-point DC input module

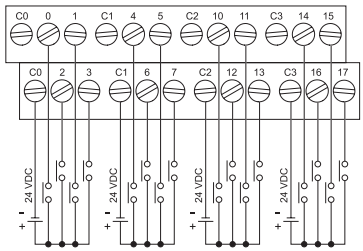
D0-16ND3 Specifications	
Number of Inputs	16 (sink/source)
Input Voltage Range	20-28VDC
Operating Voltage Range	24VDC
Peak Voltage	30.0VDC
Input Current	Typical: 4.0mA @ 24VDC
Maximum Input Current	6mA @ 28VDC
Input Impedance	4.7KΩ @ 24VDC
On Voltage Level	> 19.0 VDC
Off Voltage Level	< 7.0 VDC
Minimum ON Current	3.5mA
Minimum OFF Current	1.5mA
Off to on Response	2-8ms, Typ. 4ms
On to off Response	2-8ms, Typ. 4ms
Status Indicators	Module activity: one green LED
Commons	4 non-isolated
Fuse	No fuse
External DC power required	20-28VDC max. 200 mA (all pts. ON)
Base Power Required (5V)	Typical. 35mA (all pts. ON)



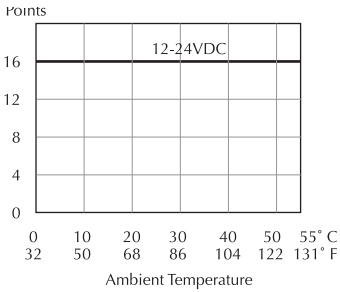
Equivalent input circuit



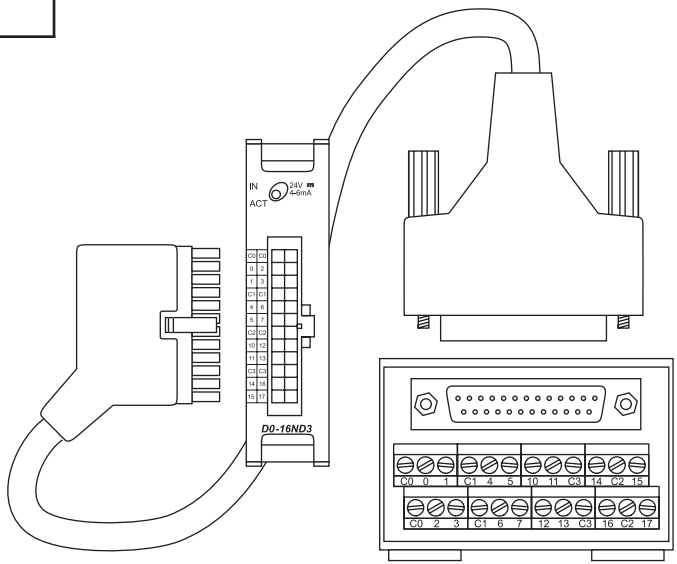
Wiring for ZL-CM056



Derating chart



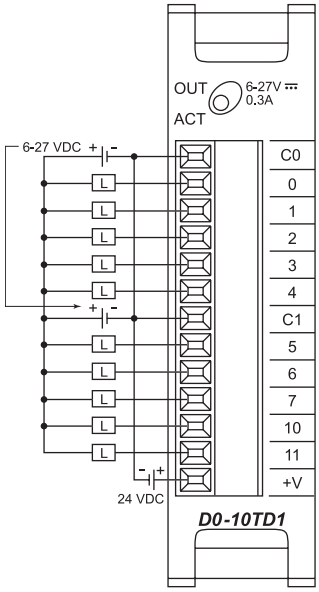
Use ZipLink ZL-CBL056 cable and ZL-CM056 connector module, or ZL-CBL056L cable and ZL-CM16L24 LED connector module. You can also build your own cables using 24-pin Molex Micro Fit 3.0 receptacle, part number 43025, or compatible.



