THE DL05 & DL06 FAMILY OF PRODUCTS

The DL05 micro PLC family includes eight different models. Each has eight inputs and six outputs in the base unit. The DL05 has one option card slot, which can be used to expand the I/O count, provide additional communications capability or add a real-time clock and battery back-up.

The larger DL06 micro PLC family has 20 inputs and 16 outputs in the base unit. The DL06 has four option card slots which can be used to add I/O or provide additional communications options.

Instruction sets

The DL05 CPU offers PID capability, high-speed counting, and the same powerful instruction set as our popular DL250 CPU. All DL05 PLCs have two built-in RS-232C communications ports that can be used for programming, operator interface, networking, etc.

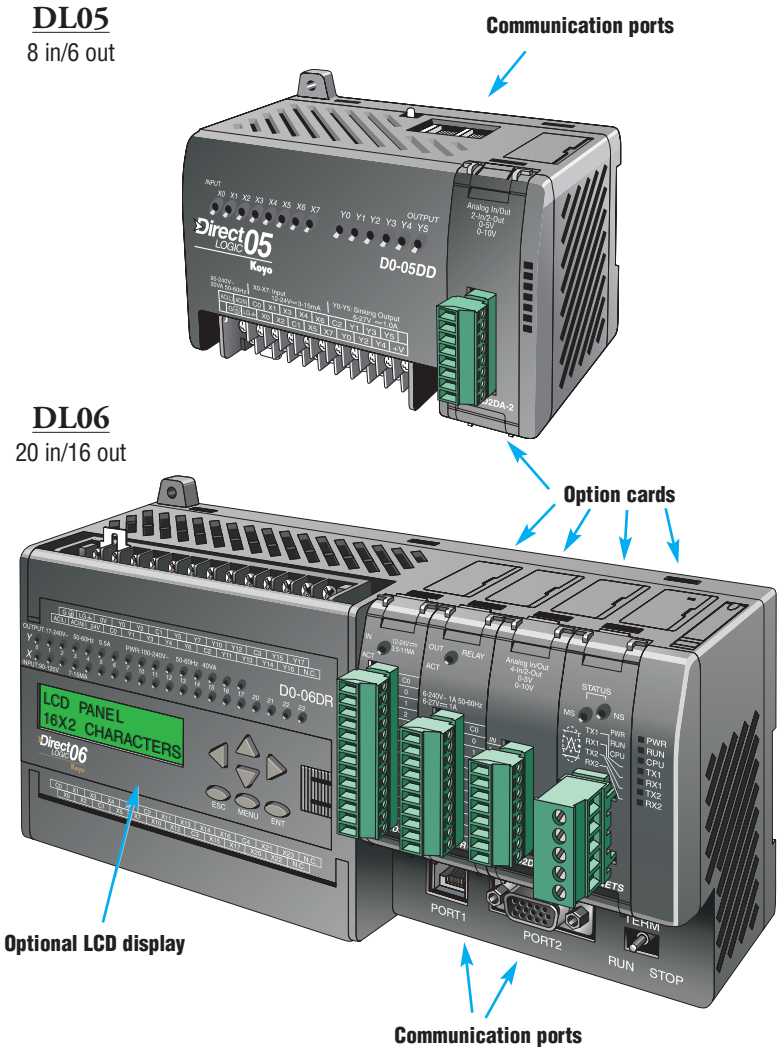
The DL06 CPU offers PID capability, floating point number handling, and an instruction set very similar to our D2-260 CPU. Many powerful new instructions are included. All DL06 PLCs have two built-in communications ports that can be used for programming, operator interface, networking, etc. One of the DL06 ports is a multi-function port capable of RS232C, RS422, or RS485 communications.

Power options

The DL05 and DL06 families have AC and DC power options. They are also offered with a variety of I/O options. You can explore the Quick Selection Guide on the next page to choose the right PLC for your application.

High-speed inputs and outputs

Units with DC inputs have selectable high-speed input features on three input points (DL05) or four input points (DL06). Units with DC outputs can use the first two outputs as a single bi-directional pulse output. Detailed specifications for each model appear later in this section.



General Specifications	AC Powered	DC Powered
Power	110/220VAC (+ 10%, -15%), 50-60Hz	12/24VDC
Input Voltage Range	95-240VAC	12-24VDC
Maximum Power	30VA (DL05) 40VA (DL06)	20W
Maximum Inrush Current	13A, 1ms (240VAC)	10A < 1ms
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	

Quick Selection Guide

110/220 (+10%, -15%) VAC Power Options

DL05

D0-05AA
- 8 AC inputs
- 6 AC outputs, 0.5A/point

D0-05AD
- 8 AC inputs
- 6 DC outputs (sinking), 1.0A/point
  - Two outputs can be used as a single bi-directional 7kHz pulse output

D0-05AR
- 8 AC inputs
- 6 relay outputs, 2A/point

D0-05DA
- 8 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 5kHz high-speed counter, interrupt input, or pulse catch input
- 6 AC outputs, 0.5A/point

D0-05DD
- 8 DC inputs
  - Four inputs are filtered inputs, can also be configured as a single 5kHz high-speed counter, interrupt input, or pulse catch input
- 6 DC outputs (sinking), 1.0A/point
  - Two outputs can be used as a single bi-directional 7kHz pulse output

D0-05DR
- 8 DC inputs
  - Four inputs are filtered inputs, can also be configured as a single 5kHz high-speed counter, interrupt input, or pulse catch input
- 6 relay outputs, 2A/point

DL06

D0-06AA
- 20 AC inputs
- 16 AC outputs, 0.5A/point

D0-06AR
- 20 AC inputs
- 16 relay outputs, 2A/point

D0-06DA
- 20 DC inputs
  - Four inputs are filtered inputs, can also be configured as a single 7kHz high-speed counter, interrupt input, or pulse catch input
- 16 AC outputs, 0.5A/point

D0-06DD1
- 20 DC inputs
  - Four inputs are filtered inputs, can also be configured as a single 7kHz high-speed counter, interrupt input, or pulse catch input
- 16 DC outputs (sinking), 1.0A/point*
  - Two outputs can be used as a single bi-directional 10kHz pulse output

D0-06DD2
- 20 DC inputs
  - Four inputs are filtered inputs, can also be configured as a single 7kHz high-speed counter, interrupt input, or pulse catch input
- 16 DC outputs (sourcing), 1.0A/point
  - Two outputs can be used as a single bi-directional 10kHz pulse output

D0-06DR
- 20 DC inputs
  - Four inputs are filtered inputs, can also be configured as a single 7kHz high-speed counter, interrupt input, or pulse catch input
- 16 relay outputs, 2A/point

12/24 VDC Power Options

DL05

D0-05DD-D
- 8 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 5kHz high-speed counter, interrupt input, or pulse catch input
- 6 DC outputs (sinking), 1.0A/point
  - Two outputs can be used as a single bi-directional 7kHz pulse output

D0-05DR-D
- 8 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 5kHz high-speed counter, interrupt input, or pulse catch input
- 6 Relay outputs, 2A/point

DL06

D0-06DD1-D
- 20 DC inputs
  - Four inputs are filtered inputs, can also be configured as a single 7kHz high-speed counter, interrupt input, or pulse catch input
- 16 DC outputs (sinking), 1.0A/point*
  - Two outputs can be used as a single bi-directional 10kHz pulse output

D0-06DR-D
- 20 DC inputs
  - Four inputs are filtered inputs, can also be configured as a single 7kHz high-speed counter, interrupt input, or pulse catch input
- 16 relay outputs, 2A/point

D0-06DD2-D
- 20 DC inputs
  - Four inputs are filtered inputs, can also be configured as a single 7kHz high-speed counter, interrupt input, or pulse catch input
- 16 DC outputs (sourcing), 1.0A/point
  - Two outputs can be used as a single bi-directional 10kHz pulse output

Note: High speed outputs cannot be used if high-speed inputs are in use, and high-speed inputs cannot be used if high-speed outputs are in use. Analog inputs and outputs can be accommodated with option cards, which are available for both the DL05 and DL06.

** These outputs must be derated to 0.6A for EN61131-2 compliance.*

FEATURES AT A GLANCE

The DL05 and DL06 micro PLCs are complete self-contained systems. The CPU, power supply, and I/O are all included inside the same housing. Option modules are available to expand the capability of each PLC family for more demanding applications. The standard features of these PLCs are extraordinary and compare favorably with larger and more expensive PLCs.

The specification tables to the right are meant for quick reference only. Detailed specifications and wiring information for each model of the DL05 and DL06 PLCs begin on page 2–33.

Program capacity

Most boolean ladder instructions require a single word of program memory. Other instructions, such as timers, counters, etc., require two or more words. Data is stored in V-memory in 16-bit registers.

Performance

The performance characteristics shown in the tables represent the amount of time required to read the inputs, solve the Relay Ladder Logic program and update the outputs.

Instructions

A complete list of instructions is available at the end of this section.

Communications

The DL05 and DL06 offer powerful communication features normally found only on more expensive PLCs.

Special features

The DC input and DC output PLCs offer high-speed counting or pulse output. Option card slots allow for discrete I/O expansion, analog I/O, or additional communication options.

DL05 CPU Specifications

System capacity

Total memory available (words)	6K
Ladder memory (words)	2,048
V-memory (words)	4,096
User V-memory	3,968
Non-volatile user V-memory	128
Battery backup	Yes[1]
Total built-in I/O	14
Inputs	8
Outputs	6
I/O expansion	Yes[1]

Performance

Contact execution (Boolean)	0.7µs
Typical scan (1K Boolean)[2]	1.5-3ms.

Instructions and diagnostics

RLL ladder style	Yes
RLLPLUS/flowchart style (Stages)	Yes/256
Run-time editing	Yes
Scan	Variable/fixed
Number of Instructions	133
Types of Instructions:	
Control relays	512
Timers	128
Counters	128
Immediate I/O	Yes
Subroutines	Yes
For/next loops	Yes
Timed interrupt	Yes
Integer math	Yes
Floating-point math	No
PID	Yes
Drum sequencers	Yes
Bit of word	Yes
ASCII print	Yes
Real-time clock/calendar	Yes[1]
Internal diagnostics	Yes
Password security	Yes
System and user error log	No

Communications

Built-in ports	Two RS-232C
Protocols supported:	
K-sequence (proprietary protocol)	Yes
DirectNet master/slave	Yes
MODBUS RTU master/slave	Yes
ASCII out	Yes
Baud rate	
Port 1	9,600 baud (fixed)
Port 2	selectable 300-38,400 baud (default 9,600)

Specialty Features

Filtered inputs	Yes[3]
Interrupt input	Yes[3]
High speed counter	Yes, 5kHz[3]
Pulse output	Yes, 7kHz[3]
Pulse catch input	Yes[3]

1- These features are available with use of certain option cards. Option card specifications are located later in this section.

2- Our 1K program includes contacts, coils, and scan overhead. If you compare our products to others, make sure you include their scan overhead.

3- Input features only available on units with DC inputs and output features only available on units with DC outputs.

DL06 CPU Specifications

System capacity

Total memory available (words)	14.8K
Ladder memory (words)	7680
V-memory (words)	7616
User V-memory	7488
Non-volatile user V-memory	128
Built-in battery backup	Yes
Total I/O	36
Inputs	20
Outputs	16
I/O expansion	Yes[1]

Performance

Contact execution (Boolean)	0.6µs
Typical scan (1K Boolean)[2]	1-2ms.

Instructions and diagnostics

RLL ladder style	Yes
RLLPLUS/flowchart style (Stages)	Yes/1024
Run-time editing	Yes
Scan	Variable/fixed
Number of Instructions	229
Types of Instructions:	
Control relays	1024
Timers	256
Counters	128
Immediate I/O	Yes
Subroutines	Yes
For/next loops	Yes
Table functions	Yes
Timed interrupt	Yes
Integer math	Yes
Trigonometric functions	Yes
Floating-point math	Yes
PID	Yes
Drum sequencers	Yes
Bit of word	Yes
Number type conversion	Yes
ASCII in, out, print	Yes
LCD instruction	Yes
Real-time clock/calendar	Yes
Internal diagnostics	Yes
Password security	Yes
System and user error log	No

Communications

Built-in ports:	One RS-232C
	One multi-function RS232C/RS422/RS485

NOTE: RS485 is for MODBUS RTU only.

Protocols supported:	
K-sequence (proprietary protocol)	Yes
DirectNet master/slave	Yes
MODBUS RTU master/slave	Yes
ASCII in/out	Yes
Baud rate	
Port 1	9,600 baud (fixed)
Port 2	selectable 300-38,400 baud (default 9,600)

Specialty Features

Filtered inputs	Yes[3]
Interrupt input	Yes[3]
High speed counter	Yes, 7kHz[3]
Pulse output	Yes, 10kHz[3]
Pulse catch input	Yes[3]

1- These features are available with use of certain option cards. Option card specifications are located later in this section.

2- Our 1K program includes contacts, coils, and scan overhead. If you compare our products to others, make sure you include their scan overhead.

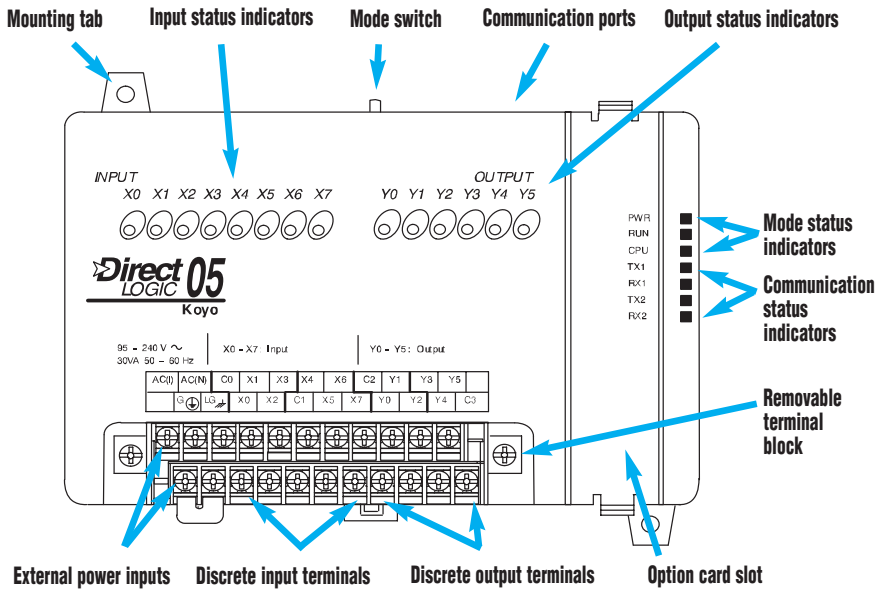
3- Input features only available on units with DC inputs and output features only available on units with DC outputs.

Features at a Glance

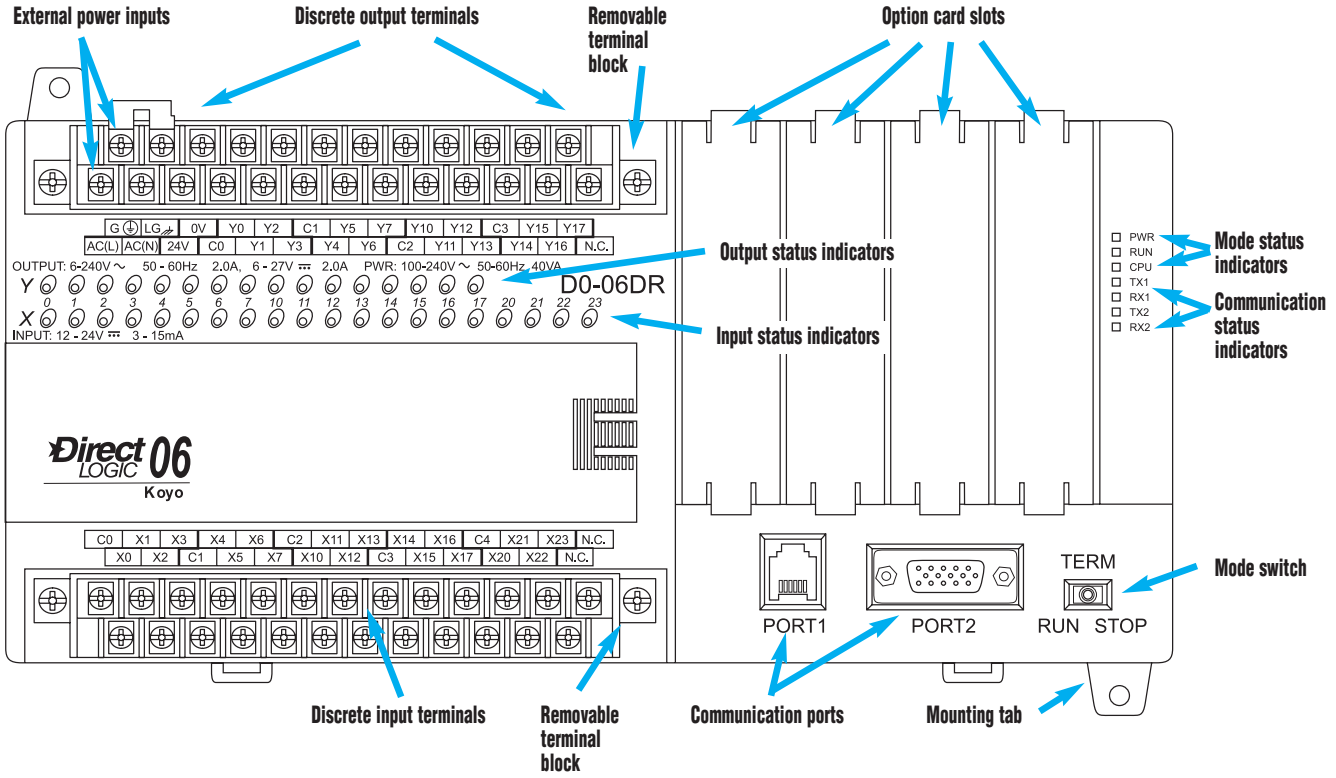
*Direct*SOFT32 software

The DL05 and DL06 PLCs use the same familiar *Direct*SOFT32 programming software that our larger PLCs use. Special low-priced software versions are available for the micro PLCs, but if you already own the complete programming package, that will work too (version 4.0 or later).

The PC-PGM-105 software is sufficient to program the DL05 PLC and the DL105 PLC (which is featured in the next section). Version 2.4 is required, but we always recommend the latest version for the most robust features. The DL06 PLC requires Version 4.0, or later, of *Direct*SOFT32, and comes bundled with the DL05 and DL105 software in the PC-PGM-BRICK package.



Hardware features diagrams

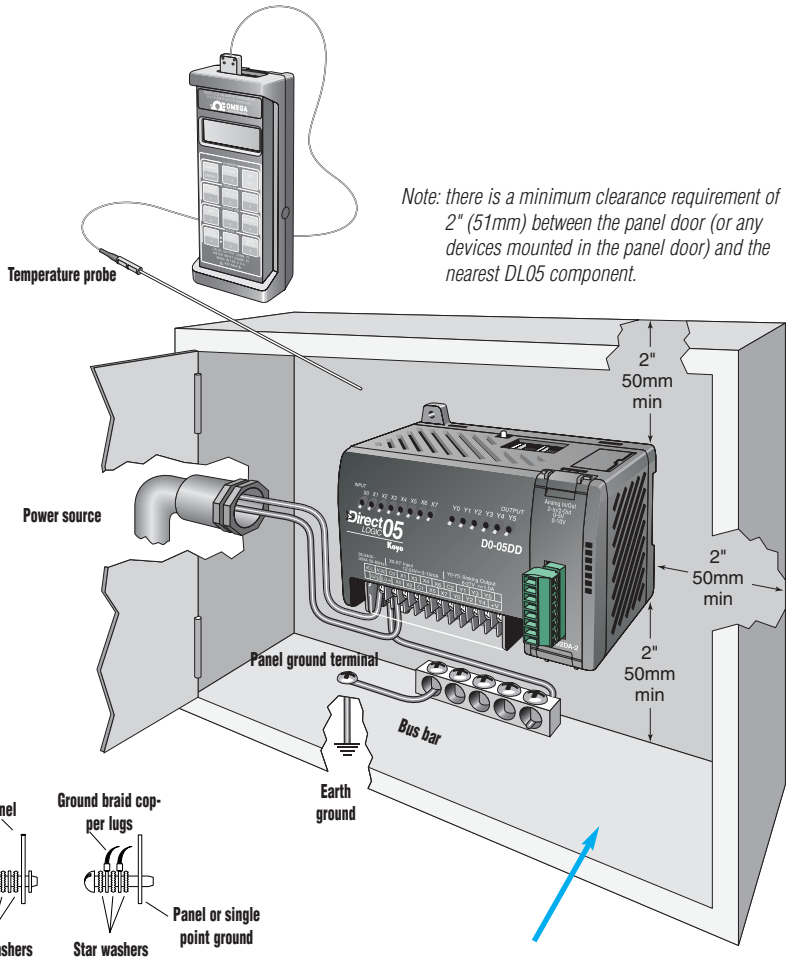


PRODUCT DIMENSIONS AND INSTALLATION

It is important to understand the installation requirements for your DL05 or DL06 system. Your knowledge of these requirements will help ensure that your system operates within its environmental and electrical limits.

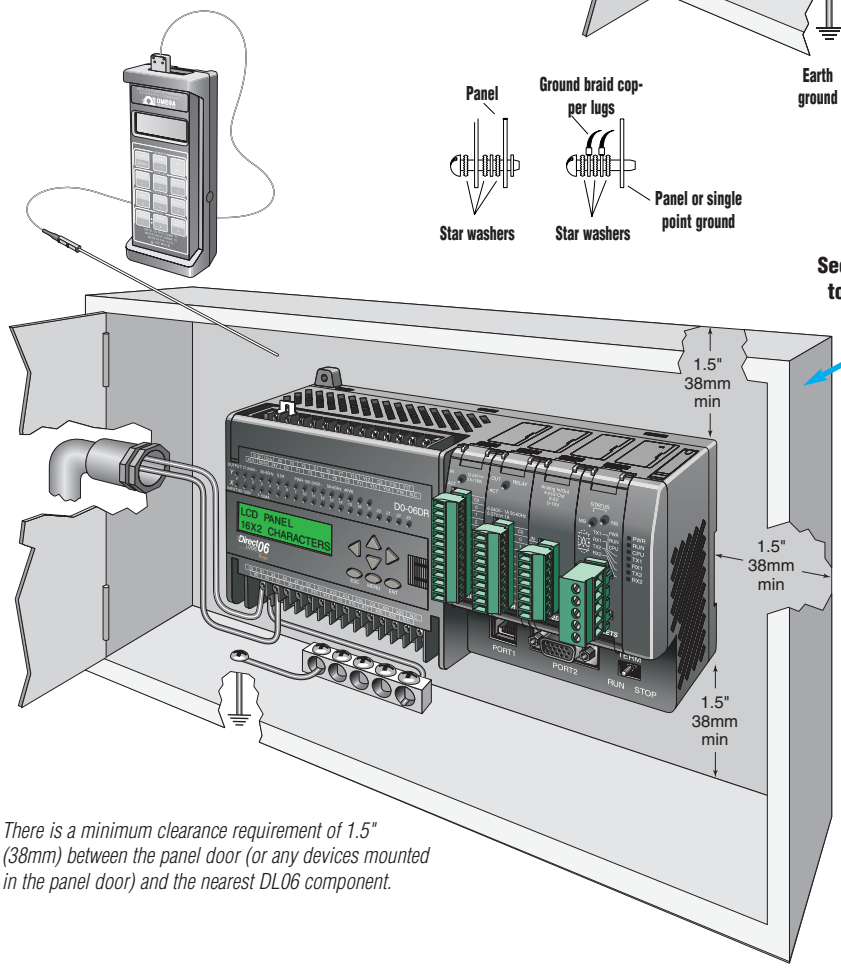
Plan for safety

This desk reference should never be used as a replacement for the user manual. You can purchase, download free, or view online the user manuals for these products. The D0-USER-M is the publication for the DL05 PLCs, and the D0-06USER-M is the publication for the DL06 PLCs. The D0-OPTIONS-M is the user manual for the option cards. These user manuals contain important safety information that must be followed. The system installation should comply with all appropriate electrical codes and standards.



Note: there is a minimum clearance requirement of 2" (51mm) between the panel door (or any devices mounted in the panel door) and the nearest DL05 component.

See the enclosure section of this desk reference to find an enclosure that fits your application.



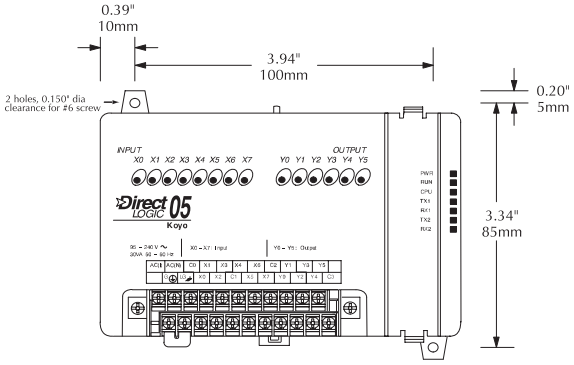
Note: There is a minimum clearance requirement of 1.5" (38mm) between the panel door (or any devices mounted in the panel door) and the nearest DL06 component.

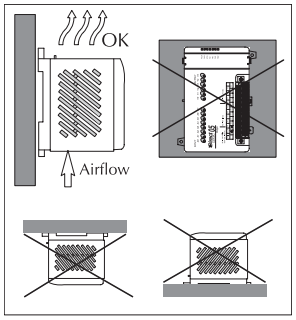
Environmental Specifications for DL05 and DL06	
Storage Temperature	-4º F-158ºF (-20ºC to 70ºC)
Ambient Operating Temperature	32ºF-131ºF (0º to 55ºC)
Ambient Humidity	5 to 95% relative humidity (non-condensing)
Vibration Resistance	MIL STD 810C Method 514.2
Shock Resistance	MIL STD 810C Method 516.2
Noise Immunity	NEMA (ICS3-304)
Atmosphere	No corrosive gases

Product Dimensions and Installation

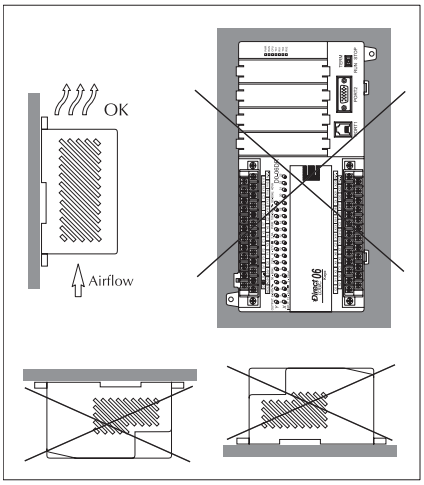
Unit dimensions and mounting orientation

DL05 and DL06 PLCs must be mounted properly to ensure ample airflow for cooling purposes. It is important to follow the unit orientation requirements and to verify that the PLC's dimensions are compatible with your application. Notice particularly the grounding requirements and the recommended cabinet clearances.

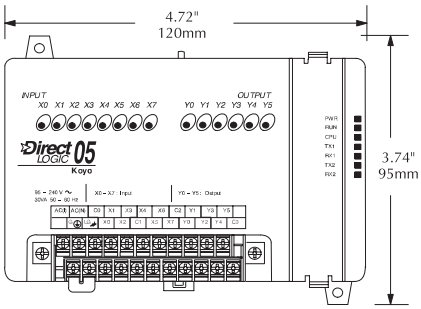


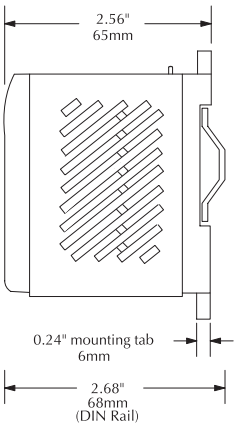


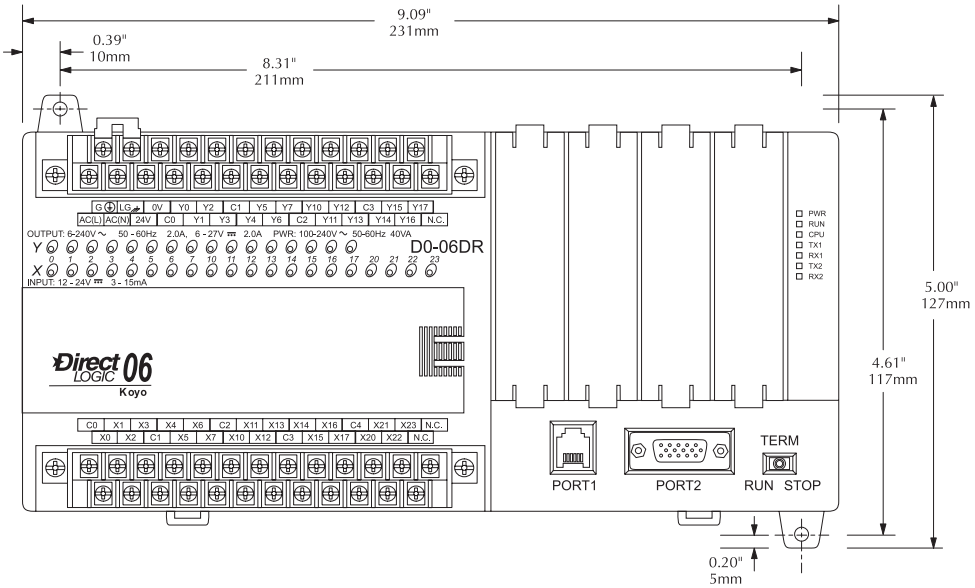
Mounting orientation

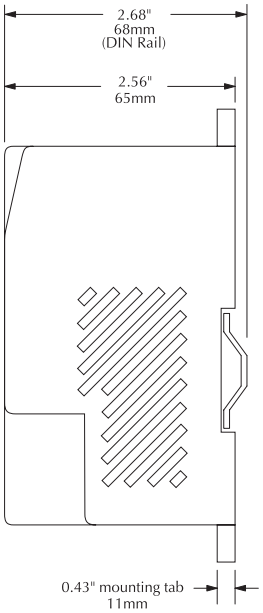


Mounting orientation









CHOOSING THE I/O TYPE

The DL05 and DL06 product families offer a number of different I/O configurations. Choose the configuration that is right for your application. Also, keep in mind that both the DL05 and the DL06 PLCs offer the ability to add I/O with the use of option cards.

Fixed discrete I/O

All DL05 micro PLCs have eight *built-in* inputs and six *built-in* outputs on the base unit. The DL06 micro PLCs have 20 *built-in* inputs and 16 *built-in* outputs on the base unit. We offer the most common I/O types for your convenience, including AC inputs and outputs, DC sinking and sourcing inputs and outputs, and relay outputs. Refer to the tables to the right to see the I/O combinations available and their voltage ranges.

Option card slots

The DL05 has one option card slot and the DL06 has four option card slots. Check out the discrete and analog I/O you can add by purchasing inexpensive option cards. Option card specialty modules are also available and are discussed later in this section.

Automatically assigned addresses

The DL05 uses automatic addressing, so for the vast majority of applications, there is no setup required. We use octal addressing for our products, which means there are no 8s or 9s. The DL05's eight input points use addresses X0-X7, and the six output points use addresses Y0-Y5. Similarly, the DL06 uses addresses X0-X23 and Y0-Y17.

Review the I/O specs and wiring diagrams

The Base Unit I/O tables give a brief description of the I/O combinations offered for the DL05 and DL06 PLCs. The I/O specifications are discussed in more detail later in this section.

DL05 Base Unit I/O Table

Part Number	Inputs			Outputs			Price
	I/O type/ commons	Sink or source	Voltage ranges	I/O type/ commons	Sink or source	Voltage/current ratings	
D0-05AR	AC/2	N/A	90-120VAC	Relay/2	N/A	6-27VDC, 2A 6-240VAC, 2A	<--->
D0-05DR	DC/2	Sink or Source	12-24VDC	Relay/2	N/A	6-27VDC, 2A 6-240VAC, 2A	<--->
D0-05AD	AC/2	N/A	90-120VAC	DC/1	Sink	6-27VDC, 0.5A (Y0-Y1) 6-27VDC, 1.0A (Y2-Y5)	<--->
D0-05DD	DC/2	Sink or Source	12-24VDC	DC/1	Sink	6-27VDC, 0.5A (Y0-Y1) 6-27VDC, 1.0A (Y2-Y5)	<--->
D0-05AA	AC/2	N/A	90-120VAC	AC/2	N/A	17-240VAC 47-63Hz 0.5A	<--->
D0-05DA	DC/2	Sink or Source	12-24VDC	AC/2	N/A	17-240VAC 47-63Hz 0.5A	<--->
D0-05DR-D	DC/2	Sink or Source	12-24VDC	Relay/2	N/A	6-27VDC, 2A 6-240VAC, 2A	<--->
D0-05DD-D	DC/2	Sink or Source	12-24VDC	DC/1	Sink	6-27VDC, 0.5A (Y0-Y1) 6-27VDC, 1.0A (Y2-Y5)	<--->

Sinking/sourcing

If you are using a DC field device, you should consider whether that device requires a sinking or sourcing PLC I/O configuration. For more information on sinking and sourcing concepts, please refer to the Appendix of this catalog.

Sink/source inputs — All *built-in* DC inputs on the DL05 and DL06 micro PLCs can be wired in a sinking or sourcing configuration. However, all inputs on a single common must use the same configuration. In some cases, the DC inputs on option cards are fixed as sinking or sourcing. Refer to the table on the next page.

Sinking outputs — All *built-in* DC outputs on the DL05 are sinking. The DL06 family offers three PLCs with sinking DC outputs, and one with sourcing outputs.

Sourcing outputs — The DL06 PLC family includes the D0-06DD2(-D) with sourcing outputs. If a sourcing output is required, you might also consider using either the D0-xxTD2 option card with sourcing outputs, which can also be installed in a DL05 or DL06 PLC.

High-speed inputs and pulse outputs

DL05s and DL06s with DC inputs offer high-speed input features, and DC output units offer pulse output features. The first three DC inputs on the DL05 PLCs are set up by default as filtered inputs with a 10 ms filter. Likewise, the first four DC inputs on the DL06 PLCs are set to the same default value. By entering a setup code in a special V-memory location, you can choose other features. In some modes of operation, you have a choice as to how you use each point. For example, if you use X0 as an up counter, you can use X2 as a reset input for the counter or as a filtered discrete input. If these features interest you, take a look at the detailed high-speed I/O descriptions found later in this section.

Choosing the I/O Type

DL06 Base Unit I/O Table							
Part Number	Inputs			Outputs			Price
	I/O Type/ Commons	Sink or source	Voltage Ranges	I/O Type/ Commons	Sink or Source	Voltage/Current Ratings	
D0-06AA	AC/5	N/A	90-120VAC	AC/4	N/A	17-240VAC, 0.5A 50/60 Hz	<--->
D0-06AR	AC/5	N/A	90-120VAC	Relay/4	N/A	6-27VDC, 2A 6-240VAC, 2A	<--->
D0-06DA	DC/5	Sink or source	12-24VDC	AC/4	N/A	17-240VAC, 0.5A 50/60Hz	<--->
D0-06DD1	DC/5	Sink or source	12-24VDC	DC/4	Sink	6-27VDC, 0.5A (Y0-Y1) 6-27VDC, 1.0A (Y2-Y17)*	<--->
D0-06DD2	DC/5	Sink or source	12-24VDC	DC/4	Source	12-24VDC, 0.5A (Y0-Y1) 12-24VDC, 1.0A (Y2-Y17)	<--->
D0-06DR	DC/5	Sink or source	12-24VDC	Relay/4	N/A	6-27VDC, 2A 6-240VAC, 2A	<--->
D0-06DD1-D	DC/5	Sink or source	12-24VDC	DC/4	Sink	6-27VDC, 0.5A (Y0-Y1) 6-27VDC, 1.0A (Y2-Y17)*	<--->
D0-06DD2-D	DC/5	Sink or source	12-24VDC	DC/4	Source	12-24VDC, 0.5A (Y0-Y1) 12-24VDC, 1.0A (Y2-Y17)	<--->
D0-06DR-D	DC/5	Sink or source	12-24VDC	Relay/4	N/A	6-27VDC, 2A 6-240VAC, 2A	<--->

Discrete I/O Option Cards							
Part Number	Inputs			Outputs			Price
	I/O Type/ Number/ Commons	Sink or source	Voltage Ranges	I/O Type/ Number/ Commons	Sink or Source	Voltage/Current Ratings	
D0-07CDR	DC/4/1	Sink or source	12-24VDC	Relay/3/1	N/A	6-27VDC, 1A 6-240VAC, 1A	<--->
D0-08CDD1	DC/4/2	Sink or source	12-24VDC	DC/4/2	Sink	6-27VDC, 0.3A	<--->
D0-08TR	N/A	N/A	N/A	Relay/8/2	N/A	6-27VDC, 1A 6-240VAC, 1A	<--->
D0-10ND3	DC/10/2	Sink or source	12-24VDC	N/A	N/A	N/A	<--->
D0-10ND3F	DC/10/2	Sink or source	12-24VDC	N/A	N/A	N/A	<--->
D0-10TD1	N/A	N/A	N/A	DC/10/2	Sink	6-27VDC, 0.3A	<--->
D0-10TD2	N/A	N/A	N/A	DC/10/2	Source	12-24VDC, 0.3A	<--->
D0-16ND3	DC/16/4	Sink or source	20-28VDC	N/A	N/A	N/A	<--->
D0-16TD1	N/A	N/A	N/A	DC/16/2	Sink	6-27VDC, 0.1A	<--->
D0-16TD2	N/A	N/A	N/A	DC/16/2	Source	12-24VDC, 0.1A	<--->
F0-04TRS	N/A	N/A	N/A	Relay/4/4	N/A	5-30VDC, 3A 5-125VAC, 3A	<--->
F0-08NA-1	AC/8/2	N/A	80-132VAC 90-150VDC	N/A	N/A	N/A	<--->
F0-08SIM	8-pt. Input simulator						<--->

*** These outputs must be derated to 0.6A for EN61131-2 compliance.**

Communications and Specialty Option Cards		
Part Number	Description	Price
H0-ECOM	Ethernet Communications Module 10 Mbit	<--->
H0-ECOM100	Ethernet Communications Module 10/100 Mbit	<--->
D0-DEVNETS	DeviceNET Slave Module	<--->
H0-CTRIO	High Speed Counter I/O Module	<--->
H0-PSCM	Profibus Slave Communications Module	<--->

Analog I/O

By using option cards, you can add analog inputs or outputs to your DL05 or DL06 PLC. The table below shows the input and output types at a glance. Detailed specifications are provided later in this section.

Analog I/O Option Cards					
Part Number	Inputs		Outputs		Price
	No.	Input Type	No.	Output Type	
F0-04AD-1	4	0-20mA or 4-20mA	0	N/A	<--->
F0-04AD-2	4	0-5VDC or 0-10VDC	0	N/A	<--->
F0-4AD2DA-1	4	0-20mA or 4-20mA	2	0-20mA or 4-20mA	<--->
F0-2AD2DA-2	2	0-5VDC or 0-10VDC	2	0-5VDC or 0-10VDC	<--->
F0-4AD2DA-2	4	0-5VDC or 0-10VDC	2	0-5VDC or 0-10VDC	<--->
F0-04RTD	4	RTD	0	N/A	<--->
F0-04THM*	4	Thermo-couple / Voltage	0	N/A	<--->

*** See module specifications page for thermocouple types and voltage input ranges supported**

Power budgeting

No power budgeting is necessary for the DL05. The built-in power supply is sufficient for powering the base unit, any of the option cards, the handheld programmer, and even a DV1000 operator interface.

Power budgeting is necessary for the DL06. With four option card slots and an optional LCD display, it is necessary to verify that sufficient power is available for all optional devices. Power budgeting is described in detail on page 2-29 and in the DL06 User Manual.

NETWORKING THE DL05 AND DL06

All DL05 and DL06 PLCs have built-in networking capability. The DL05 family offers two 6-pin, RS-232C ports. You can use these ports for programming, networking, or connecting an operator interface device. The RS232C ports support point-to-point communications using the optional D0-CBL cable. If you need to create a multi-drop network or if you require longer distances between devices, you can use the FA-ISOCON at each DL05 to convert the RS232C signal to RS422 or RS485.

The DL06 family of PLCs offers even greater communications flexibility. Port 1 is a fixed baud rate port identical to port 1 on the DL05 PLCs, but port 2 is a multi-function port that can be used as RS232C, RS422, or RS485 (MODBUS/ASCII only) without using external converters. This allows you to create multi-drop networks with minimal installation headaches.

The DL06 PLCs have *next generation* simplified instructions for handling both MODBUS RTU and ASCII communications. The ASCII instruction set makes it practical to connect an ASCII input or output device to the DL06. See page 2–28 for more information.

