DL105

Micro PLC

What is it?

The DL105 series is a fixed-I/O micro PLC with 10 inputs and eight outputs. Eight configurations are available in combinations of AC, DC and relay I/O, as well as AC or DC powered models.

What's it got?

- 10 inputs and eight outputs
- 2K program memory
- 384 words data memory
- 110/220 VAC or 24 VDC powered models
- Built-in 24 VDC auxiliary power supply for field devices included with AC powered models
- 91-instruction programming, includes time or event-based drum sequencer, timed interrupt, immediate I/O, etc.
- One RS-232C communication port
- DeviceNet slave I/O block models available

What can I do with it?

- Build an electronic drum sequencer with 18 I/O points and connect an operator interface (F1-130AR and EZ-220)
- Drive high-current (up to seven amps) loads with the AC/relay model
- Use the high-speed I/O modes of a DC input or output model to perform counting or positioning tasks

Visit our Web page at http://www.automationdirect.com/dl105 for more information

DeviceNet slaves offer inexpensive I/O nodes

Connect the DeviceNet slaves (F1-DVNET models) to any DeviceNet master for inexpensive nodes of I/O in the following configurations: DC in/Relay out, AC in/Relay out, and DC in/DC out.

It's not the smallest micro, but it will put the biggest smile on your face!

When we first introduced the DL105, no one believed we could offer a micro PLC that had 18 I/O points, higher current capability, and removable I/O connectors, for a very low price. After all, this was and still is the most competitive segment of the PLC market. These features, plus heavy-duty power supply design and built-in surge suppression on the relay outputs, make the DL105 one of the most powerful fixed-I/O units in the market.

AC inputs and AC outputs — a rare find indeed!

Check around and you will find that very few micro PLCs offer AC inputs or AC outputs. Allen-Bradley offers AC in/AC out only in the larger 32 I/O MicroLogix unit. By the way, our AC outputs are rated at an incredible 1.6 A per point! Compare this to the GE Fanuc Series 90 micro, which offers only 0.5 A and 14 I/O points at a whopping . We think you'll pick the DL105.

Big and bad seven amp relays

We used the most powerful relays in a micro and combined them with a design that sheds heat! The DL105 offers eight relay outputs that can support up to 7 A per point. (You can drive all eight outputs at 6 A per point up to 60°C.) Compare this to the typical 2.5 A of other micro PLCs.

Removable connectors

Why do most vendors put removable connectors on their larger PLCs but don't include them on micro PLCs? We know they're an important feature on all PLCs, regardless of size. That's why we didn't skimp on them for our DL105. (Just smiled, didn't you?)

FEATURES AND SPECIFICATIONS

The DL105 micro PLCs contain the CPU, power supply and I/O all in the same housing. If you examine the CPU Specifications table, you'll see that we included many features found in our modular CPUs.

Review the specs

Make sure these features can satisfy the requirements of your application. Since these units are completely self-contained, you cannot expand the system or replace the CPU as you would in a modular system.

System capacity

System capacity is the ability to accommodate a variety of applications. For ladder memory, most Boolean instructions require one word. Some other instructions, such as timers, counters, etc. require two or more words. Our V-memory words are useful for data storage, etc.

Performance

The performance is simply the scan time, which is the amount of time required to read the inputs, solve the RLL program and update the outputs.

Instructions and diagnostics

Make sure the unit offers the instructions you need.

Communications

All DL105 units offer one RS-232 port, capable of 9,600 baud.

Specialty features

For the DC input and/or DC output versions, we also offer several high-speed I/O features.

DeviceNet-ready models are also available to supply low-cost I/O nodes for DeviceNet networks.

AC-powered units

F1-130AA
10 AC inputs, eight AC outputs, 1.7 A/point

F1-130AD
10 AC inputs, eight DC outputs, 1.0 A/point, two outputs can be used as 7 kHz pulse output, 0.5 A/point

F1-130AR
10 AC inputs, eight relay outputs, 7 A/point

F1-130DA
10 DC inputs, four inputs are filtered inputs, can also be configured as a single 5 kHz high-speed counter, interrupt input, or pulse catch input
eight AC outputs, 1.7 A/point

F1-130DD
10 DC inputs, four points are filtered inputs, can also be configured as a single 5 kHz high-speed counter, interrupt input, or pulse catch input
eight DC outputs, 1.0 A/point, 2 outputs can be used as 7 kHz pulse output, 0.5 A/point

F1-130DR
10 DC inputs, four inputs are filtered inputs, can also be configured as a single 5 kHz high-speed counter, interrupt input, or pulse catch input
eight relay outputs, 7 A/point

DC-powered units

F1-130DD-D
10 DC inputs, four inputs can be used as 5 kHz high-speed counter, interrupt inputs, or pulse catch inputs
eight DC outputs, 1.0 A/point, two outputs can be used as 7 kHz pulse output, 0.5 A/point.

F1-130DR-D
10 DC inputs, four inputs can be used as 5 kHz high-speed counter, interrupt inputs, or pulse catch inputs
eight relay outputs, 7 A/point

DeviceNet units

F1-DVNET-AR
10 AC inputs, eight relay outputs, 7 A/point

F1-DVNET-DD
10 DC inputs, eight DC outputs (6 outputs at 1A/point and 2 at 0.5A/point)

F1-DVNET-DR
10 DC inputs, eight relay outputs (outputs 7A/point)

Programming

Handheld programmer.....D2-HPP
*Direct*SOFT Programming for Windows
PC-PGM-105
PC-PGM-BRICK.
PC-PGMSW

Note: Either high-speed input or pulse output can be used, but not in the same configuration.

DL105 CPU Specifications

System capacity

Total memory available (words)	2.4K
Ladder memory (words)	2,048 EEPROM
V-memory (words)	384
User V	256
Non-volatile user V	128
Battery backup	No
Total I/O	18
Inputs	10
Outputs	8
I/O expansion	No

Performance

Contact execution (Boolean)	3.3 µs
Typical scan (1K Boolean)[1]	5-6 ms

Instructions and diagnostics

RLL ladder style	Yes
RLL^{PLUS}/flowchart style (Stages)	Yes/256
Run-time editing	Yes
Variable/fixed scan	Variable
Instructions	91
Control relays	256
Timers	64
Counters	64
Immediate I/O	Yes
Subroutines	No
For/next loops	No
Timed interrupt	Yes
Integer math	Yes
Floating-point math	No
PID	No
Drum sequencers	Yes
Bit of word	No
ASCII print	No
Real-time clock/calendar	No
Internal diagnostics	Yes
Password security	Multi-level
System and user error log	No

Communications

Built-in ports	one, RS-232-C
K-sequence (proprietary protocol)	Yes
DirectNET™	No
MODBUS master/slave	No
ASCII out	No
Baud rate (fixed)	9,600 baud

Specialty features

Filtered inputs	Yes[2]
Interrupt input	Yes[2]
High-speed counter	Yes, 5 kHz[2]
Pulse output	Yes, 7 kHz[2]
Pulse catch input	Yes[2]

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

2- Input features are only available on units with DC inputs. Output features are only available on units with DC outputs.

DL105 Hardware Features

CPU status indicators

RUN .....ON ..... CPU is in RUN mode
.....OFF ..... CPU is in PROGRAM mode
PWR .....ON..... CPU power good
.....OFF ..... CPU power failure
CPU .....ON ..... CPU internal diagnostics has detected an error
.....OFF ..... CPU is OK

Mode control

The DL105 units do not have mode switches like many of our modular CPUs. You can set the unit (using special V-memory locations) so that it will power up in RUN mode.

Communications port

Protocol ..... K-sequence slave
Devices..... Can connect with HPP, *Direct*SOFT, DV-1000, *EZ*Text, and *EZ*Touch Panels
Specs..... 6P6C RJ12 connector
RS-232-C, 9,600 baud,
Odd parity,
Fixed station address (1),
8 data bits (one start,
one stop bit),
Asynchronous, half-duplex, DTE

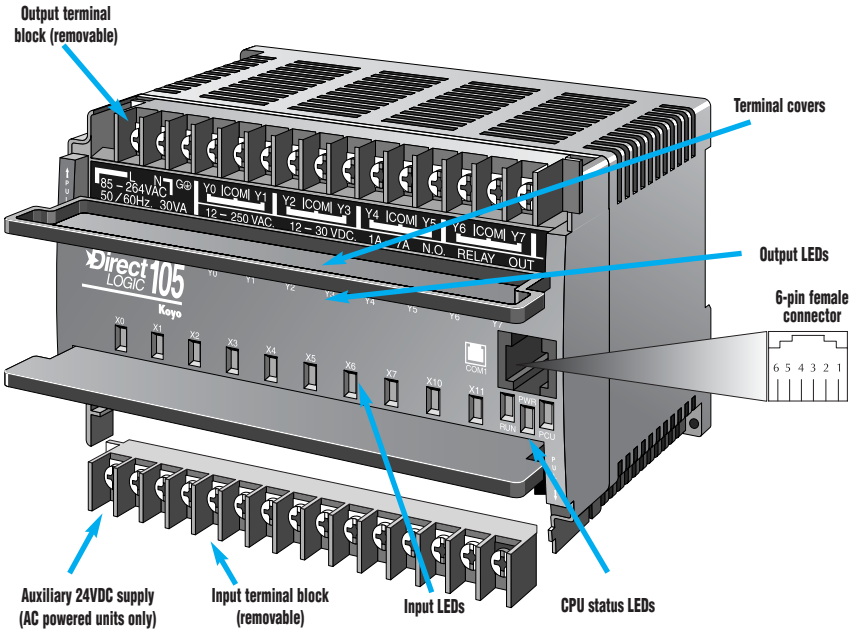
RJ12 Connector Port 1 Pinout

Pin	***Signal***
1	0V
2	5V
3	RS-232 Data in
4	RS-232 Data out
5	5V
6	0V

Fixed EEPROM memory

The DL105 units offer built-in EEPROM memory.

NOTE: Terminals accept 16-24 AWG. For 16 AWG, use type TFFN or Type MTW. Other types of 16 AWG may be acceptable, but it really depends on the thickness of the wire insulation.



Dimensions and Installation

It is important to understand the installation requirements for your DL105 system. This will help ensure that the DL105 products operate within their environmental and electrical limits.

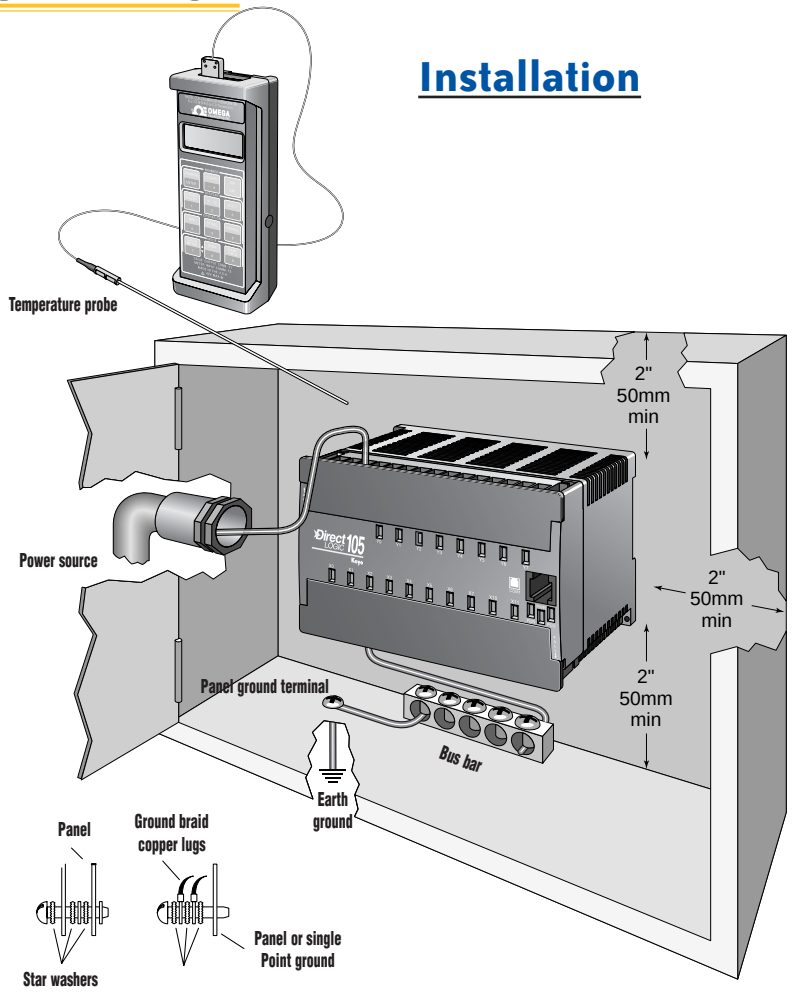
Plan for safety

This desk reference should never be used as a replacement for the user manual. The user manual, D1-USER-M, contains important safety information that must be followed. The system installation should comply with all appropriate electrical codes and standards.