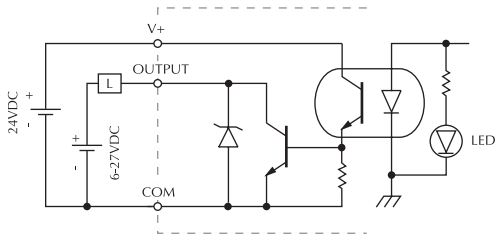
D0-10TD1

10-point DC output module

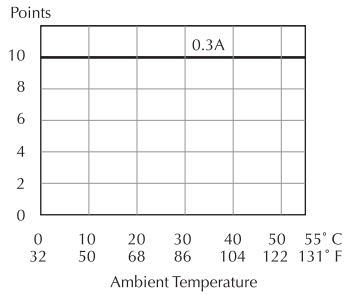
D0-10TD1 Specifications	
Number of Outputs	10 (sinking)
Operating Voltage Range	6-27VDC
Output Voltage Range	5-30VDC
Peak Voltage	50.0VDC
Maximum Output Current	0.3A/point 1.5A/common
Minimum Output Current	0.5mA
ON Voltage Drop	0.5.VDC @0.3A
Maximum Leakage Current	15µA @ 30.0VDC
Maximum Inrush Current	1A for 10ms
OFF to ON Response	<10µs
ON to OFF Response	<60µs
Status Indicators	Module activity: one green LED
Commons	2 non-isolated (5 points/common)
Fuse	No fuse
Base Power Required (5V)	Max. 150mA (All pts. on)



Equivalent output circuit



Derating chart

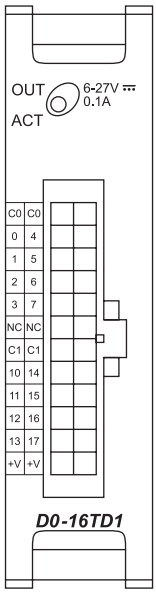


Use ZipLink ZL-CBL056 cable and ZL-CM056 connector module or build your own cables using 24-pin Molex Micro Fit 3.0 receptacle, part number 43025, or compatible.

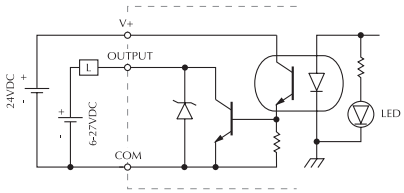
D0-16TD1

16-point DC output module

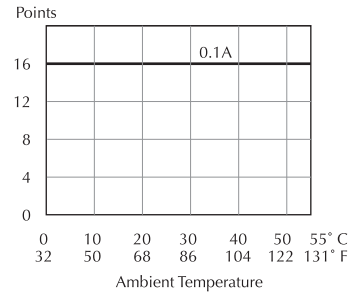
D0-16TD1 Specifications	
Number of Outputs	16 (sinking)
Operating Voltage Range	6-27VDC
Output Voltage Range	5-30VDC
Peak Voltage	50.0VDC
Maximum Output Current	0.1A/point 0.8A/common
Minimum Output Current	0.5mA
ON Voltage Drop	0.5.VDC @0.1A
Maximum Leakage Current	15µA @ 30.0VDC
Maximum Inrush Current	1A for 10ms
OFF to ON Response	<0.5 ms
ON to OFF Response	<0.5 ms
Status Indicators	Module activity: one green LED
Commons	2 isolated (8 points/common)
Fuse	No fuse
External DC power required	20-28 VDC max 70 mA (all pts. ON)
Base Power Required (5V)	Max. 200mA (All pts. ON)