Protocols supported

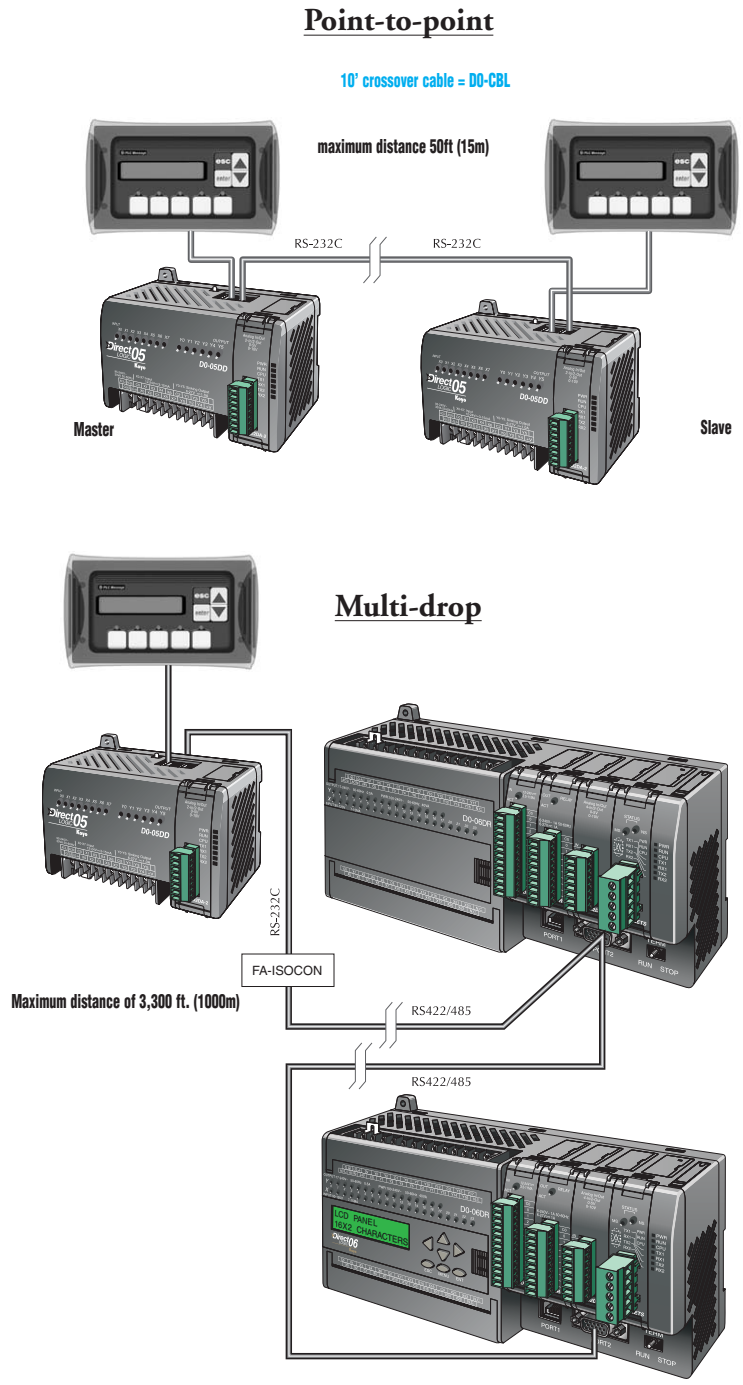
Each port is capable of communicating using K-sequence, *Direct*NET and MODBUS RTU protocols. Port 1 can only be a slave for each of the protocols. Port 2 can serve as a K-sequence slave or a network master or slave for either *Direct*NET or MODBUS RTU protocols.

Serial Bus Protocols

We also offer option modules that allow you to connect a DL05 or DL06 PLC to a DeviceNet or Profibus network as a slave device. Our D0-DEVNETS and H0-PSCM option cards plug into any DL05 or DL06 PLC. For more information, see page 2–51.

Optional Ethernet communication modules

Need to connect to a high speed HMI or computer system? We offer 10Base-T and 100Base-T Ethernet communications modules. You can use the H0-ECOM and H0-ECOM100 Ethernet communication modules with our Ethernet hub/switch (E-SW05U) or with most off-the-shelf Ethernet hubs or switches. The ECOM option cards plug into any DL05 or DL06 PLC. See page 2–52 for more information.



Ports, Status Indicators, and Modes

Port 1

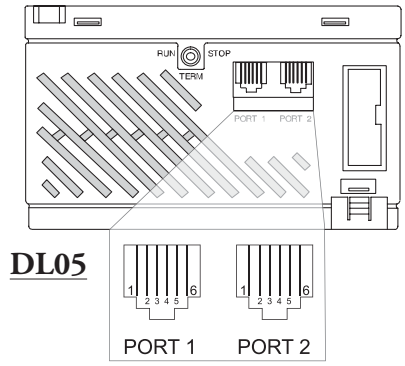
Port 1 is a 6-pin, fixed configuration port and has the same pin assignments on the DL05 and the DL06. Please refer to the table and diagrams on this page. This port can be used to connect to an HPP, *Direct*SOFT32, an operator interface, or other external device. Features include:

- 9600 baud
- 8 data bits
- Odd parity
- 1 start bit, 1 stop bit
- Station address of 1
- Asynchronous, half-duplex, DTE

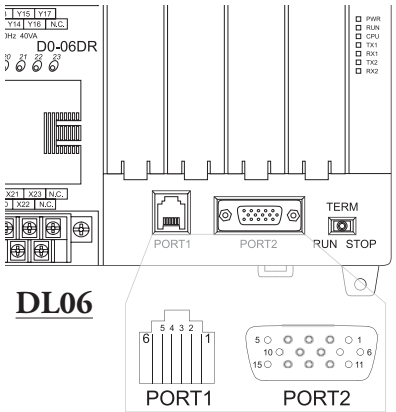
Protocols supported (as slave):

- K sequence, ***Direct***NET, MODBUS RTU

DL05 & DL06 Port 1 Pin Descriptions		
1	0V	Power (-) connection (GND)
2	5V	Power (+) connection
3	RXD	Receive data (RS-232C)
4	TXD	Transmit data (RS-232C)
5	5V	Power (+) connection
6	0V	Power (-) connection (GND)



6-pin Female Modular Connector



6-pin Female Modular Connector

15-pin Female D-sub Connector

Port 2

Port 2 is a configurable port on both the DL05 and the DL06 PLCs. The DL05 PLC uses a 6-pin modular connector and offers RS232C communications only. The DL06 PLC uses a 15-pin HD-sub connector and offers RS232C, RS422, or RS485 communications. Please refer to the table and diagrams on this page for more information. This port can be used to connect to an HPP, *Direct*SOFT32, an operator interface, or other external device. Features of port 2 include:

- 300, 600, 1200, 2400, 4800, 9600 (default), 19,200, 38,400 baud
- 8 data bits
- Odd (default), even, or no parity
- 1 start bit, 1 stop bit
- Station address:
  - 1 (default)
  - 1-90 DirectNET, K sequence
  - 1-247 MODBUS RTU
- Asynchronous, half-duplex, DTE

Protocols supported:

- K sequence (slave), ***Direct***NET (master/slave), MODBUS (master/slave)

DL05 Port 2 Pin Descriptions		
1	0V	Power (-) connection (GND)
2	5V	Power (+) connection
3	RXD	Receive data (RS-232C)
4	TXD	Transmit data (RS-232C)
5	RTS	Ready to send
6	0V	Power (-) connection (GND)

DL06 Port 2 Pin Descriptions		
1	5V	Power (+) connection
2	TXD	Transmit data (RS-232C)
3	RXD	Receive data (RS-232C)
4	RTS	Ready to Send (RS232C)
5	CTS	Clear to send
6	RXD-	Receive data (-) (RS-422/485)
7	0V	Power (-) connection (GND)
8	0V	Power (-) connection (GND)
9	TXD+	Transmit Data (+) (RS-422/485
10	TXD-	Transmit Data (-) (RS-422/485)
11	RTS+	Ready to Send (+) (RS-422/485)
12	RTS-	Ready to Send (-) (RS-422/485)
13	RXD+	Receive Data (+) (RS-422/485)
14	CTS+	Clear to send (+) (RS-422/485)
15	CTS-	Clear to send (-) (RS-422/485)

DL05 and DL06 status indicators

Status Indicators		
Indicator	*Status*	*Meaning*
PWR	ON	Power good
	OFF	Power failure
RUN	ON	CPU is in Run Mode
	OFF	CPU is in Stop or Program Mode
CPU	ON	CPU self diagnostics error
	OFF	CPU self diagnostics good
TX1	ON	Data is being transmitted by the CPU-Port 1
	OFF	No data is being transmitted by the CPU-Port 1
RX1	ON	Data is being received by the CPU-Port 1
	OFF	No data is being received by the CPU-Port 1
TX2	ON	Data is being transmitted by the CPU-Port 2
	OFF	No data is being transmitted by the CPU-Port 2
RX2	ON	Data is being received by the CPU-Port 2
	OFF	No data is being received by the CPU-Port 2

DL05 and DL06 mode switches

Mode Switch Position	CPU Action
RUN (Run Program)	CPU is forced into the RUN mode if no errors are encountered. No program changes are allowed by the programming/monitoring device.
TERM (Terminal)	RUN PROGRAM and the TEST modes are available. Mode and program changes are allowed by the programming/monitoring device.
STOP	CPU is forced into the STOP mode. No changes are allowed by the programming/monitoring device.

Use the optional low profile 15-pin adapter to make option card wiring easier.

ASCII AND MODBUS INSTRUCTIONS

ASCII instructions for DL06

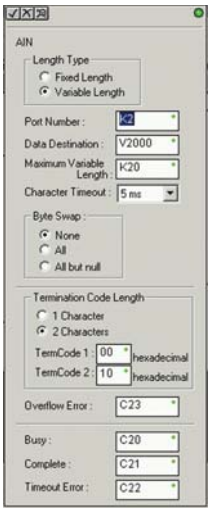
The DL06 PLC supports several easy to use instructions, which allow ASCII strings to be read into or written from the communication ports.

Raw ASCII: Port 2 can be used for either reading or writing raw ASCII strings, but not for both.

Embedded ASCII: With these instructions, you can use the DL06 PLC to locate ASCII strings embedded within a supported protocol (via Port 2).

Receiving ASCII strings

1. ASCII IN (AIN) - This instruction configures Port 2 for raw ASCII input strings, with parameters such as fixed and variable length ASCII strings, termination characters, byte swapping options, and instruction control bits. Use barcode scanners, weight scales, etc., to write raw ASCII input strings into Port 2 based on the AIN instruction's parameters.



2. Write embedded ASCII strings directly to V-memory from an external HMI (or similar master device). The ASCII string is transmitted through Port 2 using any supported communications protocol. This method uses the familiar RX/WX instructions previously available.

3. If the DL06 is used as a network master, the Network Read instruction (RX) can be used to read embedded ASCII data from a network slave device. Again, the ASCII string would be transmitted through Port 2, using any supported communications protocol.

Writing ASCII strings

1. Print from V-memory (PRINTV) - Use this instruction to write raw ASCII strings out of Port 2 to a display panel, serial printer, etc. The instruction features the starting V-memory address, string length, byte swapping options, etc. When the instruction's permissive bit is enabled, the string is written to Port 2.

2. Print to V-memory (VPRINT) - Use this instruction to create pre-coded ASCII strings in the PLC (e.g. alarm messages). When the instruction's permissive bit is enabled, the message is loaded into a pre-defined V-memory address location. Then the PRINTV instruction may be used to write the pre-coded ASCII string out of Port 2. American, European, and Asian Time/Date stamps are supported.

3. Print Message (PRINT) - This existing instruction can be used to create pre-coded ASCII strings in the PLC. When the instruction's permissive bit is enabled, the string is written to Port 2. The VPRINT/PRINTV instruction combination is more powerful and flexible than the PRINT instruction.

4. If the DL06 PLC is a network master, the Network Write (WX) can be used to write embedded ASCII data to an HMI or slave device directly from V-memory. This is done via a supported communications protocol using Port 2.

Other new ASCII instructions

ASCII Find (AFIND) - Finds where a specific portion of the ASCII string is located in continuous V-memory addresses.

ASCII Extract (AEX) - Extracts a specific portion (usually some data value) from the ASCII find location or other known ASCII data location.

Compare V-memory (CMPV) - This instruction is used to compare two blocks of V-memory addresses and is usually used to detect a change in an ASCII string. Compared data types must be of the same format (e.g. BCD, ASCII, etc.).

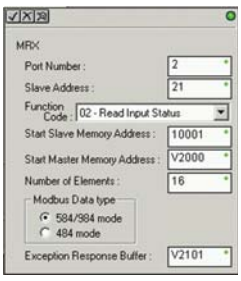
Swap Bytes (SWAPB) - Swaps V-memory bytes on ASCII data that was written directly to V-memory from an external HMI or similar master device via a communications protocol. The AIN and AEX instructions have a built-in byte swap feature.

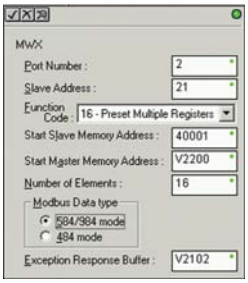
MODBUS RTU instructions for DL06

The DL06 PLC supports MODBUS Read/Write instructions that simplify setup. The MRX and MWX instructions allow you to use native MODBUS addressing, eliminating the need for octal to decimal conversions.

Function Codes 05 and 06 and the ability to read Slave Exception Codes have been added. These flexible instructions allow the user to select the following parameters within one instruction window:

- 584/984 or 484 MODBUS data type
- Slave node (0-247)
- Function code
- Starting master/slave memory address
- Number of bits
- Exception code starting address





Power Budgeting for the DL06

The DL06 has four option card slots. To determine whether the combination of cards you select will have sufficient power, you will need to perform a power budget calculation.

Power supplied

Power is supplied from two sources, the internal base unit power supply and, if required, an external supply (customer furnished). The D0-06xx (AC powered) PLCs supply a limited amount of 24 VDC power. The 24 VDC output can be used to power external devices.

For power budgeting, start by considering the power supplied by the base unit. All DL06 PLCs supply the same amount of 5 VDC power. Only the AC units offer 24 VDC auxiliary power.

Be aware of the trade-off between 5 VDC power and 24 VDC power. The amount of 5 VDC power available depends on the amount of 24 VDC power being used, and the amount of 24 VDC power available depends on the amount of 5 VDC power consumed. Determine the amount of internally supplied power from the table to the right.

Power required by base unit

Because of the different I/O configurations available in the DL06 family, the power consumed by the base unit itself varies from model to model. Subtract the amount of power *required by* the base unit from the amount of power *supplied by* the base unit. Be sure to subtract 5 VDC and 24 VDC amounts.

Power required by option cards

Next, subtract the amount of power required by the option cards you are planning to use. Again, remember to subtract both 5 VDC and 24 VDC.

If your power budget analysis shows surplus power available, you should have a workable configuration.

DL06 Power Supplied by Base Units

Part Number	5 VDC (mA)	24 VDC (mA)
D0-06xx	1500mA	300mA
	2000mA	200mA
D0-06xx-D	1500mA	none

DL06 Base Unit Power Required

Part Number	5 VDC (mA)	24 VDC (mA)
D0-06AA	800mA	none
D0-06AR	900mA	none
D0-06DA	800mA	none
D0-06DD1	600mA	280mA*
D0-06DD2	600mA	none
D0-06DR	950mA	none
D0-06DD1-D	600mA	none
D0-06DD2-D	600mA	none
D0-06DR-D	950mA	none

* Only if auxiliary 24VDC power is connected to V+ terminal.

DL06 Power Consumed by Other Devices

Part Number	5 VDC (mA)	24 VDC (mA)
D0-06LCD	50mA	none
D0-HPP	200mA	none
DV1000	150mA	none

DL05/06 Power Consumed by Option Cards

Part Number	5 VDC (mA)	24 VDC (mA)
D0-07CDR	130mA	none
D0-08CDD1	100mA	none
D0-08TR	280mA	none
D0-10ND3	35mA	none
D0-10ND3F	35mA	none
D0-10TD1	150mA	none
D0-10TD2	150mA	none
D0-16ND3	35mA	none
D0-16TD1	200mA	none
D0-16TD2	200mA	none
F0-04TRS	250mA	none
F0-08NA-1	5mA	none
F0-04AD-1	50mA	none
F0-04AD-2	75mA	none
F0-2AD2DA-2	50mA	30mA
F0-4AD2DA-1	100mA	40mA
F0-4AD2DA-2	100mA	none
F0-04RTD	70mA	none
F0-04THM	30mA	none
D0-DEVNETS	45mA	none
H0-PSCM	530mA	none
H0-ECOM	250mA	none
H0-CTRIO	250mA	none
H0-ECOM100	300mA	none
F0-08SIM	1mA	none

Power Budgeting Example

Power Source		5VDC power (mA)	24VDC power (mA)
D0-06DD1 (select row A or row B)	A	1500mA	300mA
	B	2000mA	200mA
Current Required		**5VDC power (mA)**	**24VDC power (mA)**
D0-06DD1		600mA	280mA*
D0-16ND3		35mA	0
D0-10TD1		150mA	0
D0-08TR		280mA	0
F0-4AD2DA-1		100mA	0
D0-06LCD		50mA	0
Total Used		1215mA	280mA
Remaining	A	285mA	20mA
	B	785mA	note 1

* Auxiliary 24VDC used to power V+ terminal of D0-06DD1 sinking outputs.

Note 1: If the PLC's auxiliary 24VDC power source is used to power the sinking outputs, use power choice A, above.

DL06 LCD Display

The optional D0-06LCD is a cost effective LCD display panel that is easy to install. This device is available exclusively for the DL06 PLCs.

16 X 2 backlit display

The 16 character x 2 row operator interface mounts directly on the face of the PLC. The LCD is backlit and is accessible using the seven function keys on the front of the display.

Monitor or change data values

You can view V-memory registers, view I/O status, PLC mode, or system errors without interrupting the PLC's control function.

Display messages required for alarm or monitoring purposes can be preprogrammed or imported as ASCII data.

Password protection

Two layers of password protection prevent unauthorized changes to clock and calendar setup and V-memory data values. Individuals with password authorization can change clock, calender, V-memory values, force bits on or off, etc.

One simple ladder instruction is used to set up the display. The LCD configuration instruction is available in *Direct*SOFT32, version 4.0 or later.

Note: The D2-HPP handheld programmer does not support DL06 LCD configuration.

The DL06 User Manual (D0-06USER-M) describes more fully the installation and operation of the D0-06LCD. Be sure to consult this manual before installing the DL06 LCD. The manual is available free on our Web site, or it can be purchased separately.

Snap-in installation

The display installs easily into any model DL06 PLC.

Note: Remove power to the PLC before installing the LCD display.

Remove the plastic cover (located between the input and output terminals) by sliding the cover to the left. In its place, slide in the LCD display until it snaps into place.

Display or change individual bits (up to 16 bits per screen) or 32-bit double word values from V-memory.

Buzzer

The piezo electric buzzer can be configured to provide pushbutton feedback.

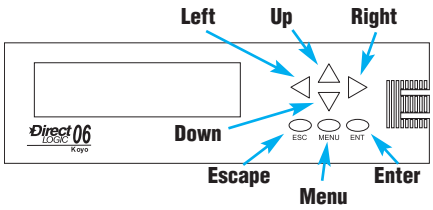
Keypad navigation

Seven function keys on the face of the LCD display provide navigation through messages or menu items. Messages fall into two categories:

- Error messages
- User-defined preprogrammed messages

At power-up the default screen is displayed. The default screen can be user-defined.

Seven menu choices allow you to view or change all accessible data values (see next page).



DL06 LCD Display

Menu choices

Pressing the Menu key takes you to the last accessed menu (or the first menu selection, if you haven't previously accessed a menu). Each time you press the Menu key (or if you simply hold the menu key down) the display will step through all menu choices.

There are seven built-in menus. Use the Menu key to locate the menu you need, and press the Enter key to view or change values.

From the default screen or a message screen, press and hold the Menu key. The display will scroll through the following choices:

M1 : PLC information
M2 : System configuration
M3 : Monitor
M4 : Calendar R/W
M5 : Password operation
M6 : Error history read
M7 : LCD test and set

Make a menu selection by pressing the Enter key. Change data values using the direction arrow keys.

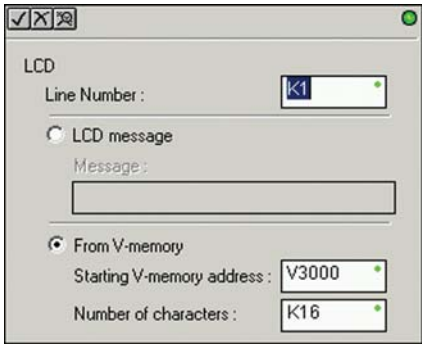
Ladder instruction

The LCD instruction in *Direct*SOFT gives the PLC programmer a convenient way to define screen messages. A literal string can be programmed using the LCD instruction. Embedding variables allows you to customize the messages for an application that involves changing values. The following example shows an embedded date and time on an alarm message:

Message with embedded date and time

The top line (16 characters) is designated K1, and the second line is K2. The sample instructions on this page show how a message is developed. A permissive contact turns on the instruction block, which sends the message to the display.

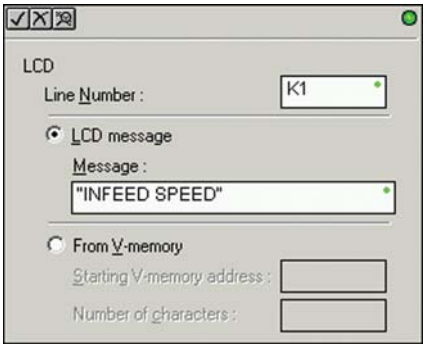
Messages can also be retrieved from V-memory and sent to the display. Select K1 or K2 to indicate which line you want to write to and select "From V-memory" as the source of the string.



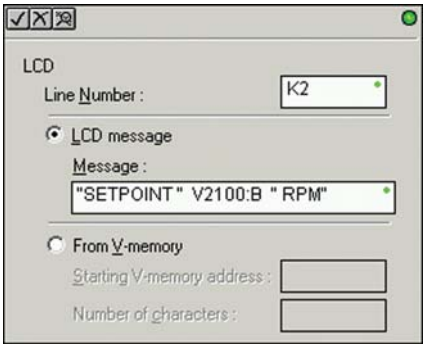
Message from PLC memory

Up to 16 characters of ASCII text can be displayed per line. In the example, K16 indicates that 16 bytes (8 words) of ASCII text is retrieved for display.

Message programming examples



Simple text message



Message with embedded data

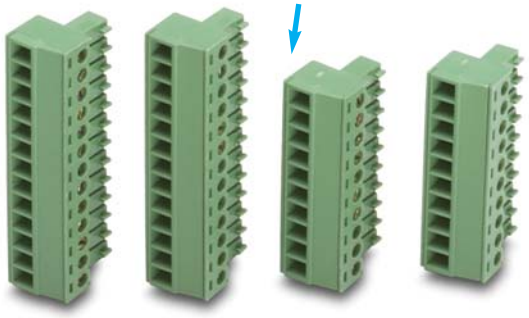
Potential uses

The potential uses for the DL06's LCD display vary widely. An operator can change values for setting up batch processes or machine timing for manufacturing different products, etc. Maintenance personnel can interface in the control cabinet to identify machine problems. LCD messages can be preprogrammed for process events or alarms. The LCD can satisfy many operator interface needs at a very cost-effective price.

ACCESSORIES

DL05, DL06, and Option Card Accessories		
Part Number	*Description*	*Price*
D0-MC-BAT	Replacement battery for the D0-01MC memory option modules (DL05 only).	<--->
F0-IOCON	DL05 or DL06 analog option card replacement terminal blocks, quantity two.	<--->
F0-IOCON-THM	DL05 or DL06 thermocouple module option card replacement terminal blocks, quantity one.	<--->
D0-CBL	12ft. (3.66m) RS232C shielded networking cable without RTS connections for DL05 or DL06 RJ12 networking ports. Enables direct networking of two PLCs.	<--->
D0-ACC-1	DL05 accessory pack includes one each of the I/O terminal block, I/O terminal block cover, and option slot cover.	<--->
D0-ACC-2	DL06 replacement terminal blocks, terminal block covers, terminal block labels and short bar.	<--->
D0-ACC-3	DL06 replacement option card slot covers, DL06 top covers, LCD slot cover, and lower access panel cover.	<--->
D0-ACC-4	D0 discrete I/O option card replacement terminal blocks, includes 13-position and 10-position.	<--->
D0-06ADPTR	DL06 15-pin high density D-sub vertical adapter for DL06 Port 2 serial communications port.	<--->
D2-FUSE-1	DL05 or DL06 F0-04TRS replacement fuse	check

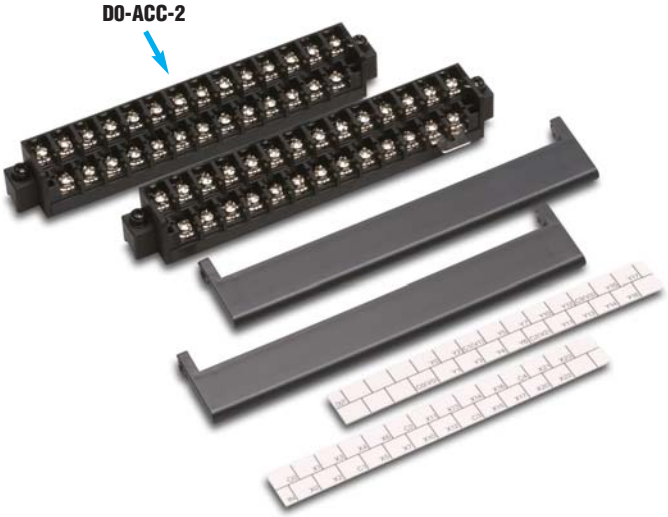
Discrete option card terminal blocks
D0-ACC-4



DL05 option card slot covers, I/O terminal block, and I/O terminal block cover
D0-ACC-1

DL06 replacement option card slot covers, DL06 top covers, LCD slot cover, and lower access panel cover
D0-ACC-3

DL06 replacement terminal blocks, terminal block covers, terminal block labels and short bar
D0-ACC-2



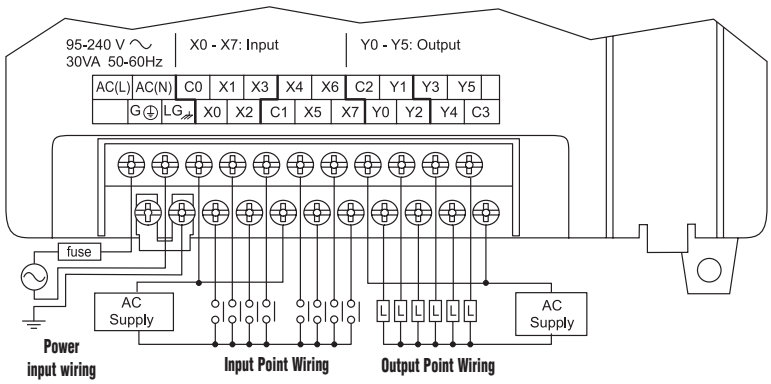
DL06 15-pin high density D-sub port adapter
D0-06ADPTR

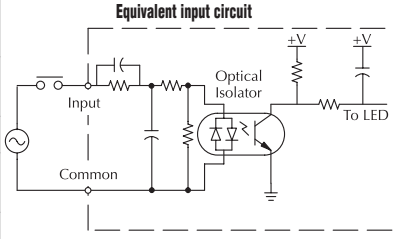
DL05 I/O Specifications

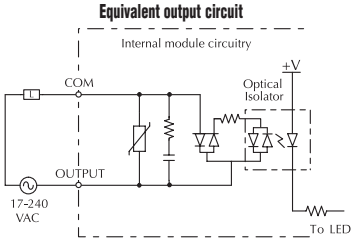
D0-05AA <--->

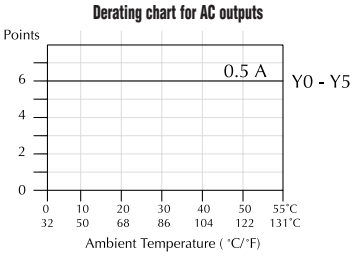
Wiring diagram and specifications

D0-05AA Specifications		
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)
AC Input Specifications	Number of Input Pts.	8
	Number of Commons	2 (isolated)
	Input Voltage Range	90-120VAC
	Frequency Range	47-63Hz
	Input Current	8mA @ 100 VAC at 50 Hz 10mA @ 100 VAC at 60Hz
	On Current/Voltage Level	>6mA/75VAC
	OFF Current/ Voltage Level	<2mA/20VAC
	OFF to ON Response	<40ms
	ON to OFF Response	<40ms
	Fuses	None
AC Output Specifications	Number of Output Points	6
	Number of Commons	2 (isolated)
	Output Voltage Range	17-240VAC 47-63Hz
	Peak Voltage	264VAC
	ON Voltage Drop	1.5 VAC>50mA 4.0VAC<50mA
	Maximum Current	0.5A/pt 1.5A/common
	Maximum Leakage Current	4mA at 264VAC
	Maximum Inrush Current	10A for 10ms
	Minimum Load	10mA
	OFF to ON Response	1ms
	ON to OFF Response	1ms + 1/2 cycle
	Fuses	None (external recommended)









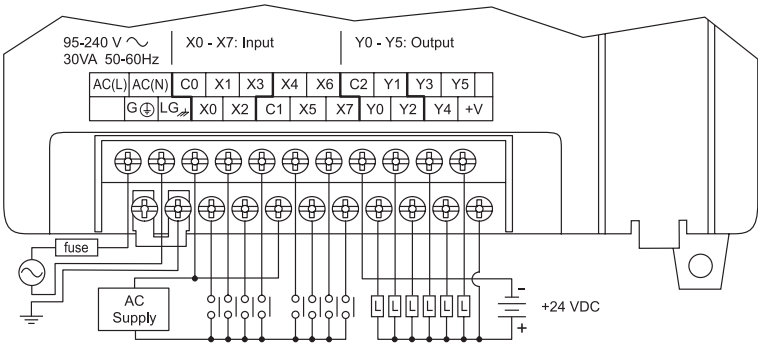
DL05 I/O SPECIFICATIONS

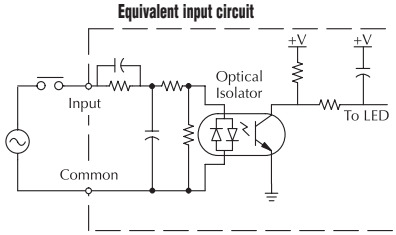
D0-05AD <--->

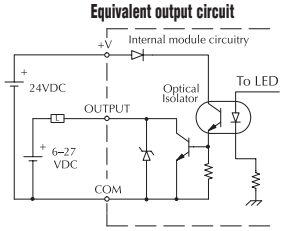
Wiring diagram and specifications

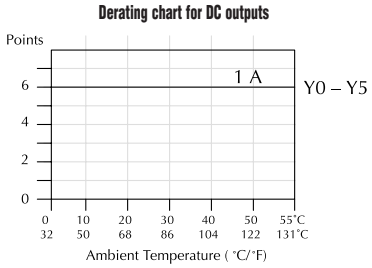
D0-05AD Specifications		
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)
AC Input Specifications	Number of Input Pts.	8
	Number of Commons	2 (isolated)
	Input Voltage Range	90-120VAC
	Frequency Range	47-63Hz
	Input Current	8mA @ 100 VAC at 50 Hz 10mA @ 100 VAC at 60Hz
	On Current/ Voltage Level	>6mA/75VAC
	OFF Current/ Voltage Level	<2mA/20VAC
	OFF to ON Response	<40ms
	ON to OFF Response	<40ms
	Fuses	None
DC Output Specifications	Number of Output Points	6 (sinking)
	Number of Commons	1
	Output Voltage Range	6-27VDC
	Peak Voltage	50VDC
	Max. Frequency (Y0, Y1)	7kHz
	ON Voltage Drop	0.5VDC @ 1A
	Maximum Current	0.5A/pt (Y0-Y1)* 1.0A pt (Y2-Y5)
	Maximum Leakage Current	15µA @ 30VDC
	Maximum Inrush Current	2A for 100ms
	OFF to ON Response	<10µs
	ON to OFF Response	<30µs (Y0-Y1) <60µs (Y2-Y5)
	External DC Power Required	20-28VDC 150mA max
	Status Indicators	Logic side
	Fuses	None (external recommended)

*When output points Y0 and Y1 are not used in pulse mode, the maximum output current is 1.0A







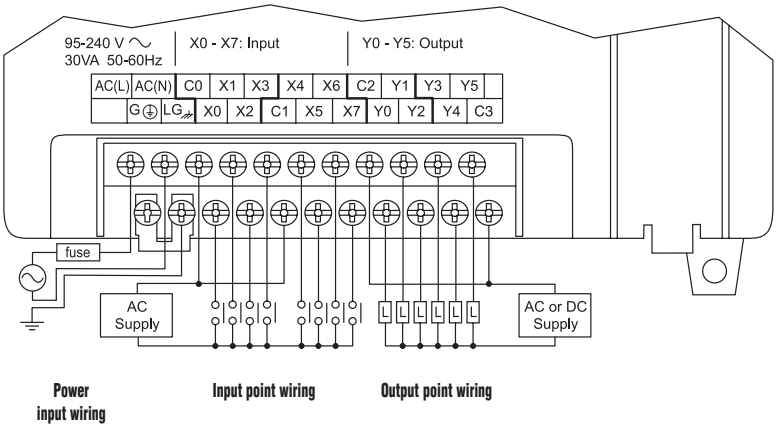


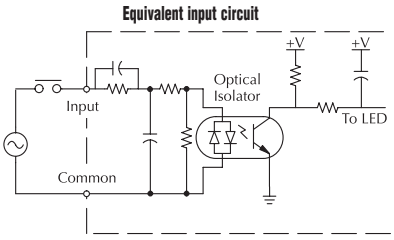
DL05 I/O Specifications

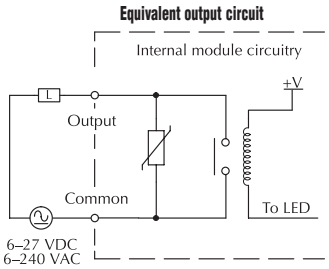
D0-05AR <--->

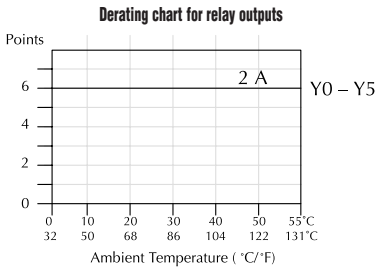
Wiring diagram and specifications

D0-05AR Specifications		
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)
AC Input Specifications	Number of Input Pts.	8
	Number of Commons	2 (isolated)
	Input Voltage Range	90-120VAC
	Frequency Range	47-63Hz
	Input Current	8mA @ 100 VAC at 50 Hz 10mA @ 100 VAC at 60Hz
	On Current/ Voltage Level	>6mA/75VAC
	OFF Current/ Voltage Level	<2mA/20VAC
	OFF to ON Response	<40ms
	ON to OFF Response	<40ms
	Fuses	None
Relay Output Specifications	Number of Output Points	6
	Number of Commons	2 (isolated)
	Output Voltage Range	6-240VAC, 47-63Hz 6-27VDC
	Maximum Voltage	264VAC,30VDC
	Maximum Current	2A/point 6A/common
	Maximum Leakage Current	0.1mA @ 246VAC
	Smallest Recommended Load	5mA @ 5VDC
	OFF to ON Response	<15ms
	ON to OFF Response	<10ms
	Status Indicators	Logic side
	Fuses	None (external recommended)









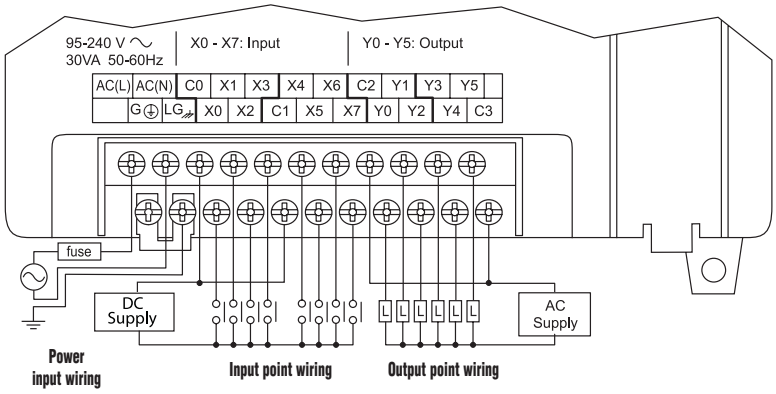
Typical Relay Life (Operations) at Room Temperature		
Voltage and Type of Load	Load Current 1A	2A
24 VDC Resistive	600K	270K
24 VDC Solenoid	150K	60K
110 VAC Resistive	900K	350K
110 VAC Solenoid	350K	150K
220 VAC Resistive	600K	250K
220 VAC Solenoid	200K	100K

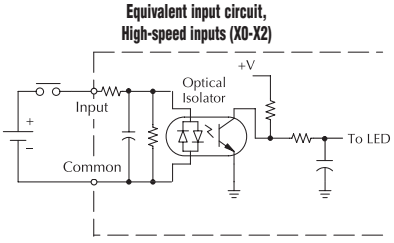
DL05 I/O SPECIFICATIONS

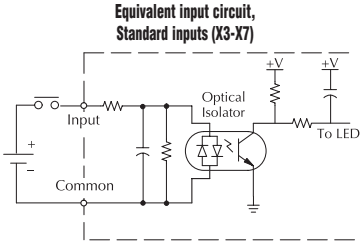
D0-05DA <--->

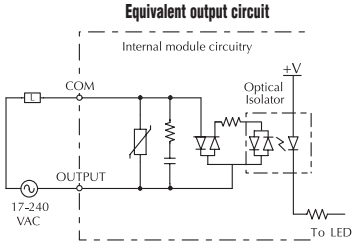
Wiring diagram and specifications

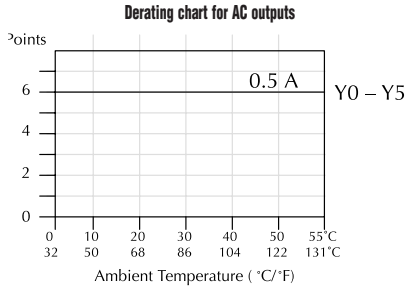
D0-05DA Specifications			
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)	
DC Input Specifications	Number of Input Pts.	8 (sink/source)	
	Number of Commons	2 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X2) 1.8K @ 12-24VDC (X3-X7) 2.8K @ 12-24VDC	
	Frequency Range	47-63Hz	
	Input Current	8mA @ 100VAC at 50Hz 10mA @ 100VAC at 60Hz	
	On Current/Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X2	X3-X7
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
AC Output Specifications	Number of Output Points	6	
	Number of Commons	2 (isolated)	
	Output Voltage Range	17-240VAC 47-63Hz	
	Peak Voltage	264VAC	
	ON Voltage Drop	1.5VAC>50mA 4.0VAC<50mA	
	Maximum Current	0.5A / point	
	Maximum Leakage Current	4mA @ 264VAC	
	Maximum Inrush Current	10A for 10ms	
	Minimum Load	10mA	
	OFF to ON Response	1ms	
	ON to OFF Response	1ms + 1/2 cycle	
	Fuses	None (external recommended)	









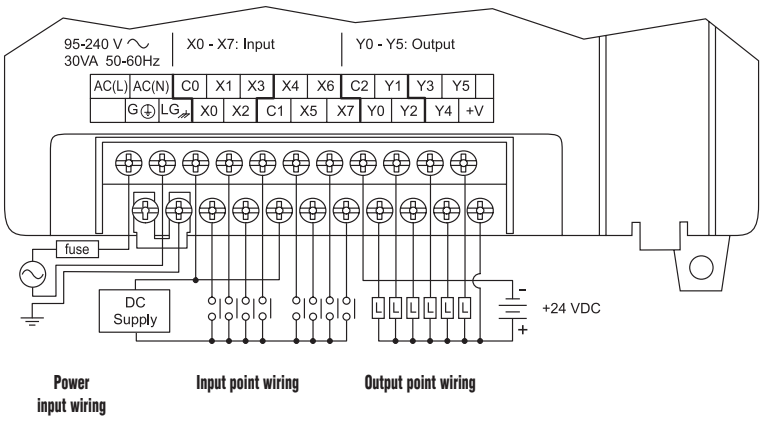


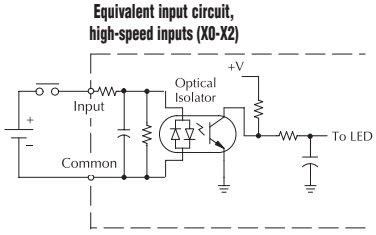
DL05 I/O Specifications

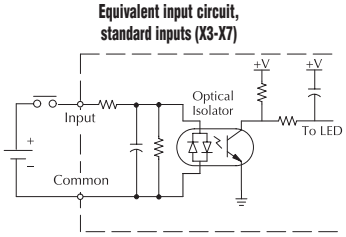
D0-05DD <--->

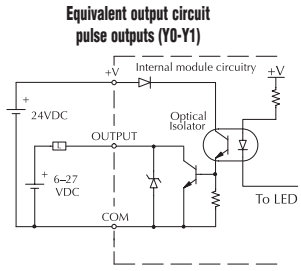
Wiring diagram and specifications

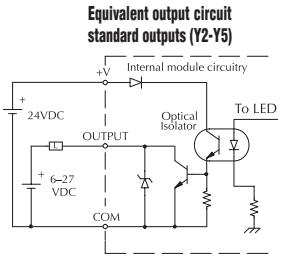
D0-05DD Specifications			
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)	
DC Input Specifications	Number of Input Pts.	8 (sink/source)	
	Number of Commons	2 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X2) 1.8K @ 12-24VDC (X3-X7) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X2	X3-X7
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
DC Output Specifications	Number of Output Points	6 (sinking)	
	Number of Commons	1	
	Output Voltage Range	6-27VDC	
	Peak Voltage	50VDC	
	Max. Frequency (Y0, Y1)	7kHz	
	ON Voltage Drop	0.5VDC @ 1A	
	Maximum Current	0.5A / point (Y0-Y1)* 1.0A / point (Y2-Y5)	
	Maximum Leakage Current	15µA @ 30VDC	
	Maximum Inrush Current	2A for 100ms10A for 10ms	
	OFF to ON Response	<10µs	
	ON to OFF Response	<30µs (Y0-Y1) <60µs (Y2-Y5)	
	External DC Power Required	20-28VDC 150mA max.	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	