Unit dimensions and mounting orientation

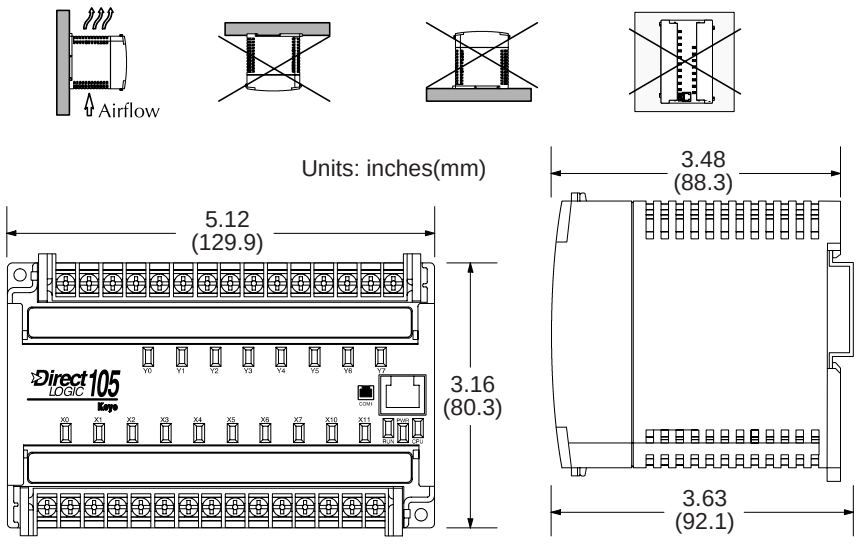
Use the following diagrams to make sure the DL105 system can be installed in your application. DL105 units must be mounted horizontally to ensure proper airflow for cooling purposes. It is important to check these dimensions against the conditions required for your application. For example, it is recommended that you leave 2" depth for ease of access and cable clearance; however, your distance may be greater or less. Also, check the installation guidelines for the recommended cabinet clearances.

Installation



Note: There is a minimum of 2" (50mm) clearance required between the panel door or any devices mounted in the panel door and the nearest DL105 component.

Dimensions and mounting



Environmental Specifications	
Storage Temperature	-4°F to 158°F (-20°C to 70°C)
Ambient Operating Temperature	32°F to 131°F (0° to 55°C)
Ambient Humidity	30% to 95% relative humidity (non-condensing)
Vibration Resistance	MIL STD 810C, Method 514.2
Shock Resistance	MIL STD810, Method 516.2
Noise Immunity	NEMA(ICS3-304)
Atmosphere	No corrosive gases

Power Supply and Type of I/O

Power supply options

This product family offers units that operate on 110/220 VAC and 12/24 VDC. Choosing the power supply is probably the most important consideration when specifying a DL105 system since not all I/O combinations are offered with each power supply option. The table to the right provides the I/O choices and power supply specifications for each type unit.

Power Supply Options		
Specification	***AC Powered Units***	***24 VDC Powered Units***
Part Numbers	F1-130AA, F1-130AR F1-130AD, F1-130DA F1-130DD, F1-130DR F1-DVNET-AR, F1-DEVNET-DD F1-DVNET-DR	F1-130DD-D F1-130DR-D
Voltage Withstand (dielectric)	one minute @ 1,500 VAC between primary, secondary and field ground	
Insulation Resistance	> 10 MΩ @ 500 VDC	
External Power Requirement	85-132 VAC (110 nominal) 170-264 VAC (220 nominal) 100-264 VDC (125 nominal)	10-30 VDC (12 to 24 VDC) with < 10 percent ripple
Auxiliary 24 VDC Output	500 mA max.	Not available
Maximum Inrush Current	12 A	8 A
Maximum Power	30 VA max.	1 A (approx. 10 W)

Choosing the I/O

The DL105 product family offers several different combinations of I/O points. Once you have chosen the power supply option, you need to choose the unit that offers the type of I/O points needed in your application.

Fixed I/O

All DL105 Micro PLCs have "fixed" I/O that is updated on every scan. This means that all units have 10 inputs and eight outputs, regardless of the actual type of points on the units (DC in/Relay out, DC in/DC out, etc.) The DL105 micro PLC is non-expandable, so you cannot add I/O points. If you are concerned about future system expansion, check our new DL06 (36 base I/O expandable to 100 total I/O), or the DL205 micro-modular product family. The DL205 also offers an incredible array of features and flexible I/O arrangements with several different base sizes.

Addresses automatically assigned

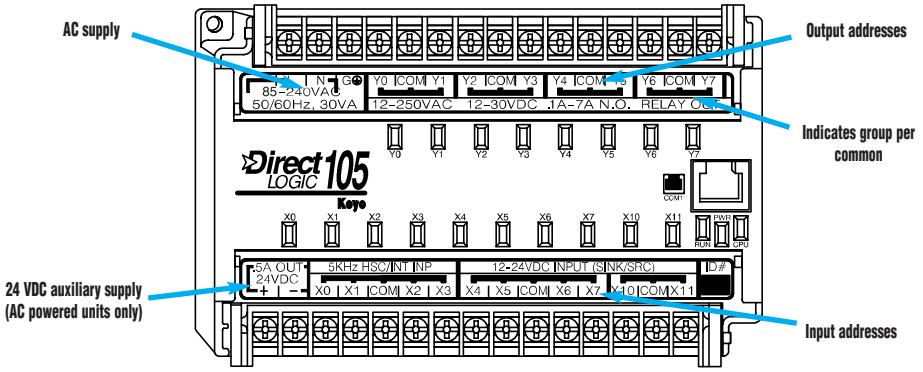
The DL105 uses automatic addressing, so for the vast majority of applications, there is no setup required. We use octal addressing for our products which means there are no 8s or 9s. The first 8 input points use addresses X0-X7, and the last two input points use X10 and X11. If you plan on using the high-speed counting features, there is some very minimal setup required in special V-memory locations.

AC-powered units

Part No.	***I/O Mix***
F1-130AA	10 Ac in, eight AC out
F1-130AD	10 AC in, eight DC out
F1-130AR	10 AC in, eight relay out
F1-130DA	10 DC in, eight AC out
F1-130DD	10 DC in, eight DC out
F1-130DR	10 DC in, eight relay out
F1-DVNET-AR	10 AC in, eight relay out
F1-DVNET-DD	10 DC in, eight DC out
F1-DVNET-DR	10 DC in, eight relay out

DC-powered units

Part No.	***I/O Mix***
F1-130DD-D	10 DC in, eight DC out
F1-130DR-D	10 DC in, eight relay out



DL105 I/O SPECIFICATIONS

F1-130AA

Wiring diagram and specifications

Power requirements

Voltage range ..... 94-240 VAC (30 VA)
..... 100-240 VDC (30 W)

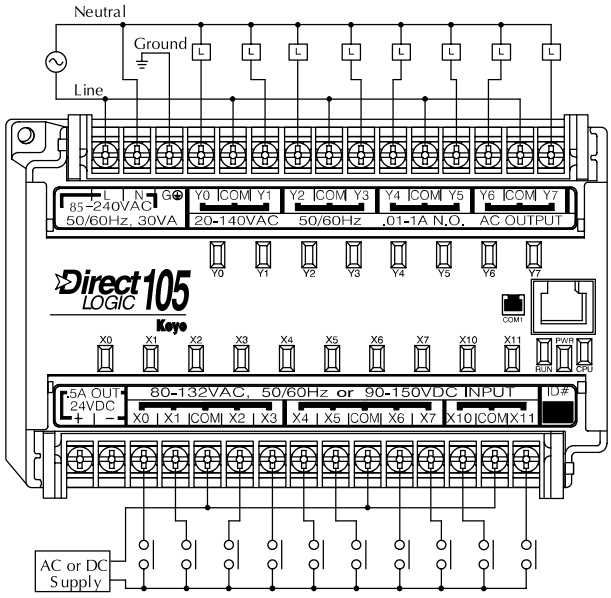
AC input specifications

Number of input points 10
Number of commons ..... 3(isolated)
Input voltage range ..... 80-132 VAC
..... 90-150 VDC
Input current ..... 6 mA @ 132 VAC
..... 6.8 mA @ 150 VDC
ON current/voltage level ..... > 4 mA / 80 VAC
..... > 4 mA / 90 VDC
OFF current/voltage level ..... < 2 mA / 45 VAC
..... < 2 mA / 60 VDC
OFF to ON response ..... < 8 ms
ON to OFF response ..... < 15 ms
Fuses ..... None

AC output specifications

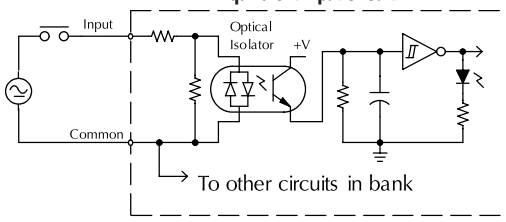
Number of output points 8
Number of commons ..... 4 (isolated)
Output circuitry ..... Triac
Output voltage range ..... 20-140 VAC
..... 47-63 Hz
Peak voltage ..... 400 VAC
ON voltage drop ..... 1.3 VAC at 2 A
Maximum current ..... 1.7 A/point
..... (subject to derating)
Maximum leakage current ..... 1 mA at 400 VAC
Maximum inrush current ..... 30 A for 10 ms
..... 15 A for 100 ms
Minimum load ..... 10 mA
OFF to ON response ..... 8.33 ms @ 60 Hz
..... 10 ms @ 50 Hz
On to OFF response ..... 8.33 ms @ 60 Hz
..... 10 ms @ 50 Hz
Fuses ..... None (external recommended)

Output point wiring

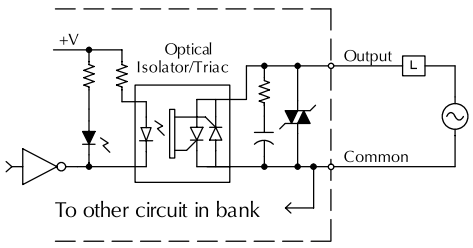


Input point wiring

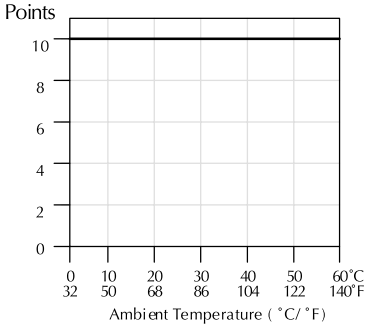
Equivalent input circuit



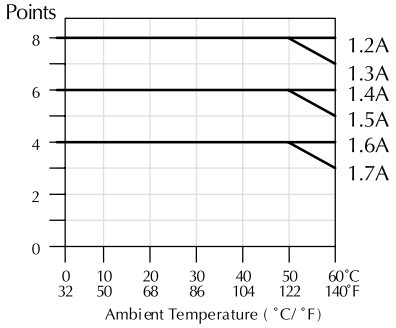
Equivalent output circuit



Derating chart for AC inputs



Derating chart for AC outputs



DL105 I/O Specifications

F1-130AD

Wiring diagram and specifications

Power requirements

Voltage range ..... 94-240 VAC (30 VA)
..... 100-240 VDC (30 W)

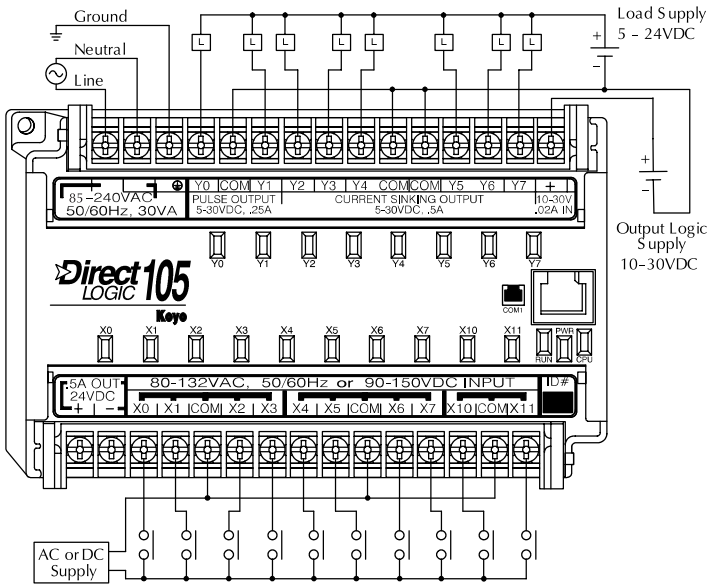
AC input specifications

Number of input points 10
Number of commons ..... 3 (isolated)
Input voltage range ..... 80-132 VAC
..... 90-150 VDC
Input current ..... 6 mA @ 132 VAC
..... 6.8 mA @ 150 VDC
ON current/voltage level ..... > 4 mA / 80 VAC
..... > 4 mA / 90 VDC
OFF current/voltage level ..... < 2 mA / 45 VAC
..... < 2 mA / 60 VDC
OFF to ON response ..... < 8 ms
ON to OFF response ..... < 15 ms
Fuses ..... None