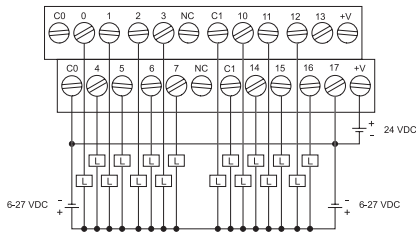
Equivalent input circuit



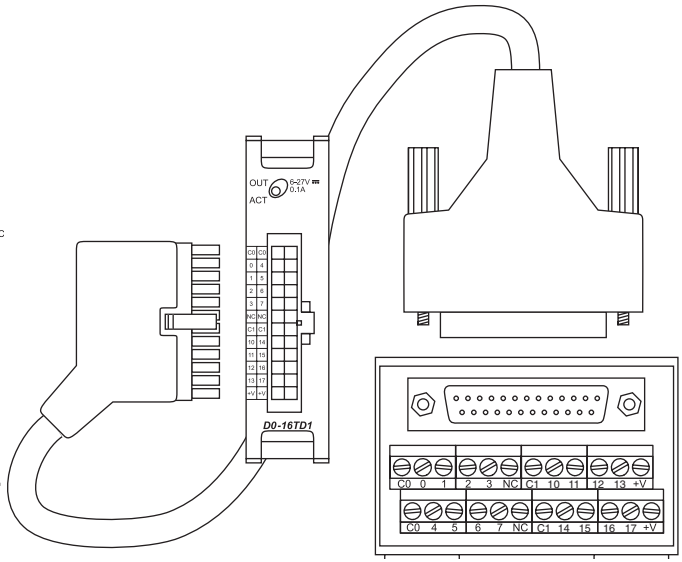
Derating chart



Wiring for ZL-CM056



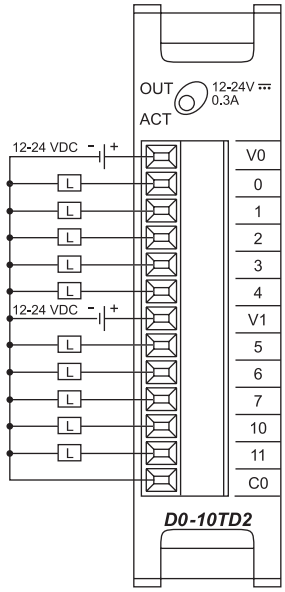
Use ZipLink ZL-CBL056 cable and ZL-CM056 connector module, or ZL-CBL056FR cable and ZL-CM16RL24B relay madule or ZL-CM16TF2. You can also build your own cables using 24-pin Molex Micro Fit 3.0 receptacle, part number 43025, or compatible.



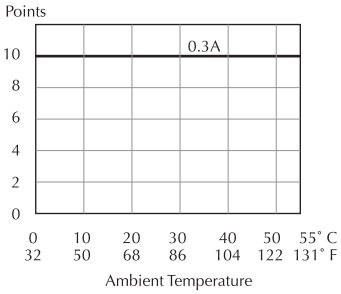
D0-10TD2

10-point DC output module

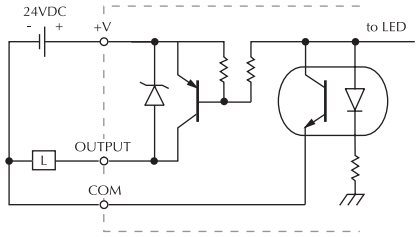
D0-10TD2 Output Specifications	
Number of Outputs	10 (sourcing)
Operating Voltage Range	12-24VDC
Output Voltage Range	10.8-26.4VDC
Peak Voltage	50.0VDC
Maximum Output Current	0.3A/point 1.5A/common
Minimum Output Current	0.5mA
ON Voltage Drop	1.0.VDC @0.3A
Maximum Leakage Current	1.5µA @ 30.0VDC
Maximum Inrush Current	1A for 10ms
OFF to ON Response	<10µs
ON to OFF Response	<60µs
Status Indicators	Module activity: one green LED
Commons	2 non-isolated (5 points/common)
Fuse	No fuse
Base Power Required (5V)	Max. 150mA (All pts. On)