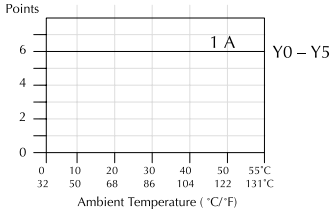












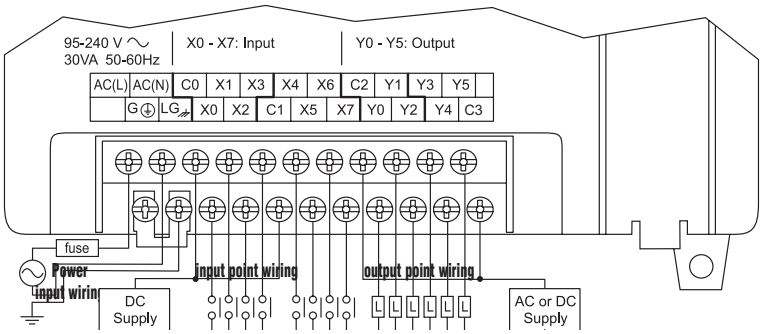
DL05 I/O SPECIFICATIONS

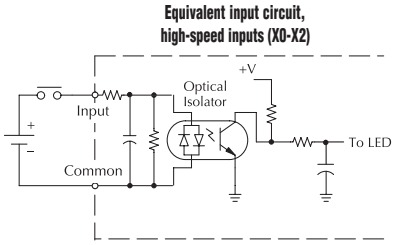
D0-05DR <--->

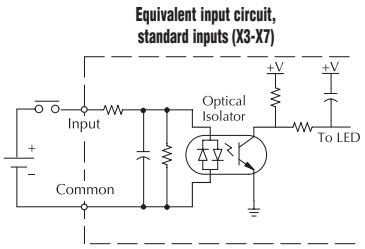
Wiring diagram and specifications

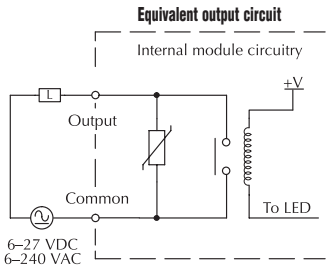
D0-05DR Specifications			
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)	
DC Input Specifications	Number of Input Pts.	8 (sink/source)	
	Number of Commons	2 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X2) 1.8K @ 12-24VDC (X3-X7) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X2	X3-X7
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
Relay Output Specifications	Number of Output Points	6	
	Number of Commons	2 (isolated)	
	Output Voltage Range	6-240VAC, 47-63Hz 6-27VDC	
	Maximum Voltage	264VAC,30VDC	
	Maximum Current	2A/point 6A/common	
	Maximum Leakage Current	0.1mA @ 246VAC	
	Smallest Recommended Load	5mA @ 5VDC	
	OFF to ON Response	<15ms	
	ON to OFF Response	<10ms	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	

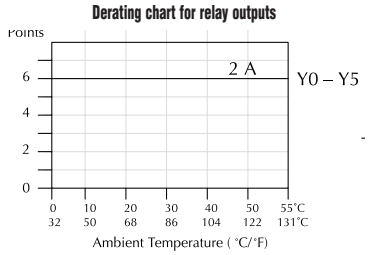
Typical Relay Life (Operations) at Room Temperature		
Voltage and Type of Load	Load Current 1A	2A
24 VDC Resistive	600K	270K
24 VDC Solenoid	150K	60K
110 VAC Resistive	900K	350K
110 VAC Solenoid	350K	150K
220 VAC Resistive	600K	250K
220 VAC Solenoid	200K	100K











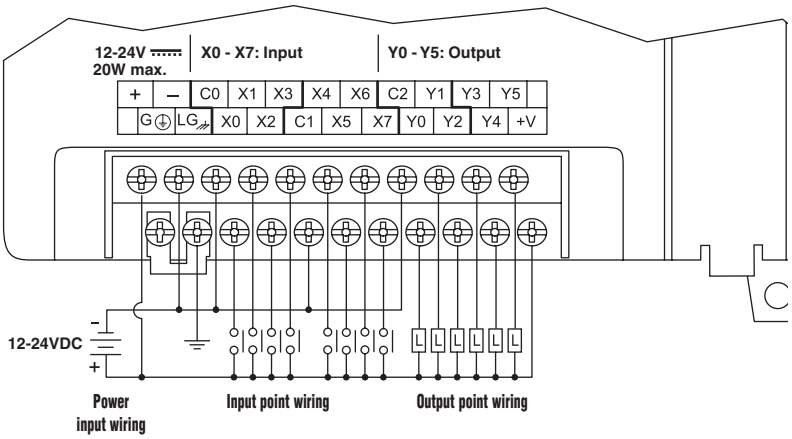
DL05 I/O Specifications

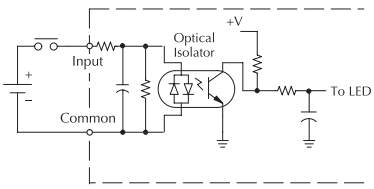
D0-05DD-D <--->

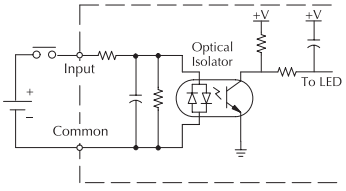
Wiring diagram and specifications

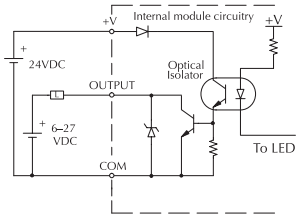
D0-05DD-D Specifications			
DC Power Supply Specifications	Voltage Range	12-24VDC 20W max.	
DC Input Specifications	Number of Input Pts.	8 (sink/source)	
	Number of Commons	2 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X2) 1.8K @ 12-24VDC (X3-X7) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X2	X3-X7
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
DC Output Specifications	Number of Output Pts.	6 (sinking)	
	Number of Commons	1	
	Output Voltage Range	6-27VDC	
	Peak Voltage	50VDC	
	Max. Frequency (Y0, Y1)	7kHz	
	ON Voltage Drop	0.5VDC @ 1A	
	Maximum Current	0.5A / point (Y0-Y1)* 1.0A / point (Y2-Y5)	
	Maximum Leakage Current	15µ @ 30VDC	
	Maximum Inrush Current	2A for 100ms 10A for 10ms	
	OFF to ON Response	<10µ	
	ON to OFF Response	<30µs (Y0-Y1) <60µs (Y2-Y5)	
	External DC Power Required	20-28VDC 150mA max.	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	

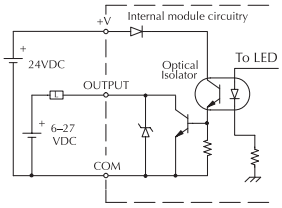
*When output points Y0 and Y1 are not used in pulse mode, the maximum output current is 1.0A

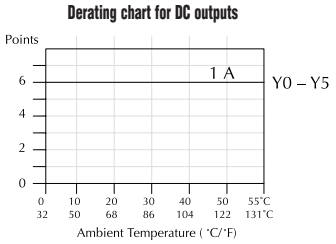










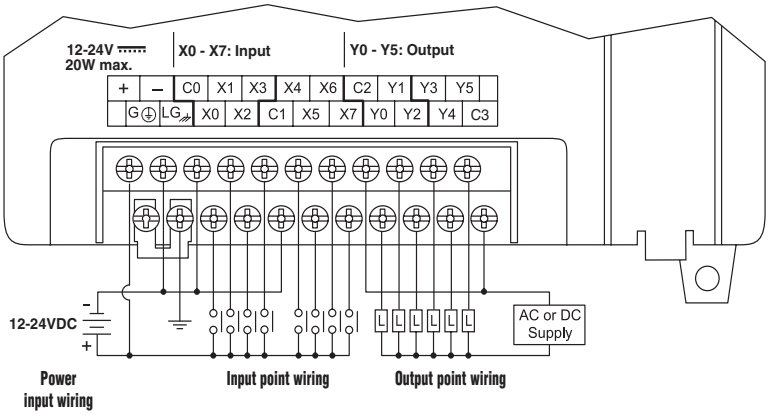


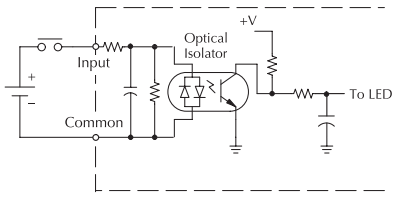
DL05 I/O SPECIFICATIONS

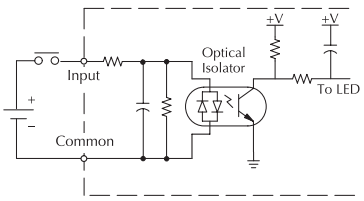
D0-05DR-D <--->

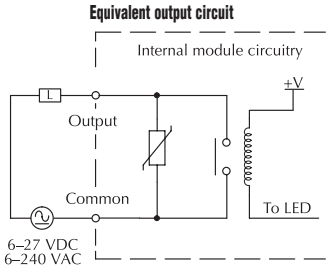
Wiring diagram and specifications

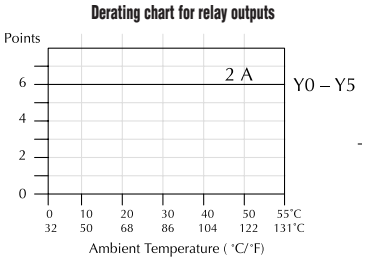
D0-05DR-D Specifications			
DC Power Supply Specifications	Voltage Range	12-24VDC 20W max.	
DC Input Specifications	Number of Input Pts.	8 (sink/source)	
	Number of Commons	2 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X2) 1.8K @ 12-24VDC (X3-X7) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X2	X3-X7
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
Relay Output Specifications	Number of Output Points	6	
	Number of Commons	2 (isolated)	
	Output Voltage Range	6-240VAC, 47-63Hz 6-27VDC	
	Maximum Voltage	264VAC,30VDC	
	Maximum Output Current	2A/point 6A/common	
	Maximum Leakage Current	0.1mA @ 246VAC	
	Smallest Recommended Load	5mA @ 5VDC	
	OFF to ON Response	<15ms	
	ON to OFF Response	<10ms	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	











Typical Relay Life (Operations) at Room Temperature		
Voltage and Type of Load	Load Current 1A	2A
24 VDC Resistive	600K	270K
24 VDC Solenoid	150K	60K
110 VAC Resistive	900K	350K
110 VAC Solenoid	350K	150K
220 VAC Resistive	600K	250K
220 VAC Solenoid	200K	100K

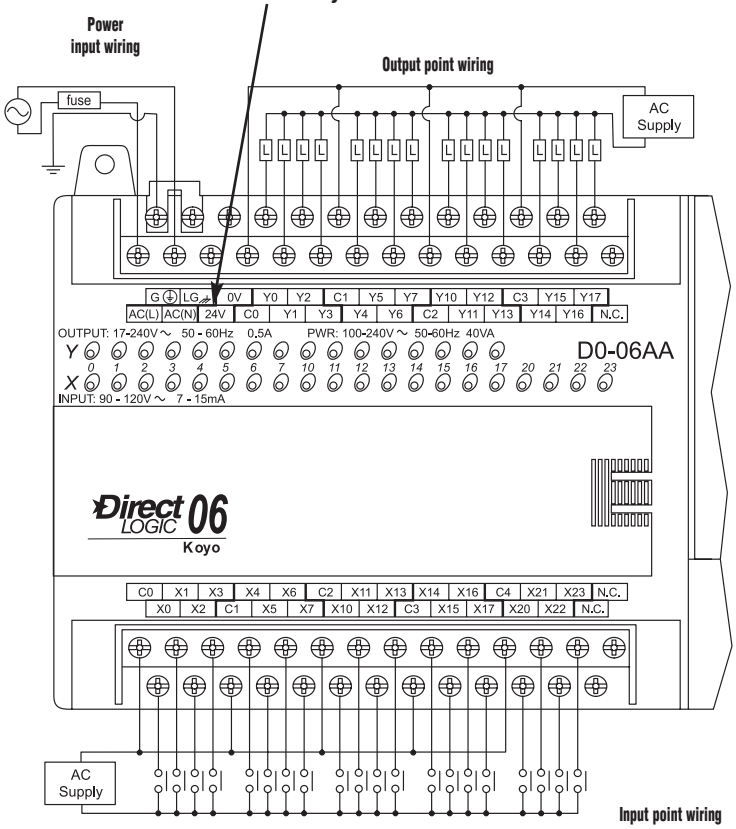
DL06 I/O Specifications

D0-06AA <--->

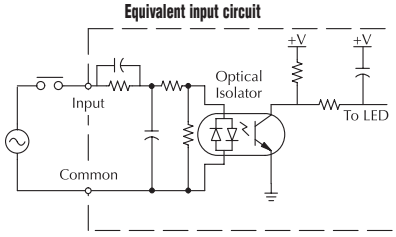
Wiring diagram and specifications

D0-06AA Specifications		
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)
AC Input Specifications	Number of Input Pts.	20
	Number of Commons	5 (isolated)
	Input Voltage Range	90-120VAC
	Frequency Range	47-63Hz
	Input Current	8mA @ 100 VAC at 50 Hz 10mA @ 100 VAC at 60Hz
	On Current/Voltage Level	>6mA/75VAC
	OFF Current/ Voltage Level	<2mA/20VAC
	OFF to ON Response	<40ms
	ON to OFF Response	<40ms
	Fuses	None
AC Output Specifications	Number of Output Points	16
	Number of Commons	4 (isolated)
	Output Voltage Range	17-240VAC 47-63Hz
	Peak Voltage	264VAC
	ON Voltage Drop	1.5 VAC>50mA 4.0VAC<50mA
	Maximum Current	0.5A/pt 2.0A/common
	Maximum Leakage Current	4mA at 264VAC
	Maximum Inrush Current	10A for 10ms
	Minimum Load	10mA
	OFF to ON Response	<1ms
	ON to OFF Response	<1ms + 1/2 cycle
	Fuses	None (external recommended)

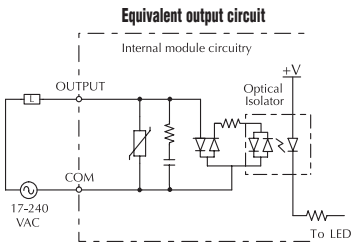
Note: Refer to page 2–29, Power Budgeting, for Auxillary 24VDC current available.



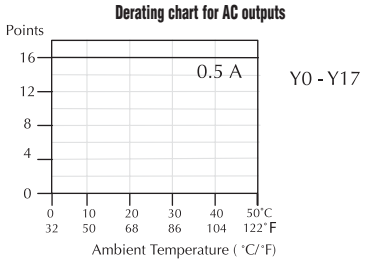
Equivalent input circuit



Equivalent output circuit



Derating chart for AC outputs



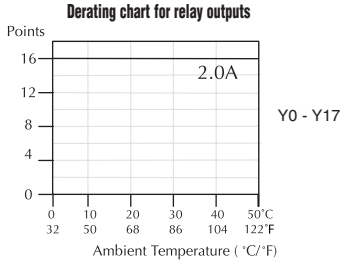
DL06 I/O SPECIFICATIONS

D0-06AR <--->

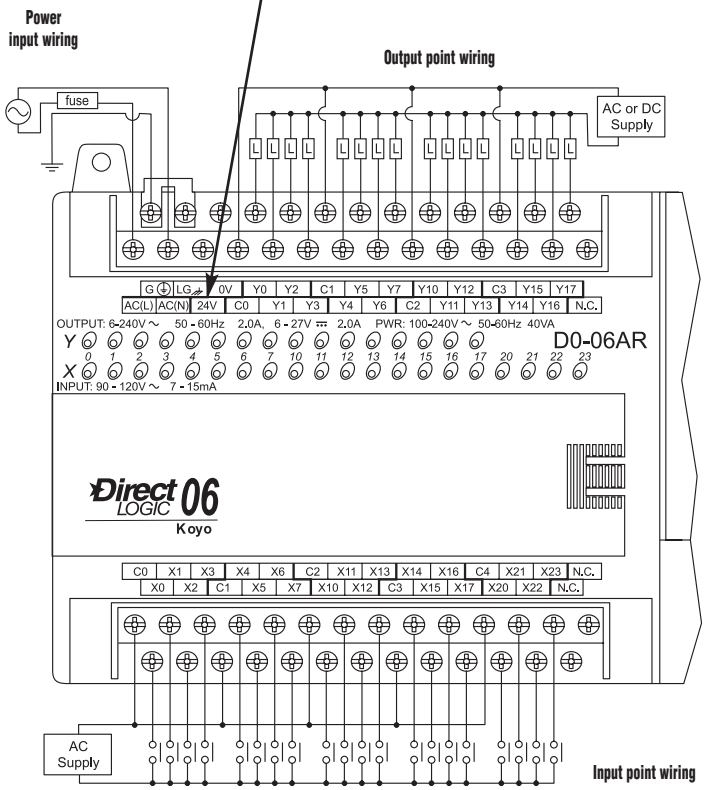
Wiring diagram and specifications

D0-06AR Specifications		
AC Power Supply Specifications	***Voltage Range***	95-240VAC (30VA)
AC Input Specifications	***Number of Input Pts.***	20
	Number of Commons	5 (isolated)
	Input Voltage Range	90-120VAC
	Frequency Range	47-63Hz
	Input Current	8mA @ 100 VAC at 50 Hz 10mA @ 100 VAC at 60Hz
	On Current/ Voltage Level	>6mA/75VAC
	OFF Current/ Voltage Level	<2mA/20VAC
	OFF to ON Response	<40ms
	ON to OFF Response	<40ms
	Fuses	None
Relay Output Specifications	***Number of Output Points***	16
	Number of Commons	4 (isolated)
	Output Voltage Range	6-240VAC, 47-63Hz 6-27VDC
	Maximum Voltage	264VAC,30VDC
	Maximum Current	2A/point 6A/common
	Maximum Leakage Current	0.1mA @ 246VAC
	Smallest Recommended Load	5mA @ 5VDC
	OFF to ON Response	<15ms
	ON to OFF Response	<10ms
	Status Indicators	Logic side
	Fuses	None (external recommended)

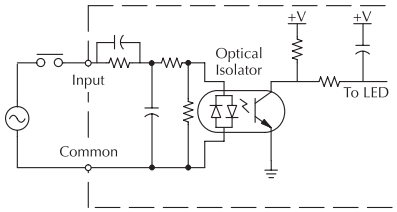
Derating chart for relay outputs



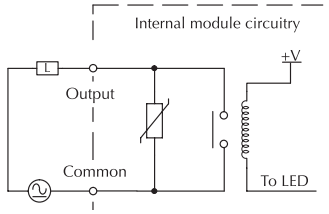
Note: Refer to page 2–29, Power Budgeting, for Auxillary 24VDC current available.



Equivalent input circuit



Equivalent output circuit



Typical Relay Life (Operations) at Room Temperature		
Voltage and Type of Load	***Load Current***	
	At 1A	***At 2A***
24 VDC Resistive	500K	250K
24 VDC Inductive	100K	50K
110 VAC Resistive	500K	250K
110 VAC Inductive	200K	100K
220 VAC Resistive	350K	200K
220 VAC Inductive	100K	50K

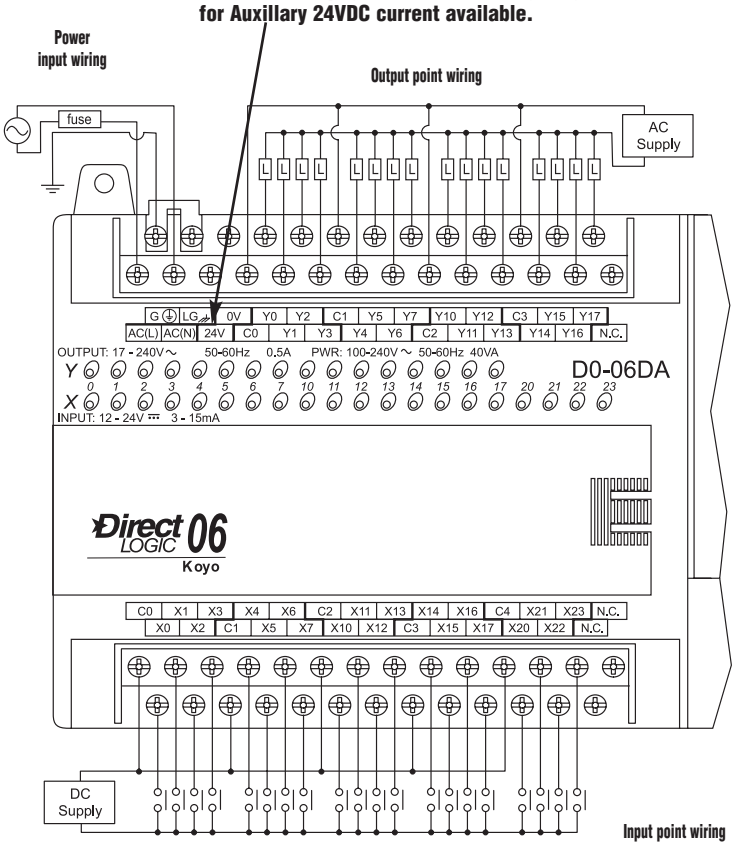
DL06 I/O Specifications

D0-06DA <--->

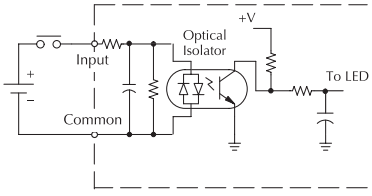
Wiring diagram and specifications

D0-06DA Specifications			
AC Power Supply Specifications	Voltage Range	100-240VAC (40VA)	
DC Input Specifications	Number of Input Pts.	20 (sink/source)	
	Number of Commons	5 (isolated)	
	Input Voltage Range	10.8-26.4VDC	
	Input Impedance	(X0-X3) 1.8K @ 12-24VDC (X4-X23) 2.8K @ 12-24VDC	
	On Current/Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X3	X4-X23
	OFF to ON Response	<70µs	2-8ms
	ON to OFF Response	<70µs	2-8ms
	Fuses	None	
AC Output Specifications	Number of Output Points	16	
	Number of Commons	4 (isolated)	
	Operating Voltage Range	17-240VAC 47-63Hz	
	Peak Voltage	264VAC	
	ON Voltage Drop	1.5VAC>50mA 4.0VAC<50mA	
	Maximum Current	0.5A / point;1.5A /common	
	Maximum Leakage Current	4mA @ 264VAC, 60 Hz	
	Maximum Inrush Current	10A for 10ms	
	Minimum Load	10mA	
	OFF to ON Response	1ms	
	ON to OFF Response	1ms + 1/2 cycle	
	Fuses	None (external recommended)	

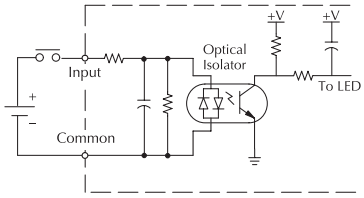
Note: Refer to page 2–29, Power Budgeting, for Auxillary 24VDC current available.



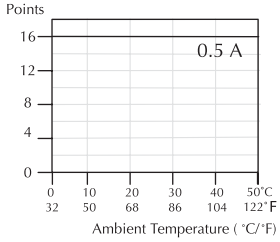
Equivalent input circuit, High-speed inputs (X0-X3)



Equivalent input circuit, Standard inputs (X4-X23)

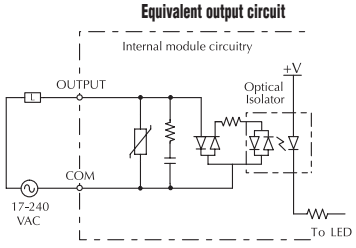


Derating chart for AC outputs



Y0 - Y17

Equivalent output circuit



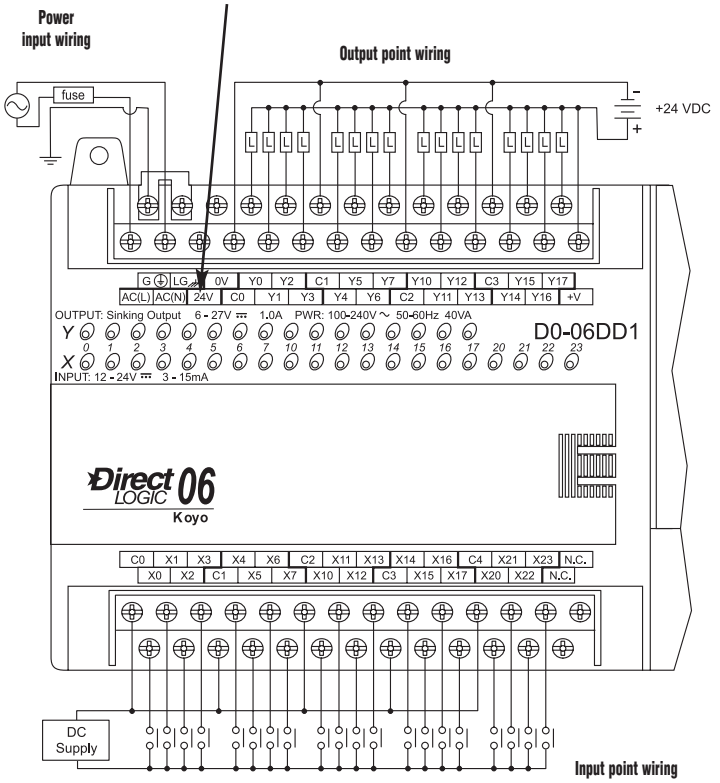
DL06 I/O SPECIFICATIONS

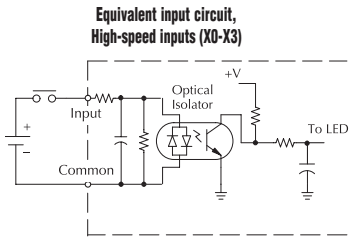
D0-06DD1 <--->

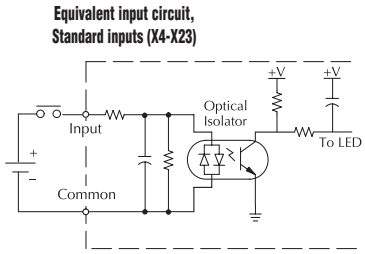
Wiring diagram and specifications

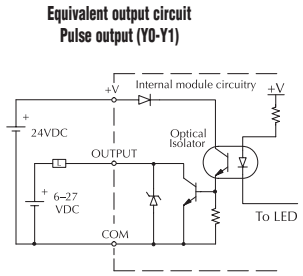
D0-06DD1 Specifications			
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)	
DC Input Specifications	Number of Input Pts.	20 (sink/source)	
	Number of Commons	5 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X3) 1.8K @ 12-24VDC (X4-X23) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X3	X4-X23
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
DC Output Specifications	Number of Output Points	16 (sinking)	
	Number of Commons	4 isolated	
	Output Voltage Range	6-27VDC	
	Peak Voltage	50VDC	
	Max. Frequency (Y0, Y1)	7kHz	
	ON Voltage Drop	0.3VDC @ 1A	
	Maximum Current	0.5A / pt (Y0-Y1)* 1.0A pt (Y2-Y17)**	
	Maximum Leakage Current	15µA @ 30VDC	
	Maximum Inrush Current	2A for 100ms	
	OFF to ON Response	<10µs	
	ON to OFF Response	<20µs (Y0-Y1) <60µs (Y2-Y17)	
	External DC Power Required	20-28VDC 150mA max. (Y0-Y1) 280 mA max. (Y2-Y17)	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	

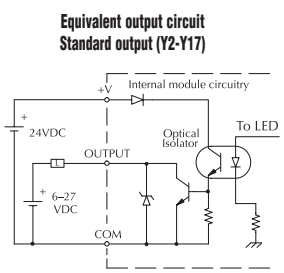
Note: Refer to page 2–29, Power Budgeting, for Auxillary 24VDC current available.







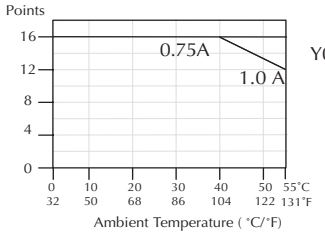




*** When Y0-Y1 are not used for pulse outputs, maximum current output is 1.0A**.**

**** These outputs must be derated to 0.6A for EN61131-2 compliance.**

Derating chart for DC outputs



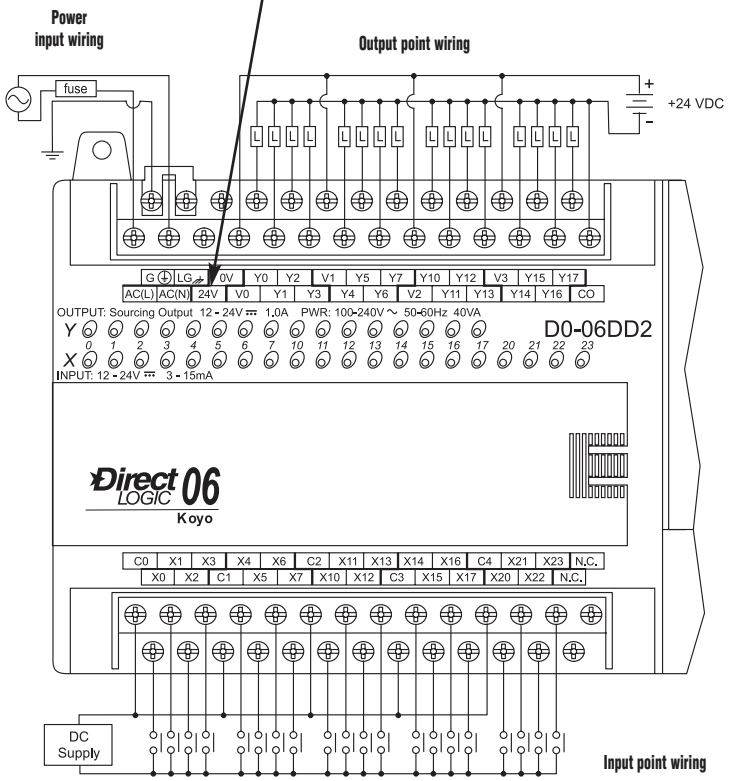
DL06 I/O Specifications

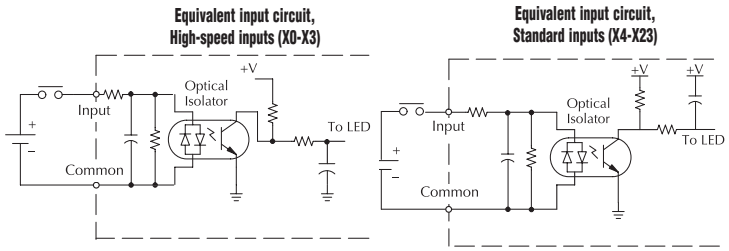
D0-06DD2 <--->

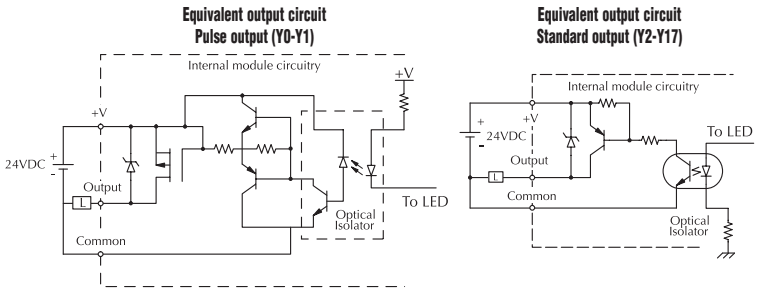
Wiring diagram and specifications

D0-06DD2 Specifications			
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)	
DC Input Specifications	Number of Input Pts.	20 (sink/source)	
	Number of Commons	5 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X3) 1.8K @ 12-24VDC (X4-X23) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X3	X4-X23
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
DC Output Specifications	Number of Output Points	16 (sourcing)	
	Number of Commons	4 isolated	
	Output Voltage Range	12-24VDC	
	Peak Voltage	30VDC	
	Max. Frequency (Y0, Y1)	7kHz	
	ON Voltage Drop	0.3VDC @ 1A	
	Maximum Current	0.5A / pt (Y0-Y1)* 1.0A pt (Y2-Y17)	
	Maximum Leakage Current	15µA @ 30VDC	
	Maximum Inrush Current	2A for 100ms	
	OFF to ON Response	<10µs	
	ON to OFF Response	<20µs (Y0-Y1) <0.5ms (Y2-Y17)	
	External DC Power Required	20-28VDC 150mA max.	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	

Note: Refer to page 2–29, Power Budgeting, for Auxillary 24VDC current available.

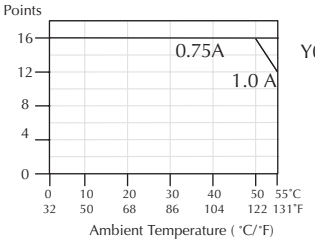






*When Y0-Y1 are not used for pulse outputs, maximum current output is 1.0A.

Derating chart for DC outputs



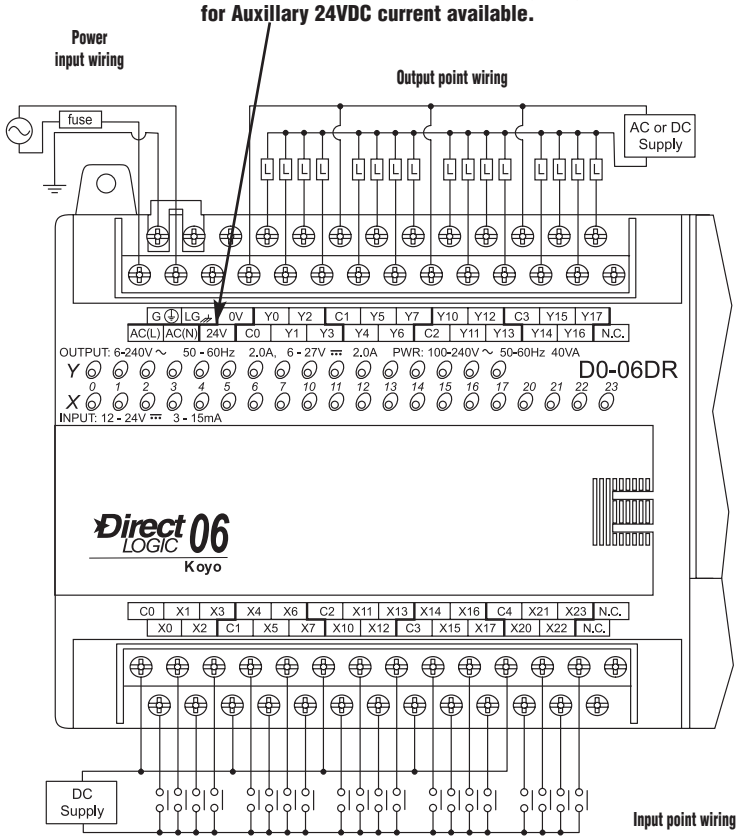
DL06 I/O SPECIFICATIONS

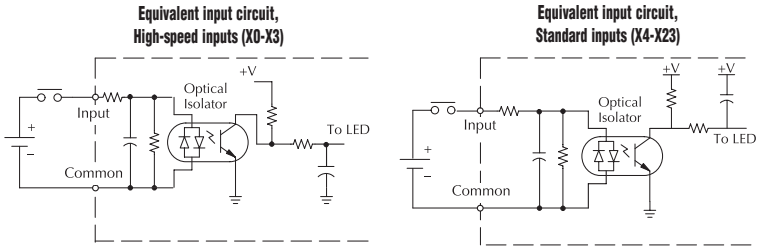
D0-06DR <--->

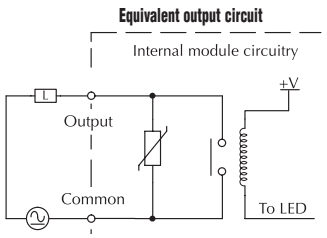
Wiring diagram and specifications

D0-06DR Specifications			
AC Power Supply Specifications	Voltage Range	100-240VAC (40VA)	
DC Input Specifications	Number of Input Pts.	20 (sink/source)	
	Number of Commons	5 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X3) 1.8K @ 12-24VDC (X4-X23) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X3	X4-X23
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
Relay Output Specifications	Number of Output Points	16	
	Number of Commons	4 (isolated)	
	Output Voltage Range	6-240VAC, 47-63Hz 6-27VDC	
	Maximum Voltage	264VAC,30VDC	
	Maximum Current	2A/point 6A/common	
	Maximum Leakage Current	0.1mA @ 246VAC	
	Smallest Recommended Load	5mA @ 5VDC	
	OFF to ON Response	<15ms	
	ON to OFF Response	<10ms	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	

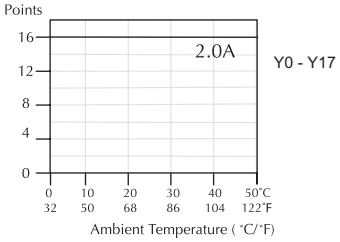
Note: Refer to page 2–29, Power Budgeting, for Auxillary 24VDC current available.







Derating chart for relay outputs



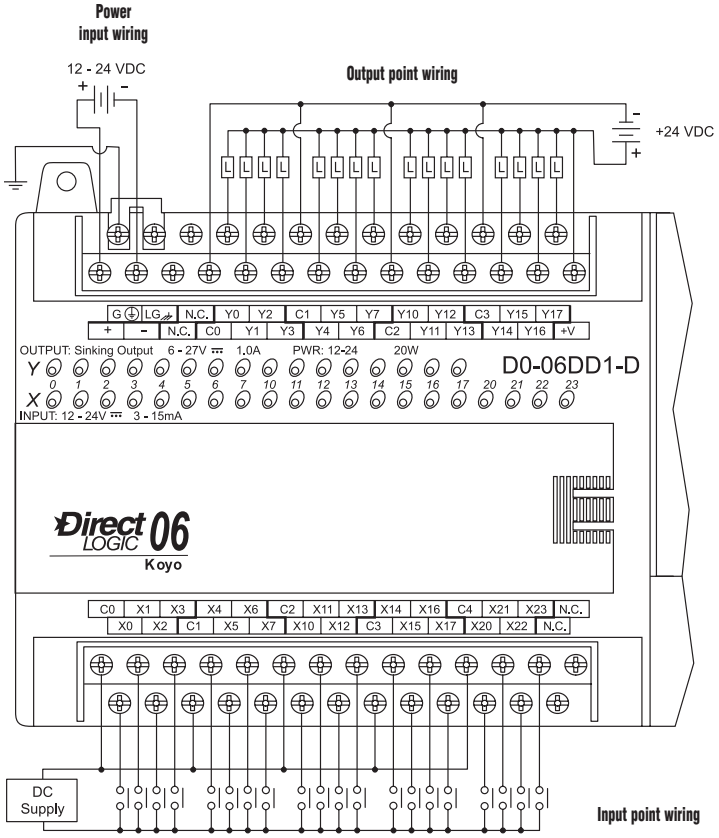
Typical Relay Life (Operations) at Room Temperature		
Voltage and Type of Load	Load Current	
	At 1A	At 2A
24 VDC Resistive	500K	250K
24 VDC Inductive	100K	50K
110 VAC Resistive	500K	250K
110 VAC Inductive	200K	100K
220 VAC Resistive	350K	200K
220 VAC Inductive	100K	50K

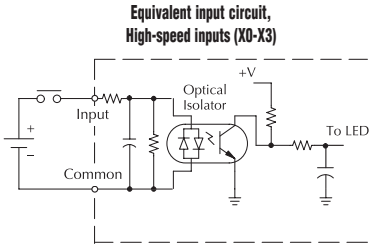
DL06 I/O Specifications

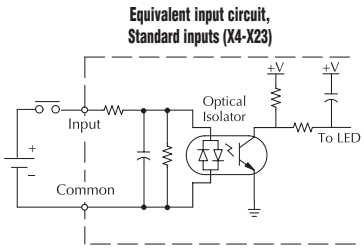
D0-06DD1-D <--->

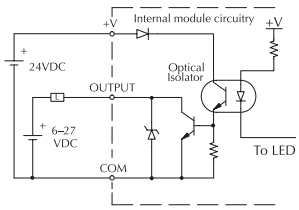
Wiring diagram and specifications

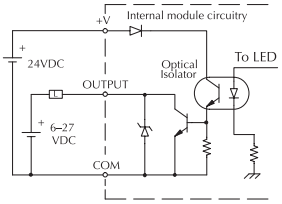
D0-06DD1-D Specifications			
DC Power Supply Specifications	Voltage Range	12-24VDC (15W)	
DC Input Specifications	Number of Input Pts.	20 (sink/source)	
	Number of Commons	5 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X3) 1.8K @ 12-24VDC (X4-X23) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X3	X4-X23
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
DC Output Specifications	Number of Output Points	16 (sinking)	
	Number of Commons	4 isolated	
	Output Voltage Range	6-27VDC	
	Peak Voltage	50VDC	
	Max. Frequency (Y0, Y1)	7kHz	
	ON Voltage Drop	0.3VDC @ 1A	
	Maximum Current	0.5A / point (Y0-Y1)* 1.0A / point (Y2-Y17)**	
	Maximum Leakage Current	15µA @ 30VDC	
	Maximum Inrush Current	2A for 100ms	
	OFF to ON Response	<10µs	
	ON to OFF Response	<20µs (Y0-Y1) <60µs (Y2-Y17)	
	External DC Power Required	20-28VDC 150mA max.	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	







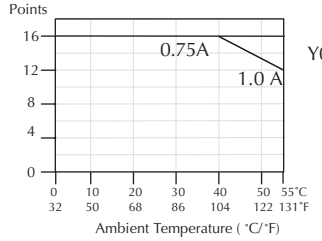




*When Y0-Y1 are not used for pulse outputs, maximum current output is 1.0A**.