DC output specifications

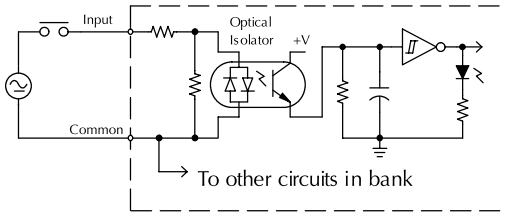
Number of output points ..... 8 (sinking)
Number of commons ..... 3 (internally connected)
Output circuitry ..... MOSFET
Output voltage range ..... 5-30 VDC
Peak voltage ..... 60 VDC
ON voltage drop ..... 0.45 VDC @ 0.5 A
Maximum current ..... 0.5 A/point (Y0-Y1)
..... 1.0 A/point (Y2-Y7)
Maximum leakage current ..... 15 µA at 30 VDC
Maximum inrush current ..... 1.5 A for 10 ms (Y0-Y1)
..... 3 A for 10 ms (Y2-Y7)
..... 0.5 A for 100 ms (Y0-Y1)
..... 1 A for 100 ms (Y2-Y7)
Minimum load ..... None
OFF to ON response ..... Y0-Y1: 10 µs
..... Y2-Y7: 3.5 µs
ON to OFF response ..... Y0-Y1: 70 µs
..... Y2-Y7: 110 µs
External DC power required ..... 10-30 VDC
..... @ 30 mA + load current
Fuses ..... None (external recommended)

Output point wiring

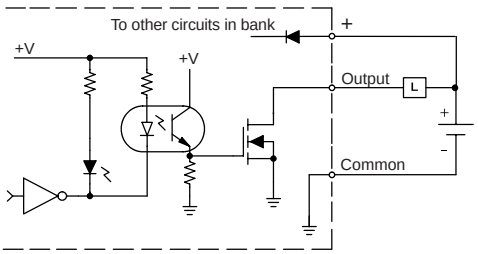


Input point wiring

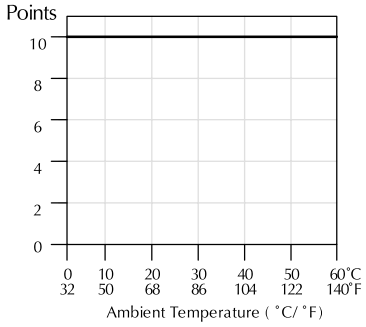
Equivalent input circuit



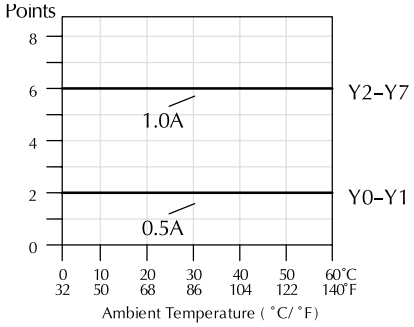
Equivalent output circuit



Derating chart for AC inputs



Derating chart for DC outputs



DL105 I/O SPECIFICATIONS

F1-130AR

Wiring diagram and specifications

Power requirements

Voltage range ..... 94-240 VAC (30 VA)
..... 100-240 VDC (30 W)

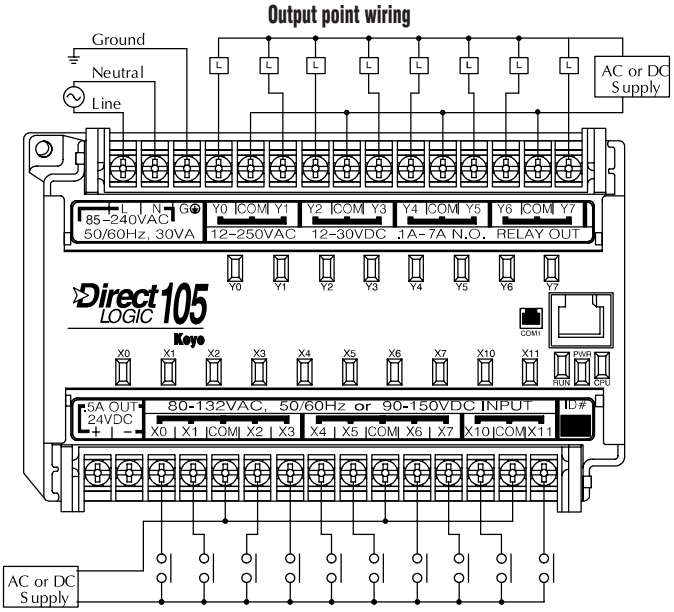
AC input specifications

Number of input points 10
Number of commons ..... 3 (isolated)
Input voltage range ..... 80-132 VAC
..... 90-150 VDC
Input current ..... 6 mA @ 132 VAC
..... 6.8 mA @ 150 VDC
ON current/voltage level ..... > 4 mA / 80 VAC
..... > 4 mA / 90 VDC
OFF current/voltage level ..... < 2 mA / 45 VAC
..... < 2 mA / 60 VDC
OFF to ON response ..... < 8 ms
ON to OFF response ..... < 15 ms
Fuses ..... None

Relay output specifications

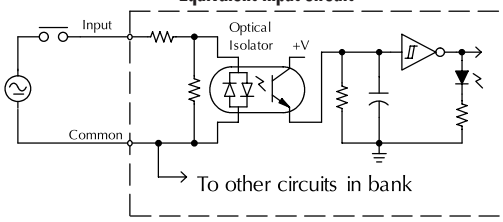
Number of output points 8
Number of commons ..... 4 (isolated)
Output circuitry ..... Relay
Output voltage range ..... 12-250 VAC
..... 12-30 VDC
Maximum voltage ..... 265 VAC, 150 VDC
Maximum current ..... 7 A/point (see derating)
Maximum inrush current ..... 12 A
Minimum load ..... 10 mA
Minimum OFF resistance ..... 100 MΩ @ 500 VDC
OFF to ON response ..... 15 ms
ON to OFF response ..... 5 ms
Fuses ..... None (external recommended)

Output point wiring

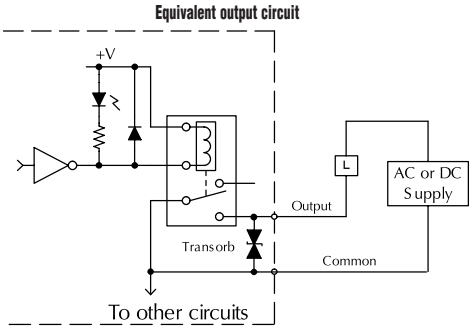


Input point wiring

Equivalent input circuit

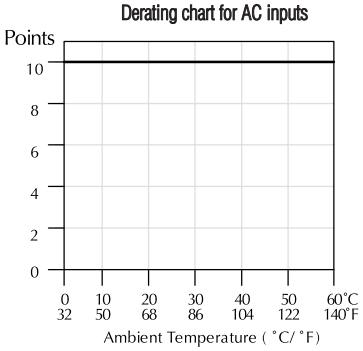


Equivalent output circuit

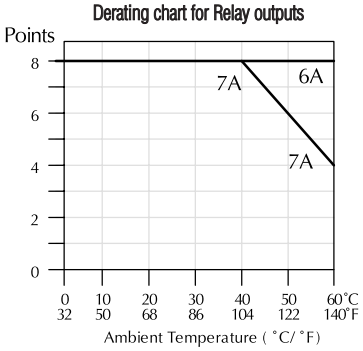


Typical Relay Life (Operations) at Room Temperature			
Voltage and Type of Load	*Load Current*		
	50 mA	*5 A*	*7 A*
24 VDC Resistive	10M	600K	300K
24 VDC Solenoid	—	150K	75K
110 VAC Resistive	—	600K	300K
110 VAC Solenoid	—	500K	200K
220 VAC Resistive	—	300K	150K
220 VAC Solenoid	—	250K	100K

Derating chart for AC inputs



Derating chart for Relay outputs



DL105 I/O Specifications

F1-130DA

Wiring diagram and specifications

Power requirements

Voltage range ..... 94-240 VAC (30 VA)
..... 100-240 VDC (30 W)

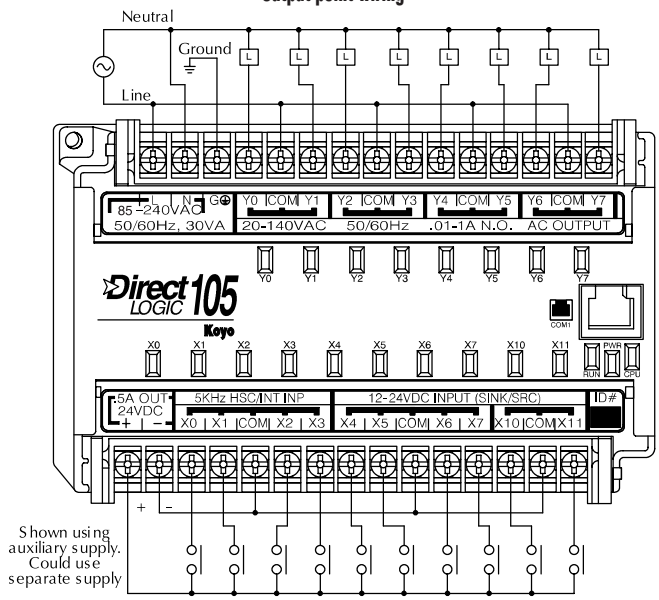
DC input specifications

Number of input points ..... 10 (sink/source)
Number of commons ..... 3 (isolated)
Input voltage range ..... (X0–X3) 10-26.4 VDC
..... (X4-X11) 10-26.4 VDC or
..... 21.6–26.4 VAC
Input impedance ..... 2.8 KΩ @ 12 VDC
..... 2.8 KΩ @ 24 VDC
ON current/voltage level ..... > 3 mA / > 9 VDC
OFF current/voltage level ..... < 0.5 mA / < 2 VDC
Response X0-X3 X4-X11
OFF to ON ..... 50 µs 2-8 ms
ON to OFF ..... 50 µs 2-8 ms
Fuses ..... None

AC output specifications

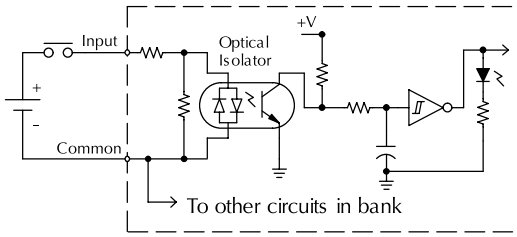
Number of output points 8
Number of commons ..... 4 (isolated)
Output circuitry ..... Triac
Output voltage range ..... 20-140 VAC
..... 47-63 Hz
Peak voltage ..... 400 VAC
ON voltage drop ..... 1.3 VAC @ 2 A
Maximum current ..... 1.7 A/point
..... (subject to derating)
Maximum leakage current ..... 1 mA at 400 VAC
Maximum inrush current ..... 30 A for 10 ms
..... 15 A for 100 ms
Minimum load ..... 10 mA
OFF to ON response ..... Y0-Y7: 8.33 ms @ 60 Hz
..... Y2-Y7: 10 ms @ 50 Hz
ON to OFF response ..... Y0-Y7: 8.33 ms @ 60 Hz
..... Y2-Y7: 10 ms @ 50 Hz
Fuses ..... None (external recommended)

Output point wiring

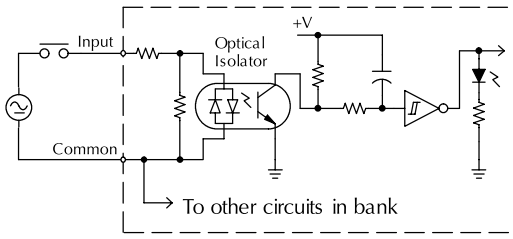


Input point wiring

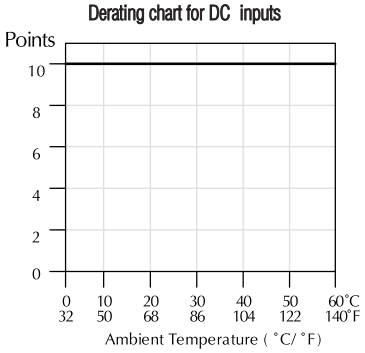
Equivalent circuit high-speed inputs (X0-X3)