Derating chart



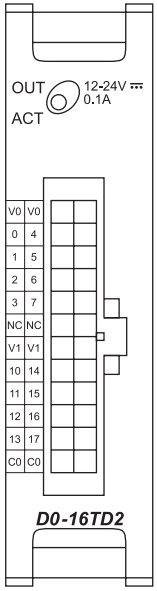
Equivalent output circuit



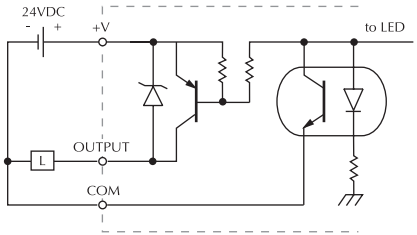
D0-16TD2

16-point DC output module

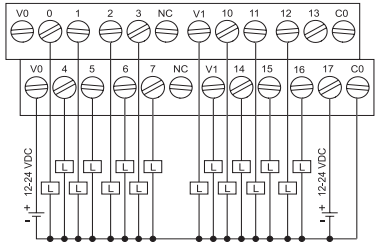
D0-16TD2 Specifications	
Number of Outputs	16 (sourcing)
Operating Voltage Range	12-24VDC
Output Voltage Range	10.8-26.4VDC
Peak Voltage	50.0VDC
Maximum Output Current	0.1A/point 0.8A/common
Minimum Output Current	0.5mA
ON Voltage Drop	1.0.VDC @ 0.1A
Maximum Leakage Current	1.5µA @ 26.4VDC
Maximum Inrush Current	1A for 10ms
OFF to ON Response	<0.5 ms
ON to OFF Response	<0.5 ms
Status Indicators	Module activity: one green LED
Commons	2 non-isolated (8 points/common)
Fuse	No fuse
Base Power Required (5V)	Max. 200mA (All pts. ON)



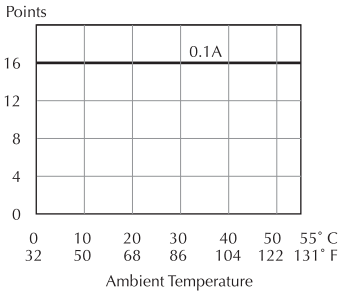
Equivalent output circuit



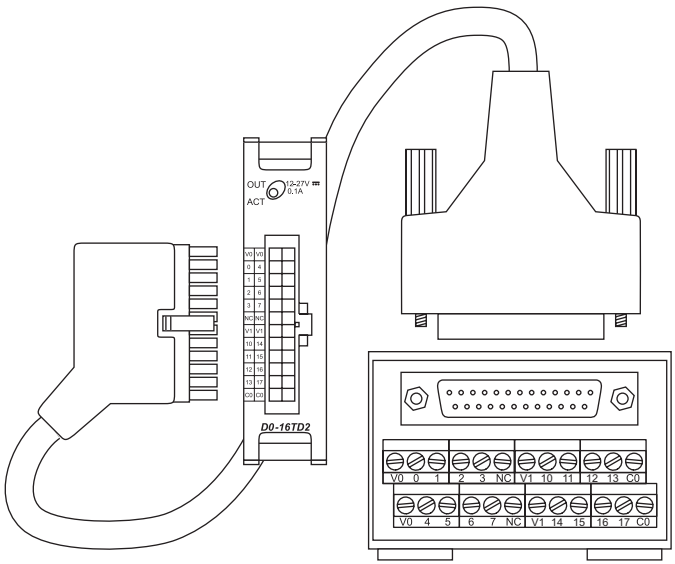
Wiring for ZL-CM056



Derating chart



Use ZipLink ZL-CBL056 cable and ZL-CM056 connector module, or ZL-CBL056FR cable and ZL-CM16RL24B relay module or ZL-CM16TF2 fuse module.
You can also build your own cables using 24-pin Molex Micro Fit 3.0 receptacle, part number 43025, or compatible.



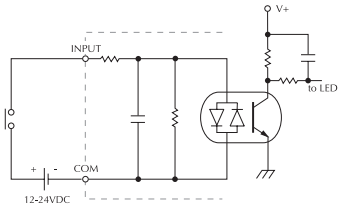
D0-07CDR

4-point DC input and 4-point relay output module

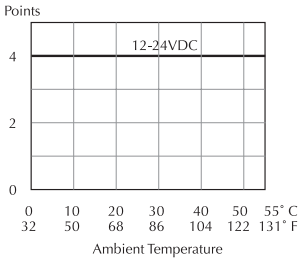
Input Specifications	
Inputs per module	4 (sink/source)
Operating voltage range	12-24 VDC
Input voltage range	10.8-26.4 VDC
Peak voltage	30.0 VDC
Maximum input current	11 mA @ 26.4 VDC
Input current	Typical: 4mA @ 12VDC 8.5 mA @ 24VDC
Input impedance	2.8KΩ @ 12-24VDC
ON voltage level	>10.0 VDC
OFF voltage level	< 2.0 VDC
Minimum ON current	3.5 mA
Maximum OFF current	0.5 mA
ON to OFF response	2-8 ms, typical 4 ms
OFF to ON response	2-8 ms, typical 4 ms
Commons	1 (4 points/common)