** These outputs must be derated to 0.6A for EN61131-2 compliance.

Derating chart for DC outputs



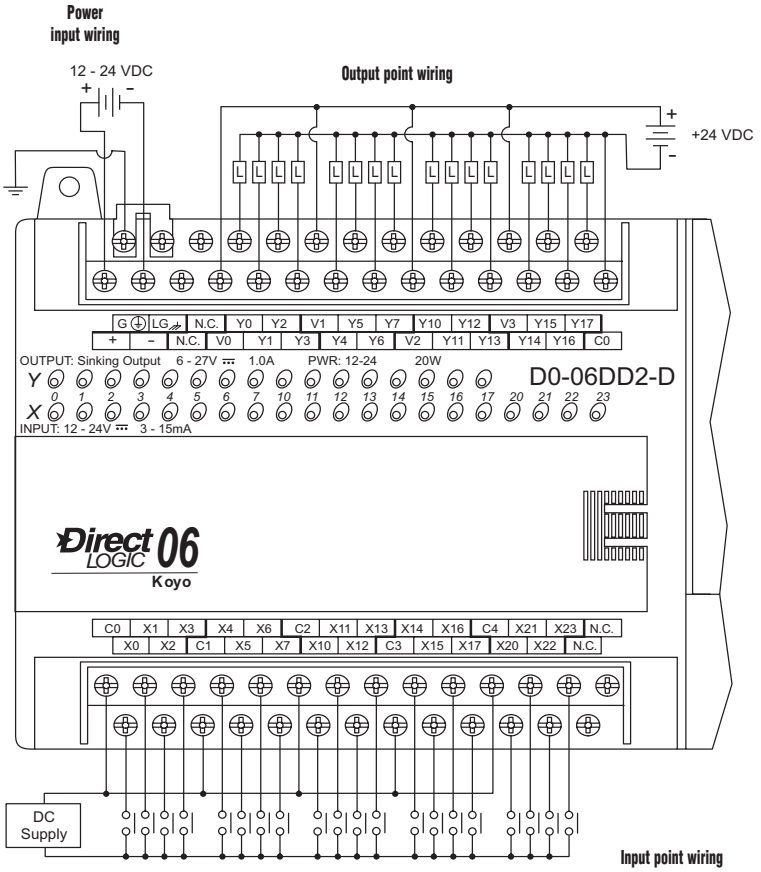
DL06 I/O SPECIFICATIONS

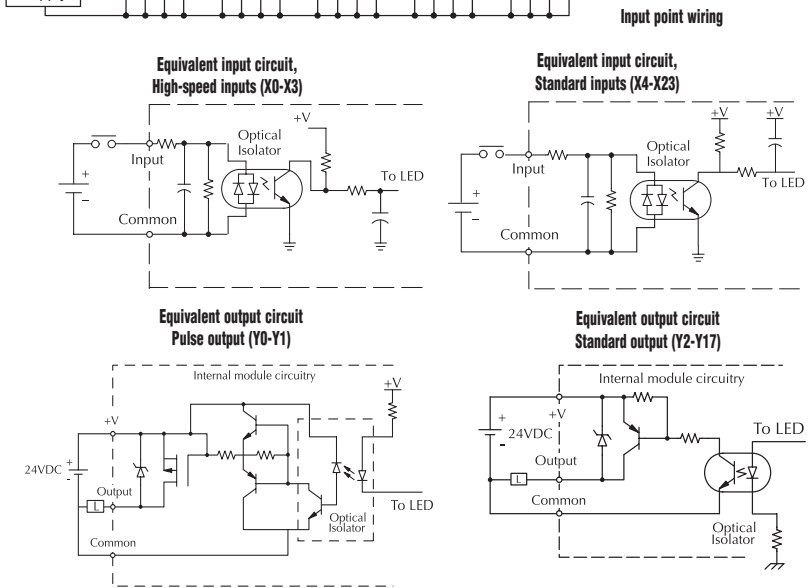
D0-06DD2-D <--->

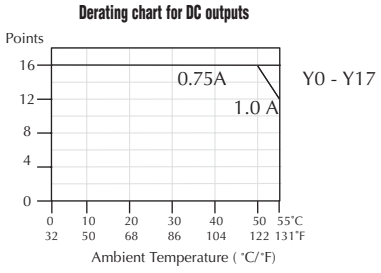
Wiring diagram and specifications

D0-06DD2-D Specifications			
DC Power Supply Specifications	Voltage Range	12-24VDC (15W)	
DC Input Specifications	Number of Input Pts.	20 (sink/source)	
	Number of Commons	5 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X3) 1.8K @ 12-24VDC (X4-X23) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	5mA/>10VDC	
	OFF Current/ Voltage Level	0.5mA/<2VDC	
	Response Time	X0-X3	X4-X23
	OFF to ON Response	<70µS	2-8mS Typ. 4mS
	ON to OFF Response	<70µS	2-8mS Typ. 4mS
	Fuses	None	
DC Output Specifications	Number of Output Points	16 (sourcing)	
	Number of Commons	4 isolated	
	Output Voltage Range	10.8-26.4VDC	
	Peak Voltage	30VDC	
	Max. Frequency (Y0, Y1)	10kHz	
	ON Voltage Drop	0.5VDC @ 1A (Y0-Y1) 1.2VDC @ 1A (Y2-Y17)	
	Maximum Current	0.5A / point (Y0-Y1)* 1.0A / point (Y2-Y17)	
	Maximum Leakage Current	15µ @ 30VDC	
	Maximum Inrush Current	2A for 100ms	
	OFF to ON Response	<10µS	
	ON to OFF Response	<20µS (Y0-Y1) <0.50mS (Y2-Y17)	
	External DC Power Required	N/A	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	

*When Y0-Y1 are not used for pulse outputs, maximum current output is 1.0A.





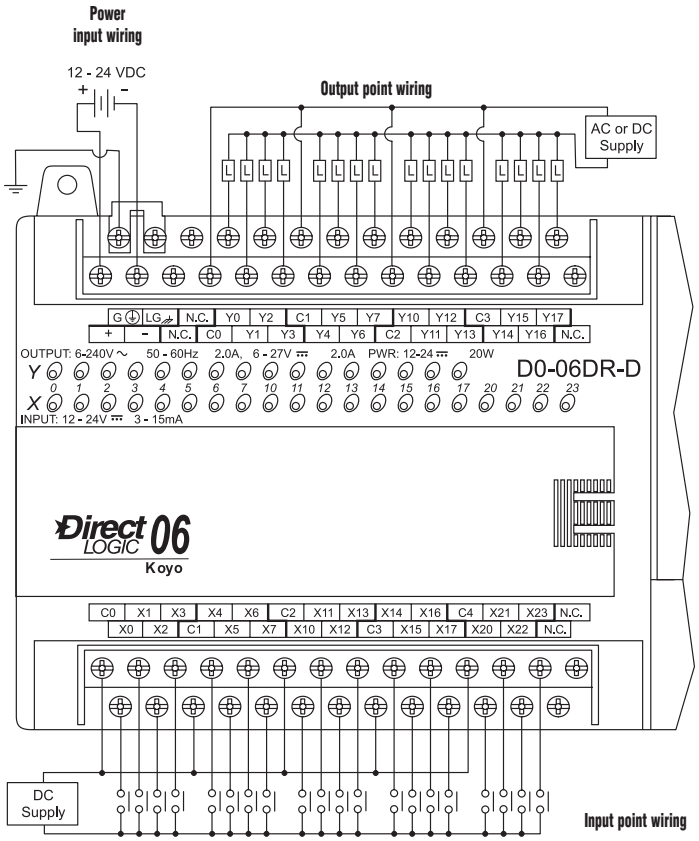


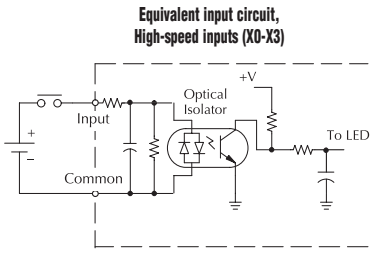
DL06 I/O Specifications

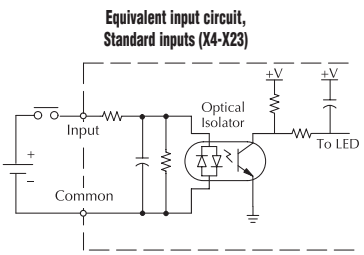
D0-06DR-D <--->

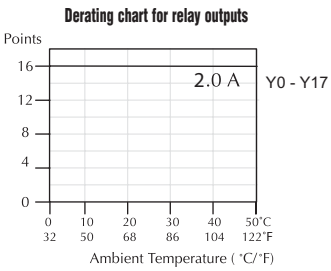
Wiring diagram and specifications

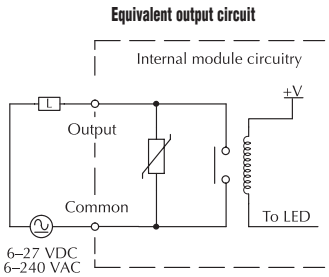
D0-06DR-D Specifications			
DC Power Supply Specifications	Voltage Range	12-24VDC 20W max.	
DC Input Specifications	Number of Input Pts.	20 (sink/source)	
	Number of Commons	5 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X3) 1.8K @ 12-24VDC (X4-X23) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X3	X4-X23
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
Relay Output Specifications	Number of Output Points	16	
	Number of Commons	4 (isolated)	
	Output Voltage Range	6-240VAC, 47-63Hz 6-27VDC	
	Maximum Voltage	264VAC,30VDC	
	Maximum Current	2A/point 6A/common	
	Maximum Leakage Current	0.1mA @ 246VAC	
	Smallest Recommended Load	5mA @ 5VDC	
	OFF to ON Response	<15ms	
	ON to OFF Response	<10ms	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	











Typical Relay Life (Operations) at Room Temperature		
Voltage and Type of Load	Load Current	
	At 1A	At 2A
24 VDC Resistive	500K	250K
24 VDC Inductive	100K	50K
110 VAC Resistive	500K	250K
110 VAC Inductive	200K	100K
220 VAC Resistive	350K	200K
220 VAC Inductive	100K	50K

DL05/06 Option Modules

Need to expand your DL05 or DL06?

Customize your DL05 or DL06 PLC to fit your application by adding option cards in the built-in slots. You can add these features without adding size. We offer the following option modules:

- Discrete I/O modules
- Analog I/O modules
- DeviceNet slave module
- Etherent communications modules
- Profibus slave module
- High-Speed Counter module

DL05 (Only) Memory Module

DL05 flash memory

The standard DL05 PLC uses non-volatile flash memory to back-up the user program. Program data (V-memory) is backed by a super capacitor. If you need longer retention of program data, we recommend the D0-01MC. We also recommend the D0-01MC for applications that require transferring programs without a programming device or that require a real-time clock.

Simple and inexpensive

The D0-01MC slides easily into the option card slot in any DL05 PLC to back up PLC programs and data for extended periods of time.

Battery-backed RAM

The memory cartridge makes programs portable from one DL05 PLC to another. The memory map is identical to the internal memory in the DL05 PLC, so no program changes are necessary.

The on-board lithium battery lasts up to three years. If PLC power is lost and the battery is already dead, an on-board super capacitor backs up the memory four to seven days, allowing time to insert a new battery.

Real-time clock

Access the year, month, day of the week, hour, minute and second for event scheduling or data logging applications.

Operation

The D0-01MC installs into any of the DL05 PLCs. The MC module backs up all ladder and data in CMOS RAM.

The module's V-memory maps one-for-one to the PLC's memory locations. If the memory cartridge is inserted in the option slot, it automatically becomes the source of the controlling program.

You may choose to overwrite the PLC program, but it is not necessary. You can transfer the program from the PLC to the module, or from the module to the PLC, or you can operate directly from the memory cartridge. By removing the module, you return control to the PLC's internal program.

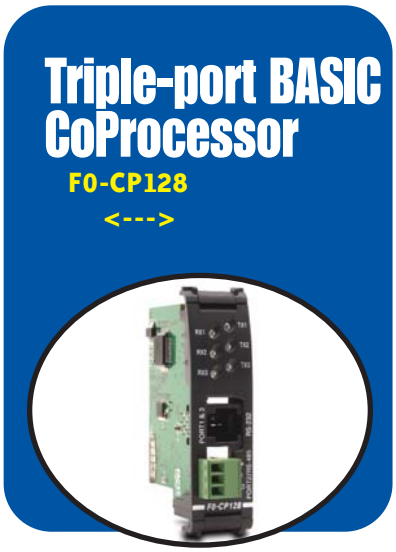
Two pushbuttons on the face of the module initiate memory transfers. The pushbuttons are clearly marked to indicate the direction of the transfer, and an LED flashes to confirm the direction and success of the memory transfer.

A jumper enables/disables the write function in the D0-01MC. Write disable prevents overwriting of the module's memory. Write enable allows overwriting of the module's memory.

An LED alerts you to a low battery condition. If the battery drops below 2.5V the "BATT" LED comes on, and an internal bit is set. You can use the internal bit to activate alarm functions or to execute an orderly shutdown.

The date and time are easily set or accessed in the ladder logic program. Environmental specifications for the D0-01MC are the same as for the DL05 PLCs.

DL05/06 CoProcessor Module



Overview

The BASIC CoProcessor Module interfaces the DL05/06 family of programmable controllers with bar code readers, operator interface terminals, instrumentation equipment, computers and other serial devices.

BASIC CoProcessor™ applications

BASIC CoProcessors are designed for use with intelligent devices such as:

- Bar code readers
- Welders
- Board level controllers
- Serial printers
- Intelligent sensors
- Almost any device with an RS-232 or RS-485 port

They are also good solutions for applications requiring complex math, such as floating point math, sine, cosine, tangent, exponential, square roots, etc.

Features

- FACTS Extended BASIC and ABM Commander for Windows software for IBM PCs makes program development fast and simple. (The software is included with the CoPro module on CD-ROM). It allows online, full-screen BASIC program editing and the ability to upload/download programs on disk. The included CD has MODBUS master and slave BASIC programs and other application examples.
- Non-volatile memory of up to 128K allows multiple program storage and execution, DL05/06 register expansion, and retentive data storage and retrieval.
- 100MHz BASIC CoProcessor provides fast program execution independent of the CPU scan.
- Three buffered ports permit communication from the module to three external devices.
- The module is programmable from port 1 or 3 for complete serial port utilization without switching cables.
- A real-time clock/calendar maintains time/date with battery backup when power outages occur.
- Programmable time based BASIC interrupts to 5ms.
- Direct access of up to 256 bytes of DL05/06 CPU memory per scan is possible. No supporting ladder logic is required.
- Floating point math solves complex formulas to eight significant digits.
- An RJ12 Port 1 and Port 3 splitter, included with the module, provides easy connection of RS-232 cables to both Port 1 and Port 3. (If you are using RTS1 and CTS1 for port 1, then port 3 is not available.)

DL06 PLC with multiple F0-CP128 modules

Included with CoPro

The following items are included with the F0-CP128 module:

- ABM Commander CD-ROM
- 7ft. 6P6C-to-6P6C cable (phone-style RJ12 connectors)
- 9-pin D-sub connector (9-pin female to RJ12) to adapt to PC comm port
- RJ12 port splitter

DL05/06 CoProcessor Module

Triple Port BASIC CoProcessor Module Specifications	
Module Type	CoProcessor™, Intelligent
Modules per CPU	DL05: one; DL06: up to four
Communication	256 character type-ahead input buffer on all ports. Ports are independently programmed by software. Seven or eight data bits, one or two stop bits, even, odd, or no parity. XON/XOFF software flow control and RTS/CTS handshake.
Clock Speed	100MHz
User Memory	128K total (64K data, 64K program) non-volatile; Real time battery backed calendar/clock
F0-CP128 Ports	Port 1: RS-232 512K baud maximum Port 2: RS-485, 512K baud maximum Port3*: RS-232, 115.2K baud max. **** Port 3 physically located in the same RJ12 jack as Port 1 (RS-232). Port 3 uses the RTS1/CTS1 pins on that jack. If you use these lines for other purposes (e.g. hardware handshaking on Port 1), then Port 3 cannot be used.***
ABM Commander for Windows (CD included with module)	Standard programming/documentation software for IBM PCs is shipped with each coprocessor module Key features include: • Runs under Windows 98/ME/2000/XP • On-line full-screen BASIC program editing (similar to GW Basic, with industrial application enhancements added for easier programming) • Internal Editor for block copy, block move, search and replace • Text upload and download BASIC programs on disk • Binary upload and download BASIC programs and data on disk • Download control statement allows multiple programs to be downloaded and saved with one download file. • CD includes Modbus master and slave BASIC programs and other application examples
Field Termination	One RJ12 jack: Port 1 and 3 RS-232; One three-position removable terminal block: Port 2 RS-485
Indicator LEDs	RX1, TX1, RX2, TX2, RX3 (CTS1), TX3 (RTS1)
Power Consumption	150mA @ 5VDC
Operating Environment	0ºC - 60ºC (32ºF - 140ºF), 5% to 95% humidity (non-condensing)
Manufacturer	FACTS Engineering

CPU	Firmware Required	DirectSOFT Required
DL05	Version 5.00 or later	Version 3.0c or later
DL06	Version 1.90 or later	Version 4.0, Build 16 or later

DL05/06 DATA COMMUNICATIONS MODULE

Data Communications Module

D0-DCM

<--->

Specifications		
Module Type		Intelligent
Modules per CPU		DL05: one; DL06: up to four
Field Wiring Connectors		Port 1: 6-pin RJ12 RS-232 Port 2: 15-pin HD-sub connector RS-232, RS-422/485
Communications	***Port 1***	RS-232 signal levels, DirectNET slave, K-sequence slave, MODBUS RTU slave protocols, baud rate selectable from 9.6K to 115.2K baud, odd or no parity, selectable address, 8 data bits, one start/stop bit, DirectNET HEX or ASCII mode. (Defaults: slave, 9600bps, odd parity, address 1, auto-detect protocols)
	Port 2	RS-232/422/485 signal levels, ***Direct***NET master/slave, K-sequence slave, MODBUS RTU master/slave protocols, baud rate selectable from 300 to 115.2K baud, odd/even/no parity, selectable address, 7 or 8 data bits, one start bit, 1 or 2 stop bits, selectable timeout/response-delay times, ***Direct***NET HEX or ASCII mode. (Defaults: slave, 19200bps, odd parity, address 1, eight data bits, one stop bit, auto-detect protocols)
Recommended Cable		RS-422: Belden 9729 or equivalent; RS-485: Belden 9841 or equivalent
Internal Power Consumption		250mA maximum at 5VDC (supplied by base)
Operating Environment		0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Manufacturer		Koyo Electronics

CPU	Firmware Required	*Direct*SOFT Required
DL05	Version 5.00 or later	Version 3.0c or later
DL06	Version 1.90 or later	Version 4.0, Build 16 or later

Overview

The D0-DCM Data Communications Module offers two communication ports for a variety of simultaneous communications possibilities:

- Extra communications port to connect a PC, operator interface, etc.
- Network interface to ***Direct***NET
- Network interface to a MODBUS network using the RTU protocol

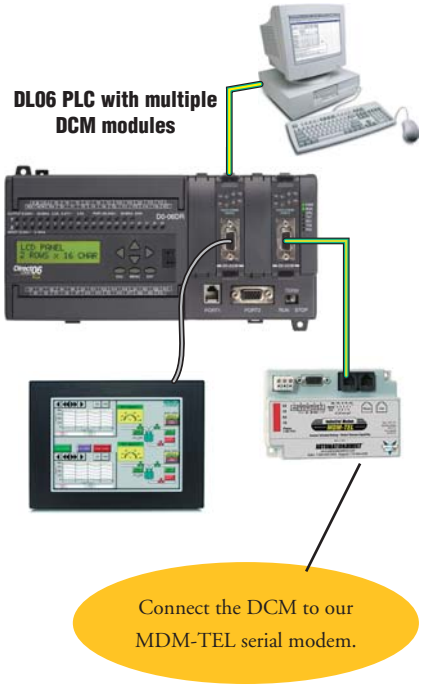
The top RJ12 RS-232 port (Port 1) can be used for PLC programming, connection to an OI panel or as a single K-sequence, *Direct*Net or MODBUS RTU slave. The 15-pin front port (Port 2) can be used for RS-232/422/485 communications and supports the following protocols: K-sequence slave, *Direct*NET master/slave and MODBUS RTU master/slave.

Module Configuration

Since the D0-DCM does not have DIP switches to set baud rate, station address, parity, etc., ladder logic programming is required to configure its communication parameters, unless the default settings are acceptable for your application. If the D0-DCM is to be used as a network master, you must use ladder logic code to configure these parameters.

Extra communications ports for DL05/06

If additional communication ports are needed in the PLC, they can easily be added by installing DCM modules. Connect additional devices such as operator interfaces, PCs, etc. Set the DCM communication parameters using DirectSOFT programming software, connect the cables, and start transferring data. Make sure the connected device has a DL05/06 compatible driver.



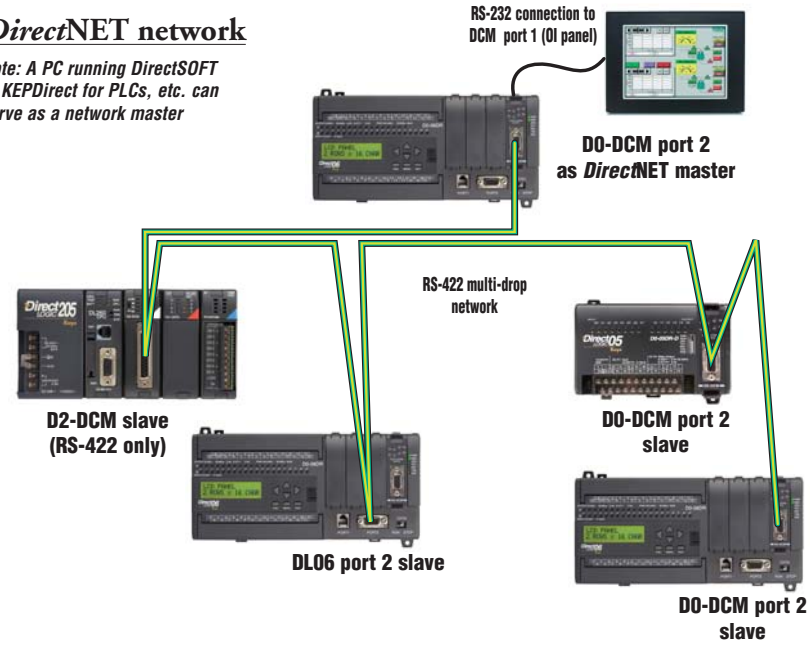
DL05/06 Data Communications Module

*Direct*NET network interface

The DCM can be used as a network interface for applications requiring data to be shared between PLCs, or between PLCs and an intelligent device such as a host PC. *Direct*NET allows you to upload or download virtually any type of system data including Timer/Counter data, I/O information, and V-memory information from any *Direct*LOGIC or compatible PLC. Port 2 on the DCM allows the DL05/06 to function as a *Direct*NET network master or slave using RS-422 communications (RS-232 can be used for single slave networks). Use RX and WX instructions in your RLL program to initiate communications.

*Direct*NET network

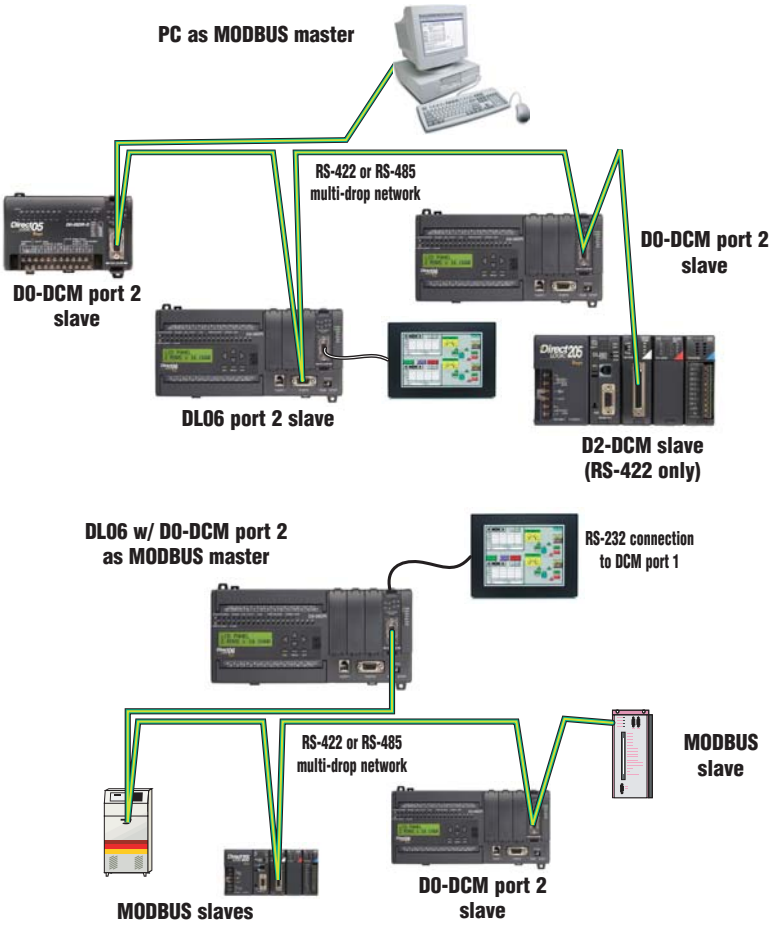
Note: A PC running DirectSOFT or KEPDirect for PLCs, etc. can serve as a network master



MODBUS RTU interface

The DCM can be used as a master or slave station interface to connect your DL05/06 system to a MODBUS® network using the MODBUS RTU protocol. Port 2 on the DCM allows the DL05/06 to function as a MODBUS RTU network master or slave using RS-422 or RS-485 communications (RS-232 can be used for single slave networks). Use RX and WX instructions in your RLL program to initiate communications.

MODBUS RTU networks



DL05/06 DeviceNet Slave Comm. Module

DeviceNet Slave Module

D0-DEVNETS <--->

General Specifications	
DeviceNet Compatibility	Predefined Group 2 Master/Slave communications
Maximum Field Devices per Bus	64 (see table below)
Communication to Field Devices	Standard 4-wire shielded cable to cabinet connector, molded 4-wire cable @ up to 500Kbps to field devices
Module Connector	5-position removable terminal (European style)
Operating Temperature	0 to 55°C (32 to 131° F)
Storage Temperature	20 to 70°C (-4 to 158° F)
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	Impulse noise 1μs, 1000V FCC class A RFI (144Mhz, 430Mhz 10W, 10cm)
Power Consumption	45mA @ 5VDC

The D0-DEVNETS option card transforms any DL05 or DL06 into a smart device node on your DeviceNet controller network. Now you don't have to turn to a more expensive PLC to get DeviceNet capability.

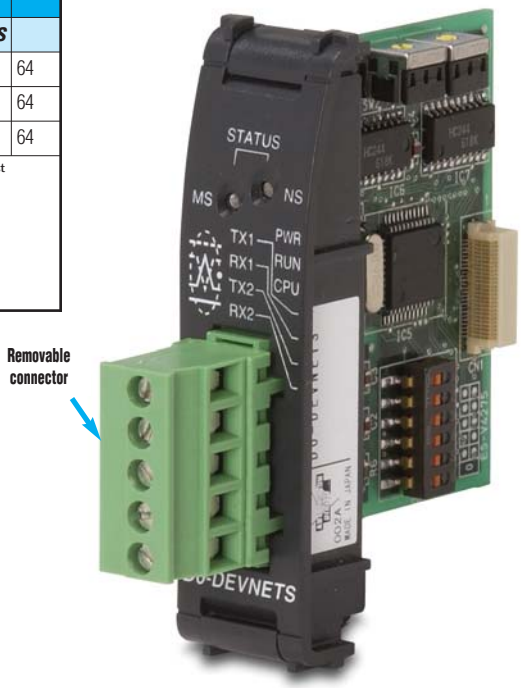
DeviceNet is a low-cost control bus used to connect field devices to PLCs and PCs. DeviceNet is designed to reduce the need for hard-wiring while providing device-level diagnostics. This industrial protocol links up to 64 nodes on a single network.

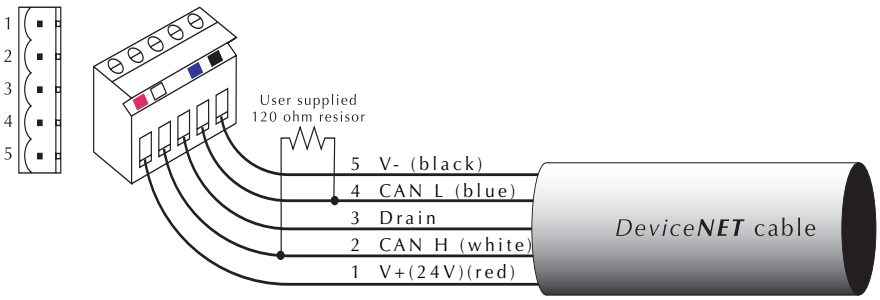
The D0-DEVNETS slave module slides into the option card slot of any DL05 or DL06 PLC. The module collects and reports all discrete I/O data to a DeviceNet master.

The D0-DEVNETS module has a removable connector that makes the four-wire connection easy to implement and maintain. The DeviceNet module incorporates advanced diagnostics not commonly found on traditional industrial networks. This module has the quick response time and high dependability expected from any DeviceNet device.

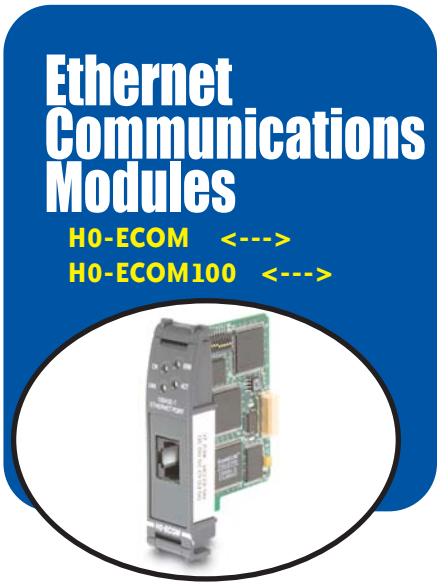
Trunk Length		Bits per sec	Branch Length		Devices
Feet	***Meters***		***Feet***	***Meters***	
328ft	100m	500Kbps	20ft	6m	64
820ft	250m	250Kbps	20ft	6m	64
1,640ft	500m	125Kbps	20ft	6m	64

Other DeviceNet specifications, compatible products, and latest DeviceNet information are made available through:
Open DeviceNet Vendor Association
Phone: (954) 340-5412 Fax: (954) 340-5413
Internet Address: http://www.odva.org
e-mail: odva@powerinternet.com
ODVA, Inc.
20423 State Road 7
Boca Raton, FL 33498





DL05/06 Ethernet Communications Modules



Simple connections

Use Category 5 UTP cables which can be run up to 100 meters between nodes. Use repeaters to extend distances and expand the number of nodes.

Our HA-TADP (10/100BaseT) PC network adapter card is compatible with the ECOM modules. See the Communications Products section in this desk reference for information on the adapter card.

Choose your slot

The ECOM module plugs into any option card slot of any DL05 PLC or DL06 PLC. The module maintains identification data, descriptive information, and communication parameters for PLC-to-PLC communications in flash memory. Disconnect power before installing or removing any PLC module.

Overview

Ethernet Communications Modules offer features such as:

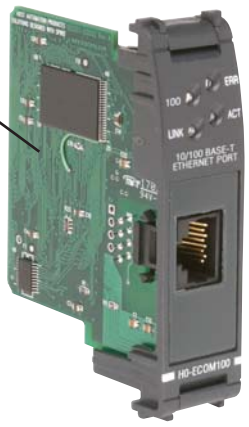
- High-speed peer-to-peer networking of PLCs
- Fast updates with *Direct*SOFT32 Programming Software
- High-performance access for Human Machine Interface (HMI), ERP, MES or other Windows-based software
- Industry standard MODBUS TCP/IP Client/Server Protocol (H0-ECOM100)
- Free SDK for custom drivers
- Easy setup

The Ethernet Communication (ECOM) Modules represent a price breakthrough for high-speed peer-to-peer networking of PLCs. No longer are you forced to designate a single PLC to be the network master. Any PLC can initiate communications with any other PLC. Link your PLCs with PCs using industry standard MODBUS TCP/IP protocol connected through standard cables, hubs, and repeaters. Or, use our KEP*Direct* I/O Server to link to your favorite HMI/SCADA, data historian, MES or ERP software to *Direct*LOGIC PLCs. Our Lookout*Direct* HMI and our DataWorx data collection software include ECOM drivers. *Direct*SOFT32 Programming Software can be used to monitor or update the program in any *Direct*LOGIC PLC on the network.

Specifications	H0-ECOM	H0-ECOM100
Communications	10 BaseT Ethernet	10/100 BaseT Ethernet
Data Transfer Rate	10Mbps	100 Mbps
Link Distance	100 meters	
Ethernet Port	RJ45	
Ethernet Protocols	TCP/IP, IPX	TCP/IP, IPX, Modbus TCP/IP DHCP, HTML Configuration
Power Consumption	250mA @ 5 VDC	250mA @ 5 VDC
Manufacturer	Host Automation Products, LLC	

CPU	Firmware Required	DirectSOFT32 Required
DL05	ECOM: Version 4.60 or later ECOM100: Version 4.90 or later	Version 3.0c or later
DL06	ECOM: Version 1.40 or later ECOM100: Version 1.80 or later	Version 4.0, Build 16 or later

The H0-ECOM100 supports the Industry Standard MODBUS TCP/IP Client/Server Protocol

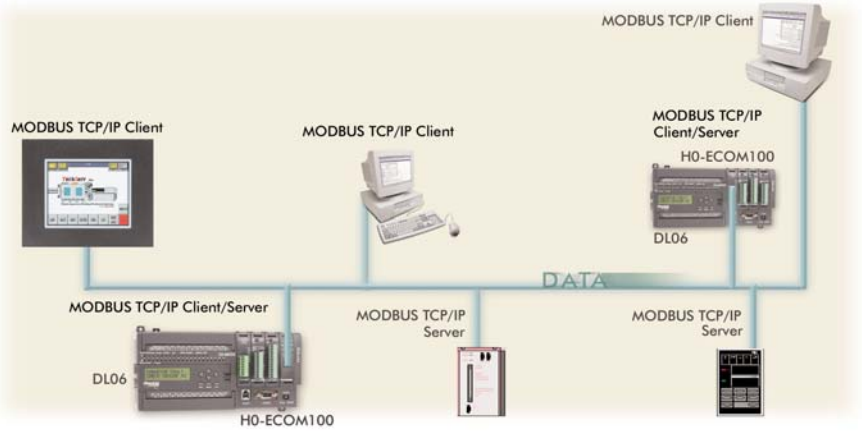


DL05/06 Ethernet Communications Modules

MODBUS TCP/IP support

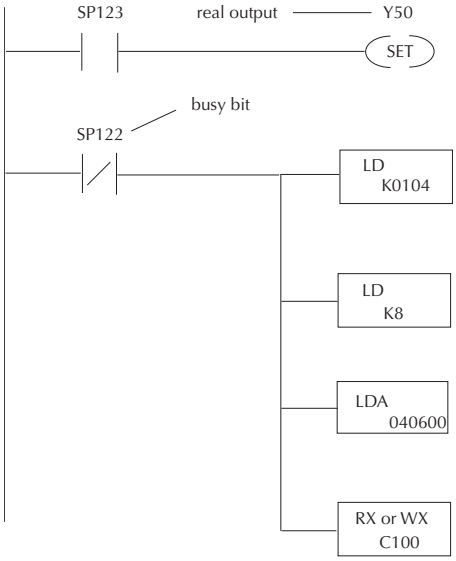
The H0-ECOM100 supports the industry standard MODBUS TCP/IP Client/Server protocol in addition to the standard IP and IPX protocols. This allows the DL06/06 PLC with an H0-ECOM100 module to serve as a client (master) or as a server (slave) on a MODBUS TCP/IP Ethernet network. The H0-ECOM100 can actively issue MODBUS commands to other nodes or devices on the MODBUS TCP/IP network or simply respond to connected MODBUS TCP/IP clients.

MODBUS TCP/IP communications architecture



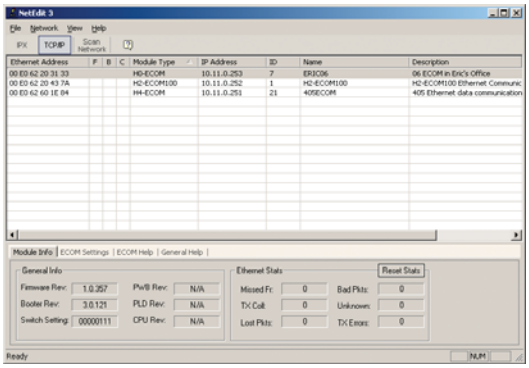
PLC-to-PLC communications

PLC-to-PLC or PLC to a MODBUS TCP/IP device communications are accomplished using Read from Network (RX) and Write to Network (WX) instructions. Build the RX and/or WX instructions into a routine as shown. One SP relay (the busy bit) is used for sequencing of multiple instructions or to prevent a single RX or WX instruction from being overwritten. The other SP relay can be used to annunciate a communication error. The first Load (LD) instruction contains the base and slot number of the initiating ECOM and the Module ID of the responding ECOM or MODBUS TCP/IP device. The second LD instruction contains the number of bytes being transferred. You can transfer up to 128 bytes with one RX or WX instruction. The Load Address (LDA) instruction contains the beginning address in the initiating PLC's memory, regardless of whether or not it is an RX or WX instruction that is being executed. The RX or WX instruction contains the beginning address in the responding PLC or MODBUS TCP/IP device.



NetEdit3 software

NetEdit3 Software ships for free with the ECOM User Manual. Use NetEdit3 to set up the ECOM modules for your network. Flexible addressing allows you to use your choice of protocols and identifying methods. Assign each module a number or a name or both. You don't have to use an IP address, but you can if it's necessary for your network. NetEdit3 uses two protocols for PC-to-PLC communications: IPX and TCP/IP. Select the one you want to use, or use them both. The NetEdit3 screen displays all identifiers and troubleshooting information for each module on the network. You can use NetEdit3 to adjust parameters for PLC-to-PLC communications by clicking on Advanced Settings. The network identifiers can also be changed from *Direct*SOFT32 Programming Software.



DL05/06 Profibus Slave Comm. Module

Overview

You can now add a DL05/06 PLC I/O sub-system to a Profibus controller network. The H0-PSCM module allows the DL05/06 I/O sub-system to be linked with a Profibus master controller. Profibus is a control bus that provides a common method to connect automation equipment with devices on a single network and significantly reduces hard-wiring costs. Profibus provides specifications for information exchanged between nodes, such as controller data associated with low level device and configuration parameters that are individually related to system operations.

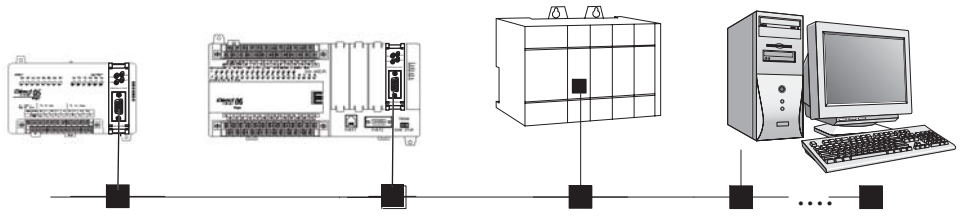
How it works

The H0-PSCM module is a Profibus slave device which can be inserted into the option slot of a DL05 or a DL06 PLC. The H0-PSCM module is used to transfer blocks of data between a Profibus master and a DL05/06 PLC. The user can choose up to four blocks of data to be transferred. The data blocks can range in size from 1 Byte to 32 words and can be either input or output data. The data blocks can be mapped to real I/O within the PLC or user data areas of memory. The H0-PSCM module uses 'config' and 'parm' data, configured by the user with a program such as COM Profibus, to determine what data types and addresses are to be transferred onto the Profibus network. Once configured, the H0-PSCM will continually transfer the data to/from the PLC.

Specifications	
Module Location	PLC option slot
Module Type	Interface device
Maximum Expansion	126 stations, 32 stations per segment, 9 repeaters in a row
Communications	RS-485 Profibus, Profibus-DP. Baud rate selectable from 9.6Kbaud to 12M baud.
Module Connectors	Profibus 9-pin D-shell, RJ-12 serial (firmware update only)
Internal Power Consumption	530mA maximum at 5VDC (supplied by PLC power supply)
Operating Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Manufacturer	Host Automation Products, LLC

CPU	Firmware Required	*Direct*SOFT32 Required
DL05	Version 4.60 or later	Version 3.0c or later
DL06	Version 1.40 or later	Version 4.0, Build 16 or later

Connect our DL05 or DL06 I/O...



... to your PLC or PC based Profibus Master.

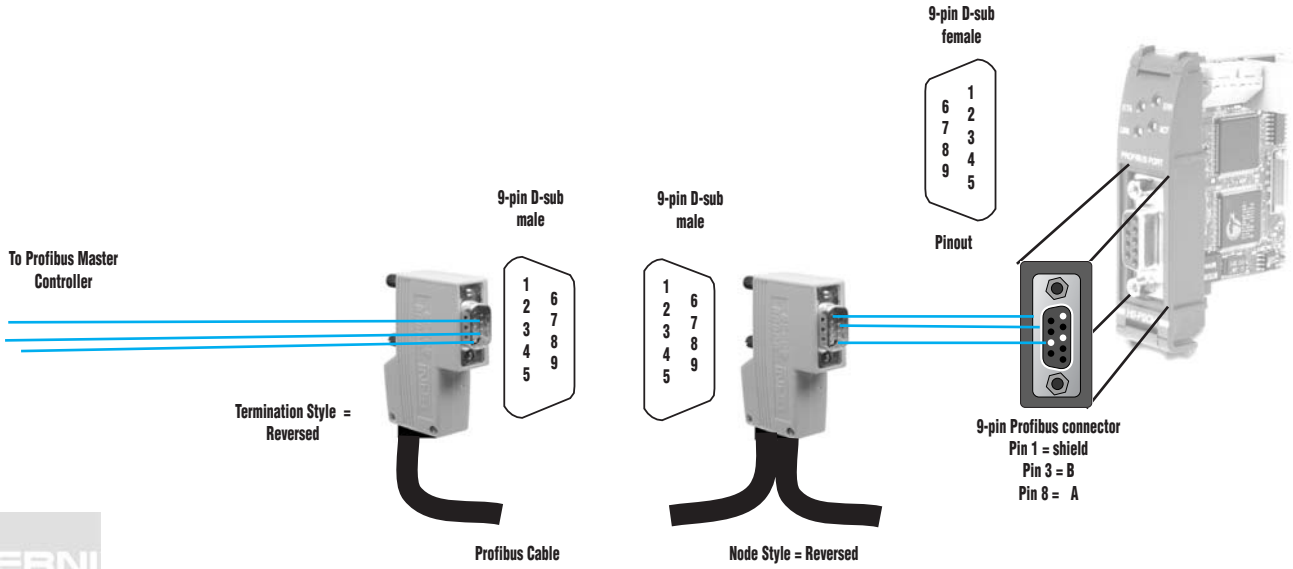
HX-PSCM-M, the H0-PSCM Profibus Slave Communications Module User Manual contains the information pertaining to the I/O modules, power budgeting, installation and wiring.