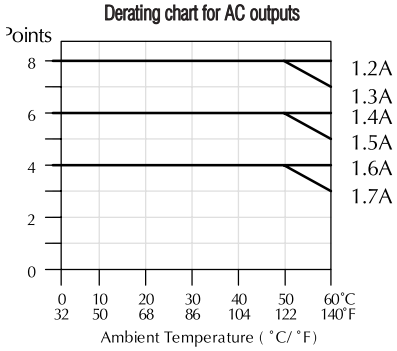
Equivalent circuit standard inputs (X4-X11)



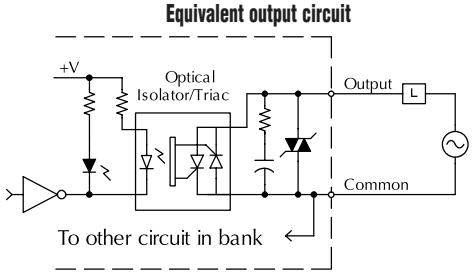
Derating chart for DC inputs



Derating chart for AC outputs



Equivalent output circuit



DL105 I/O SPECIFICATIONS

F1-130DD

Wiring diagram and specifications

Power requirements

Voltage range ..... 94-240 VAC (30 VA)
..... 100-240 VDC (30 W)

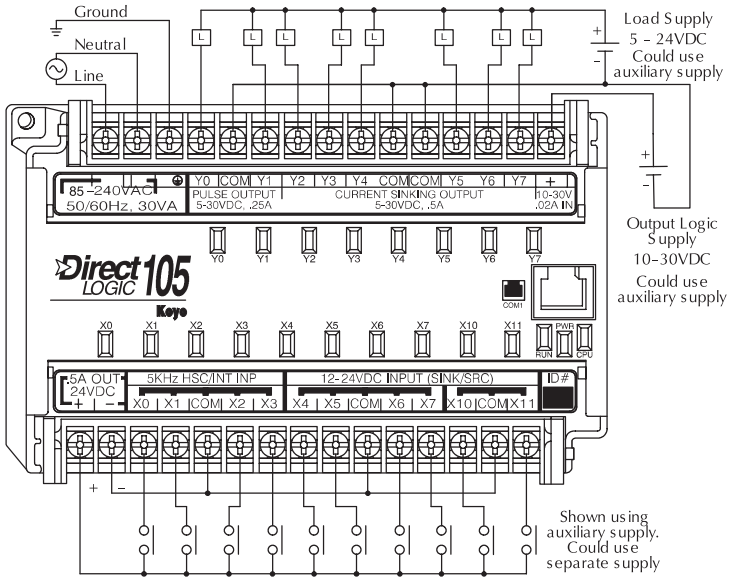
DC input specifications

Number of input points ..... 10 (sink/source)
Number of commons ..... 3 (isolated)
Input voltage range ..... (X0–X3) 10-26.4 VDC
..... (X4-X11) 10-26.4 VDC or
..... 21.6–26.4 VAC
Input impedance ..... 2.8 KΩ @ 12-24 VDC
ON current/voltage level ..... > 3 mA / > 9 VDC
OFF current/voltage level ..... < 0.5 mA / < 2 VDC
OFF to ON response ..... X0-X3: 50 µs
..... X4-X11: 2-8 ms
ON to OFF response ..... X0-X3: 50 µs
..... X4-X11: 2-8 ms
Fuses ..... None

DC output specification

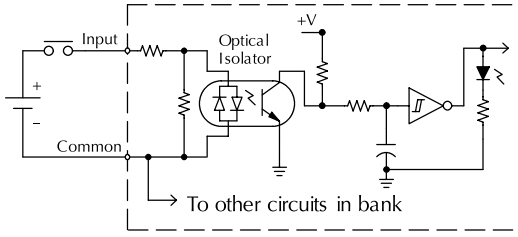
Number of output points ..... 8 (sinking)
Number of commons ..... 3 (internally connected)
Output circuitry ..... MOSFET
Output voltage range ..... 5-30 VDC
Peak voltage ..... 60 VDC
ON voltage drop ..... 0.4 VDC @ 0.5 A
Maximum current ..... 0.5 A /point (Y0-Y1)
..... 1.0 A /point (Y2-Y7)
Maximum leakage current ..... 15 µA at 30 VDC
Maximum inrush current .....
..... Y0-Y1: 1.5 A for 10 ms, 0.5 A for 100 ms
..... Y2-Y7: 3 A for 10 ms, 1 A for 100 ms
Minimum load ..... None
OFF to ON response ..... Y0-Y1: 10 µs
..... Y2-Y7: 3.5 µs
ON to OFF response ..... Y0-Y1: 70 µs
..... Y2-Y7: 110 µs
External DC power required ..... 10-30 VDC,
..... @ 30 mA + load current
Fuses ..... None (external recommended)

Output point wiring

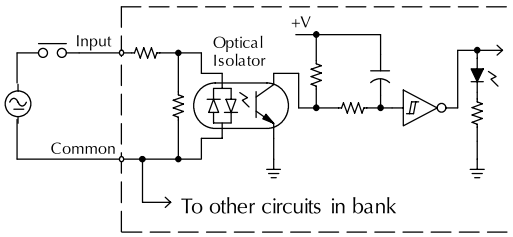


Input point wiring

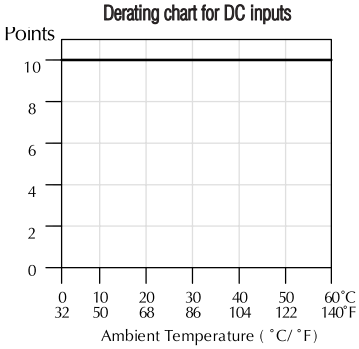
Equivalent circuit high-speed inputs (X0-X3)



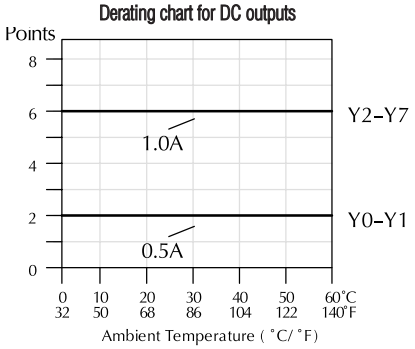
Equivalent circuit standard inputs (X4-X11)



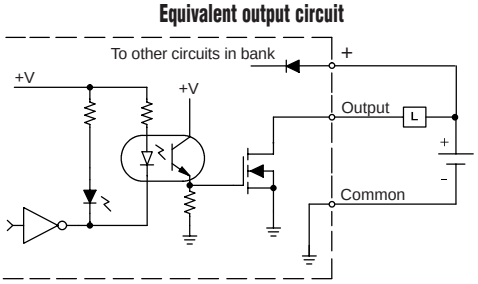
Derating chart for DC inputs



Derating chart for DC outputs



Equivalent output circuit



DL105 I/O Specifications

F1-130DR

Wiring diagram and specifications

Power requirements

Voltage range ..... 94-240 VAC (30 VA)
..... 100-240 VDC (30 W)

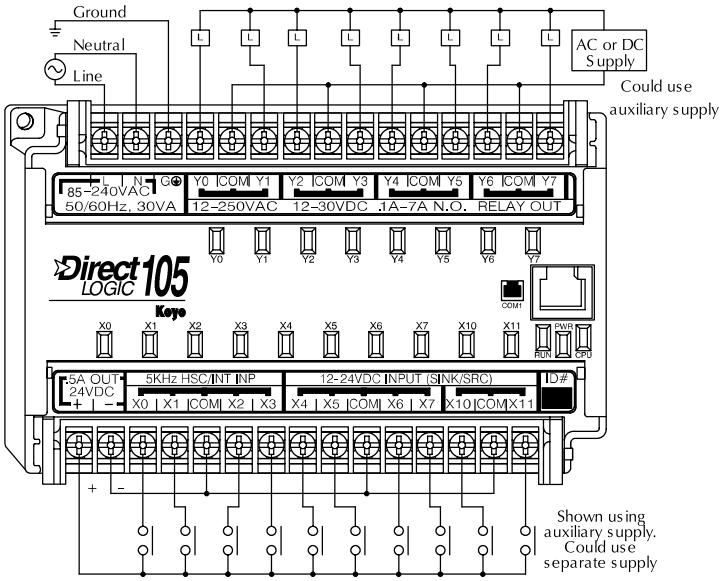
DC input specifications

Number of input points ..... 10 (sink/source)
Number of commons ..... 3 (isolated)
Input voltage range ..... (X0–X3):10-26.4 VDC
..... (X4-X11):10-26.4 VDC or
..... 21.6–26.4 VAC
Input impedance ..... 2.8 KΩ @ 12-24 VDC
ON current/voltage level ..... > 3 mA / > 9 VDC
OFF current/voltage level ..... < 0.5 mA / < 2 VDC
OFF to ON response ..... X0-X3: 50 µs
..... X4-X11: 2-8 ms
ON to OFF response ..... X0-X3: 50 µs
..... X4-X11: 2-8 ms
Fuses ..... None

Relay output specifications

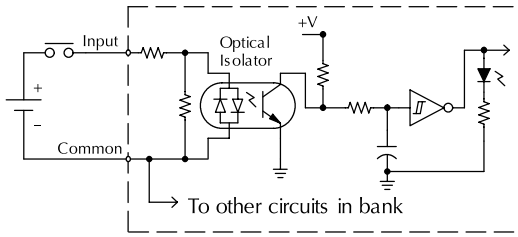
Number of output points 8
Number of commons ..... 4 (isolated)
Output circuitry ..... Relay
Output voltage range ..... 12-250 VAC
..... 12-30 VDC
Maximum voltage ..... 265 VAC, 150 VDC
Maximum current ..... 7 A/point (see derating)
Maximum inrush current ..... 12 A
Minimum load ..... 10 mA
Minimum OFF resistance ..... 100 MΩ @ 500 VDC
OFF to ON response ..... 15 ms
ON to OFF response ..... 5 ms
Fuses ..... None (external recommended)

Output point wiring

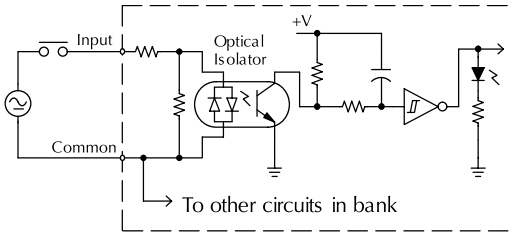


Input point wiring

Equivalent circuit high-speed inputs (X0-X3)



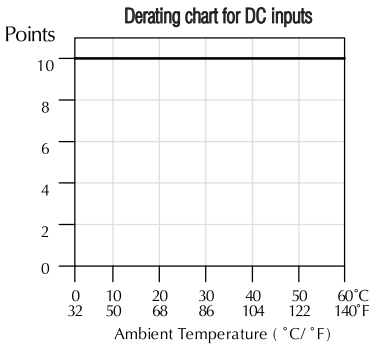
Equivalent circuit standard inputs (X4-X11)



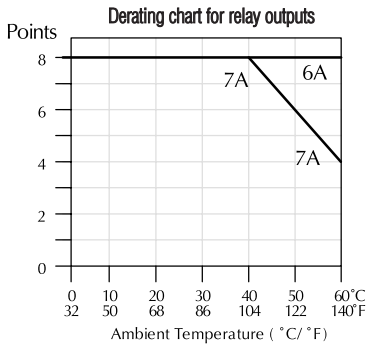
Typical Relay Life (Operations) at Room Temperature

Voltage and Type of Load	Load Current		
	50 mA	5 A	7 A
24 VDC Resistive	10M	600K	300K
24 VDC Solenoid	—	150K	75K
110 VAC Resistive	—	600K	300K
110 VAC Solenoid	—	500K	200K
220 VAC Resistive	—	300K	150K
220 VAC Solenoid	—	250K	100K

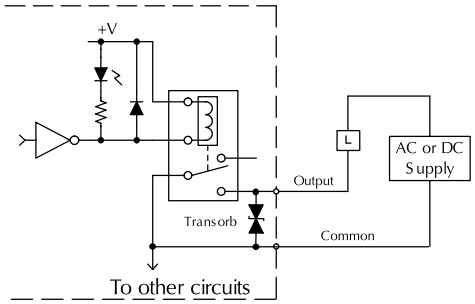
Derating chart for DC inputs



Derating chart for relay outputs



Equivalent output circuit



DL105 I/O SPECIFICATIONS

F1-130DD-D

Wiring diagram and specifications

Power requirements

Voltage range ..... 10-30 VDC
..... 10 W max.