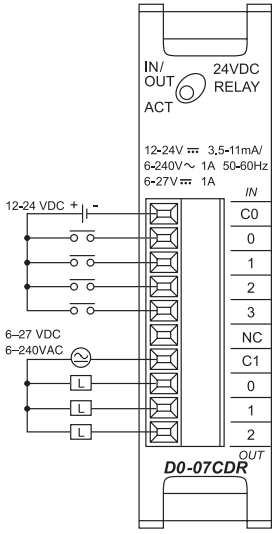
Output Specifications	
Outputs per module	3
Operating voltage range	6-27 VDC/6-240 VAC
Output type	Relay, form A, SPST
Peak voltage	30.0 VDC/264 VAC
Maximum current (resistive)	1 A/point, 4 A/common
Minimum load current	5mA @ 5VDC
Maximum leakage current	0.1 mA @ 264 VAC
ON voltage drop	N/A
Maximum inrush current	Output: 3A for 10 ms Common: 10A for 10 ms
ON to OFF response	< 10 ms
OFF to ON response	< 15 ms
Status indicators	Module acitivity: one green LED
Commons	1 (3 points/common)
Fuse	N/A
Base power required (5V)	Max. 200 mA (all points ON)

Equivalent input circuit

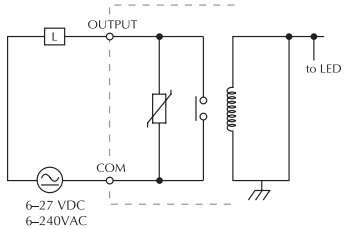


Derating chart for DC inputs

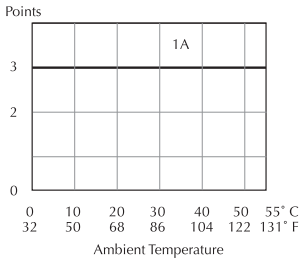




Equivalent output circuit



Derating chart for relay outputs

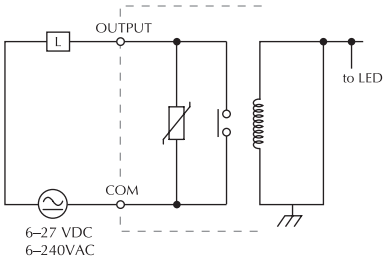


D0-08TR

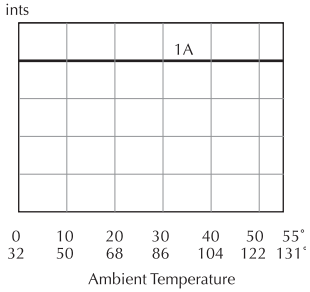
8-point Relay output module

D0-08TR Specifications	
Outputs per module	8
Operating voltage range	6-27 VDC/6-240 VAC
Output type	Relay, form A, SPST
Peak voltage	30.0 VDC/264 VAC
Maximum current (resistive)	1 A/point, 4 A/common
Minimum load current	0.5mA
Maximum leakage current	0.1 mA @ 264 VAC
ON voltage drop	N/A
Maximum inrush current	Output: 3A for 10 ms Common: 10A for 10 ms
ON to OFF response	< 10 ms
OFF to ON response	< 15 ms
Status indicators	Module acitivity: one green LED
Commons	2 isolated. (4 points/common)
Fuse	N/A
Base power required (5V)	Max. 280 mA (all points ON)

Equivalent output circuit



Derating chart



D0-08CDD1

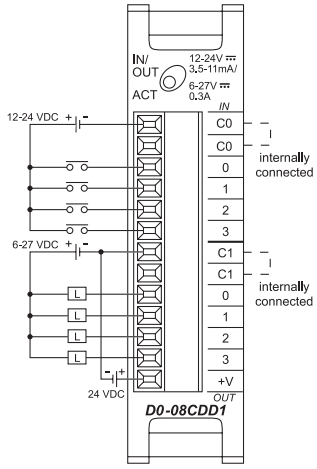
4-point DC input and 4-point DC output module