DL05/06 Profibus Slave Comm. Module

Baud	Max. Segment Length		Max. Expansion	
	Feet	*Meters*	*Feet*	*Meters*
9.6Kbps	3278ft.	1000m	32786ft	10000m
19.2Kbps	3278ft.	1000m	32786ft	10000m
93.75Kbps	3278ft.	1000m	32786ft	10000m
187.5Kbps	3278ft.	1000m	32786ft	10000m
500Kbps	1311ft.	400m	13114ft	4000m
1.5Mbps	655ft.	200m	6557ft	2000m
3Mbps	327ft.	100m	3270ft	1000m
6Mbps	327ft.	100m	3270ft	1000m
12Mbps	327ft.	100m	3270ft	1000m

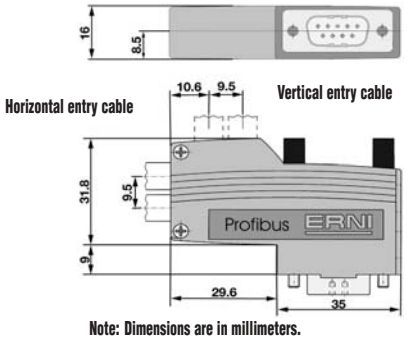
DL05/06 Style of I/O Modules Supported	
Discrete Types	*Analog Types*
10-point Input	4-channel Input
16-point Input	2-channel In/ 2-channel Output
8-point Output	4-channel In/ 2-channel Output
10-point Output	
16-point Output	
4-point Input/3 point Output	
4-point Input/4 point Output	

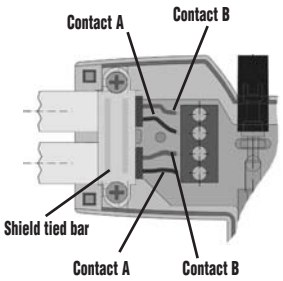
Recommended Cables	
Siemens	6XV1 830 0AH10
Belden	3079A



ERNI ER*bic* connectors for Profibus networks

ERNI ER*bic* connectors are available for the Profibus Slave Communications Module. They are available in node and termination reversed styles for the H0-PSCM and PC connections, horizontal or vertical cable entry, and termination or daisy-chain configurations.





ERNI ER*bic* connectors		
Part No.	*Description*	*Device*
103658	Profibus-certified reverse node horizontal connector. 9-pin Male D-Sub	H2-PBC or any Profibus ISA/PCI Personal Computer Master/Slave Card
103659	Profibus-certified reversed termination horizontal connector. 9-pin Male D-Sub	H2-PBC or any Profibus ISA/PCI Personal Computer Master/Slave Card

DL05/06 High-Speed Counter I/O Module

Overview

The High-Speed Counter I/O (CTRIO) module is designed to accept high-speed pulse-type input signals for counting or timing applications and to provide high-speed pulse-type output signals for stepper/servo motor control, monitoring, alarm or other discrete control functions. The CTRIO module offers great flexibility for applications that call for precise counting or timing, based on an input event or for high-speed control output applications.

The CTRIO module has its own microprocessor and operates asynchronously with respect to the PLC/controller. This means that the on-board outputs respond in real time to incoming signals so there is no delay waiting for the PLC/controller to scan I/O.

The H0-CTRIO module is designed to work with incremental encoders or other field devices that send pulse outputs.

CTRIO features

The CTRIO modules offer the following I/O features:

- 4 DC sink/source inputs, 9-30VDC
- 2 isolated sink/source DC outputs, 5-36 VDC, 1A per point

Inputs supported:

- 1 quadrature encoder counter up to 100KHz, or 2 single-channel counters up to 100KHz using module terminals A, B, C and D
- High-speed edge timers, dual edge timers, pulse catch, count reset, count inhibit, count capture or home search limits using module terminals C or D

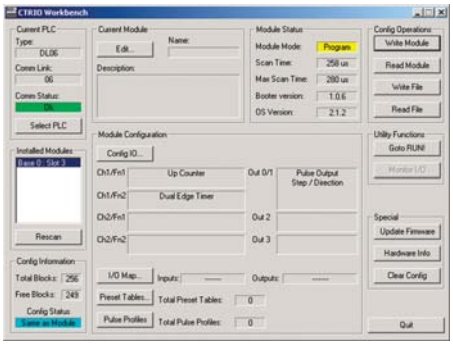
Outputs supported:

- 2 independently configurable high-speed discrete outputs or 1 channel pulse output control (20Hz-25KHz)
- Pulse and direction or cw/ccw pulses supported for pulse output control
- Raw control of discrete output directly from user control program

Software configuration

All scaling and configuration is done via CTRIO Workbench, a Windows software utility program. This eliminates the need for PLC ladder programming or other interface device programming to configure the module. CTRIO Workbench runs under Windows 98/2000/XP and NT 4.0 SP5 or later.

CTRIO Workbench main configuration screen



CPU	Firmware Required	DirectSOFT32 Required
DL05	Version 4.60 or later	Version 3.0c or later
DL06	Version 1.40 or later	Version 4.0, Build 16 or later

Typical applications

- High-speed cut-to-length operations using encoder input
- Pick-and-place or indexing functions controlling a stepper/servo drive
- Dynamic registration for web material control
- Accurate frequency counting for speed control with onboard scaling
- PLS (Programmable Limit Switch) functions for high-speed packaging, gluing, or labeling
- Sub 10 usec pulse-catch capability for high-speed product detection
- Functions for level or flow

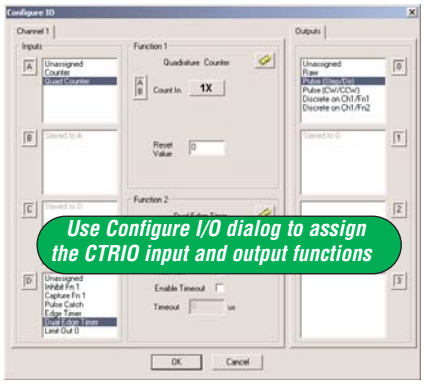
Supported systems

Multiple CTRIO modules can reside in the same PLC, provided the base power budget is adequate.

*Direct*LOGIC DL05 and DL06 PLCs

You can use the H0-CTRIO module with any of the DL05 and DL06 PLCs.

Configure I/O screen



High-Speed Counter

I/O Specifications

General	
Module Type	Intelligent
Modules Per Base	Limited only by power consumption
I/O Points Used	None, I/O map directly in PLC V-memory or PC control access
Field Wiring Connector	Standard removable terminal block
Internal Power Consumption	250mA Max at +5V from base power supply; (All I/O in ON state at max voltage/current)
Operating Environment	32°F to 140°F (0°C to 60°C), humidity (non-condensing) 5% to 95%
Manufacturer	Host Automation Products, LLC
Isolation	2500V I/O to Logic, 1000V among input channels and all outputs

H0-CTRIO Input Specifications	
Inputs	4 pts sink/source 100K Hz Max
Minimum Pulse Width	5 µsec
Input Voltage Range	9-30VDC
Maximum Voltage	30VDC
Input Voltage Protection	Zener Clamped at 33VDC
Rated Input Current	8mA typical 12mA maximum
Minimum ON Voltage	9.0VDC
Maximum OFF Voltage	2.0VDC
Minimum ON Current	5.0mA (9VDC required to guarantee ON state)
Maximum OFF Current	2.0mA
OFF to ON Response	Less than 3 µsec
ON to OFF Response	Less than 3 µsec

H0-CTRIO Output Specifications	
Outputs	2 pts, independently isolated, current sourcing or sinking FET outputs: open drain and source with floating gate drive
Voltage range	5VDC - 36VDC
Maximum voltage	36VDC
Output clamp voltage	60VDC
Maximum load current	1.0A
Maximum load voltage	36VDC
Maximum leakage current	100µA
Inrush current	5A for 20ms
OFF to ON response	less than 3µsec
ON to OFF response	less than 3µsec
ON state V drop	m 0.3V
External power supply	For loop power only, not required for internal module function*
Overcurrent protection	15A max
Thermal shutdown	Tjunction = 150°C
Overtemperature reset	Tjunction = 130°C
Duty cycle range	1% to 99% in 1% increments (default = 50%)
Configurable Presets a) single b) multiple	a) each output can be assigned one preset, or b) each output can be assigned one table of presets, one table can contain max. 128 presets, max. predefined tables = 255

*** User supplied power source required for stepper drive configuration.**

H0-CTRIO Input Resources	
Counter/Timer	2
Resource Options	1X, 2X, or 4X Quadrature, Up or Down Counter, Edge Timer, Dual Edge Timer, Input Pulse Catch, Reset, Inhibit, Capture
Timer Range / Resolution	4.2 billion (32 bits); 1 µsec
Counter Range	+ / - 2.1 billion (32 bits or 31 bits + sign bit)

H0-CTRIO Output Resources	
Pulse output / Discrete outputs	Pulse outputs: 1 channel (20Hz-25KHz); Discrete outputs: 2 pts.
Resource Options	Pulse outputs: pulse/direction or cw/ccw; Profiles:Trapezoid, S-Curve, Symmetrical S-Curve, Dynamic Position, Dynamic Velocity, Home Search, Velocity Mode, Run to Limit Mode and Run to Position Mode Discrete outputs: configurable for set, reset, pulse on, pulse off, toggle, reset count functions (assigned to respond to Timer/Counter input functions). Raw mode: Direct access to discrete output from user application program
Target Position Range	+ / - 2.1 billion (32 bits or 31 bits + sign bit)

HIGH-SPEED COUNTER

Status indicators

H0-CTRIO LED Descriptions	
OK	Module OK
ER	User Program Error
A	Channel 1 Fn1 Status
B	Channel 1 Fn2 Status
Y0 - Y1	Output Status

H0-CTRIO LED Diagnostic Definitions		
OK	***ERR***	***Description***
ON	OFF	All is well - RUN Mode
ON	ON	Hardware Failure
Blinking	Blinking	Boot Mode - Used for Field OS Upgrades
Blinking	OFF	Program Mode
OFF	Blinking	Module Self-diagnostic Failure
OFF	ON	Module Error Due to Watchdog Timeout
OFF	OFF	No Power to Module

H0-CTRIO LED Diagnostic Definitions	
A	Blinks when Channel 1 Function 1 is counting or timing
B	Blinks when Channel 1 Function 2 is counting or timing
Y0 - Y1	Follow actual output state; ON = output is passing current

Installation and wiring

The H0-CTRIO module has one input channel, consisting of four optically isolated input points (pts. A-D on common M). The inputs can be wired to either sink or source current. The module has two optically isolated output points (pts. Y0-Y1 on common YC).

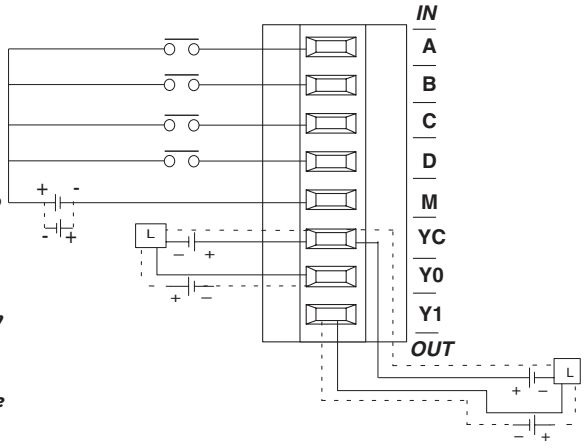
The outputs must be wired so positive current flows into the Cn terminal and then out of the Yn terminal. The module's internal jumpers must be set to the High Side Common position for high side switching (sourcing) outputs or to the Low Side Common position for low side switching (sinking) outputs. Source operation is the factory default setting. See the schematic on the next page for example jumper settings.

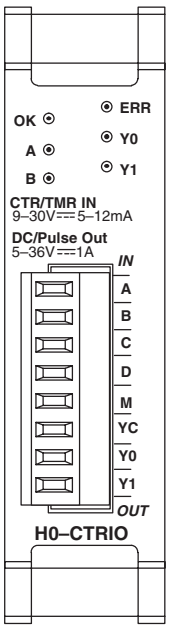
The module is configured using CTRIO Workbench to accommodate the user's application. The function of each input (counting, timing, reset, etc.) and output (pulse output, discrete output, etc.) is defined in the configuration of the module.

See the notes below for further details about power source considerations, circuit polarities, and field devices.

Notes:

1. ***Inputs (A, B, C, D) require user-provided 9-30VDC power sources. Terminal M is the common for Channel 1 inputs. Maximum current consumption is 12mA per input point.***
2. ***Polarity of the input power sources can be reversed. Consideration must be given, however, to the polarity of the field device. Many field devices are designed for only one polarity and can be damaged if power wiring is reversed.***
3. ***Outputs have one polarity only and are powered by user-provided 5-36VDC power sources. The maximum allowable current per output circuit is 1A. Module output jumpers must be set to the High side or Low side common position for Source/Sink applications. Refer to the diagrams on the next page for example jumper settings.***



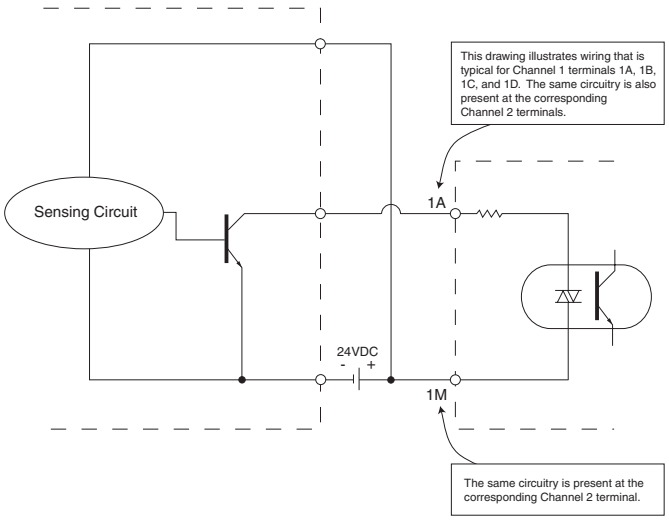


High-Speed Counter

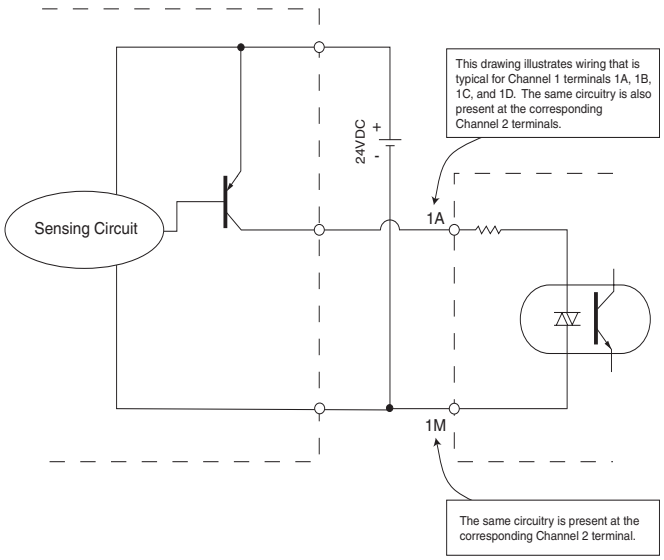
Solid state input wiring device

DC types of field devices are configured to either sink or source current. This affects the wiring of the device to the CTRIO module. Refer to the sinking/sourcing appendix in the Volume 8 desk reference for a complete explanation of sinking and sourcing concepts.

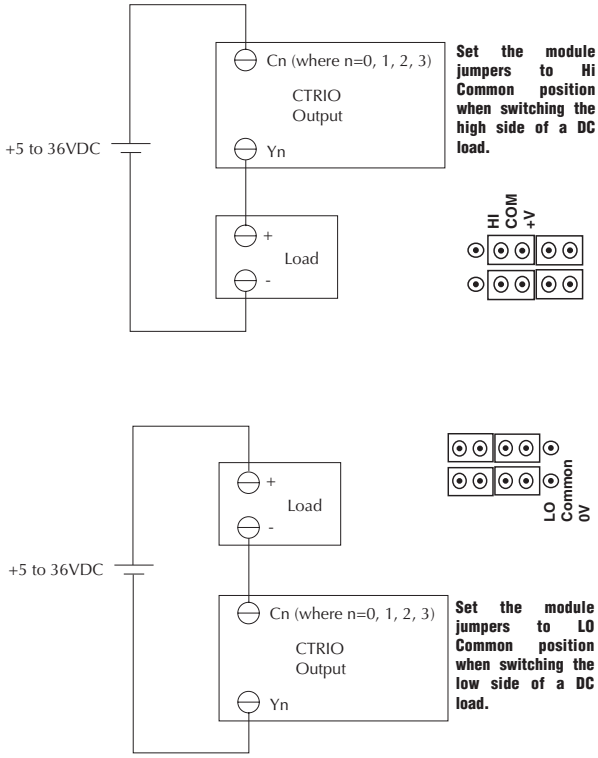
NPN Field Device (sink)



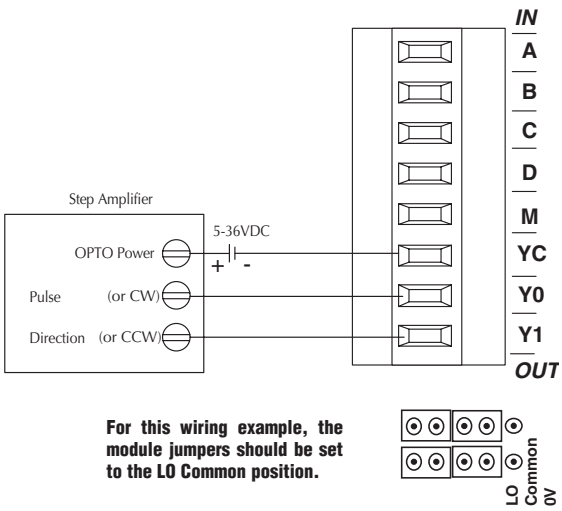
PNP Field Device (source)



Pulse output schematic



Stepper/servo drive wiring example

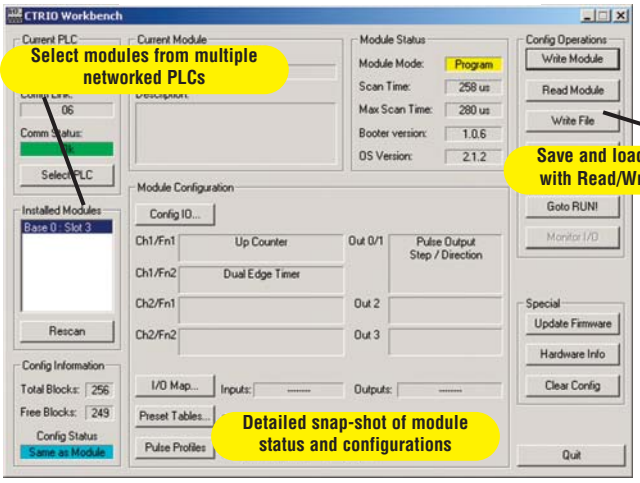


HIGH-SPEED COUNTER

Fill-in-the-blank configuration software

The CTRIO Workbench is the software utility used to configure the CTRIO module and to scale signals to desired engineering units. Workbench also allows you to perform various other functions, such as switching between the CTRIO's Program mode and Run mode, monitoring I/O status and functions, and diagnostic control of module functions. The CTRIO Workbench utility ships with the CTRIO User Manual. You can also download the latest version free at the Host Engineering's Web site: www.hosteng.com.

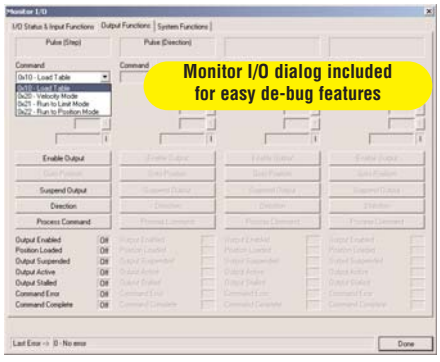
CTRIO Workbench main configuration screen



CTRIO Workbench diagnostics and monitoring

The Monitor I/O dialog is accessible from the main Workbench dialog when the module is in Run Mode. This allows for a convenient way to test and debug your configuration prior to installation. The Monitor I/O dialog is divided into three functional areas: Input Functions, Output Functions and System Functions. The data displayed under the Input Functions tab includes all input Dword parameters, status bits and the current status of each configured input and output function. The fields displayed under the Output Functions tab includes all output Dword parameters and configuration information that can be altered during runtime and the bits that indicate successful transfers or errors. The System Functions can be used to read from or write to the CTRIO's internal registers.

Monitor I/O screen

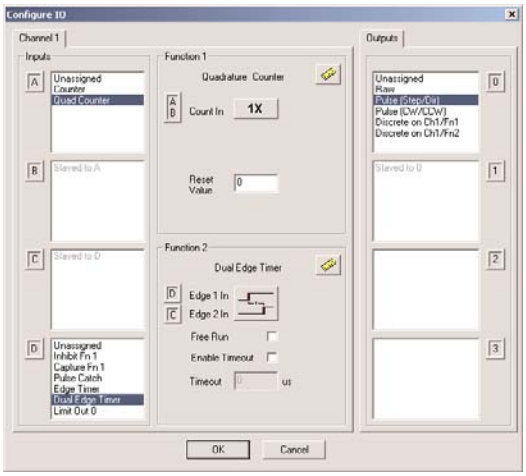


CTRIO Workbench configure I/O setup

The Configure IO dialog is the location where input and output functions are assigned to the module. The choice of input and output functions determines which options are available. The input function boxes prompt you with selections for supported functions. The Workbench software automatically disallows any unsupported configurations.

H0-CTRIO

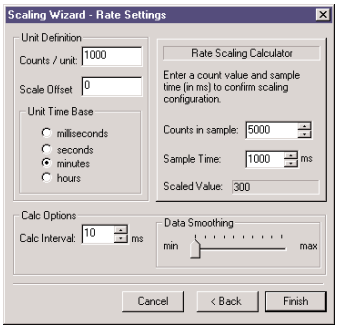
Configure I/O screen



CTRIO Workbench on-board scaling

Scaling raw signals to engineering units is accomplished using the Scaling Wizard. The Scaling Wizard options are different for the Counter functions as compared with the Timer functions. "Position" and "Rate" scaling are available when you select a Counter function. "Interval" scaling is available when you select a Timing function.

Scaling Wizard screen



High-Speed Counter

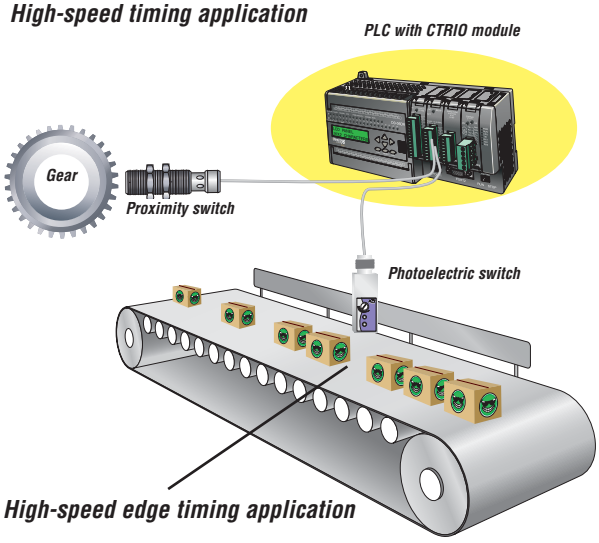
High-speed input operations

The CTRIO module is capable of a wide variety of high speed input and output operations all within one module. With its single channel input and separate single channel output design, the CTRIO can satisfy both high-speed counting, timing, pulse catch operations, along with high speed discrete output or several profile choices of pulse output operations. Not all combinations of input functions and output functions are possible within the resources of the module, but the following examples are some of the most common applications for the CTRIO. Check out these examples and see how they relate to your high speed application needs.

High-speed timing

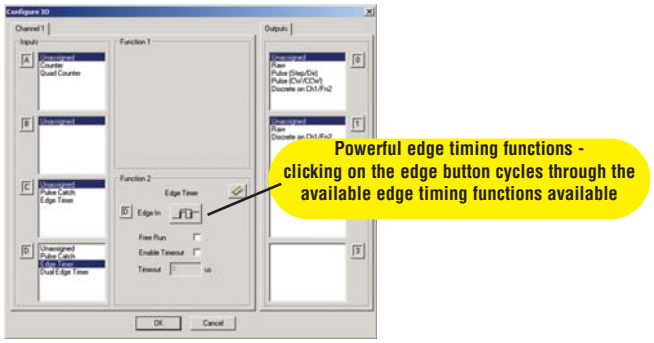
The CTRIO can be configured for timing functions based on both count or rate. Using a common configuration of a proximity switch sensing the teeth on a gear, the module is able to calculate the velocity of the gear based on the rate it receives its counts. This value can be scaled within the module to the engineering units required for the application.

High-speed timing application



High-speed edge timing application

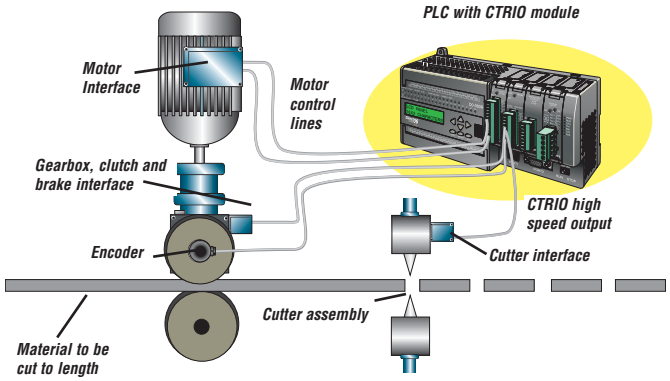
Using Configure I/O screen to configure CTRIO for high-speed timing



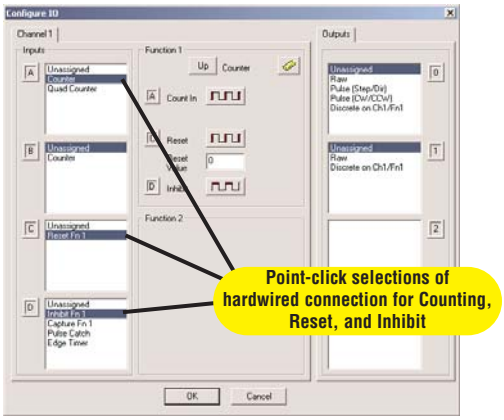
High-speed counting

The CTRIO can be configured for counting functions for the use of an encoder input, (up to two quadrature encoders per module) with available connections for external reset, capture and inhibit signals. In a simple cut to length application as shown, the encoder provides an input position reference for the material to the module. The module's high speed outputs are wired to the cutting device and to the clutch and/or braking device. When the count from the encoder is equal to a pre-programmed setpoint within the module, the high speed outputs are activated to stop and cut the material to a repeatable fixed length. Additionally, the clutch/brake signal can be used for an inhibit signal to not accumulate counts while the material is being cut.

High-speed cut-to-length application



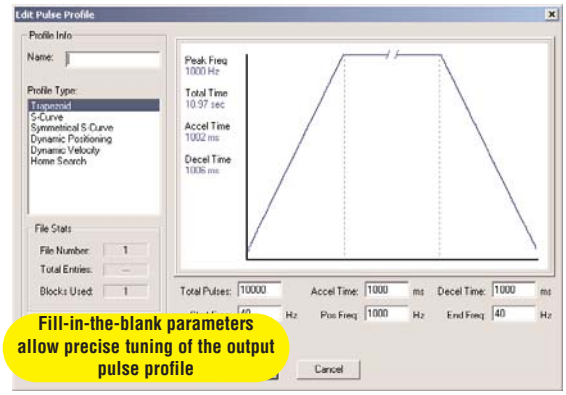
Using Configure I/O screen to configure CTRIO for high-speed counting



HIGH-SPEED COUNTER

Pulse output operations

Using Edit Pulse Profile screen to select Trapezoid pulse output profile

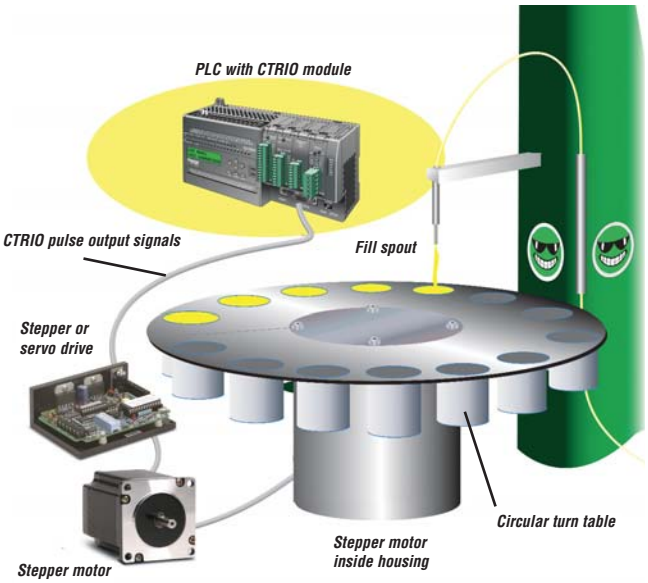


Pulse output for stepper/servo control

The CTRIO module is capable of multiple configurations for pulse output control, most often when connected to a stepper or servo drive system. The module can deliver a pulse output signal up to a maximum of 25Khz with support for pulse-and-direction or CW/CCW pulses. The available profile choices include Trapezoid, S-Curve, Symmetrical S-Curve, Dynamic Positioning, Dynamic Velocity and Home Search. All profiles can be easily configured using the CTRIO Workbench software with fill-in-the-blank parameter fields and a graphic representation of the selected profile. Three additional profiles are available that are completely controlled by the user program (no CTRIO profile is configured). They are Velocity Mode, Run to Limit Mode and Run to Position Mode.

Example application

In a simple rotary indexing application, as shown above, a fixed Trapezoid profile is chosen. The CTRIO for this application is wired to a stepper drive for pulse-and-direction. The requirement for this application is to provide a smooth movement of the rotary table to allow product to be filled into individual containers equal distance apart. The predetermined number of pulses required for each movement is entered into the CTRIO Workbench as "Total Pulses" along with the Starting Frequency, Ending Frequency, and Positioning Frequency (speed after acceleration). The Acceleration and Deceleration parameters are entered in units of time, so no ramp-distance calculations are required. After all parameters are entered, a graphical representation of the configured profile is shown automatically. Once the configuration has been downloaded to the module, all that is needed is from the PLC CPU is the Enable Output signal to begin a movement.

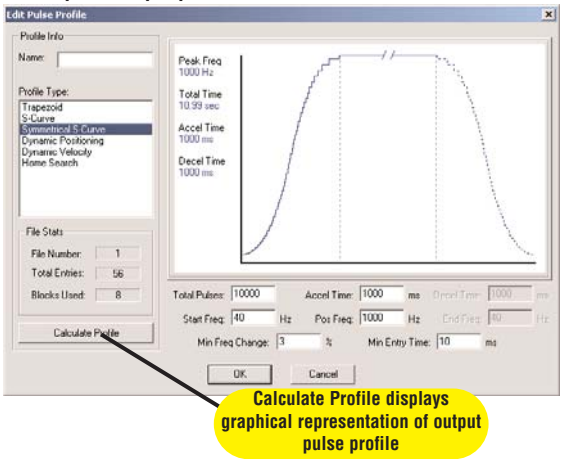


Rotary indexing liquid fill application

Other common pulse output applications:

- S-Curve accel/decel profile for signaling a stepper or servo drive that needs a curved acceleration and deceleration profile, i.e. for diminishing any initial "jerk" upon movement of static products, boxes on conveyors, liquids in containers on an indexer, printing registrations, etc.
- Dynamic Positioning for any run-to-a-specific-position requirement, either by a pre-programmed count of an external high speed discrete input wired to the module. This is popular in winding or webcontrol with any dynamic registration mark or variable speed requirement.
- Home search routines to seek a home position based on CTRIO discrete input limit(s).

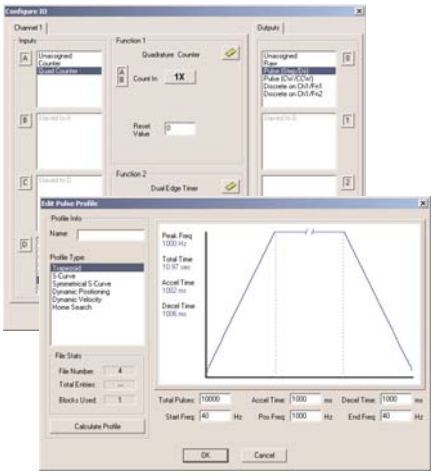
Example of S-Curve acceleration and deceleration pulse output profile



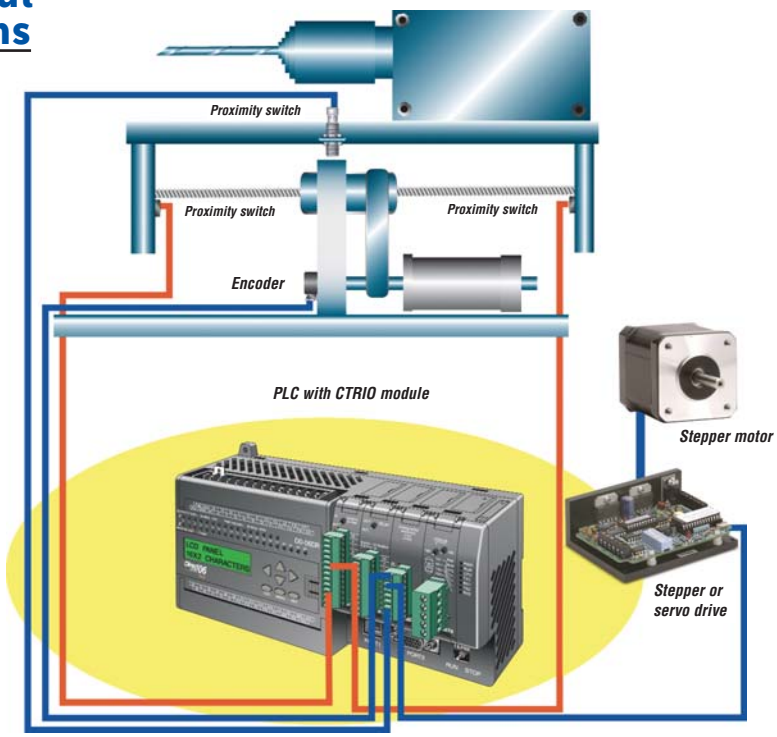
High-Speed Counter

Combining high-speed input and pulse output operations

Using CTRIO Workbench to configure the module for simultaneous high-speed input and high-speed pulse output operation



Multihead drill machine application

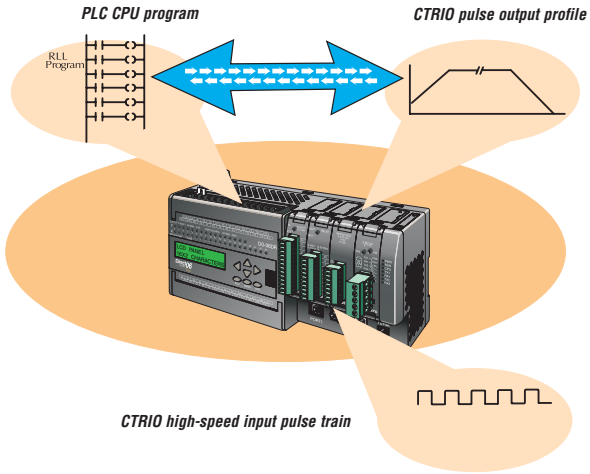


High-speed inputs and pulse output combinations

The flexible design of the CTRIO module allows for combining high speed inputs and delivering high speed pulse output signals simultaneously. There are limitations to this type of configuration in that the module does not internally support closed loop control. Providing closed loop control with the CTRIO involves additional PLC code to coordinate this control, making the application subject to the PLC CPU program scan. Simple position/speed monitoring, via a high speed counting input for non-critical response, while providing pulse outputs to a drive, is easily achievable for the CTRIO.

Example application

In the simple drill-head application shown above, the CTRIO pulse outputs are wired to a stepper and/or servo drive. The inputs are wired to an encoder attached to the lead screw on the movable portion of the drill-head assembly. The CTRIO module output pulse train to the drive allows the motor to spin the lead screw, making the drill move forward into the passing material. The encoder monitors the speed and position of the drill-head. Prox switches at each end act as limit switches ensuring the drill-head will not over-travel. A home sensor is positioned in the middle of the assembly, which allows the PLC to reset the count.



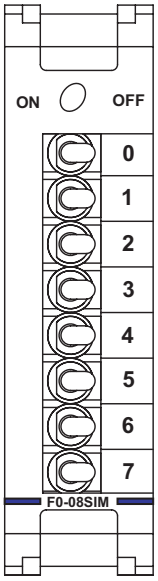
Closed loop control for the CTRIO module requires PLC CPU program interaction to close the loop. This makes the application subject to the PLC CPU scan.