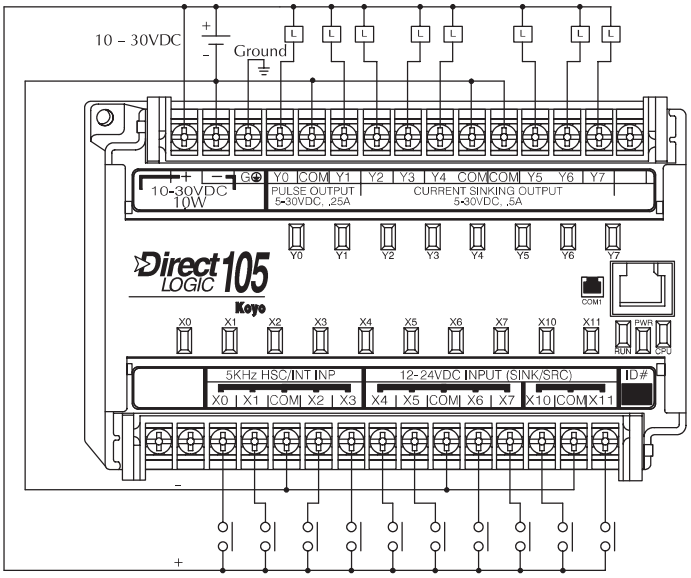
DC input specifications

Number of input points ..... 10 (sink/source)
Number of commons ..... 3 (isolated)
Input voltage range ..... (X0–X3): 10-26.4 VDC
..... (X4-X11): 10-26.4 VDC or
..... 21.6–26.4 VAC
Input impedance ..... 2.8 KΩ @ 12-24 VDC
ON current/voltage level ..... > 3 mA / > 9 VDC
OFF current/voltage level ..... < 0.5 mA / < 2 VDC
OFF to ON response ..... X0-X3: 50 µs
..... X4-X11: 2-8 ms
ON to OFF response ..... X0-X3: 50 µs
..... X4-X11: 2-8 ms
Fuses ..... None

DC output specifications

Number of output points ..... 8 (sinking)
Number of commons ..... 3 (internally connected)
Output circuitry ..... MOSFET
Output voltage range ..... 5-30 VDC
Peak voltage ..... 60 VDC
ON voltage drop ..... 0.4 VDC @ 0.5 A
Maximum current ..... Y0-Y1: 0.5 A/point
..... Y2-Y7: 1.0 A/point
Maximum leakage current ..... 15 µA at 30 VDC
Maximum inrush current ..... Y0-Y1: 1.5 A for 10 ms
..... 0.5 A for 100 ms
..... Y2-Y7: 3 A for 10 ms
..... 1 A for 100 ms
Minimum load ..... None
OFF to ON response ..... Y0-Y1: 10 µs
..... Y2-Y7: 3.5 µs
ON to OFF response ..... Y0-Y1: 70 µs
..... Y2-Y7: 110 µs
Fuses ..... None (external recommended)

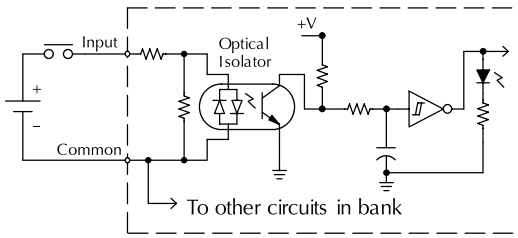
Output point wiring



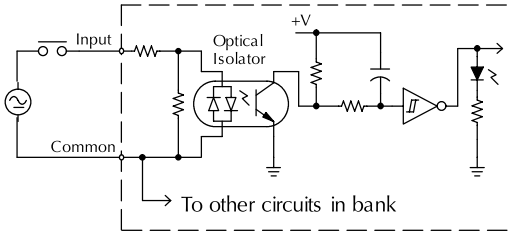
Input point wiring

Note: Same supply can be used to power both input and output circuits because all circuits are isolated from the internal logic.

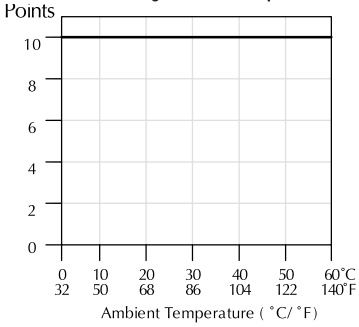
Equivalent circuit high-speed inputs (X0-X3)



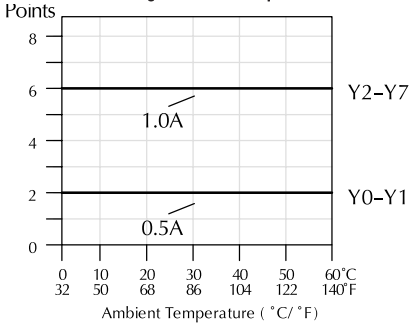
Equivalent circuit standard inputs (X4-X11)



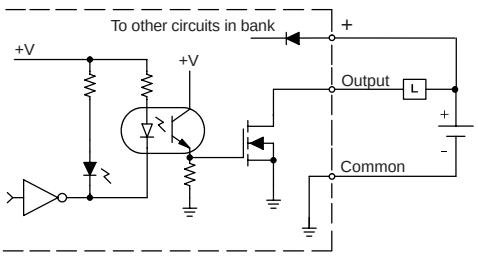
Derating chart for DC inputs



Derating chart for DC outputs



Equivalent output circuit



DL105 I/O Specifications

F1-130DR-D

Wiring diagram and specifications

DC power supply specifications

Voltage range ..... 10-30 VDC
..... 10 W max.

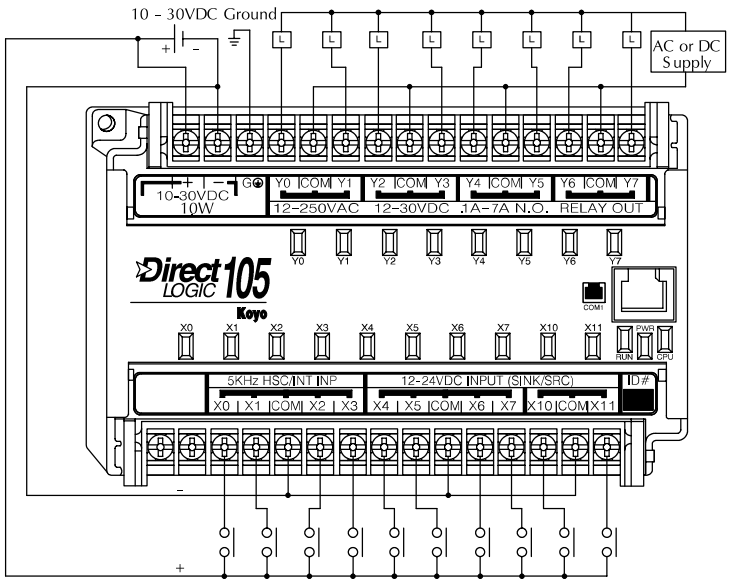
DC input specifications

Number of input points..... 10 (sink/source)
Number of commons ..... 3 (isolated)
Input voltage range..... X0–X3: 10-26.4 VDC
..... X4-X11: 10-26.4 VDC or
..... 21.6–26.4 VAC
Input impedance..... 2.8 KΩ @ 12-24 VDC
ON current/voltage level..... > 3 mA / > 9 VDC
OFF current/voltage level ..... < 0.5 mA / < 2 VDC
OFF to ON response ..... X0-X3: 50 µs
..... X4-X11: 2-8 ms
ON to OFF response ..... X0-X3: 50 µs
..... X4-X11: 2-8 ms
Fuses..... None

Relay output specifications

Number of output points 8
Number of commons ..... 4 (isolated)
Output circuitry ..... Relay
Output voltage range ..... 12-250 VAC
..... 12-30 VDC
Maximum voltage ..... 265 VAC, 150 VDC
Maximum current ..... 7 A/point (See derating)
Maximum inrush current ..... 12 A
Minimum load ..... 10 mA
Minimum OFF resistance ..... 100 MΩ @ 500 VDC
OFF to ON response ..... 15 ms
ON to OFF response ..... 5 ms
Fuses ..... None (external recommended)

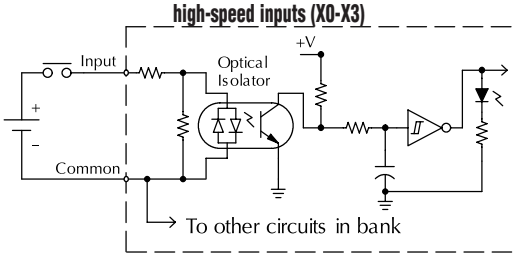
Output point wiring



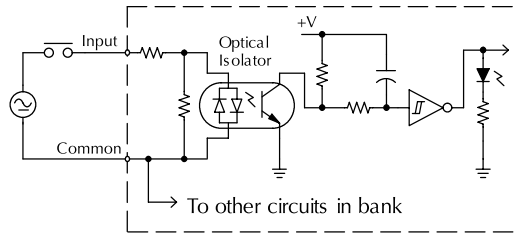
Input point wiring

Note: Same supply can be used to power both input and output circuits because all circuits are isolated from the internal logic.

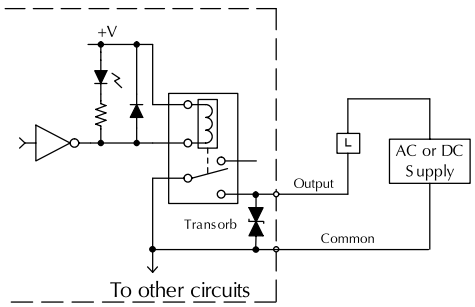
Equivalent circuit high-speed inputs (X0-X3)



Equivalent circuit standard inputs (X4-X11)

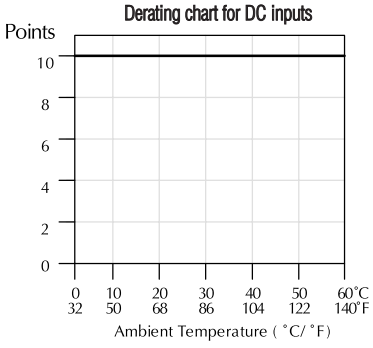


Equivalent output circuit

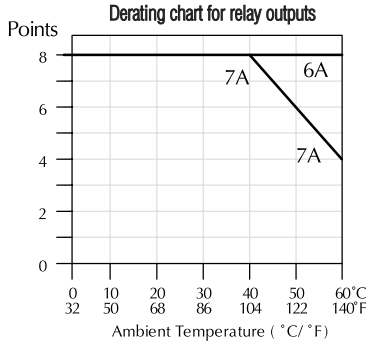


Typical Relay Life (Operations) at Room Temperature			
Voltage and Type of Load	***Load Current***		
	50 mA	***5 A***	***7 A***
24 VDC Resistive	10M	600K	300K
24 VDC Solenoid	—	150K	75K
110 VAC Resistive	—	600K	300K
110 VAC Solenoid	—	500K	200K
220 VAC Resistive	—	300K	150K
220 VAC Solenoid	—	250K	100K