2

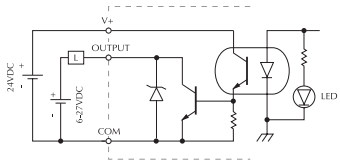
Input Specifications	
Inputs per module	4 (sink/source)
Operating voltage range	10.8-26.4 VDC
Input voltage range	12-24 VDC
Peak voltage	30.0 VDC
Maximum input current	11 mA @ 26.4 VDC
Input current	Typical: 4mA @ 12 VDC 8.5 mA @ 24 VDC
Input impedance	2.8KΩ @ 12-24 VDC
ON voltage level	>10.0 VDC
OFF voltage level	< 2.0 VDC
Minimum ON current	3.5 mA
Maximum OFF current	0.5 mA
ON to OFF response	2-8 ms, typical 4 ms
OFF to ON response	2-8 ms, typical 4 ms
Commons	2 non-isolated (4points/common)

Output Specifications	
Outputs per module	4 (sinking)
Operating voltage range	6-27 VDC
Output voltage range	5-30 VDC
Peak voltage	50.0 VDC/
Maximum output current	0.3 A/point, 1.2 A/common
Minimum outpu current	0.5 mA
Maximum leakage current	1.5 µA @ 30.0 VDC
ON voltage drop	0.5 VDC @ 0.3A
Maximum inrush current	1A for 10 ms
ON to OFF response	<60 ms
OFF to ON response	<10 ms
Status indicators	Module acitivity: one green LED
Commons	2 non-isolated (4 points/common)
Fuse	N/A
Base power required (5V)	Max. 200 mA (all points ON)
External DC power required (24V)	20 - 28 VDC, maximum 80 mA (all pts. ON)

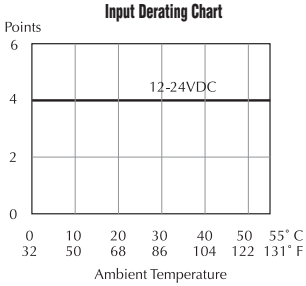
Equivalent input circuit



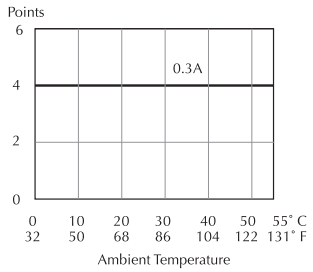
Equivalent output circuit



Input Derating Chart



Output Derating chart



I/O Addressing

Module I/O Points and Addressing

Each discrete option module has a set number of I/O points. The following chart shows the number of I/O points per module when used in the DL06. For more information regarding I/O configuration and addressing, refer to the Module Placement section in Chapter 4.

DC Input Modules	Physical I/O Points	Total I/O Points Condensed	Slot 1 I/O Address
D0-10ND3	10 Input	16 Input (6 unused)	X100 - X107 and X110 - X111
D0-16ND	16 Input	16 Input	X100 - X107 and X110 - X117
DC Output Modules	**I/O Points**	**Total I/O Points Condensed**	**Slot 1 I/O Address**
D0-10TD1	10 Output	16 Output (6 unused)	Y100 - Y107 and Y110 - Y111
D0-16TD1	16 Output	16 Output	Y100 - Y107 and Y110 - Y117
D0-10TD2	10 Output	16 Output (6 unused)	Y100 - Y107 and Y110 - Y111
D0-16TD2	16 Output	16 Output	Y100 - Y107 and Y110 - Y117
Relay Output Modules	**I/O Points**	**Total I/O Points Condensed**	**Slot 1 I/O Address**
D0-08TR	8 Output	8 Output	Y100 - X107
Combination Modules	**I/O Points**	**Total I/O Points Condensed**	**Slot 1 I/O Address**
D0-07CDR	4 Input, 3 Output	8 Input (4 unused) 8 Output (5 unused)	X100 - X103 and Y100 - Y102
D0-08CDD1	4 Input, 4 Output	8 Input (4 unused) 8 Output (5 unused)	X100 - X103 and Y100 - Y103