DL05/06 I/O Option Modules

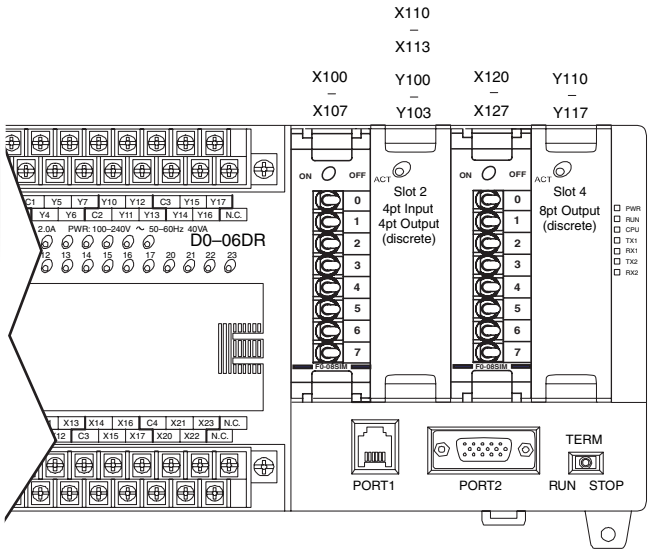
F0-08SIM <--->

8-input simulator module

F0-08SIM Input Specifications	
Number of Inputs	8
Base Power Required (5VDC)	1 mA
Terminal Type	None
Status Indicator	None
Weight	1.6 oz. (45.36 g)



F0-08SIM addressing example

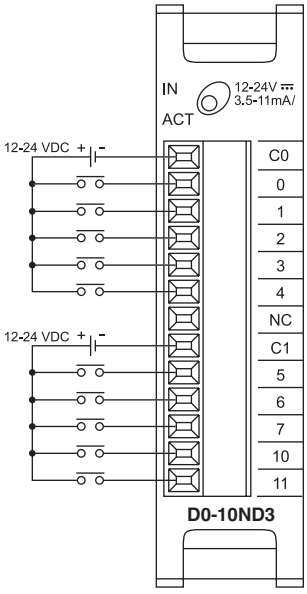


NOTE: *The DL05 CPU's discrete feature for the F0-08SIM module requires* ***Direct****SOFT32 Version 3.0c (or later) and firmware version 4.90 (or later). The DL06 requires* ***Direct****SOFT32 version V4.0, build 16 (or later) and firmware version 1.80 (or later). See our website for more information:* ***www.automationdirect.com****.*

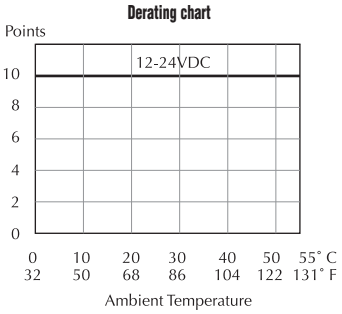
D0-10ND3 <--->

10-point DC input module

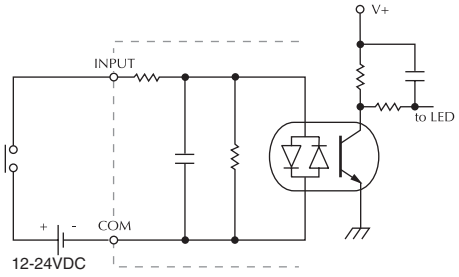
D0-10ND3 Input Specifications	
Number of Inputs	10 (sink/source)
Input Voltage Range	10.8-26.4 VDC
Peak Voltage	30.0 VDC
Input Current	Typical: 4.0 mA @ 12 VDC 8.5 mA @ 24 VDC
Maximum Input Current	11 mA @ 26.4 VDC
Input Impedance	2.8 KΩ @ 12-24 VDC
On Voltage Level	> 10.0 VDC
Off Voltage Level	< 2.0 VDC
Minimum ON Current	3.5 mA
Minimum OFF Current	0.5 mA
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 (5 pts/common) isolated
Fuse	N/A
Base Power Required (5V)	Typical. 35 mA (all pts. on)



Derating chart



Equivalent input circuit

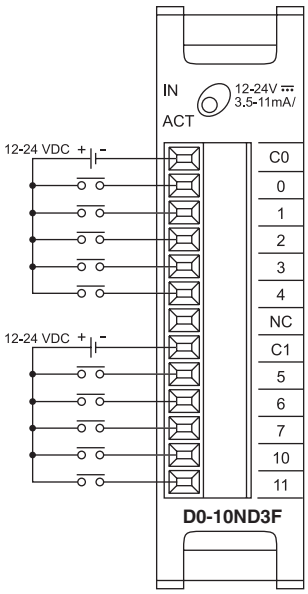


DL05/06 I/O Option Modules

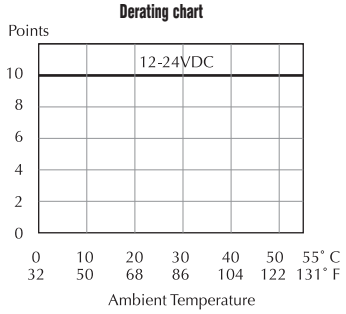
D0-10ND3F <--->

10-point DC fast input module

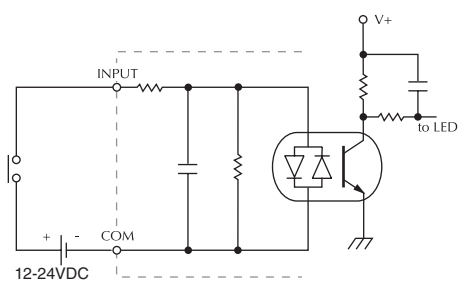
D0-10ND3F Input Specifications	
Number of Inputs	10 (sink/source)
Input Voltage Range	10.8-26.4 VDC
Peak Voltage	30.0 VDC
Input Current	Typical: 4.0 mA @ 12 VDC 8.5 mA @ 24 VDC
Maximum Input Current	11 mA @ 26.4 VDC
Input Impedance	2.8 KΩ @ 12-24 VDC
On Voltage Level	> 10.0 VDC
Off Voltage Level	< 2.0 VDC
Minimum ON Current	3.5 mA
Minimum OFF Current	0.5 mA
Off to On Response	2 ms, Typ. 1 ms
On to Off Response	2 ms, Typ. 1 ms
Status Indicators	Module activity: one green LED
Commons	2 (5 pts/common) isolated
Fuse	No fuse
Base Power Required (5V)	Typical. 35 mA (all pts. on)



Derating chart



Equivalent input circuit



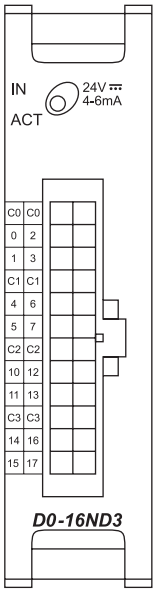
NOTE: *The DL05 CPU's discrete feature for this module requires* ***Direct****SOFT32 Version 3.0c (or later) and firmware version 4.70 (or later). The DL06 requires* ***Direct****SOFT32 version V4.0, build 16 (or later) and firmware version 1.50 (or later). See our website for more information:* ***www.automationdirect.com****.*

DL05/06 I/O Option Modules

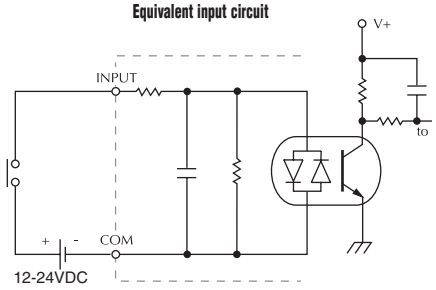
D0-16ND3 <--->

16-point DC input module

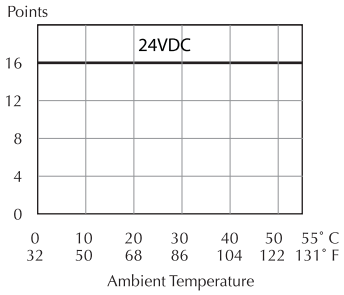
D0-16ND3 Input Specifications	
Number of Inputs	16 (sink/source)
Input Voltage Range	20-28VDC
Peak Voltage	30.0VDC
Input Current	Typical: 4.0mA @ 24VDC
Maximum Input Current	6mA @ 28VDC
Input Impedance	4.7KΩ @ 24VDC
On Voltage Level	> 19.0 VDC
Off Voltage Level	< 7.0 VDC
Minimum ON Current	3.5mA
Minimum 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 (4pts/common) isolated
Fuse	No fuse
Base Power Required	Typical. 35mA (all pts. on)



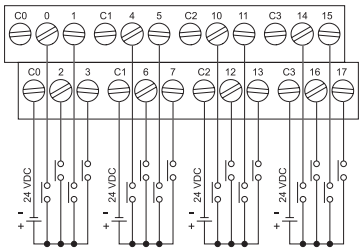
Equivalent input circuit

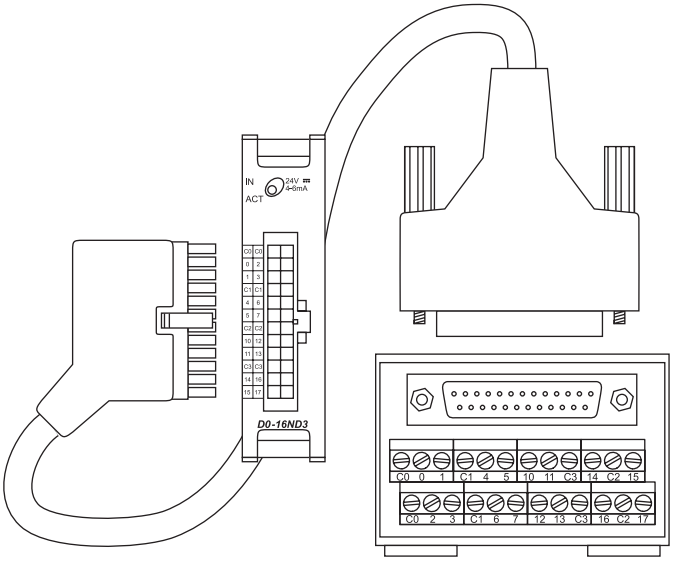


Derating chart



Wiring for ZL-CM056





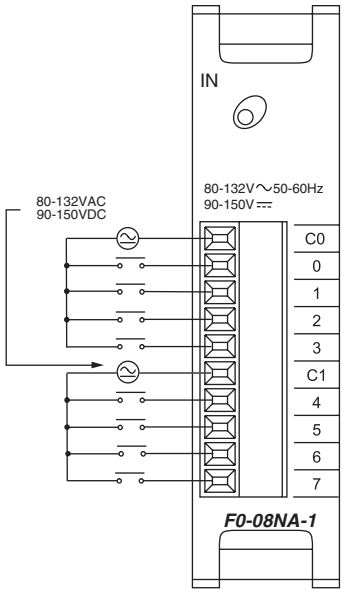
Use ZipLink ZL-CBL056 cable and ZL-CM056 connector module, or ZL-CBL056L cable and ZL-CM16L24 LED connector module. You can also build your own cables using 24-pin Molex Micro Fit 3.0 receptacle, part number 43025, or compatible.

DL05/06 I/O Option Modules

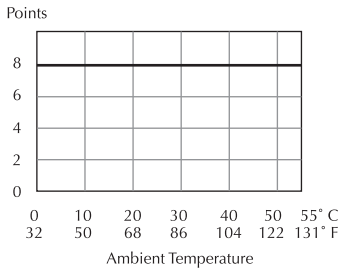
F0-08NA-1 <--->

8-point AC input module

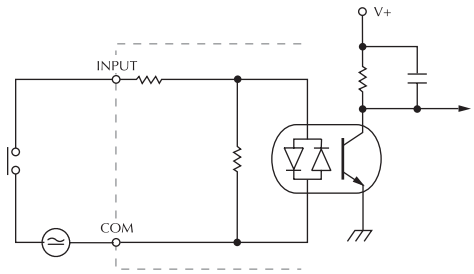
F0-08NA-1 AC Input Specifications	
Number of Inputs	8
Input Voltage Range	80-132VAC (90-150VDC)
AC Frequency	47-63Hz
Input Current	4.0mA @ 132VAC
Input Impedance	33KΩ
On Voltage Level	80VAC minimum
Off Voltage Level	20VAC maximum
Minimum On Current	2.4mA
Maximum Off Current	1.6mA
Off to On Response	< 20ms
On to Off Response	< 10ms
Status Indicators	None
Commons	2 (4 pts/common) isolated
Fuse	No fuse
Base Power Required (5V)	5mA (all points ON)



Derating chart



Equivalent input circuit



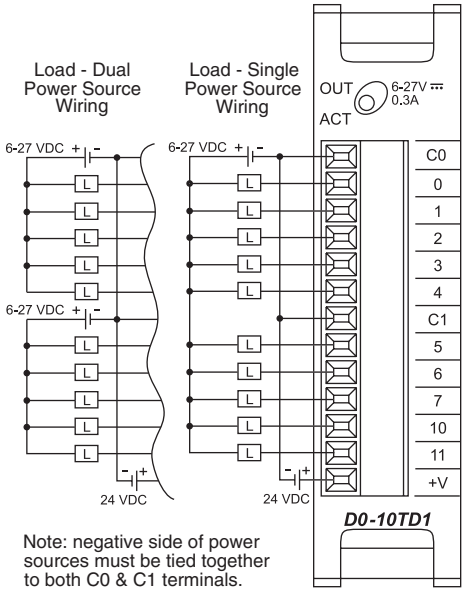
NOTE: *The DL05 CPU's discrete feature for this module requires* ***Direct****SOFT32 Version 3.0c (or later) and firmware version 4.70 (or later). The DL06 requires* ***Direct****SOFT32 version V4.0, build 16 (or later) and firmware version 1.50 (or later). See our website for more information:* ***www.automationdirect.com****.*

DL05/06 I/O Option Modules

D0-10TD1 <--->

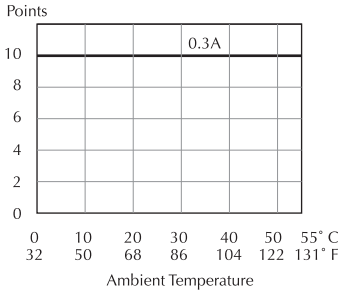
10-point DC output module

D0-10TD1 Output 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
Maximum Leakage Current	15μA @ 30.0VDC
On Voltage Drop	0.5VDC @ 0.3A
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 (5 points/common) isolated
Fuse	No fuse
External DC Power Required	20-28VDC max 200mA (all pts. on)
Base Power Required (5V)	Max. 150mA (all pts. on)

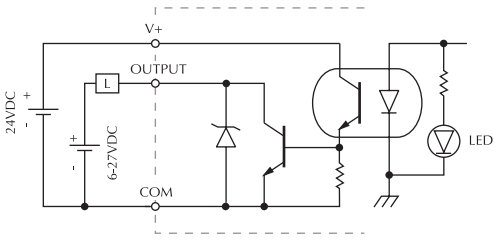


Note: negative side of power sources must be tied together to both C0 & C1 terminals.

Derating chart



Equivalent output circuit

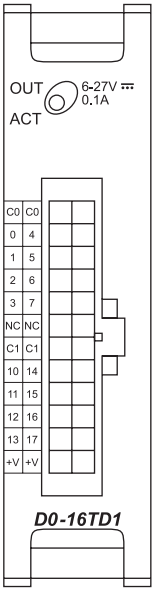


DL05/06 I/O Option Modules

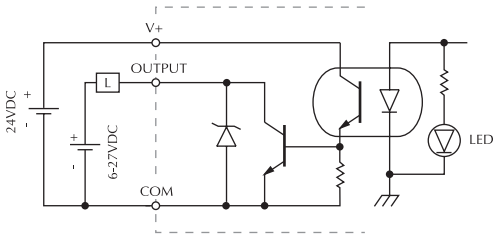
D0-16TD1 <--->

16-point DC output module

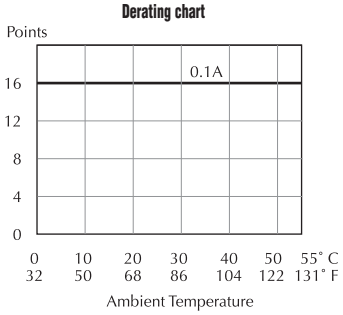
D0-16TD1 Output Specifications	
Number of Outputs	16 (sinking)
Operating Voltage Range	6-27VDC
Output Voltage Range	5-30VDC
Peak Voltage	50.0VDC
Maximum Output Current	0.1A/point, 0.8A/common
Minimum Output Current	0.5mA
Maximum Leakage Current	15μA @ 30.0VDC
On Voltage Drop	0.5VDC @ 0.1A
Maximum Inrush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



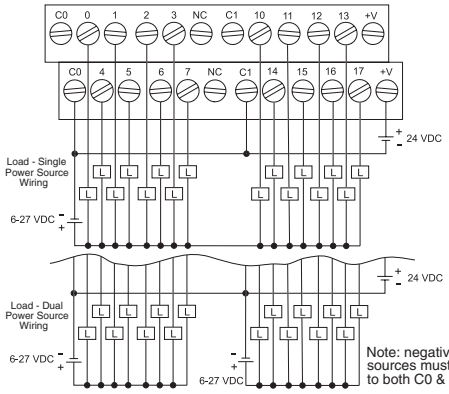
Equivalent output circuit



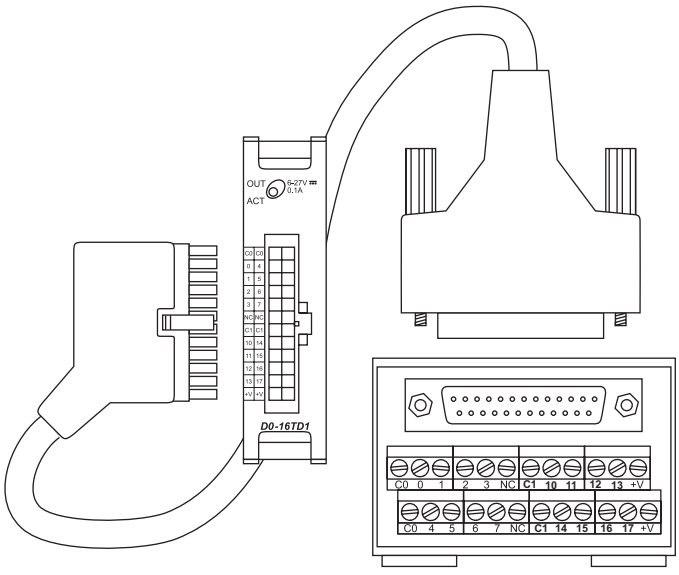
Derating chart



Wiring for ZL-CM056



Note: negative side of power sources must be tied together to both C0 & C1 commons.



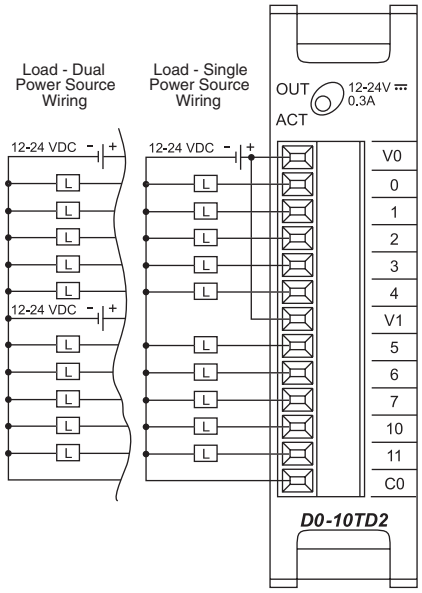
Use ZipLink ZL-CBL056 cable and ZL-CM056 connector module, or ZL-CBL056FR cable and ZL-CM16RL24B relay module or ZL-CM16TF2 fuse module.
You can also build your own cables using 24-pin Molex Micro Fit 3.0 receptacle, part number 43025, or compatible.

DL05/06 I/O Option Modules

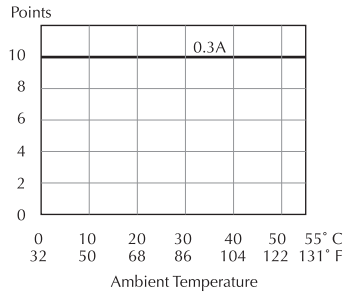
D0-10TD2 <--->

10-point DC output module

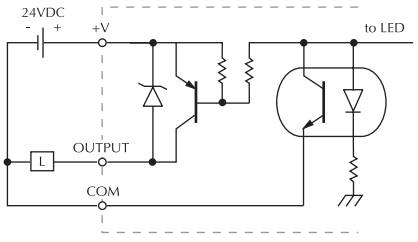
D0-10TD2 Output Specifications	
Number of Outputs	10 (sourcing)
Peak Voltage	50.0VDC
Maximum Output Current	0.3A/point, 1.5A/common
Minimum Output Current	0.5mA
Maximum Leakage Current	1.5μA @ 26.4VDC
On Voltage Drop	1.0VDC @ 0.3A
Maximum Inrush Current	1A for 10ms
Off to On Response	< 10μs
On to Off Response	< 60μs
Status Indicators	Module activity: one green LED
+V Terminals & Common	2 (5 points/+V Term.) Isolated, 1 Common
Fuse	No fuse
Base Power Required (5V)	Max. 150mA (all pts. on)



Derating chart



Equivalent output circuit

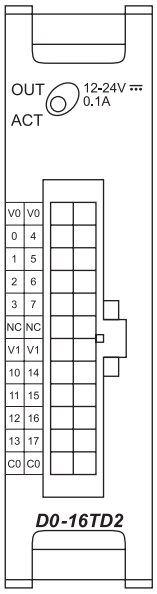


DL05/06 I/O Option Modules

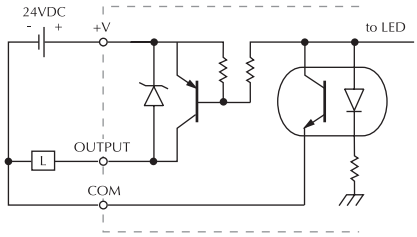
D0-16TD2 <--->

16-point DC output module

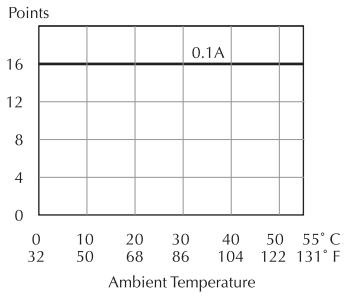
D0-16TD2 Output Specifications	
Number of Outputs	16 (sourcing)
Peak Voltage	50.0VDC
Maximum Output Current	0.1A/point, 0.8A/common
Minimum Output Current	0.5mA
Maximum Leakage Current	1.5μA @ 26.4VDC
On Voltage Drop	1.0VDC @ 0.1A
Maximum Inrush Current	1A for 10ms
Off to On Response	< 0.5ms
On to Off Response	< 0.5ms
Status Indicators	Module activity: one green LED
+V Terminals & Common	2 (8 points/+V Term.) Isolated, 1 Common
Fuse	No fuse
Base Power Required (5V)	Max. 200mA (all pts. on)



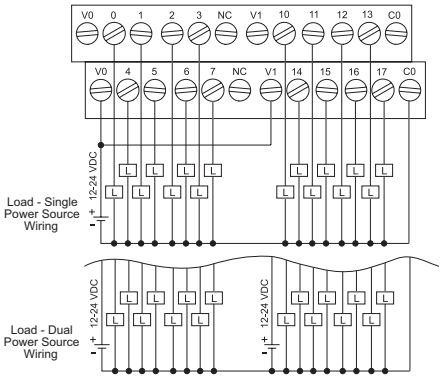
Equivalent output circuit

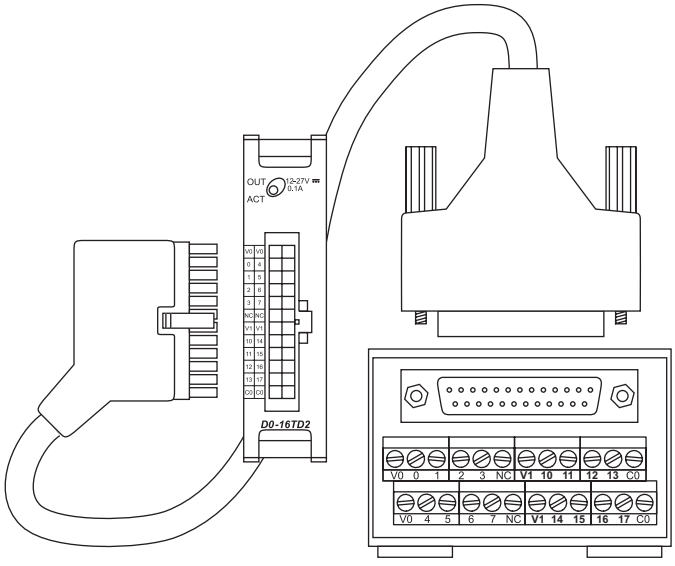


Derating chart



Wiring for ZL-CM056





Use ZipLink ZL-CBL056 cable and ZL-CM056 connector module, or ZL-CBL056FR cable and ZL-CM16RL24B relay 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.

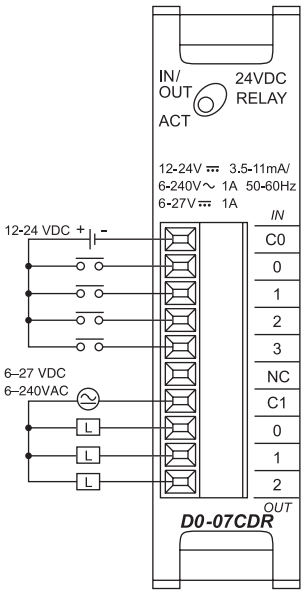
DL05/06 I/O Option Modules

D0-07CDR <--->

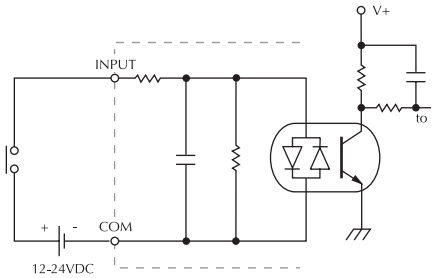
4-point DC input and
3-point relay output module

D0-07CDR Input Specifications	
Number of Inputs	4 (sink/source)
Input Voltage Range	10.8-26.4VDC
Peak Voltage	30VDC
Maximum Input Current	11mA @ 26.4VDC
Input Current	Typical: 4mA @ 12VDC 8.5mA @ 24VDC
Input Impedance	2.8K @ 12-24VDC
ON Voltage Level	> 10.0VDC
OFF Voltage Level	< 2.0VDC
Minimum ON Current	3.5ms
Maximum OFF Current	0.5ms
ON to OFF Response	2-8ms, Typical 4ms
OFF to ON Response	2-8ms, Typical 4ms
Commons	1 (4 points/common)

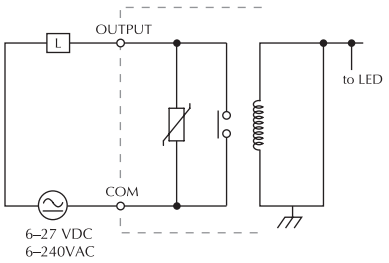
D0-07CDR Output Specifications	
Number of Outputs	3
Output Voltage Range	6-27VDC/6-240VAC
Output Type	Relay, form A (SPST)
Peak Voltage	30.0VDC/264VAC
Maximum Current (resist.)	1A/point, 4A/common
Minimum Load Current	5mA @ 5VDC
Maximum Leakage Current	0.1mA @ 264VAC
On Voltage Drop	N/A
Maximum Inrush Current	Output: 3A for 10ms Common: 10A for 10ms
Off to On Response	< 15ms
On to Off Response	< 10ms
Status Indicators	Module activity: one green LED
Commons	1 (3 points/common)
Fuse	No fuse
Base Power Required (5V)	Max. 200mA (all pts. on)



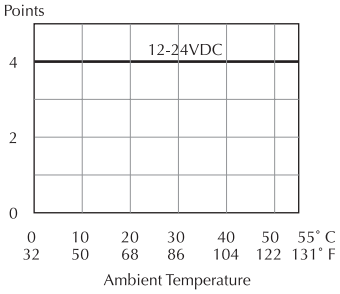
Equivalent input circuit



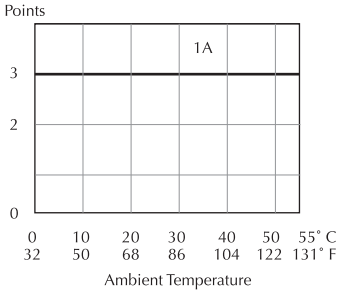
Equivalent output circuit



Derating chart for DC inputs



Derating chart for relay outputs

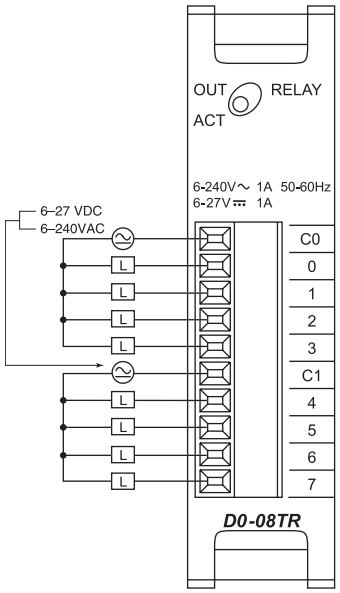


DL05/06 I/O Option Modules

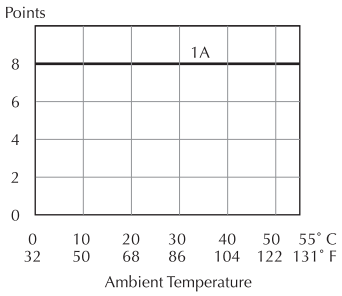
D0-08TR <--->

8-point relay output module

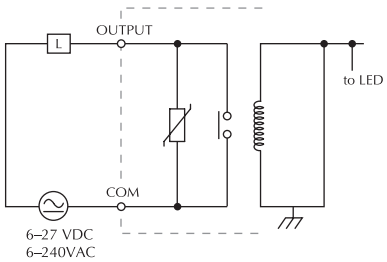
D0-07CDR Output Specifications	
Number of Outputs	8
Output Voltage Range	6-27VDC/6-240VAC
Output Type	Relay, form A (SPST)
Peak Voltage	30.0VDC/264VAC
Maximum Current (resist.)	1A/point, 4A/common
Minimum Load Current	5mA @ 5VDC
Maximum Leakage Current	0.1mA @ 264VAC
On Voltage Drop	N/A
Maximum Inrush Current	Output: 3A for 10ms Common: 10A for 10ms
Off to On Response	< 15ms
On to Off Response	< 10ms
Status Indicators	Module activity: one green LED
Commons	2 isolated (4 points/common)
Fuse	No fuse
Base Power Required (5V)	Max. 280mA (all pts. on)



Derating chart



Equivalent output circuit



Typical Relay Life (Operations) at Room Temperature		
Voltage and Type of Load	***Load Current 1A***	***2A***
24 VDC Resistive	500K	250K
24 VDC Solenoid	100K	50K
110 VAC Resistive	500K	250K
110 VAC Solenoid	200K	100K
220 VAC Resistive	350K	200K
220 VAC Solenoid	100K	50K

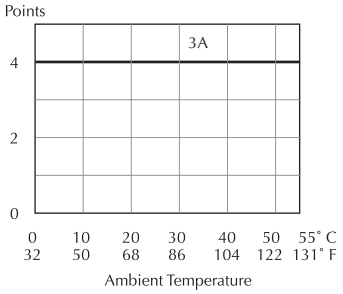
DL05/06 I/O Option Modules

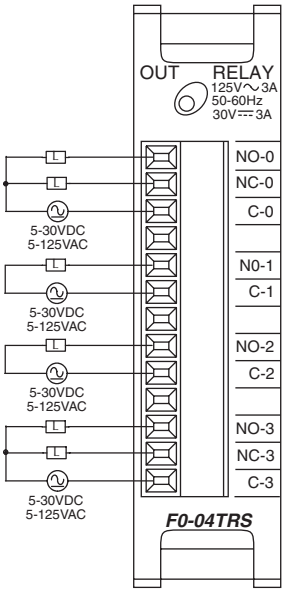
F0-04TRS <--->

4-point relay output module

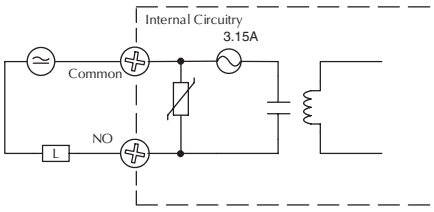
F0-04TRS Output Specifications	
Number of Outputs	4
Output Voltage Range	5-30VDC/5-125VAC
Output Type	2 - form C (SPDT) 2 - form A (SPST normally open)
Output Points Consumed	8
Peak Voltage	60VDC/220VAC
AC Frequency	47-63Hz
Maximum Current (resist.)	3A/point with no derating
Minimum Load Current	10mA @ 5V
Maximum Leakage Current	N/A
ON Voltage Drop	N/A
Maximum Inrush Current	5A
Off to On Response	≤ 5mS (typical)
On to Off Response	≤ 5mS (typical)
Status Indicators	None
Commons	4 isolated
Fuses	4, IEC 3.15A, replaceable, D2-FUSE-1
Base Power Required (5V)	250mA Max. (all points ON)

F0-04TRS Typical Relay Life at 30 Operations per Minute			
Load Type	*Rated Voltage*	*Rated Current*	*Number of Operations*
Resistive	120VAC	3A	120,000
Resistive	120VAC	1A	550,000
Resistive	24VDC	1A	>2M
Inductive: SC-E5 Motor Starter	24VDC	0.2A	>2M (see Note)
Inductive: SC-E5 Motor Starter	120VAC	0.1A operating 1.7A fault	>2M (see Note)
Note: Transient suppression must be installed with inductive loads.			

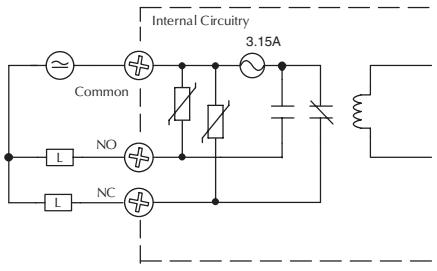




Typical Circuit



Typical Circuit



NOTE: *The DL05 CPU's discrete feature for this module requires* ***Direct****SOFT32 Version 3.0c (or later) and firmware version 4.70 (or later). The DL06 requires* ***Direct****SOFT32 version V4.0, build 16 (or later) and firmware version 1.50 (or later). See our website for more information:* ***www.automationdirect.com****.*

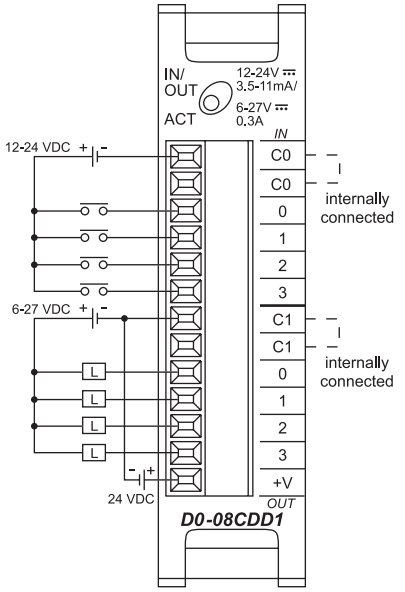
DL05/06 I/O Option Modules

D0-08CDD1 <--->

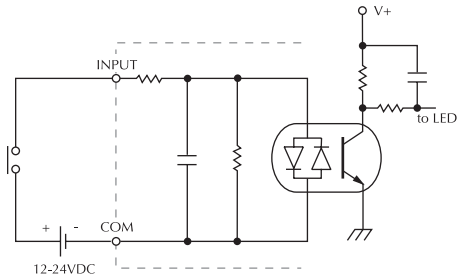
4-point DC input and 4-point DC output module

D0-08CDD1 Input Specifications	
Number of Inputs	4 (sink/source)
Input Voltage Range	10.8-26.4VDC
Peak Voltage	30.0VDC
Input Current	Typical: 4.0mA @ 12VDC 8.5mA @ 24VDC
Maximum Input Current	11mA @ 26.4VDC
Input Impedance	2.8KΩ @ 12-24VDC
On Voltage Level	> 10.0 VDC
Off Voltage Level	< 2.0 VDC
Minimum ON Current	3.5mA
Maximum OFF Current	0.5mA
Off to On Response	2-8ms, Typ. 4ms
On to Off Response	2-8ms, Typ. 4ms
Commons	1(4 pts/common) non-isolated

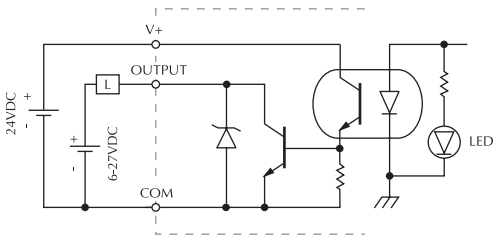
D0-08CDD1 Output Specifications	
Number of Outputs	4 (sinking)
Operating Voltage Range	6-27VDC
Output Voltage Range	5-30VDC
Peak Voltage	50.0VDC
Maximum Output Current	0.3A/point, 1.2A/common
Minimum Output Current	0.5mA
Maximum Leakage Current	1.5μA @ 30.0VDC
On Voltage Drop	0.5VDC @ 0.3A
Maximum Inrush Current	1A for 10ms
Off to On Response	< 10μs
On to Off Response	< 60μs
Status Indicators	Module activity: one green LED
Commons	1(4 pts/common) non-isolated
Fuse	No fuse
Base Power Required (5V)	Max. 200mA (all pts. on)
External DC Power Required (24V)	20-28VDC, max. 80mA (all pts. on)



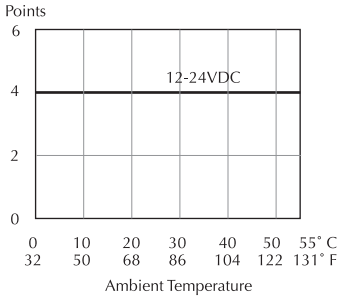
Equivalent input circuit



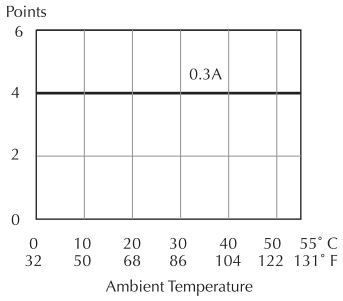
Equivalent output circuit



Derating chart for DC inputs



Derating chart for DC outputs

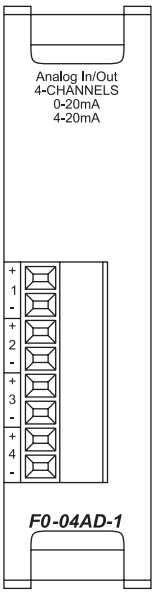


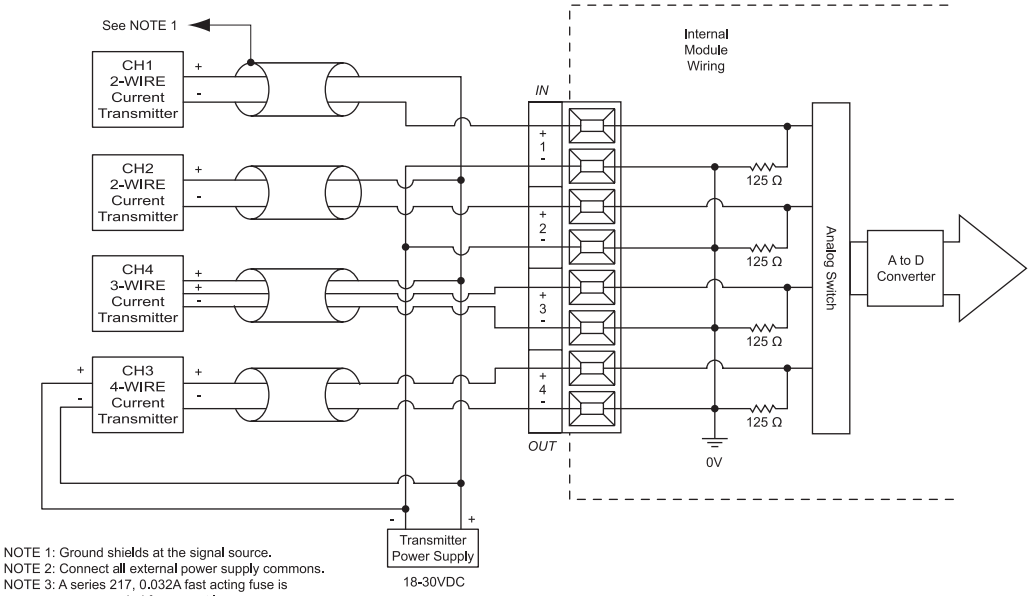
DL05/06 Option Modules

F0-04AD-1 <--->

4-channel analog input module

F0-04AD-1 Input Specifications	
Number of Channels	4, single ended (one common)
Input Range	0 to20mA or 4 to 20mA (jumper selectable)
Resolution	12 bit (1 in 4096)
Step Response	25.0mS (typ.) to 95% of full step change
Crosstalk	1/2 count max (-80db)*
Active Low-pass Filtering	-3dB at 40Hz (-12dB per octave)
Input Impedance	125Ω ±0.1%, 1/8 watt
Absolute Max Ratings	-30mA to +30mA, current input
Converter Type	Successive approximation
Linearity Error (end to end)	±2 counts
Input Stability	±1 count*
Full-scale Calibration Error	±10 counts max. @ 20mA*
Offset Calibration Error	±5 counts max. @ 4mA*
Max Inaccuracy	±0.4% at 25°C (77°F) ±0.85% at 0 to 60°C (32 to 140°F)
Accuracy vs. Temperature	±100 ppm/°C typical
Recommended Fuse	0.032A, series 217 fast-acting, current inputs





NOTE 1: Ground shields at the signal source.
NOTE 2: Connect all external power supply commons.
NOTE 3: A series 217, 0.032A fast acting fuse is recommended for current loops.

DL05/06 I/O Option Modules

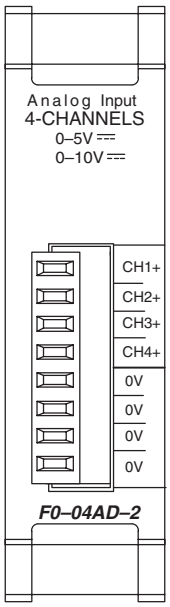
F0-04AD-2 <--->

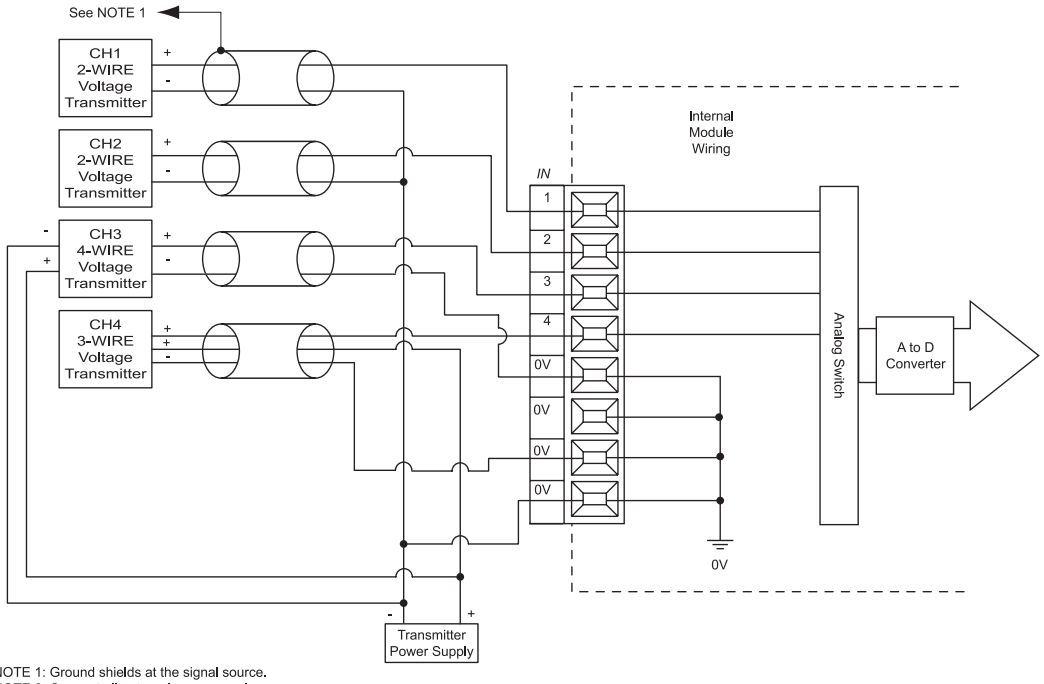
4-channel analog voltage input module

F0-04AD-2 Input Specifications	
Number of Channels	4, single ended (one common)
Input Range	0 to 5VDC or 0 to 10VDC (jumper selectable)
Resolution	12 bit (1 in 4096)
Step Response	10.0mS to 95% of full step change
Crosstalk	1/2 count max (-80db)*
Active Low-pass Filtering	-3dB at 300Hz (-12dB per octave)
Input Impedance	>20KΩ
Absolute Max Ratings	±15V
Linearity Error (end to end)	±2 count (0.025% of full scale) max*
Input Stability	±1 count*
Gain Error	±6 counts max*
Offset Error	±2 counts max*
Max Inaccuracy	±0.3% at 25°C (77°F) ±0.6% at 0 to 60°-C (32 to 140°F)
Accuracy vs. Temperature	±100 ppm/°C typical

CPU	Firmware Required	DirectSOFT32 Required
DL05	Version 4.60 or later	Version 3.0c or later
DL06	Version 1.40 or later	Version 4.0, Build 16 or later

**** One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096)***





NOTE 1: Ground shields at the signal source.
NOTE 2: Connect all external power supply commons.