Derating chart for DC inputs



Derating chart for relay outputs



DeviceNet Slave I/O Specifications

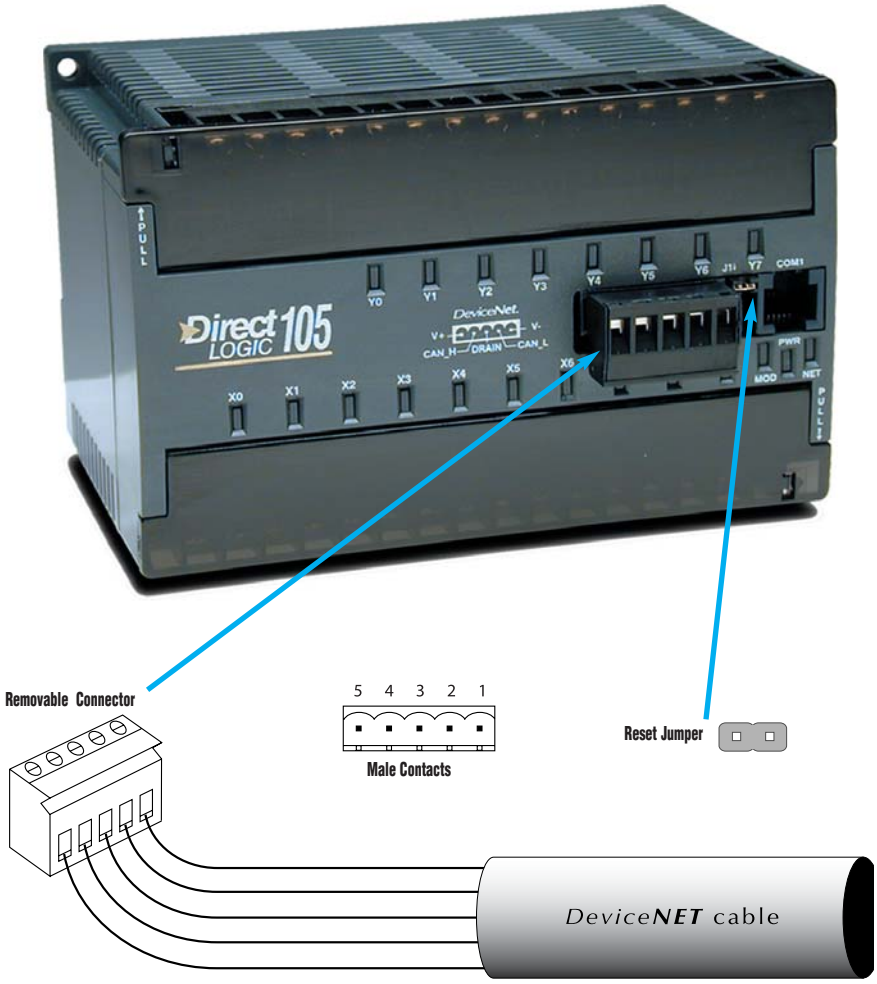
DL105 DeviceNet slave

The DL105 DeviceNet slave allows you to distribute the same I/O found on the DL105 PLCs across your DeviceNet control system. DeviceNet is designed to reduce the need for hardwiring while providing device-level diagnostics. This industrial protocol links up to 64 nodes on a single network.

All F1-DVNET models have a removable connector that makes the five-wire DeviceNet connection easy to implement and maintain. The DeviceNet units incorporate advanced diagnostics not commonly found on traditional industrial networks. This unit has the quick response time and high dependability expected of any DeviceNet product.

The F1-DVNET slaves have the same I/O configurations and specifications as their DL105 counterparts. The F1-DVNET units also support polling and explicit messaging.

DL105 DeviceNet Slaves	
F1-DVNET-AR	10 AC inputs; eight relay outputs
F1-DVNET-DD	10 DC inputs; eight DC outputs
F1-DVNET-DR	10 DC inputs; eight relay outputs



Trunk Length		Bits per Sec	Branch Length	
Feet	*Meters*		*Feet*	*Meters*
328 ft	100 m	500 kbps	20 ft	6 m
820 ft	250 m	250 kbps	20 ft	6 m
1,640 ft	500 m	125 kbps	20 ft	6 m

Other DeviceNet specifications, compatible products, and latest DeviceNet information are made available through:
Open DeviceNet Vendor Association
Contact: William H. (Bill) Moss, Executive Director
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

Four-Point Simulator

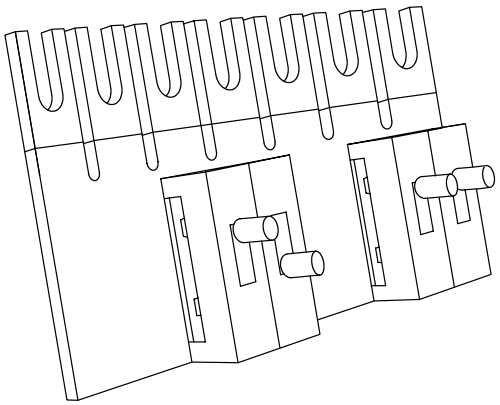
F1-04SIM

Wiring diagram and specifications

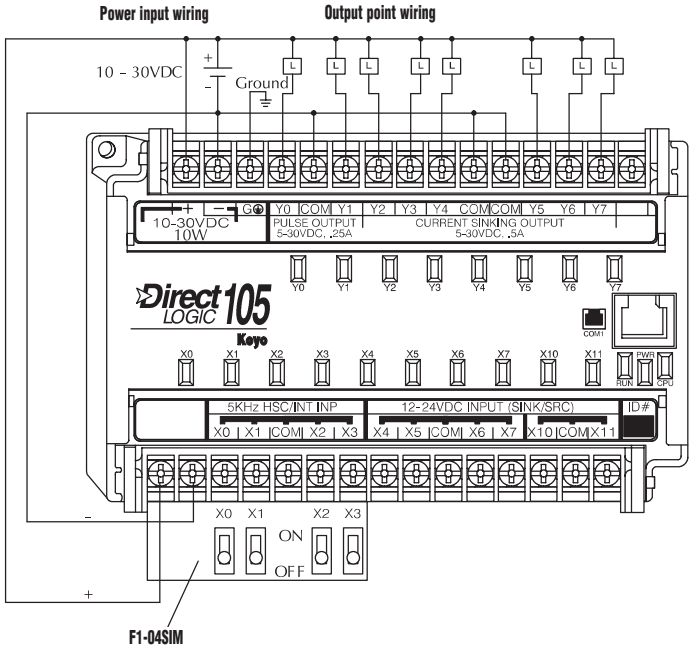
The F1-04SIM is a simple 4-point simulator that can be used with DC input versions of the DL105 micro PLCs. It uses input points X0-X3 and is great for testing purposes.

Please note, you cannot use this simulator with units that have AC discrete input points.

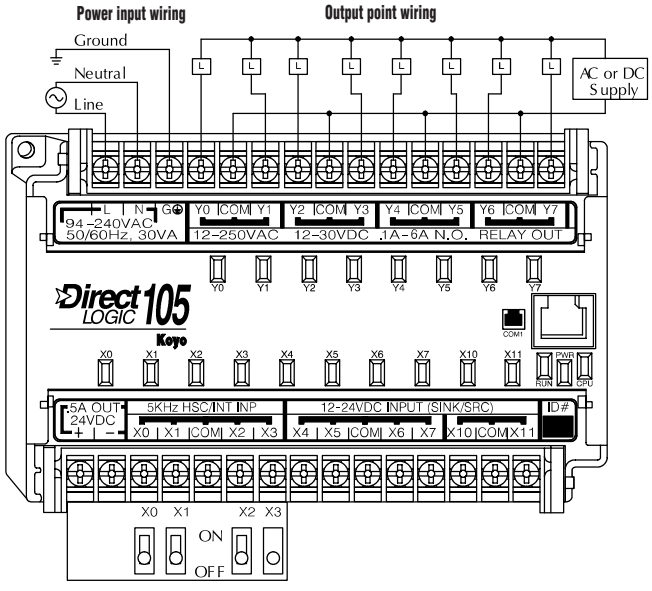
The simulator is a single circuit board that simply slides underneath the screw terminals on the DL105 micro PLC. One advantage with this simulator is that power is obtained directly from the auxiliary 24 VDC supply located on the input terminal strip. So for most applications, the task is extremely simple. If you are using an F1-130DD-D or F1-130DR-D, then you have to jumper the power input before you can use the simulator. This is because the DC-powered units do not offer this auxiliary supply.



To use with DC powered units, simply connect the input power wiring to the unused terminals normally occupied by the 24 VDC auxiliary supply.



For AC powered units, there are no extra wiring connections. Power is obtained directly from the 24 VDC auxiliary supply.

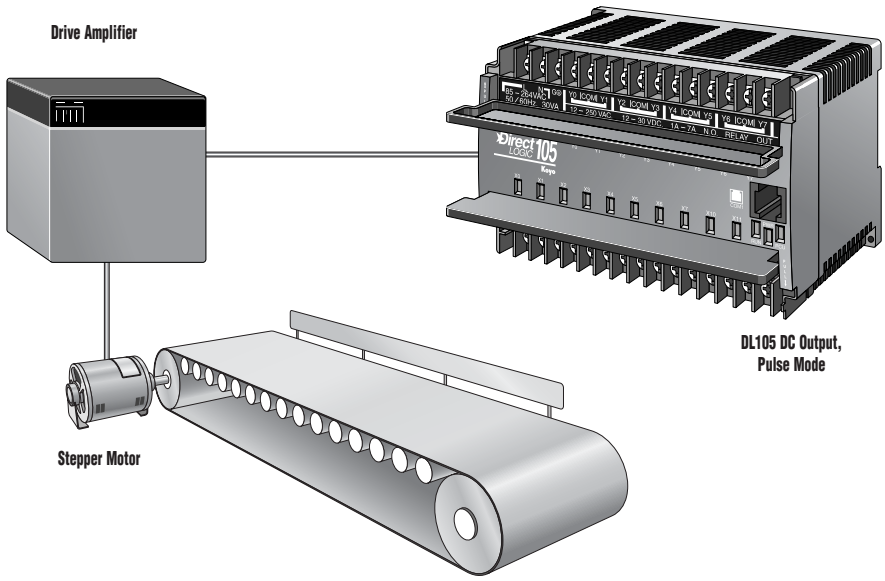


HIGH-SPEED I/O FEATURES

Selected DL105 micro PLCs offer special high-speed input features (on units with DC inputs) and pulse output features (on units with DC outputs). These features are available on the first four input points (Y0-Y3) and the first two output points (Y0-Y1). This allows you to use the economical DL105 micro PLC to solve a diverse range of high-speed machine control applications.

There are several modes of operation from which to choose. Here's a brief description of the modes provided.

- Single 5 kHz high-speed counter with 24 presets. When the preset is reached, an interrupt routine is executed.
- Single quadrature encoder input (up/down counter) for clockwise and counterclockwise position control.
- Single-channel programmable 7 kHz pulse output with an external interrupt and separate acceleration/deceleration profiles for positioning and velocity control.
- A single external interrupt input for an immediate response to time-critical tasks.
- Single pulse catch input allows the CPU to read an input with a pulse width as small as 0.1 ms.



- Four inputs with selectable filters (0-99 ms) to ensure input signal integrity. This is the default mode, which is set at 10 ms filter.
- A single timed interrupt that can be scheduled on a 5 ms - 999 ms cycle. (All units have this feature.)

Combine features to use the full potential of the module. Some modes do not use all available points, so in some cases you can assign one of the other features to the point(s) not used by the main mode of operations.

You cannot use the DL105 for closed-loop control. **You cannot use the Up counter and pulse output features at the same time.**

You can easily select the mode of operation just by entering an appropriate "code" in a special CPU V-memory location. These features are explained in more detail later in this section. Remember, not all features can be used at the same time. The Counter Mode Options table provides point-by-point usage for each mode of operation.

Counter Mode Options

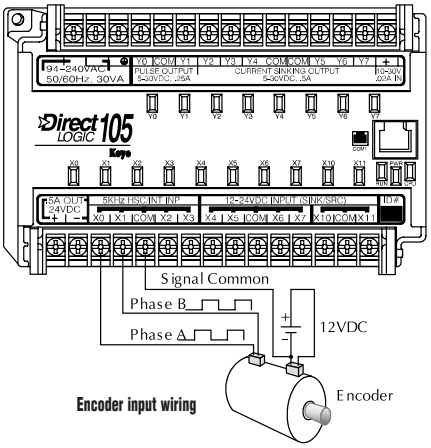
Mode	DC Input Points				DC Output Points	
	X0	X1	X2	X3	Y0	Y1
Filtered Input	Filtered Input	Filtered Input	Filtered Input	Filtered Input	Regular Output	Regular Output
Up Counter	Count Input	Filtered Input	Filtered Input, or Counter Reset	Filtered Input	Regular Output	Regular Output
Up/Down Counter	Phase A Input	Phase B Input	Filtered Input, or Counter Reset	Filtered Input	Regular Output	Regular Output
Interrupt Input	Interrupt Input	Filtered Input	Filtered Input	Filtered Input	Regular Output	Regular Output
Pulse Catch	Pulse Catch	Filtered Input	Filtered Input	Filtered Input	Regular Output	Regular Output
Pulse Output	Not available for use	Filtered Input	Filtered Input, or Interrupt to Trigger Pulse Output	Filtered Input	Pulse or CW Output	Direction or CCW Output
Timed Interrupt	Filtered Input	Filtered Input	Filtered Input	Filtered Input	Regular Output	Regular Output

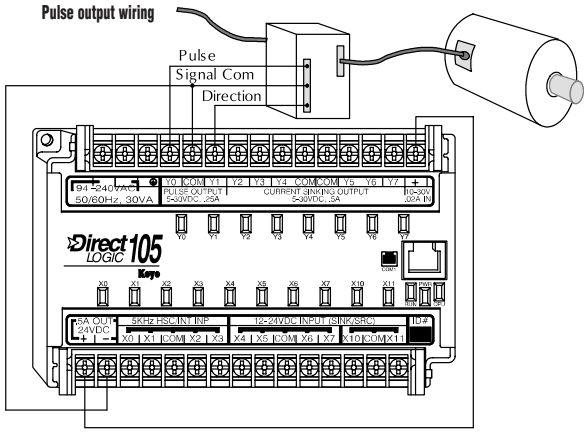
High-Speed I/O Specifications

High-Speed Input Specifications	
Inputs	4 pts. max., X0-X3, sink or source 5 kHz max.
Minimum Pulse Width	100 µs
Input Voltage Range	10-26.4 VDC
Input Impedance	3.0 KΩ @ 12 VDC 2.8 KΩ @ 24 VDC
ON Current/Voltage Level	> 3 mA / > 9 VDC
OFF Current/Voltage Level	< 0.5 mA / < 2 VDC
OFF to ON Response	< 50 µs
ON to OFF Response	< 50 µs

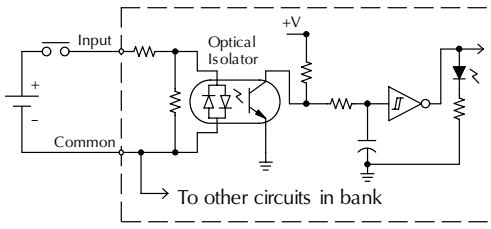
High-Speed Output Specifications	
Outputs	2 pts. Max., Y0&Y1 current sinking, 7 kHz Max.
Voltage Range	5-30 VDC
Maximum Load Current	0.5 A/point
ON Voltage Drop	0.45 VDC @ 0.5 A
Leakage Current	15 µA @ 30 VDC
Inrush Current	1.5 A (10 ms) 0.5 A (100 ms)
OFF to ON Response	< 50 µs
ON to OFF Response	< 50 µs

Wiring diagram

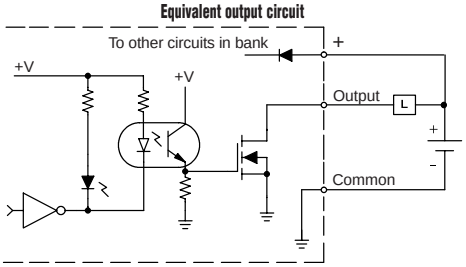




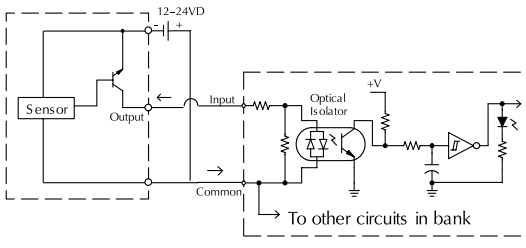
Equivalent circuit, high-speed inputs



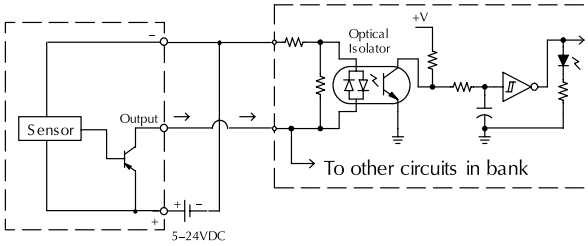
Equivalent output circuit



Equivalent circuit, high-speed inputs (NPN) current sinking field device



Equivalent circuit, high-speed inputs (PNP) current sourcing field device



MODE 10: SINGLE HIGH-SPEED UP COUNTER

Overview

Each DL105 micro PLC with DC inputs has embedded features that support a single high-speed counter up to 5 kHz. You connect the external pulse input and reset input signals to the internal counter by using the first four discrete input points (X0-X3). The embedded counters are independent of the PLC's ladder logic execution, so counting is not affected by the scan time. When the counter reaches any one of up to 24 preset values, the PLC 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 is finished.) 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 easily trigger actions based on the current count. For example, you could use Immediate I/O instructions to provide a fast response.

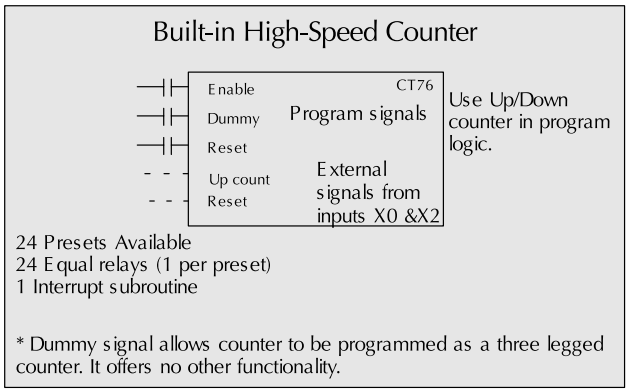
Using the counter in your program is fairly simple. An up/down counter box is used, and you can start and stop the counter just by turning an enable contact (of your choice) on and off as needed. Counters can be reset either by an external signal (X2) or by special internal relays that can be activated by the program. Presets are absolute, which means they are compared directly to the actual count.

Input assignments for up counter mode

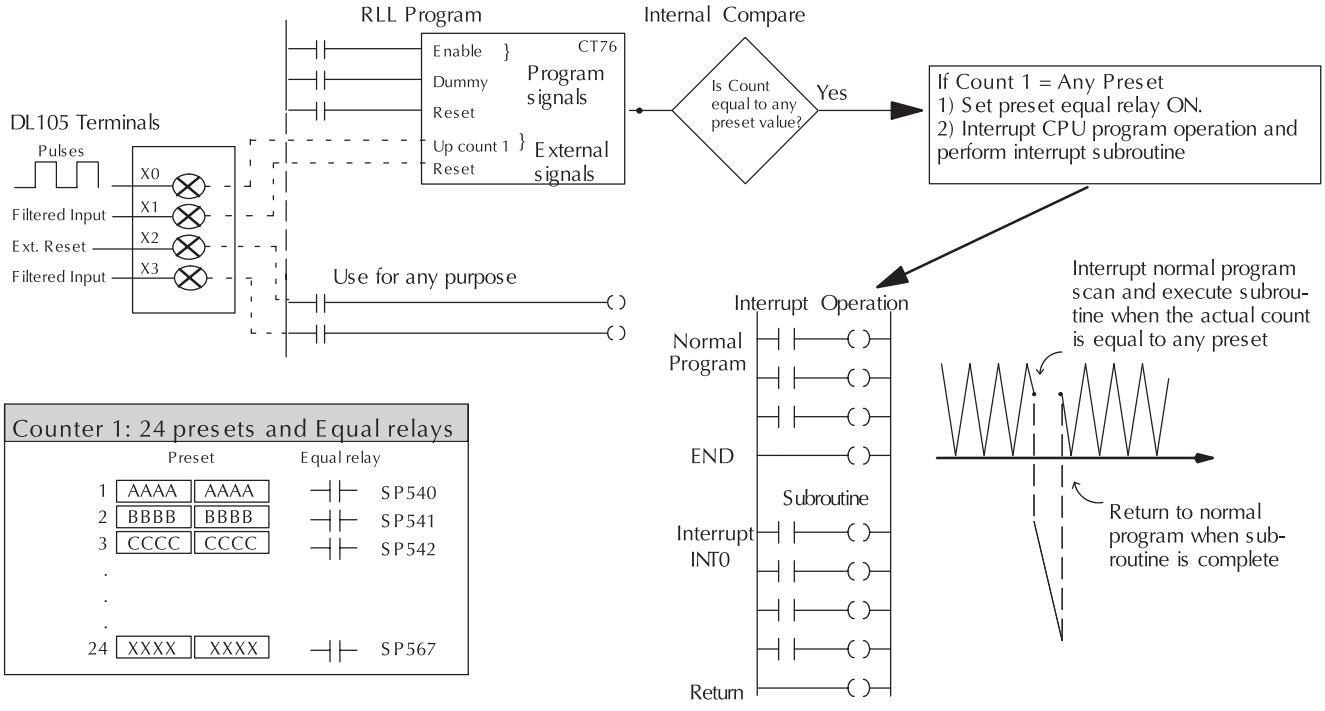
X0: ..... Up count of UP counter
X1: ..... Filtered input
X2: ..... External counter reset (or filtered input)
X3: ..... Filtered input

Input specifications

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



Example operation



Mode 20: Single Quadrature Counter

Overview

By selecting Mode 20, you can use the high-speed input features to connect up to a 5 kHz quadrature encoder. 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 DL105 Micro PLC at points X0, X1, and X2 respectively (X2 can be used as an external reset or as a discrete filtered input). 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: you cannot use two individual encoders as the input devices with the DL105 micro PLC.

Like the UP counter, the quadrature counter is independent of the CPU ladder logic execution, so the actual pulse counting is not affected by the scan time. However, the quadrature counter cannot trigger an interrupt based on the current count/preset relationship. To perform simple positioning or to control output devices, 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 micro 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:

Pulses per Scan = Scan Time (ms) x Frequency (kHz).

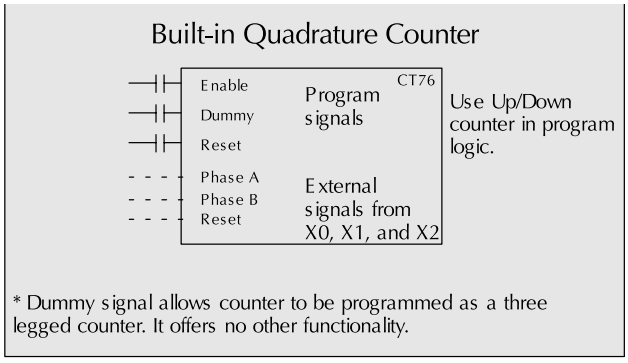
For example, a 10 ms scan and a 5 kHz encoder input yields a maximum of 50 pulses per scan. So, the maximum positioning precision would be the amount of encoder revolution that yields 50 pulses. The amount of precision will also depend on the field device delay, PLC output off/on delay, etc. This amount of precision may be acceptable for many simple positioning applications. If you need additional flexibility for your applications, check out our DL06 and DL205 PLC families.

Input assignments for quadrature counter mode

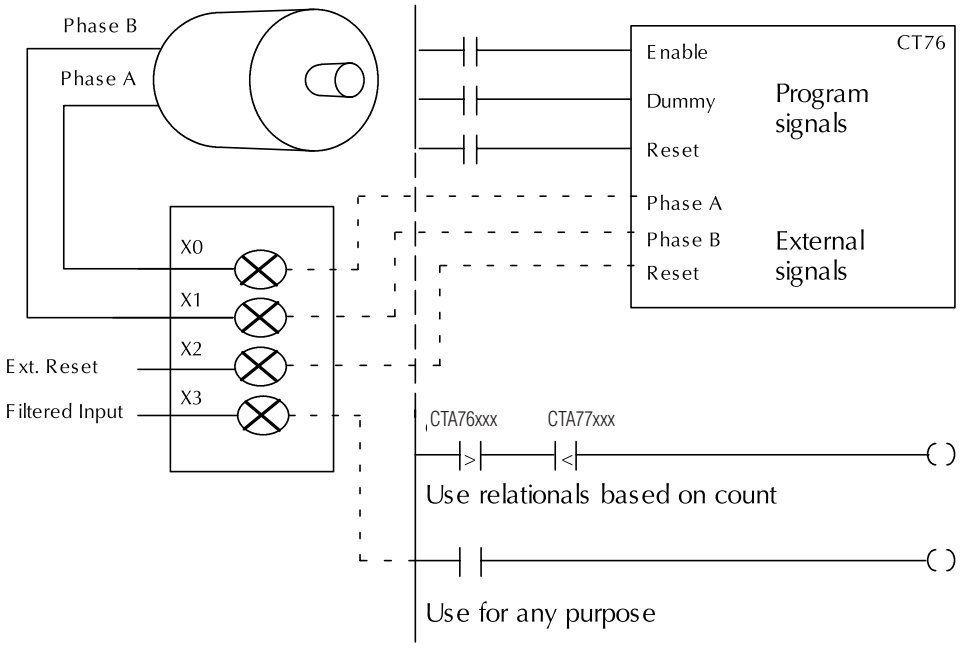
X0: ..... Phase A
X1: ..... Phase B
X2: ..... External counter reset (or filtered input)
X3: ..... Filtered Input

Input specifications

Input voltage ..... 12 or 24 VDC
Frequency ..... 5 kHz maximum
Minimum pulse width ..... 100 µs
Count range ..... 0 to 99,999,999 unipolar
8388608 to 8388607 bipolar
Number of presets ..... None, use relational contacts or use CT76 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 use by 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 acceleration/deceleration

The trapezoid profile is also referred to as the **Automatic Acceleration Profile**. You simply specify a target destination (number of pulses), a starting velocity (pulses per second), a positioning velocity, an acceleration time, and a deceleration time.