DL05/06 I/O Option Modules

F0-04THM <--->

4-channel thermocouple input module

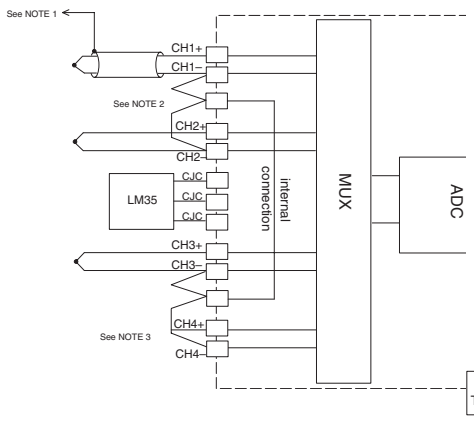
F0-04THM 4-Channel Thermocouple Input	
General Specifications	
Number of Channels	4, differential
Common Mode Range	-1.3VDC to +3.8VDC
Common Mode Rejection	100dB min. @ VDC 50/60Hz.
Input Impedance	5MΩ
Absolute Maximum Ratings	Fault-protected inputs to ±50 VDC
Accuracy vs. Temperature (Max. Full Scale Error)	±15ppm/°C maximum 0 - 1.25V ±35ppm/°C maximum (including maximum offset change)
PLC Update Rate	4 channels per scan
Digital Inputs	None; uses special V-memory location based on slot
Base Power Required	30mA @ 5VDC supplied by base
Operating Temperature	32° to 140°F (0° to 60°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
Replacement Terminal Block	F0-IOCON-THM (comes with CJC)

Thermocouple Specifications		
Input Ranges	Type J -190 to 760°C Type E -210 to 1000°C Type K -150 to 1372°C Type R 65 to 1768°C Type S 65 to 1768°C Type T -230 to 400°C Type B 529 to 1820°C Type N -70 to 1300°C Type C 65 to 2320°C	-310 to 1400°F -346 to 1832°F -238 to 2502°F 149 to 3214°F 149 to 3214°F -382 to 752°F 984 to 3308°F -94 to 2372°F 149 to 4208°F
Display Resolution	±0.1°C or ±0.1°F	
Cold Junction Compensation	Automatic	
Conversion Time	270ms per channel	
Warm-Up Time	30 minutes typically ± 1°C repeatability	
Linearity Error (End to End)	±1°C maximum, ±0.5°C typical	
Maximum Inaccuracy	±3°C (excluding thermocouple error)	

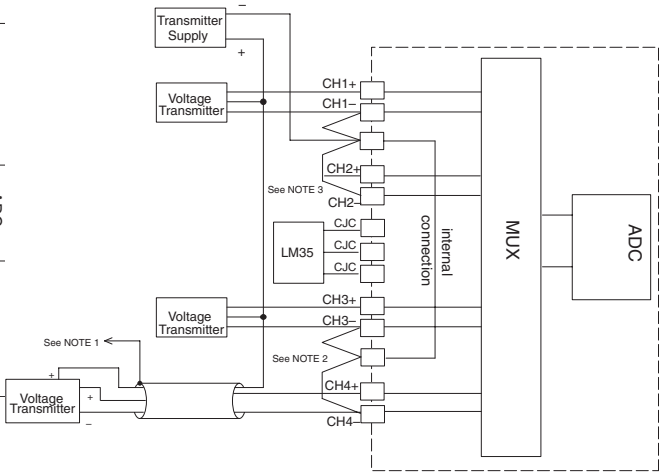
Voltage Input Specifications	
Voltage Ranges	0-39.0625mV, ±39.0625mV, ±78.125mV, 0-156.25mV, ±156.25mVDC, 0-1.25V
Resolution	16 bit (1 in 65535)
Max. Offset Error (All Input Ranges)	0.05% @ 0-60°C; Typical: 0.04% @ 25°C
Linearity Error (All Input Ranges)	0.05% @ 0-60°C; Typical: 0.03% @ 25°C
Maximum Inaccuracy	0-39.0625mV, ±39.0625mV, ±78.125mV ranges: 0.1% @ 0-60°C; Typical: 0.04% @ 25°C 0-156.25mV, ±156.25mVDC, 0-1.25V ranges: 0.05% @ 0-60°C; Typical: 0.04% @ 25°C

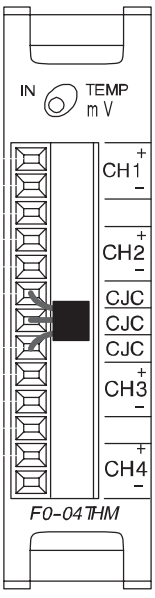
NOTE: *The DL05 CPU's analog feature for this module requires* ***Direct****SOFT32 Version 3.0c (or later) and firmware version 4.60 (or later). The DL06 requires* ***Direct****SOFT32 version V4.0, build 16 (or later) and firmware version 1.40 (or later). See our website for more information:* ***www.automationdirect.com****.*

Thermocouple Input wiring diagram



Voltage Input wiring diagram





Notes:

1. Shields should be grounded at the PLC power source only.

2. All CH- terminals must be connected together.

3. Unused channels should have a shorting wire (jumper) installed from CH+ to CH-.

DL05/06 Option Modules

F0-04RTD <--->

4-channel RTD input module

F0-04RTD Input Specifications	
Number of Channels	4
Input Ranges	Type Pt100: -200.0/850.0°C, -328/1562°F Type Pt1000: -200.0/595.0°C, -328/1103°F Type jPt100: -38.0/450.0°C, -36/842°F Type CU-10/25: -200.0/260.0°C, -328/500°F Type NI-120: -80.0/260.0°C, -112/500°F
Resolution	16 bit (1 in 65535)
Display Resolution	±0.1°C, ±0.1°F (±3276.7)
RTD Excitation Current	200 µA
Notch Filter	> 50 db notches at 50/60 Hz
Maximum Setting Time	100 ms (full-scale step input)
Common Mode Range	0-5 VDC
Absolute Maximum Ratings	Fault protected inputs to ±50 VDC
Sampling Rate	140 ms per channel

F0-04RTD Input Specifications (cont'd)	
Converter Type	Charge Balancing
Linearity Error	±.05°C maximum, ±.01°C typical
Maximum Inaccuracy	±1°C
PLC Update Rate	4 channel/scan
Digital Input Points Required	None; uses special V-memory location based on slot
Base Power Required 5VDC	70 mA
Operating Temperature	32° to 140°F (0° to 60°C)
Storage Temperature	-4° to 158°F (-20° to 70°C)
Temperature Drift	15 ppm / °C max
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

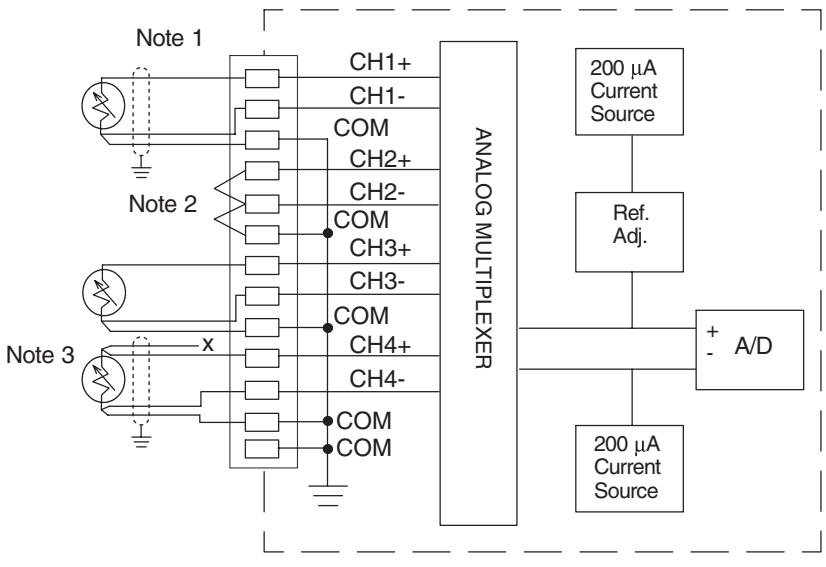
NOTE: *The DL05 CPU's analog feature for this module requires* ***Direct****SOFT32 Version 3.0c (or later) and firmware version 4.70 (or later). The DL06 requires* ***Direct****SOFT32 version V4.0, build 16 (or later) and firmware version 1.50 (or later). See our website for more information:* ***www.automationdirect.com****.*

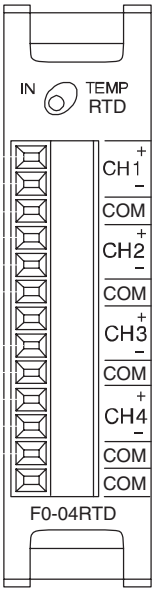
Notes:

1. The three wires connecting the RTD to the module must be the same type and length. Do not use the shield or drain wire for the third connection.

2. Unused channels require shorting wires (jumpers) installed from terminals CH+ to CH– to COM to prevent possible noise from influencing active channels. This should be done even if the unused channel is not enabled in the V-memory configuration.

3. If a RTD sensor has four wires, the plus sense wire should be left unconnected as shown.





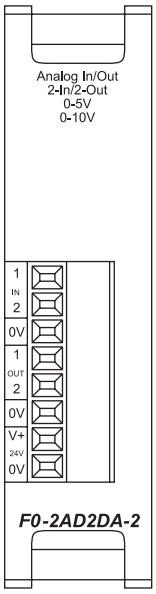
DL05/06 Option Modules

F0-2AD2DA-2 <--->

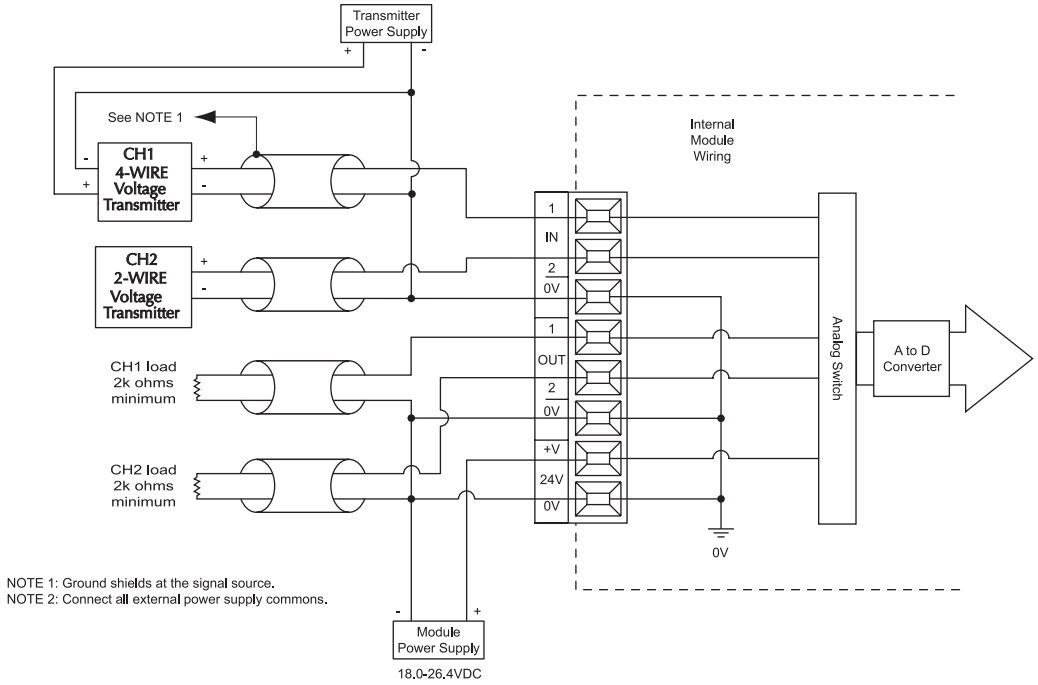
2-point analog input and
2-point analog output module

F0-2AD2DA-2 Input Specifications	
Number of Channels	2, single ended (one common)
Input Range	0 to 5VDC or 0 to 10VDC (jumper selectable)
Resolution	12 bit (1 in 4096)
Step Response	10.0mS to 95% of full step change
Crosstalk	1/2 count max (-80db)*
Active Low-pass Filtering	-3dB at 300Hz (-12dB per octave)
Input Impedance	>20KΩ
Absolute Max Ratings	±15V
Linearity Error (end to end)	±2 counts (0.025% of full scale) max*
Input Stability	±1 count*
Gain Error	±6 counts max*
Offset Error	±2 counts max*
Max Inaccuracy	±0.3% at 25°C (77°F) ±0.6% at 0 to 60°-C (32 to 140°F)
Accuracy vs. Temperature	±100 ppm/°C typical

F0-2AD2DA-2 Output Specifications	
Number of Channels	2, single ended (one common)
Output Range	0 to5VDC or 0 to 10VDC (jumper selectable)
Resolution	12 bit (1 in 4096)
Conversion Settling Time	50μS for full scale change
Crosstalk	1/2 count max (-80db)*
Peak Output Voltage	±15VDC (power supply limited)
Offset Error	0.1% of range
Gain Error	0.4% of range
Linearity Error (end to end)	±1 counts (0.075% of full scale) max*
Output Stability	±2 counts*
Load Impedance	2KΩ min
Load Capacitance	0.01μF max
Accuracy vs. Temperature	±50 ppm/°C typical



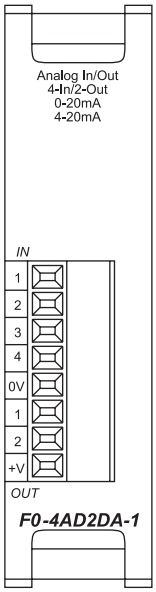
**** One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096)***



DL05/06 Option Modules

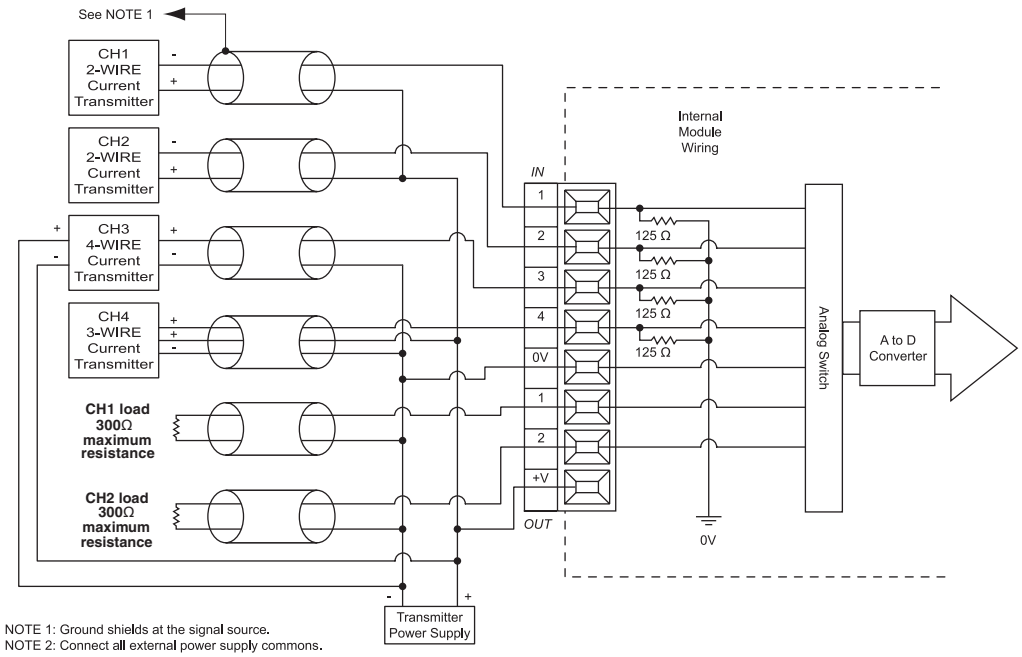
F0-4AD2DA-1 <--->

4-point analog input and 2-point analog output module



F0-4AD2DA-1 Input Specifications	
Number of Channels	4, single ended (one common)
Input Range	0 to 20 mA or 4 to 20 mA (jumper selectable)
Resolution	12 bit (1 in 4096)
Step Response	25.0 mS (typ.) to 95% of full step change
Crosstalk	1/2 count max (-80db)*
Active Low-pass Filtering	-3 dB at 40 Hz (-12dB per octave)
Input Impedance	125 Ω ±0.1%, 1/8 watt
Absolute Max Ratings	-30mA to +30 mA, current input
Converter Type	Successive approximation
Linearity Error (end to end)	±2 counts
Input Stability	±1 count*
Full-scale Calibration Error	±10 counts max. @ 20 mA*
Offset Calibration Error	±5 counts max. @ 0 mA*
Max Inaccuracy	±0.4% at 25°C (77°F) ±0.85% at 0 to 60°C (32 to 140°F)
Accuracy vs. Temperature	±100 ppm/°C typical
Recommended Fuse	0.032 A, series 217 fast-acting, current inputs

F0-4AD2DA-1 Output Specifications	
Number of Channels	2, single ended (one common)
Output Range	0 to 20 mA or 4 to 20 mA (jumper selectable)
Output Type	Current sourcing
Resolution	12 bit (1 in 4096)
Max. Loop Voltage	30 VDC
Load/loop Power Supply	0-300 Ω /18-30 VDC
Linearity Error (end to end)	±2 counts (0.050% of full scale) max.*
Conversion Settling Time	400 μs max. for full scale change
Full-scale Calibration Error	±26 counts max. @ 300 Ω load ±18 counts max.. @ 250 Ω load ±12 counts max.. @ 125 Ω load
Offset Calibration Error	±10 counts max.. @ 300 Ω load ±8 counts max.. @ 250 Ω load ±6 counts max.. @ 125 Ω load
Max. Full- scale Inaccuracy (all errors included)	300 Ω load 0.4%. @ 60° C 250 Ω load 0.3%. @ 60° C 125 Ω load 0.2%. @ 60° C

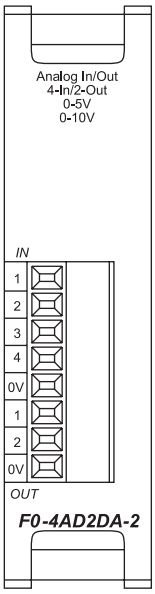


NOTE 1: Ground shields at the signal source.
NOTE 2: Connect all external power supply commons.

DL05/06 Option Modules

F0-4AD2DA-2 <--->

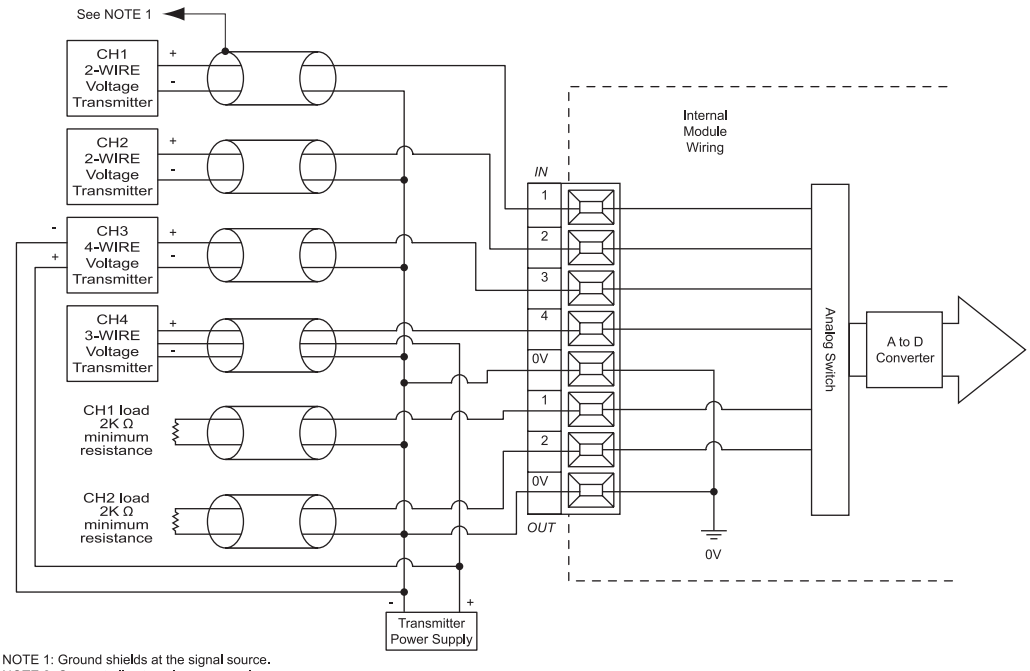
4-point analog input and 2-point analog output module



F0-4AD2DA-2 Input Specifications	
Number of Channels	4, single ended (one common)
Input Range	0 to5VDC or 0 to 10VDC (jumper selectable)
Resolution	12 bit (1 in 4096)
Step Response	10.0mS to 95% of full step change
Crosstalk	1/2 count max (-80db)*
Active Low-pass Filtering	-3dB at 300Hz (-12dB per octave)
Input Impedance	>20KΩ
Absolute Max Ratings	±15V
Linearity Error (end to end)	±2 count (0.025% of full scale) max*
Input Stability	±1 count*
Gain Error	±6 counts max*
Offset Error	±2 counts max*
Max Inaccuracy	±0.3% at 25°C (77°F) ±0.6% at 0 to 60°-C (32 to 140°F)
Accuracy vs. Temperature	±100 ppm/°C typical

F0-4AD2DA-2 Output Specifications	
Number of Channels	2, single ended (one common)
Output Range	0 to5VDC or 0 to 10VDC (jumper selectable)
Resolution	12 bit (1 in 4096)
Conversion Settling Time	50μS for full scale change
Crosstalk	1/2 count max (-80db)*
Peak Output Voltage	±15VDC (power supply limited)
Offset Error	0.1% of range
Gain Error	0.4% of range
Linearity Error (end to end)	±1 counts (0.075% of full scale) max*
Output Stability	±2 counts*
Load Impedance	2KΩ max
Load Capacitance	0.01μF max
Accurracy vs. Temperature	±50 ppm/°C typical

** One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096)*



NOTE 1: Ground shields at the signal source.
NOTE 2: Connect all external power supply commons.

High-Speed I/O Features

You can use the DL05 or DL06 micro PLCs to solve a diverse range of motion and high-speed machine control applications.

The DL05 and DL06 micro PLCs offer high-speed input and pulse output features exclusively on DC input and DC output models. On DL05 PLCs *with DC inputs*, the high-speed features are accessible on the first three input points (X0-X2). On DL06 PLCs *with DC inputs*, the high-speed features are accessible on the first four input points (X0-X3). On DL05 or DL06 PLCs *with DC outputs*, the pulse output feature is accessible on the first two output points (Y0-Y1).

Several modes of operation are available that meet the needs of many applications. A brief description of each of the high-speed modes is listed below:

- High-speed counters offer 24 presets. When the preset is reached, an interrupt routine is executed.
- Quadrature encoder input (up/down counter) for clockwise and counterclockwise position control
- Pulse outputs are programmable to follow a predetermined profile. An external interrupt can be used in conjunction with separate acceleration/deceleration profiles for positioning and velocity control.
- External interrupt inputs can be used for an immediate response to urgent application tasks.
- The pulse catch input allows the CPU to read an input with a pulse width as narrow as 0.1ms.
- Input filters are configurable (0-99ms) to ensure input signal integrity. The default input mode is a 10ms filter.
- Timed interrupts can be configured for time critical events. Interrupt 0 can be scheduled on a 5ms-999ms cycle. Interrupt 1, available exclusively on the DL05, can be scheduled on a 5ms-9999ms cycle.

Note: The high-speed counter features cannot be used if the pulse output features are in use, and vice versa.

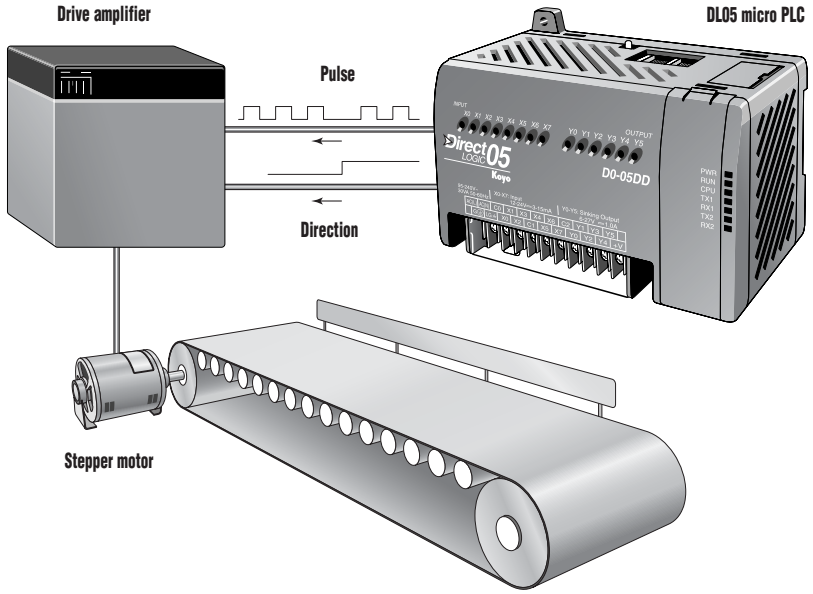
The operating modes are explained in more detail later in this section.

DL05 High-speed I/O Features

Mode	DC Inputs Points			DC Output Points	
	X0	X1	X2	Y0	Y1
High Speed Up Counter	Counter input	Filtered input	Reset count Filtered input	Regular output	Regular output
Quadrature Counter	Phase A input	Phase B input	Reset count Filtered input	Regular output	Regular output
High-Speed Interrupt	Interrupt input	Filtered input	Filtered input	Regular output	Regular output
Pulse Catch	Pulse input	Filtered input	Filtered input	Regular output	Regular output
Pulse Output	Filtered input	Filtered input	Positioning interrupt Filtered input	Pulse CW pulse	Direction CCW pulse
Filtered Input	Filtered input	Filtered input	Filtered input	Regular output	Regular output

DL06 High-speed I/O Features

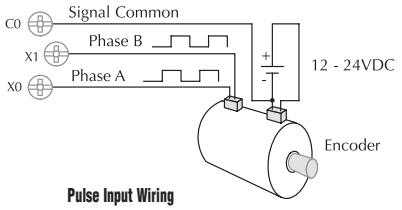
Mode	DC Inputs Points				DC Output Points	
	X0	X1	X2	X3	Y0	Y1
High Speed Up Counter	Counter Ch 1	Counter Ch 2 Interrupt Pulse input Filtered input	Reset Ch 1 Interrupt Pulse input Filtered input	Reset Ch 2 Interrupt Pulse input Filtered input	Regular output	Regular output
Up/Down Counter	Up input	Down input	Reset Pulse input Filtered input	Pulse input Filtered input	Regular output	Regular output
Quadrature Counter	Phase A input	Phase B input	Reset Pulse input Filtered input	Pulse input Filtered input	Regular output	Regular output
High-Speed Interrupt	Interrupt input	Interrupt Pulse input Filtered input	Interrupt Pulse input Filtered input	Interrupt Pulse input Filtered input	Regular output	Regular output
Pulse Catch	Pulse input	Interrupt Pulse input Filtered input	Interrupt Pulse input Filtered input	Interrupt Pulse input Filtered input	Regular output	Regular output
Pulse Output	Filtered input	Interrupt Pulse input Filtered input	Pulse input Filtered input	Pulse input Filtered input	Pulse CW Pulse	Direction CCW pulse
Filtered Input	Filtered input	Filtered input	Filtered input	Filtered input	Regular output	Regular output



HIGH SPEED SPECIFICATIONS

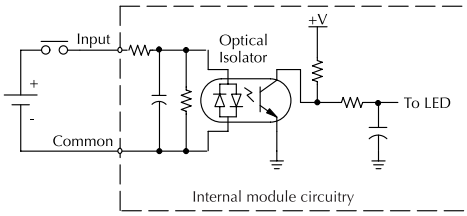
High-Speed Input Specifications		
PLC	**DL05**	**DL06**
High-speed Inputs	3 pts. sink or source (X0-X2)	4 pts. sink or source (X0-X3)
Max. Input Frequency	5kHz	7kHz
Minimum Pulse Width	100 µs	70 µs
Input Voltage Range	12-24 VDC	
Input Impedance (hs only)	1.8K @ 12-24VDC	
ON Current/Voltage Level	>5mA/>10VDC	
OFF Current/Voltage Level	<0.5mA/<2VDC	
OFF to ON Response	<100µs	<70 µs
ON to OFF Response	<100µs	<70 µs

High-Speed Output Specifications		
PLC	**DL05**	**DL06**
Pulse Outputs	2 pts. (Y0 and 1) current sinking	2 pts. (Y0 and Y1) current sinking or sourcing (sourcing outputs on D0-06DD2 only)
Max. Output Frequency	7kHz	10kHz
Voltage Range	6-27VDC	
Max. Load Current	0.5A/point	
ON Voltage Drop	0.3VDC @ 1.0A	
Leakage Current	15µA @ 30VDC	
Inrush Current	2A (100ms)	
OFF to ON Response	<10µs	<10µs
ON to OFF Response	<30µs	<20µs

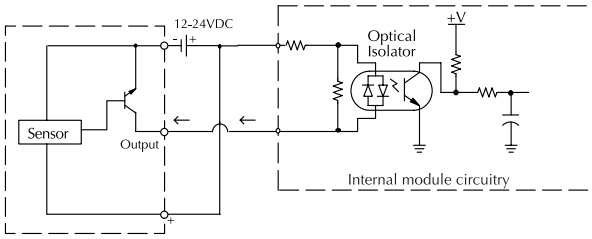


Pulse Input Wiring

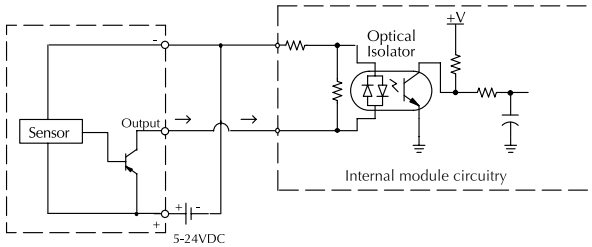
Equivalent Circuit, High-Speed Inputs

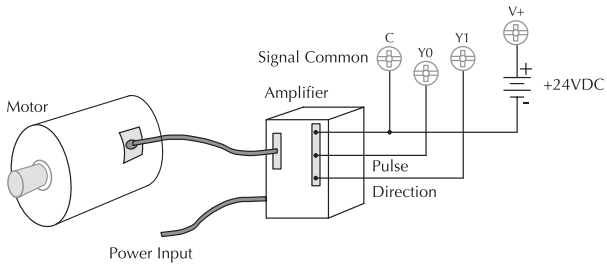


Equivalent Circuit, High-Speed Inputs (NPN) Current Sinking Field Device



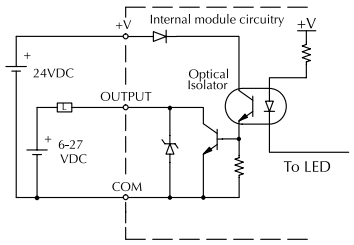
Equivalent Circuit, High-Speed Inputs (PNP) Current Sourcing Field Device



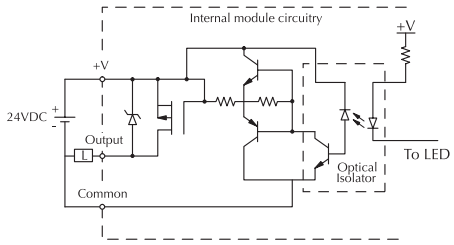


Pulse Output Wiring

Equivalent Pulse Output Circuit Sinking Output



Equivalent Pulse Output Circuit Sourcing Output (D0-06DD2 only)



Mode 10: High Speed Up Counter

Overview

The DC input versions of the DL05 and DL06 micro PLCs support high-speed counter inputs up to 5 kHz for the DL05 and 7 kHz for the DL06.

Access the high-speed counter by connecting the external pulse input and external reset signals to the internal counter at the designated discrete input points.

The embedded counter is independent of the micro PLC's ladder logic execution, so counting is not affected by the scan time.

Presets

When the counter reaches any one of up to 24 preset values, the CPU stops executing the main RLL program and executes a special interrupt subroutine that is associated with the UP counter. The CPU resumes normal operations from where it left off after the interrupt subroutine has completed.

You can program the subroutine with any of the instructions that are normally available in subroutines. Also, each preset value has a corresponding *equal relay*. These are individual internal control relays that are turned on when the associated preset matches the actual count. This allows you to trigger actions based on the current count. For example, you could use *immediate I/O* instructions to provide a fast response.

Use an *up/down counter* box in your ladder logic and start and stop the counter just by turning on or off an enable contact (of your choice) as needed. Counters can be reset either by an external signal or by special internal relays that can be activated by your ladder program. Presets are absolute, which means they are compared directly to the actual count.

Up Counter Mode

DL05 Designated Terminals

X0: ..... Up count of up counter
X1: ..... Filtered input
X2: ..... External counter reset (or filtered input)

Input Specifications

Input voltage ..... 12 or 24VDC
Frequency DL05 ..... 5kHz maximum
Minimum pulse width ..... 100 µs
Maximum count 99,999,999
Preset types ..... Absolute
Number of presets 24

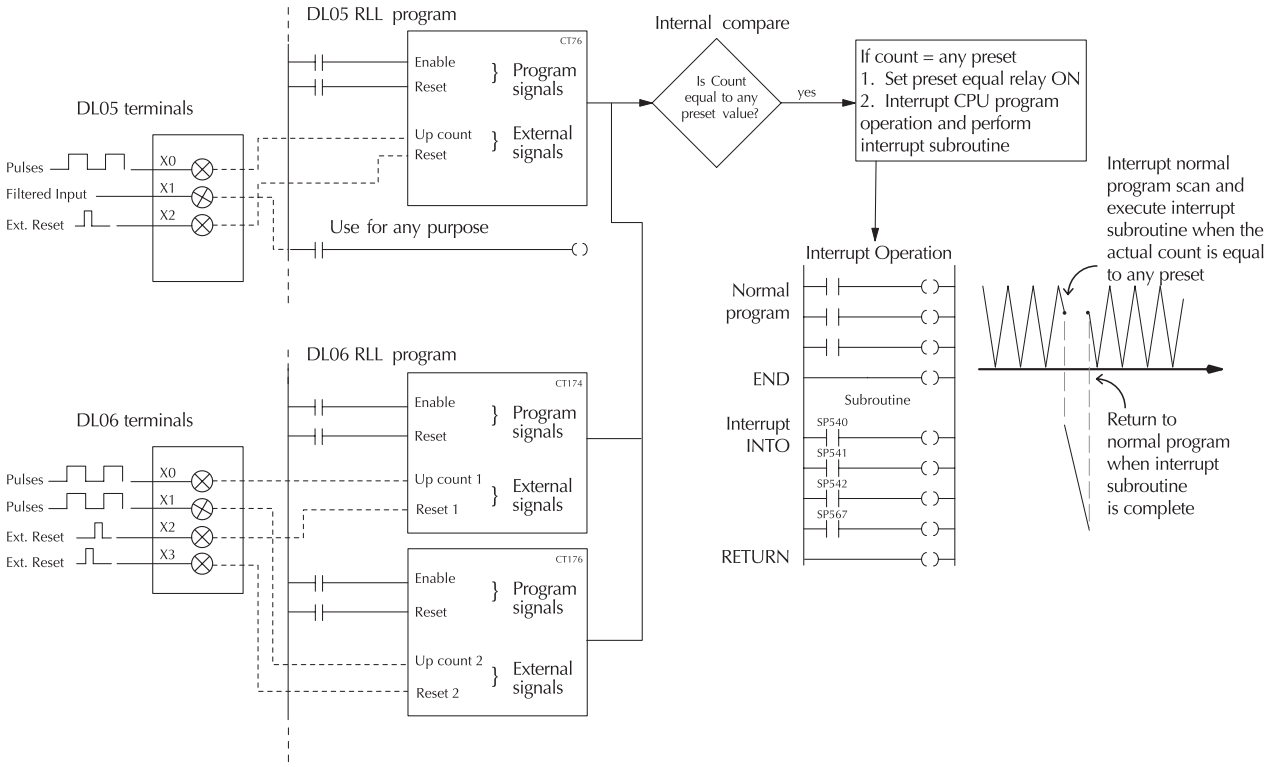
DL06 Designated Terminals

X0: ..... Up count of up counter 1
X1: ..... Up count of up counter 2
X2: ..... External counter 1 reset or filtered input
X3: ..... External counter 2 reset or filtered input

Input Specifications

Input voltage ..... 12 or 24VDC
Frequency DL06 ..... 7kHz maximum
Minimum pulse width ..... 70 µs
Maximum count 99,999,999
Preset types ..... Incremental or Absolute
Number of presets 24/counter

Example operation



Mode 20: Quadrature (or up/down) Counter

Overview

By selecting Mode 20, you can connect a quadrature encoder to the high-speed input terminals of a DL05 or DL06 PLC. In this mode, you can have two external pulse inputs from the encoder (Phase A and Phase B) and one reset input signal. These are connected to the terminals indicated in the adjacent table. In addition to the physical inputs, there are also two internal references used in the control program, a counter enable input, and a counter reset input. Note: the DL05 and DL06 micro PLCs support a maximum of one quadrature encoder (the DL06, however, will support two simple encoders).

As with the UP counter, the quadrature counter is independent of the CPU ladder logic execution. The actual pulse counting is not affected by the scan time. The quadrature counter can trigger an interrupt based on the current count/preset relationship in the DL06, but not in the DL05.

To perform simple positioning or to control output devices in the DL05, you must use relational contacts (based on the current count) within your RLL program. Since these contacts are within the RLL program, the resolution obtained with this method is actually limited by the PLC scan time. That is, the margin for error is equal to the maximum number of pulses that could be expected during one scan.

You can determine the resolution with a simple formula:

$$\text{Pulses per scan} = \text{Scan Time (ms)} \times \text{Frequency (kHz)}$$

For example, a 10 ms scan and a 5 kHz encoder input (0.01seconds x 5000Hz) yields a maximum of 50 pulses per scan. The maximum positioning precision would be the number of encoder revolutions that yields 50 pulses. The amount of precision will also depend on the field device delay, PLC output off/on delay, etc.). This amount of precision may be acceptable for many simple positioning applications.

If you need additional flexibility for your application, check out our DL205 micro modular family of PLCs and the H2-CTRIO counter module.

Quadrature mode

DL05 Designated Terminals

X0: ..... Phase A
X1: ..... Phase B
X2: ..... External counter reset (or filtered input)

Input Specifications

Input voltage ..... 12 or 24VDC
Frequency ..... 5kHz maximum
Minimum pulse width ..... 100 µs
Count range ..... 0 to 99,999,999 unipolar –
..... -8,388,608 to 8,388,607 bipolar
Number of presets ..... None, use relational
..... contacts or use CT76 status contact

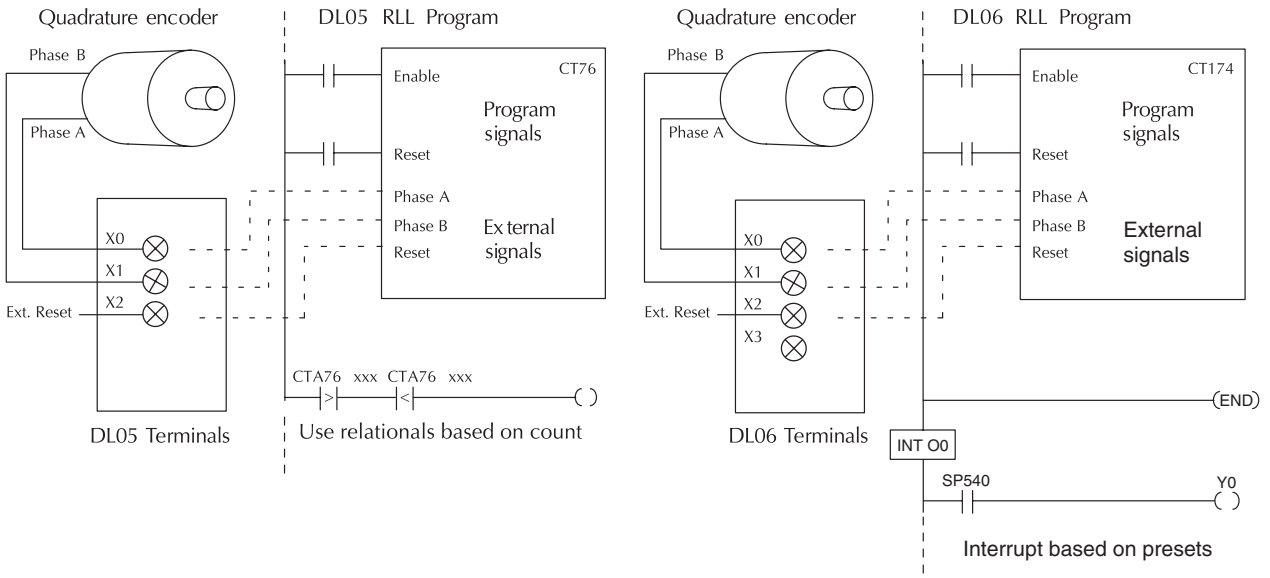
DL06 Designated Terminals

X0: ..... Phase A
X1: ..... Phase B
X2: ..... External counter reset (or filtered input)
X3: ..... Filtered input

Input Specifications

Input voltage ..... 12 or 24VDC
Frequency ..... 7kHz maximum
Minimum pulse width ..... 70 µs
Count range ..... 0 to 99,999,999 unipolar –
..... -8,388,608 to 8,388,607 bipolar
Preset types ..... Incrememtal or Absolute
Number of presets 24/counter
..... contacts or use CT174 status contact

Example operation



Mode 30: Pulse Output

Overview

By selecting Mode 30, you can use the pulse output feature to build simple motion and positioning control systems. Transfer and indexing tables are common applications. There are two operation profiles available (shown below). You choose the profile and motion parameters by using special CPU V-memory locations that are reserved for the high-speed I/O features. You can configure the pulse output for independent CW/CCW pulse train output, or step and direction. With independent operation, Y0 is the CW pulse output and Y1 is the CCW pulse output. If you choose step and direction, Y0 is the pulse train output and Y1 controls the CW/CCW operation (OFF/ON respectively). In either case, the pulses are sent out independently of the CPU scan, so scan time does not affect the pulse generation. The pulse output is enabled through ladder logic by activating Y0.

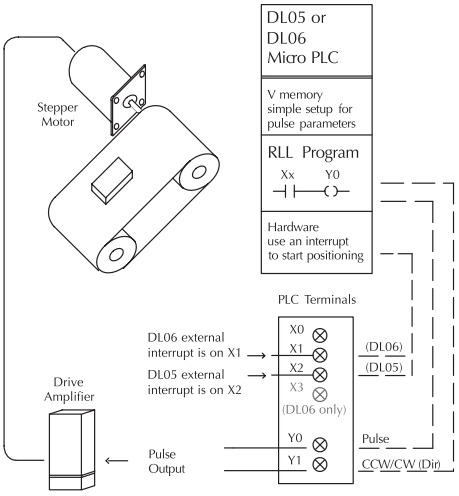
Automatic accel/decel profile

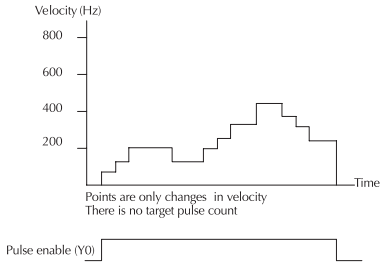
The trapezoid profile is also referred to as the automatic acceleration/deceleration profile. You specify a target destination (number of pulses), a starting velocity (pulses per second), a positioning velocity, an acceleration time, and a deceleration time. Once these parameters are specified, the DL05 or DL06 automatically controls the actual acceleration/deceleration. Times can be in the range of 100ms to 10 seconds. This profile also allows you to perform simple registration. By using the external interrupt, you can delay counting toward the target number of pulses until the interrupt occurs.

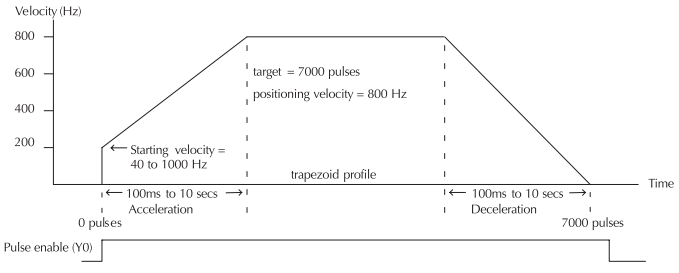
Velocity control

You can also choose a velocity-only profile. In this scenario, you only control the velocity. There is no target destination (number of pulses). You simply change the velocity value as necessary to achieve the desired results.

Example operation







Pulse output mode

DL05 Designated Terminals

X0: . . . . . Filtered input
X1: . . . . . Filtered input
X2: . . . . . Positioning interrupt or filtered input

Output Assignments for Pulse Output Mode

Y0: . . . . . Independent mode, CW pulse output
. . . . . Step and direction mode, pulse output
Y1: . . . . . Independent mode, CCW pulse output
. . . . . Step and direction mode, OFF=CW, ON=CCW

Output Specifications

Output voltage range 6-27VDC
Frequency . . . . . 7kHz maximum
Target pulse range . . . . . -8,388,608 to 8,388,607
Velocity range . . . . . 40 to 7000 pulses/sec
. . . . . (in units of 10 pulses)

DL06 Designated Terminals

X0: . . . . . Filtered input
X1: . . . . . Positioning interrupt (or filtered input)
X2: . . . . . Filtered input
X3: . . . . . Filtered input

Output Assignments for Pulse Output Mode

Y0: . . . . . Independent Mode, CW pulse output
. . . . . Step & Direction Mode, pulse output
Y1: . . . . . Independent Mode, CCW pulse output
. . . . . Step & Direction Mode, OFF=CW, ON=CCW

Output Specifications

Output voltage range 6-27VDC
Frequency . . . . . 10kHz maximum
Target pulse range . . . . . -8,388,608 to 8,388,607
Velocity range . . . . . 40 to 10,000 pulses/sec
. . . . . (in units of 10 pulses)

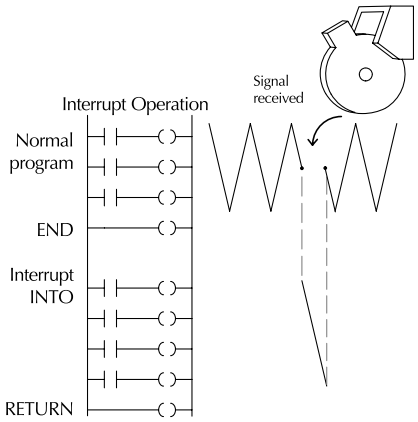
Mode 40 and Mode 50

Mode 40: external interrupt overview

By selecting Mode 40, you can use the designated terminals as a high-speed interrupt input. An interrupt input is especially useful in applications that have a high-priority event that requires special operations to be performed. When this high-priority event occurs, the interrupt input senses an ON input signal. The input automatically sends an interrupt request to the CPU. The CPU immediately suspends its routine scan cycle execution and jumps to an interrupt subroutine. You can program the subroutine with any of the instructions that are normally available in subroutines. For example, you could use immediate I/O instructions to immediately read inputs and update outputs without waiting on the normal I/O update cycle. When the subroutine is complete, the CPU automatically resumes the normal scan cycle starting from the exact location where it was interrupted. The CPU continues the routine scan until another interrupt signal is sensed.

A note on timed interrupts

If you use the external hardware interrupt (Mode 40), you cannot use the internal timed interrupt INT0. This is because they both share the same interrupt routine, INT0. Exclusively on the DL05, there is a second internal timed interrupt, INT 1.



Interrupt mode

DL05 Designated Terminals

X0: . . . . . Interrupt input
X1: . . . . . Filtered input
X2: . . . . . Filtered input

Input Specifications

Input voltage . . . . . 12 or 24VDC
Minimum pulse width . . . . . 100 µs
Pulse period . . . . . 0.5ms or greater
Trigger . . . . . Leading edge
Interrupt subroutine. INT0

DL06 Designated Terminals

X0: . . . . . Interrupt input
X1: . . . . . Interrupt input (or filtered input)
X2: . . . . . Interrupt input (or filtered input)
X3: . . . . . Interrupt input (or filtered input)

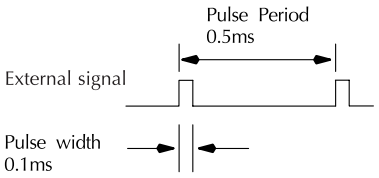
Input Specifications

Input voltage . . . . . 12 or 24VDC
Minimum pulse width . . . . . 100 µs
Pulse period . . . . . 0.5ms or greater
Trigger . . . . . Leading edge
Interrupt subroutine. INT0, INT1, INT2, INT3

Mode 50: pulse catch input overview

By selecting Mode 50, you can use X0 as a pulse catch input. In this configuration, the DL05 or DL06 micro PLC can capture very fast (narrow) pulse inputs that cannot normally be detected during the normal input update cycle. You can detect pulse widths as small as 0.1ms (100µS) and a pulse period greater than 0.5ms (500µS). When an external pulse is encountered, X0 is set on for the next CPU scan, and then it is automatically set to the OFF state. Like the other modes, the pulse catch feature operates independently of the CPU scan and is not affected by scan time fluctuations.

Mode 50 is not recommended for high-speed pulse counting.



Pulse catch mode

DL05 Designated Terminals

X0: . . . . . Pulse catch input
X1: . . . . . Filtered input
X2: . . . . . Filtered input

Input Specifications

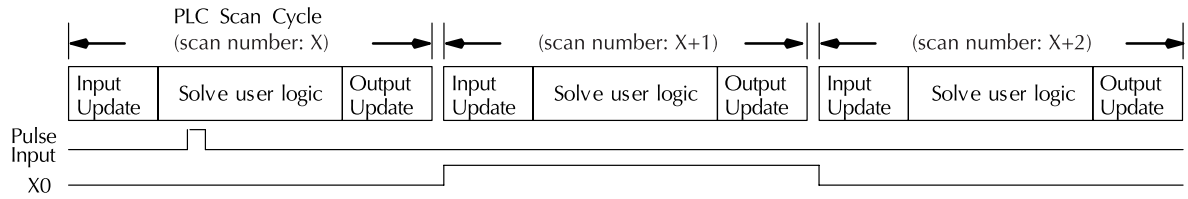
Input voltage. . . . . 12 or 24 VDC
Minimum pulse width . . . . . 100 µs
Pulse period . . . . . 0.5ms or greater
Trigger . . . . . Leading edge

DL06 Designated Terminals

X0: . . . . . Pulse catch input
X1: . . . . . Pulse catch input (or filtered input)
X2: . . . . . Pulse catch input (or filtered input)
X3: . . . . . Pulse catch input (or filtered input)

Input Specifications

Input voltage. . . . . 12 or 24 VDC
Minimum pulse width . . . . . 100 µs
Pulse period . . . . . 0.5ms or greater
Trigger . . . . . Leading edge



Default Mode 60 and Timed Interrupts

Default Mode 60: filtered inputs overview

Mode 60, which is the default mode set at the factory, provides selectable filtering for the designated inputs. Filtering can be especially useful because it reduces the possibility of false ON conditions (which can in turn trigger events in your ladder logic program). When an external signal is first detected (ON state), a programmable filter is activated, which begins a timed countdown. The slight delay temporarily prevents the CPU from reading the input during the normal input update portion of the scan cycle. The ON signal must stay present long enough for the filter to time out. If the ON signal stays present during the entire filter time, it is latched by the filter and accepted by the CPU during the CPU's normal input update portion of the scan cycle. The signal is latched for the remaining duration of the ON signal, plus an amount of time equal to the filter time. The filter time can be programmed from 0 to 99ms in 1ms increments (default is 10ms).

Filtered input

DL05 Designated Terminals

X0 ..... Filtered input
X1 ..... Filtered input
X2 ..... Filtered input

Input Specifications

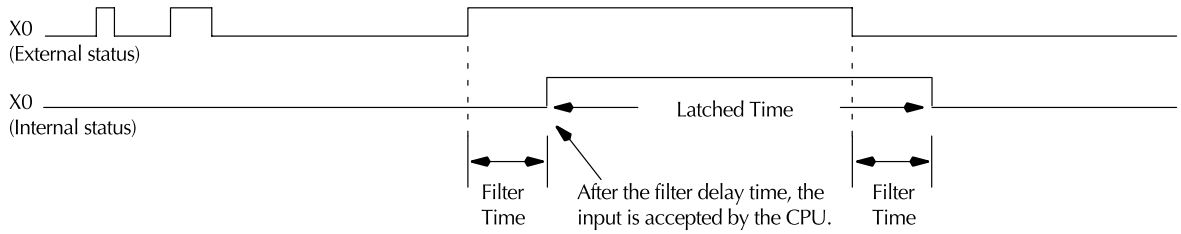
Filter time: ..... Programmable from
..... 0-99ms in 1ms increments

DL06 Designated Terminals

X0 ..... Filtered input
X1 ..... Filtered input
X2 ..... Filtered input
X3 ..... Filtered input

Input Specifications

Filter time: ..... Programmable from
..... 0-99ms in 1ms increments

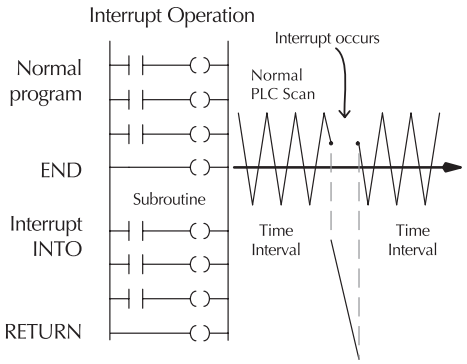


Understanding the timed interrupt

There is also a timed interrupt feature available in the DL05 and DL06 micro PLCs. This cyclical interrupt allows you to program a time-based interrupt that occurs on a scheduled basis. This feature is available in all units, regardless of input type.

The CPU's timed interrupt operates in a similar manner to the external interrupt input, but instead of the interrupt subroutine being triggered by an external event tied to X0, it is triggered by a cyclical interval of time. This interval can be programmed from 5 ms to 999 ms for INT0, which is available on either the DL05 or the DL06. The programmable time interval for INT1, which is available exclusively on the DL05, is 5 to 9999 ms .

Whenever the programmed time elapses, the CPU immediately suspends its routine scan cycle and jumps to the selected interrupt subroutine. As with the other modes, when the interrupt subroutine execution is complete, the CPU automatically resumes its routine scan cycle starting from the location where it was interrupted. Because the CPU scan time and the interrupt time interval are different, the point at which the RLL program is interrupted can change over time.



DL05 Designated Terminals

X0: ..... Filtered input (uses filter time set for X1)

Timed Interrupt Specifications

Timed interrupts ..... 2 (internal to CPU)
Interrupt Subroutine INT0, INT1
Time interval .....
INT0 ..... 5 to 999ms (1ms increments)
INT1 ..... 5 to 9999ms (1ms increments)

DL06 Designated Terminals

X0: ..... Filtered input (uses filter time set for X1)

Timed Interrupt Specifications

Timed interrupts ..... 1 (internal to CPU)
Interrupt subroutine INT0
Time interval .....
INT0 ..... 5 to 999ms (1ms increments)

INSTRUCTION SET

Boolean Instructions

Store (STR)
Begins a new rung or an additional branch in a rung with a normally open contact.

Store Not (STRN)
Begins a new rung or an additional branch in a rung with a normally closed contact.

Store Bit-of-Word (STRB)
DL06 Only. Begins a new wrung or an additional branch in a rung with a normally open contact.

Store Not Bit-of-Word (STRNB)
DL06 Only. Begins a new wrung or an additional branch in a rung with a normally closed contact.

Or (OR)
Logically ors a normally open contact in parallel with another contact in a rung.

Or Not (ORN)
Logically ors a normally closed contact in parallel with another contact in a rung.

Or Bit-of-Word (ORB)
DL06 Only. ors a normally open contact in parallel with another contact in a rung.

Or Not Bit-of-Word (ORNB)
DL06 Only. ors a normally closed contact in parallel with another contact in a rung.

And (AND)
Logically ands a normally open contact in series with another contact in a rung.

And Not (ANDN)
Logically ands a normally closed contact in series with another contact in a rung

And Bit-of-Word (ANDB)
DL06 Only. andss a normally closed contact in series with another contact in a rung.

And Not Bit-of-Word (ANDNB)
DL06 Only. ands a normally open contact in series with another contact in a rung.

And Store (ANDSTR)
Logically ands two branches of a rung in series.

Or Store (ORSTR)
Logically ors two branches of a rung in parallel.

Out (OUT)
Reflects the status of the rung (on/off) and outputs the discrete (on/off) state to the specified image register point or memory location.

Or Out(OROUT)
Reflects the status of the rung and outputs the discrete (ON/OFF) state to the image register. Multiple OR OUT instructions referencing the same discrete point can be used in the program.

Out Bit-of-Word (OUTB)
DL06 Only. Reflects status of the rung (on/off) and outputs the discrete (on/off) state to the specified bit in the referenced memory location.

Not (NOT)
Inverts the status of the rung at the point of the instruction.

Positive differential (PD)
One-shot output coil. When the input logic produces an off to on transition, the output will energize for one CPU scan.

Store Positive Differential (STRPD)
Leading edge triggered one-shot contact. When the corresponding memory location transitions from low to high, the contact comes on for one CPU scan.

Store Negative Differential (STRND)
Trailing edge triggered one-shot contact. When the corresponding memory location transitions from high to low, the contact comes on for one CPU scan.

Or Positive Differential (ORPD)
Logically ors a leading edge triggered one-shot contact in parallel with another contact in a rung.

Or Negative Differential (ORND)
Logically ors a trailing edge triggered one-shot contact in parallel with another contact in a rung.

And Positive Differential (ANDPD)
Logically ands a leading edge triggered one-shot contact in series with another contact in a rung.

And Negative Differential (ANDND)
Logically ands a trailing edge triggered one-shot contact in series with another contact in a rung.

Set (SET)
An output that turns on a point or a range of points. The reset instruction is used to turn the point(s) OFF that were set ON with the set instruction.

Reset (RST)
An output that resets a point or a range of points.

Set Bit-of-Word (SETB)
DL06 Only. Sets or turns on a bit in a V memory location.

Reset Bit-of-Word (RSTB)
DL06 Only. Resets or turns off a bit in a V memory location.

Pause outputs (PAUSE)
Disables the update for a range of specified output points.

Comparative Boolean Instructions

Store if Equal (STRE)
Begins a new rung or additional branch in a rung with a normally open comparative contact. The contact will be on when A = B.

Store if Not Equal (STRNE)
Begins a new rung or additional branch in a rung with a normally closed comparative contact. The contact will be on when A is not equal to B.

Or if Equal (ORE)
Connects a normally open comparative contact in parallel with another contact. The contact will be on when A = B.

Or if Not Equal (ORNE)
Connects a normally closed comparative contact in parallel with another contact. The contact will be on when A is not equal to B.

And if Equal (ANDE)
Connects a normally open comparative contact in series with another contact. The contact will be on when A = B.

And if Not Equal (ANDNE)
Connects a normally closed comparative contact in series with another contact. The contact will be on when A is not equal to B.

Store (STR)
Begins a new rung or additional branch in a rung with a normally open comparative contact. The will be on when A ≥ B.

Store Not (STRN)
Begins a new rung or additional branch in a rung with a normally closed comparative contact. The will be on when A > B.

Or (OR)
connects a normally open comparative contact in parallel with another contact. The contact will be on when A ≥ B.

Or Not (ORN)
connects a normally open comparative contact in parallel with another contact. The contact will be on when A < B.

And (AND)
Connects a normally open comparative contact in series with another contact. The contact will be on when A ≥ B.

And Not < (ANDN)
Connects a normally closed comparative contact in parallel with another contact. The contact will be on when A < B.

Immediate Instructions

Store Immediate (STRI)
Begins a rung/branch of logic with a normally open contact. The contact will be updated with the current input field status when processed in the program scan.

Store Not Immediate (STRNI)
Begins a rung/branch of logic with a normally closed contact. The contact will be updated with the current input field status when processed in the program scan.

Or Immediate (ORI)
Connects a normally open contact in parallel with another contact. The contact will be updated with the current input field status when processed in the program scan.

Or Not Immediate (ORNI)
Connects a normally closed contact in parallel with another contact. The contact will be updated with the current input field status when processed in the program scan.

And Immediate (ANDI)
Connects a normally open contact in series with another contact. The contact will be updated with the current input field status when processed in the program scan.

And Not Immediate (ANDNI)
Connects a normally closed contact in series with another contact. The contact will be updated with the current input field status when processed in the program scan.

Out Immediate (OUTI)
Reflects the status of the rung. The output field device status is updated when the instruction is processed in the program scan.

Or Out Immediate (OROUTI)
Reflects the status of the rung and outputs the discrete (ON/OFF) state to the image register. Multiple OR OUT instructions referencing the same discrete point can be used in the program. The output field device status is updated when the instruction is processed in the program scan.

Set Immediate (SETI)
An output that turns on a point or a range of points. The reset instruction is used to turn the point(s) off that were set. The output field device status is updated when the instruction is processed in the program scan.

Reset Immediate (RSTI)
an output that resets a point or a range of points. The output field device status is updated when the instruction is processed in the program scan.

Load Immediate (LDI)
DL06 Only. Loads the accumulator with the contents of a specified 16-bit V-memory location. The status for each bit of the specified V-memory location is loaded into the accumulator. Typically used for input module V-memory addresses. Allows you to specify the V-location instead of the X location and the number of points as with the LDIF.

Load Immediate Formatted (LDIF)
DL06 Only. Loads the accumulator with a specified number of consecutive inputs. The field device status for the specified inputs points is loaded into the accumulator when the instruction is executed

Out Immediate Formatted (OUTIF)
DL06 Only. Outputs the contents of the accumulator to a specified number of consecutive outputs The output field devices are updated when the instruction is processed by the program scan.

Timer, Counter, and Shift Register Instructions

Timer (TMR)
Single input incrementing timer with 0.1 second resolution (0-999.9 seconds)

Fast Timer (TMRF)
Single input incrementing timer with 0.01 second resolution (0-99.99 seconds)

Accumulating Timer (TMRA)
Two input incrementing timer with 0.1 second resolution (0-9,999,999.9 sec.). Time and enable/reset inputs control the timer.

Accumulating Fast Timer (TMRAF)
Two input incrementing timer with 0.1 second resolution (0-99,999.9 sec.). Time and enable/reset inputs control the timer

Counter (CNT)
Two input incrementing counter (0-9999). Count and reset inputs control the counter.

Stage Counter (SGCNT)
Single input incrementing counter (0-9999) RST instruction must be used to reset count.

Up Down Counter (UDC)
Three input counter (0-99,999,999). Up, down and reset inputs control the counter.

Shift Register (SR)
Shifts data through a range of control relays with each clock pulse.The data clock and reset inputs control the shift register.

Accumulator/Stack Load and Output Data

Load (LD)
Loads a 16-bit word into the lower 16 bits of the cumulator/stack.

Load Double (LDD)
Loads a 32-bit word into the accumulator/stack.

Load Real Number (LDR)
DL06 Only. Loads a real number contained in two consecutive V-memory locations into the accumulator.

Load Formatted (LDF)
Loads the accumulator with a specified number of consecutive discrete memory bits.

Load Address (LDA)
Loads the accumulator with the HEX value for an octal constant (address).

Load Accumulator Indexed (LDX)
Specifies a source address (V memory) which will be offset by the value in the first stack location.

Out (OUT)
Copies the value in the lower 16 bits of the accumulator to a specified V memory location.

Out Double (OUTD)
Copies the value in the accumulator to two consecutive V memory locations.

Out Formatted (OUTF)
Outputs a specified number of bits (1-32) from the accumulator to the specified discrete memory locations.

Pop (POP)
Moves the value from the first level of the accumulator stack to the accumulator and shifts each value in the stack up one level.

Out Least (OUTL)
DL06 Only. Copies the value in the lower 8-bits of the accumulator to the lower 8-bits of a specified V-memory location

Out Most (OUTM)
DL06 Only. Copies the value in the upper 8-bits of the lower accumulator word (1st 16 bits) to the upper 8 bits of a specified V-memory location

Output indexed (OUTX)
DL06 Only. Copies a 16-bit value from the first level of the accumulator stack to a source address offset by the value in the accumulator

Logical Instructions (Accumulator)

And (AND)
Logically ands the lower 16 bits in the accumulator with a V memory location.

And Double (ANDD)
Logically ands the value in the accumulator with an 8-digit constant or a value in two consecutive V-memory locations.

And Formatted (ANDF)
DL06 Only. Logically ands the value in the accumulator and a specified range of discrete memory bits (1-32)

And with stack (ANDS)
DL06 Only. logically ands the value in the accumulator with the first value in the accumulator stack

Or (OR)
Logically ors the lower 16 bits in the accumulator with a V memory location.

Or Double (ORD)
Logically ors the value in the accumulator with an 8-digit constant or a value in two consecutive V-memory locations.

Or Formatted (ORF)
DL06 Only. Logically ors the value in the accumulator with a range of discrete bits (1-32)

Or with Stack (ORS)
DL06 Only. Logically ors the value in the accumulator with the first value in the accumulator stack

Exclusive Or (XOR)
Performs an Exclusive Or of the value in the lower 16 bits of the accumulator and a V-memory location.

Exclusive Or Double (XORD)
Performs an Exclusive Or of the value in the accumulator and an 8-digit constant or a value in two consecutive V-memory locations.

Exclusive Or Formatted (XORF)
DL06 Only. Performs an exclusive or of the value in the accumulator and a range of discrete bits (1-32)

Exclusive Or with Stack (XORS)
DL06 Only. Performs an exclusive or of the value in the accumulator and the first accumulator stack location

Compare (CMP)
Compares the value in the lower 16 bits of the accumulator with a V memory location.

Compare Double (CMPD)
Compares the value in the accumulator with two consecutive V memory locations or an 8-digit constant.

Compare Formatted (CMPF)
DL06 Only. Compares the value in the accumulator with a specified number of discrete locations (1-32)

Compare with Stack (CMPS)
DL06 Only. Compares the value in the accumulator with the first accumulator stack location

Compare Real Number (CMPR)
DL06 Only. Compares the real number in the accumulator with two consecutive V-memory locations or a real number constant.

Instruction Set

Math Instructions (Accumulator)

Add (ADD)
Adds a BCD value in the lower 16 bits in the accumulator with a V memory location. The result resides in the accumulator.

Add Double (ADDD)
Adds a BCD value in the accumulator with two consecutive V memory locations or an 8-digit constant. The result resides in the accumulator.

Add Real Number (ADDR)
DL06 Only. Adds a real number in the accumulator with a real number constant or a real number contained in two consecutive V-memory locations. The result resides in the accumlator.

Subtract (SUB)
Subtract a BCD value, which is either a V memory location or a 4-digit constant from the lower 16 bits in the accumulator. The result resides in the accumulator.

Subtract Double (SUBD)
Subtracts a BCD value, which is either two consecutive V memory locations or an 8-bit constant, from a value in the accumulator. The result resides in the accumulator.

Subtract Real Number (SUBR)
DL06 Only. Subtracts a real number, which is either two consecutive V-memory locations or an 8-digit constant, from the real number in the accumulator. The result resides in the accumlator.

Multiply (MUL)
Multiplies a BCD value, which is either a V memory location or a 4-digit constant, by the value in the lower 16 bits in the accumulator. The result resides in the accumulator.

Multiply Double (MULD)
Multiplies a BCD value contained in two consecutive V memory locations by the value in the accumulator. The result resides in the accumulator.

Multiply Real Number (MULR)
DL06 Only. Multiplies a real number, which is either two consecutive V-memory locations or a real number constant, by the real number in the accumulator. The result resides in the accumlator.

Divide (DIV)
Divides a BCD value in the accumulator by a BCD value which is either a V memory location or a 4-digit constant. The result resides in the accumulator.

Divide Double (DIVD)
Divides a BCD value in the accumulator by a BCD value which is either two consecutive V memory locations or a 8-digit constant. The result resides in the accumulator.

Divides Real Number (DIVR)
DL06 Only. Divides a real number in the accumulator by a real number which is either two consecutive V-memory locations or a real number constant. The result resides in the accumlator.

Increment (INC)
Increments a BCD value in a specified V memory location by 1 each time the instruction is executed.

Decrement (DEC)
Decrements a BCD value in a specified V memory location by 1 each time the instruction is executed.

Add Binary (ADDB)
Adds the binary value in the lower 16 bits of the accumulator to a value which is either a V memory location or a 16-bit constant. The result resides in the accumulator.

Add Binary Double (ADDBD)
DL06 Only. Adds the binary value in the accumulator to a value which is either two consecutive V-memory locations or a 32-bit constant. The result resides in the accumulator

Subtract Binary (SUBB)
Subtract a 16-bit binary value, which is either a V memory location or a 16-bit constant, from the lower 16 bits in the accumulator. The result resides in the accumulator.

Subtract Binary Double (SUBBD)
DL06 Only. subtracts a 32-bit binary value, which is either two consecutive V-memory locations or a 32-bit constant, from the value in the accumulator. The result resides in the accumulator

Multiply Binary (MULB)
Multiples a 16-bit binary value, which is either a V memory location or a 16-bit constant, by the lower 16 bits in the accumulator. The result resides in the accumulator.

Divide Binary (DIVB)
Divides the binary value in the lower 16 bits in the accumulator by a value which is either a V memory location or a 16-bit constant. The result resides in the accumulator.

Increment Binary (INCB)
Increments a binary value in a specified V memory location by 1 each time the instruction is executed.

Decrement Binary (DECB)
Decrements a binary value in a specified V memory location by 1 each time the instruction is executed.

Add Formatted (ADDF)
DL06 Only. Adds the BCD value in the accumulator to a value which is a range of discrete bits (1-32). The result resides in the accumulator

Subtract Formatted (SUBF)
DL06 Only. Subtracts a BCD value which is a range of discrete bits (1-32) from the BCD value in the accumulator. The result resides in the accumulator

Multiply Formatted (MULF)
DL06 Only. Multiplies a BCD value in the lower 16-bits in the accumulator by a BCD value which is a range of discrete bits (1-16). The result resides in the accumulator

Divide Formatted (DIVF)
DL06 Only. Divides the BCD value in the lower 16-bits in the accumulator by the BCD value which is a range of discrete bits (1-16). The result resides in the accumulator

Add Top of Stack (ADDS)
DL06 Only. Adds the BCD value in the accumulator with the BCD value in the first level of the accumulator stack. The result resides in the accumulator

Subtract Top of Stack (SUBS)
DL06 Only. Subtracts the BCD value in the first level of the accumulator stack from the BCD value in the accumulator. The result resides in the accumulator

Multiply Top of Stack (MULS)
DL06 Only. Multiplies a 4-digit BCD value in the first level of the accumulator stack by a 4-digit BCD value in the accumulator. The result resides in the accumulator

Divide by Top of Stack (DIVS)
DL06 Only. Divides the 8-digit BCD value in the accumulator by the 4-digit BCD value in the first level of the accumulator by the 4-digit BCD value in the first level of the accumulator stack. The result resides in the accumulator

Add Binary Top of Stack (ADDBS)
DL06 Only. Adds the binary value in the accumulator with the binary value in the first accumulator stack location. The result resides in the accumulator

Subtract Binary Top of Stack (SUBBS)
DL06 Only. Subtracts the binary value in the first level of the accumulator stack from the binary value in the accumulator. The result resides in the accumulator

Multiply Binary Top of Stack (MULBS)
DL06 Only. Multiplies the 16-bit binary value in the first level of the accumulator stack by the 16-bit binary value in the accumulator. The result resides in the accumulator

Divide Binary Top of Stack (DIVBS)
DL06 Only. Divides a value in the accumulator by the binary value in the top location of the stack. The accumulator contains the result

Transcendental Instructions (DL06 only)

Square Root Real (SQRTR)
Takes the square root of the real number stored in the accumulator. The result resides in the accumulator.

Sine Real (SINR)
Takes the sine of the real number stored in the accumulator. The result resides in the accumulator.

Cosine Real (COSR)
Takes the cosine of the real number stored in the accumulator. The result resides in the accumulator.

Tangent Real (TANR)
Takes the tangent of the real number stored in the accumulator. The result resides in the accumulator.

ARC Sine Real (ASINR)
Takes the inverse sine of the real number stored in the accumulator. The result resides in the accumulator.

ARC Cosine Real (ACOSR)
Takes the inverse cosine of the real number stored in the accumulator. The result resides in the accumulator.

ARC Tangent Real (ATANR)
Takes the inverse tangent of the real number stored in the accumulator. The result resides in the accumulator.

Bit Instructions (Accumulator)

Sum (SUM)
Counts the number of bits set to "1" in the accumulator. The HEX result resides in the accumulator..

Shift Left (SHFL)
Shifts the bits in the accumulator a specified number of places to the left.

Shift Right (SHFR)
Shifts the bits in the accumulator a specified number of places to the right.

Rotate Left (ROTL)
Rotates the bits in the accumulator a specified number of places to the left.

Rotate Right (ROTR)
Rotates the bits in the accumulator a specified number of places to the right.

Encode (ENCO)
Encodes the bit position set to 1 in the accumulator, and returns the appropriate binary representation in the accumulator.

Decodes (DECO)
Decodes a 5 bit binary value (0-31) in the accumulator by setting the

Number Conversion Instructions (Accumulator)

Binary (BIN)
Converts the BCD value in the accumulator to the equivalent binary value. The result resides in the accumulator.

Binary Coded Decimal (BCD)
Converts the binary value in the accumulator to the equivalent BCD value. The result resides in the accumulator.

Invert (INV)
Takes the one's complement of the 32-bit value in the accumulator. The result resides in the accumulator.

Ten's Complement (BCDCPL
DL06 Only. Takes the 10's complement (BCD) of the 8-digit accumulator.

ASCII to HEX (ATH)
Converts a table of ASCII values to a table of hexadecimal values.

HEX to ASCII (HTA)
Converts a table of hexadecimal values to a table of ASCII values.

Segment (SEG)
Dl06 Only. Converts four digit HEX value in accumulator to seven segment display format.

Gray Code to BCD (GRAY)
Converts a 16-bit GRAY code value in the accumulator to a corresponding BCD value. The result resides in the accumulator.

Shuffle Digits (SFLDGT)
Shuffles a maximum of 8 digits, rearranging them in a specified order. The result resides in the accumulator.

Radian Real Conversion (RADR)
DL06 Only. Converts the real degree value in the accumulator to the equivalent real number in radians. The result resides in the accumulator

Degree Real Conversion (DEGR)
DL06 Only. Converts the real radian value in the accumulator to the equivalent real member of degrees. The result resides in the accumulator

Binary to Real Number (BTOR)
DL06 Only. Converts the binary value in the accumulator into a real number. The result resides in the accumulator.

Real to Binary (RTOB)
DL06 Only. Converts the real number in the accumulator into a binary value. The result resides in the accumulator.

Table Instructions

Move (MOV)
Moves the values from one V memory table to another V memory table.

Move Memory Cartridge/Load Label (MOVMC/LDLBL)
DL05 Only. Copies data between V memory and program ladder memory.

Set Bit (SETBIT)
DL06 Only. Sets a single bit (to a 0) in a V-memory location.

Reset Bit (RSTBIT)
DL06 Only. Resets a single bit (to a 0) in a V-memory location.

Extended Table Instructions (DL06 only)

Fill (FILL)
Fills a table of specified V-memory locations with a value which is either a V-memory location or a 4-digit constant.

Find (FIND)
Finds a value in a V-memory table and returns the table position containing the value to the accumulator.

Find Greater Than (FDGT)
Finds a value in a V-memory table which is greater than the specified search value. The table position containing the value is returned to the accumulator.

Find Block (FINDB)
Finds a block of data values in a V-memory table and returns the starting address of the table containing the values to the accumulator.

Table to Destination (TTD)
Moves the value form the top of a V-memory table to a specified V-memory location. The table pointer increments each scan.

Remove from Bottom (RFB)
Moves the value from the bottom of a v-memory table to a specified V-memory location. The table pointer increments each scan.

Source To Table (STT)
Moves a value from a specified V-memory location to a V-memory table. The table pointer increments each scan.

Remove from Top (RFT)
Pops a value from the top of a V-memory table and stores it in a specified V-memory location. All other values in the V-memory table are shifted up each time a value is popped from the table.

Add To Top of Table (ATT)
Pushes a value from a specified V-memory location onto the top of a V-memory table. All other values in the V-memory table are shifted down each time a value is pushed onto the table.

Table Shift Left (TSHFL)
Shifts s specified number of bits to the left in a V-memory table.

Table Shift Right (TSHFR)
Shifts a specified number of bits to the right in a V-memory table.

And Move (ANDMOV)
Copies data from a table to the specified location, ANDing each word with the accumulator data as it is written.

Or Move (ORMOV)
Copies data from a table to the specified memory location, ORing each word with the accumulator data as it is written.

Exclusive Or Move (XORMOV)
Copies data from a table to the specified memory location, XORing each word with the accumulator data as it is written.

Swap (SWAP
Exchanges the data in two tables of equal length.

Clock / Calender Instructions

Date (DATE)
Use to set the date in the CPU.

Time (TIME)
Use to set the time in the CPU.

CPU Control Instructions

No Operation (NOP)
Inserts a no operation coil at specified program address.

End (END)
Marks the termination point for the normal program scan. An End instruction is required at the end of the main program body.

Stop (STOP)
Changes the operational mode of the CPU from Run to Program (Stop)

Reset Watchdog Timer (RSTWT)
Resets the CPU watchdog timer.

Program Control Instructions

Goto Label (GOTO) (LBL)
Skips all instructions between the Goto and coresponding LBL instructions.

For/Next (FOR/NEXT)
Executes the logic between the FOR and NEXT instructions a specified number of times.

Goto Subroutine (GTS/SBR/RT/RTC)
When a GTS instruction is executed the program jumps to the SBR (Subroutine). The subroutine is terminated with a RT instruction (unconditional return). When a return is executed, the program continues from the instruction after the calling GTS instruction. The RTC (Subroutine return conditional) instruction is used with an input contact to implement a conditional return from the subroutine.

Master Line Set/Master Line Reset (MLS/MLR)
Allows the program to control sections of ladder logic by forming a new power rail. The MLS marks the beginning of a power rail and the MLR marks the end of the power rail control.

INSTRUCTION SET

Interrupt Instructions

Interrupt Routine/Interrupt Return/Interrupt Return Conditional (INT/IRT/IRTC)
When a hardware or software interrupt occurs, the interrupt routine will be executed. The INT instruction is the beginning of the interrupt routine. The interrupt routine is terminated with an IRT of the interrupt routine. The in interrupt routine is terminated with an IRT instruction (unconditional interrupt return). When a interrupt return is reached the execution of the program continues from the instruction where the program execution was prior to the interrupt.

Enable Interrupt (ENI)
Enables hardware and software interrupts to be acknowledged.

Disable Interrupt (DISI)
Disables hardware and software interrupts from being acknowledged.

Message Instructions

Fault/Data Label (FAULT/DLBL)
Displays a V memory value or a data label constant to the hand-held programmer or personal computer using DirectSOFT.

Numerical Constant/ASCII constant (NCON/ACON)
Stores constants in numerical or ASCII form for use with other instructions.

Print Message (PRINT)
Prints the embedded text or text/data variable message to the specified communications port. Maximum message length is 255 words. appropriate bit position to 1 in the accumulator.

Network Instructions

Read from network (RX)
Reads a block of data from another CPU on the network.

Write to network (WX)
Writes a block of data from the master device to a slave device on the network.

LCD Display Instructions (DL06 only)

LCD
Configures LCD display.

MODBUS Instructions (DL06 only)

MODBUS Read (MRX)
Used CPU port 2 to read a block of data from MODBUS RTU devices on the network.

MODBUS Write (MWX)
Writes a block of data from CPU port 2 to MODBUS RTU devices on the network.

ASCII Instructions (DL06 only)

ASCII IN (AIN)
Configures port 2 to read raw ASCII input strings.

ASCII Find (AFIND)
Searches ASCII strings in V-memory to find a specific portion of the string.

ASCII IN (AEX)
Extracts a specific portion from an ASCII string.

Compare V-memory (CMPV)
Compares two blocks of V-memory.

Swap Bytes (SWAPB)
Swaps V-memory bytes.

Print to V-memory (VPRINT)
Used to send pre-coded ASCII strings to a pre-defined V-memory address when enabled.

Print from V-memory (PRINTV)
Used to write raw ASCII string out of port 2 when enabled.

Drum Instructions

Tuned Drum with Discrete Outputs (DRUM)
Time driven drum with up to 16 steps and 16 discrete output points. Output status is written to the appropriate output during each step. Specify a time base per count (in milliseconds). Each step can have a different number of counts to trigger the transition to the next step. Also define preset step as destination when reset occurs.

Time & Event Drum with Discrete Outputs (EDRUM)
Time and/or event driven drum with up to 16 steps and 16 discrete output points. Output status is written to the appropriate output during each step. Specify a time base per count (in milliseconds). Each step can have a different number of counts and an event to trigger the counting. Once the time has expired, a transition to the next step occurs. Also define preset step as destination when reset occurs.

Time and Event Drum with Discrete Outputs and Output Mask (MDRMD)
DL06 Only. Time and/or event driven drum with up to 16 steps and 16 discrete output points. Actual output status is the result of a bit-by-bit AND between the output mask and bit mask in the step. Specify a time base per count (in milliseconds). Each step can have a different number of counts and an event to trigger the counting. Once the time has expired, a transition to the next step occurs. Also define present step as destination when reset occurs.

Time and Event Drum with Word Output and Output Mask (MDRMW)
DL06 Only. Time and/or event driven drum with up to 16 steps and a single V-memory output location. Actual output word is the result of a bit-by-bit AND between the word mask and the bit mask in the step. Specify a time base per count (in milliseconds). Each step can have a different number of counts and an event to trigger the counting. Once the time has expired, a transition to the next step occurs. Also define preset step as destination when reset occurs.

RLL^{PLUS} Programming Instructions

Initial stage (ISG)
The initial stage instruction is used for a starting point for user application program. The ISG instruction will be active on power up and PROGRAM to RUN transitions.

Stage (SG)
Stage instructions are used to create structured programs. They are program segments which can be activated or deactivated with control logic.

Jump (JMP)
Normally open coil that deactivates the active stage and activates a specified stage when there is power flow to the coil.

Not Jump (NJMP)
Normally closed coil that deactivates the active stage and activates a specified stage when there is power flow to the coil.

Converge Stages (CV)
Converge stages are a group of stages that when all stages are active the associated converge jump(s). (CVJMP)will activate another stage(s). One scan after the CVJMP is executed, the converge stages will be deactivated.

Converge Jump (CVJMP)
Normally open coil that deactivates the active CV stages and activates a specified stage when there is power flow to the coil.

Block Call/Block/Block End (BCALL w/BLK and BEND)
DL06 Only BCALL is a normally open coil that activates a block of stages when there is power flow to the coil. BLK is the label which marks the beginning of a block of stages. Bend is a label used to mark the end of a block of stages