Once you have specified these parameters, the DL105 micro PLC automatically controls the actual acceleration/deceleration velocity and pulse output.

Acceleration/deceleration times can be in the range of 100 ms to 10 seconds. This profile also allows you to perform simple registration. By using the external interrupt (X2), you can delay counting toward the target number of pulses until the interrupt occurs.

Input assignments for pulse output mode

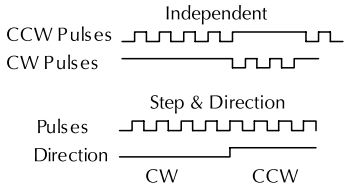
X0: . . . . . Not available (used internally as position complete)
X1: . . . . . Filtered input
X2: . . . . . Filtered input or positioning interrupt
X3: . . . . . Filtered input

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

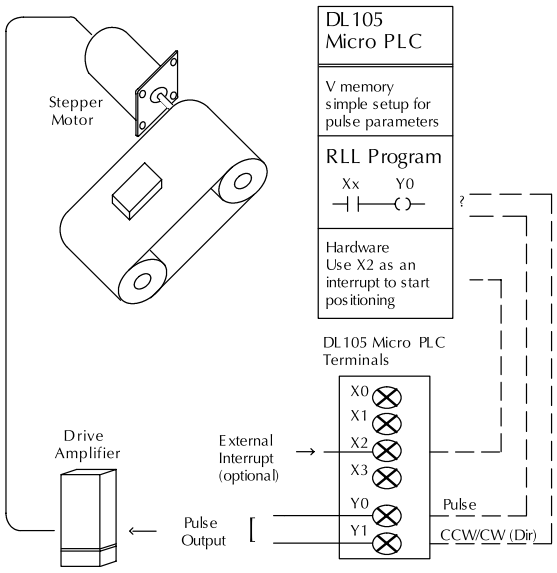
Output voltage . . . . . 5-30 VDC

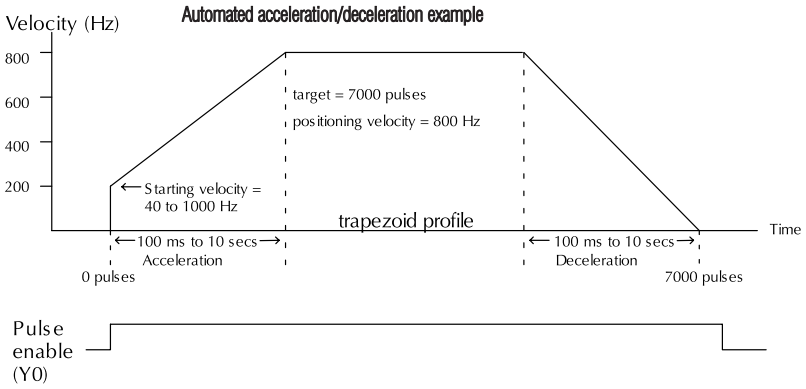


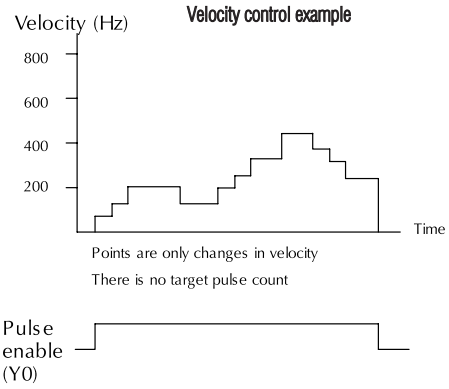
Frequency . . . . . 7 kHz maximum
Target pulse range . . . . . -8,388,608 to 8,388,607
Velocity range . . . . . 40 to 7000 pulses/sec (in units of 10 pulses)

Velocity control

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







Mode 40: External Interrupt

Overview

By selecting Mode 40*, you can use X0 as a high-speed interrupt input. An interrupt input is especially useful in applications that have a high-priority event which 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 a subroutine which is associated with the interrupt input point. 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 instantly 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 cycles starting at the exact location from where it was interrupted. The CPU continues the routine scan until another interrupt signal is sensed.

A note on timed interrupt

If you use the external hardware interrupt (Mode 40), you cannot use the internal timed interrupt. You can use either hardware interrupt or a timed interrupt, but not both. This is because they both share the same interrupt routine, INT0.

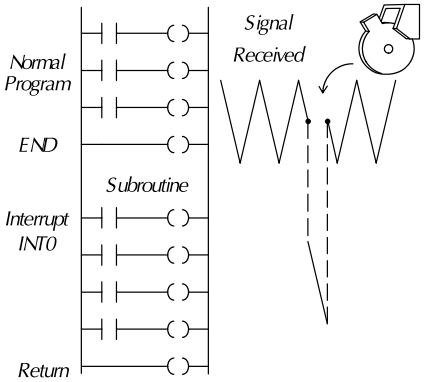
**** Mode 40 is not available on the F1-DVNET units.***

Input assignment for interrupt mode

X0:	Interrupt input
X1:	Filtered Input
X2:	Filtered Input
X3:	Filtered Input

Input specifications

Input voltage	12 or 24 VDC
Minimum pulse width	100 µs
Trigger	Leading edge
Interrupt subroutine	INT0



Mode 50: Pulse Catch Input

Overview

By selecting Mode 50*, you can use X0 as a pulse catch input. In this configuration, the DL105 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 0.1 ms (and a pulse period greater than 0.5 ms). 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. The special purpose relay remains 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.*

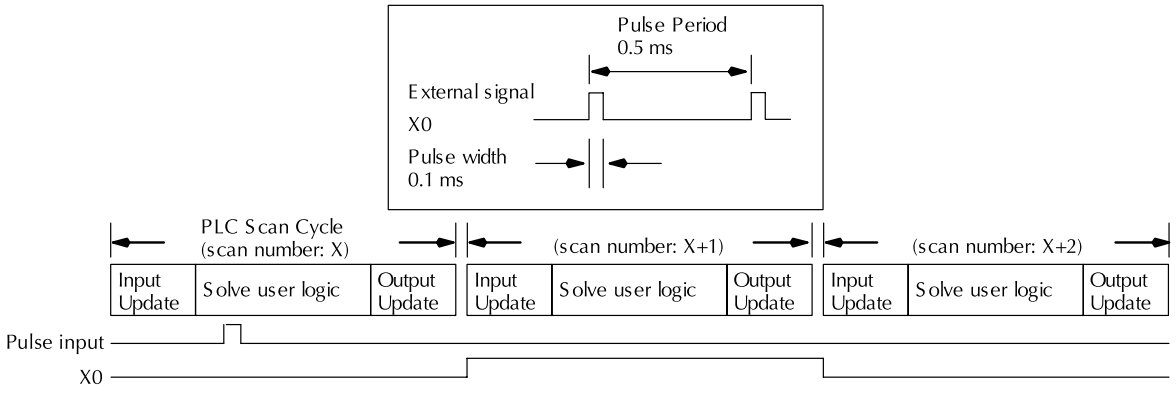
**** Mode 50 is combined with Mode 60 on the F1-DVNET units.***

Input assignments for pulse catch mode

X0:	Pulse catch input
X1:	Filtered input
X2:	Filtered input
X3:	Filtered input

Input specifications

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



Mode 60: Four Discrete Inputs with Filter

Overview

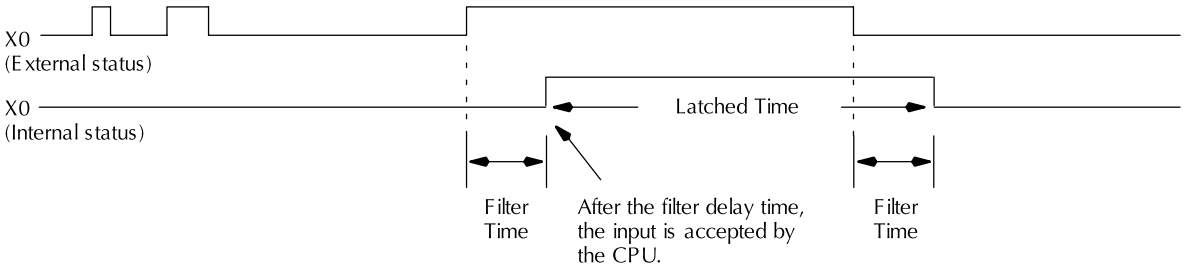
Mode 60*, which is the default mode set at the factory, provides selectable filtering for the first four inputs (X0-X3). Filtering can be especially useful because it reduces the possibility of false ON conditions (which can in turn trigger events in your ladder logic program). When an external signal 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 allowed to be 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 99 ms in 1 ms increments (default is 10 ms).

**** Mode 60 is combined with Mode 50 on the F1-DVNETS units.***

Input assignments for filtered input mode

Point assignments: . . . . . 4 inputs (X0, X1, X2, X3)
Filter time: . . . . . Programmable from 0-99 ms in 1 ms increments



Understanding the Timed Interrupt

Overview

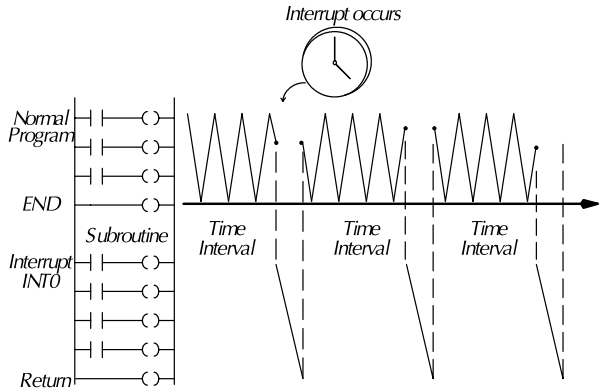
There is also a timed interrupt feature available in the DL105 micro PLCs. This cyclical interrupt allows you to easily program a time-based interrupt that occurs on a scheduled basis. This feature is available in all units, regardless of input type. The CPU's timed interrupt operates in a manner similar to the external interrupt input, but instead of the interrupt subroutine being triggered by an external event tied to X0, it is now triggered by a cyclical interval of time. This interval can be programmed from 5 ms to 999 ms. Whenever the programmed time elapses, the CPU immediately suspends its routine scan cycle and jumps to interrupt subroutine INT0. As with the other modes, when the subroutine execution is complete, the CPU automatically resumes its routine scan cycle starting from the exact location where it was interrupted. Since the CPU scan time and the interrupted time interval are different, the RLL program gets interrupted at various points in the execution over time. This does not present a problem. The CPU always returns to the point where it left to resume the program execution.

Input assignments for timed interrupt mode

X0: . . . . . Filtered input (uses filter time set for X1)
X1: . . . . . Filtered input
X2: . . . . . Filtered input
X3: . . . . . Filtered input

Timed interrupt specification

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



DL105 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.

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.

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

Or Store (ORST)
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 (OR OUT)
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.

Positive Differential (PD)
Is typically known as a one shot. When the input logic produces an off to on transition, the output will energize for one CPU scan.

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.

Pause Outputs (PAUSE)
Disable the update for range of specified output points.

Accumulator/Stack Load and Output Data

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

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

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).

Out (OUT)
Copies the values 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.

Comparative Boolean Instructions

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

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

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

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

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

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

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 0.01 second resolution (0-999,999.99 sec.). Time and enable/reset inputs control 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 (0-99999999). Up, down, and reset inputs control the counter.

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

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 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.

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 (RST)
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.

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 two consecutive V-memory locations or an 8-digit constant.

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 two consecutive V-memory locations or an 8-digit constant.

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 as Exclusive Or of the value in the accumulator with two consecutive V memory locations or an 8-digit constant.

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

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

Subtract (SUB)
Subtract a BCD value, in a V memory location from the lower 16 bits in the accumulator. The result resides in the accumulator.

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

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

Divide (DIV)
Divides a BCD value in the lower 16 bits of the accumulator by a BCD value which is either a V memory location or a 4-digit 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.

Table Instructions

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

Move Memory Cartridge/Load Label (MOVMC/LDLBL)
Copies data from data label area in program ladder memory to V-memory.

Bit Instruction (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.

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

Decode (DECO)
Decodes a 5-bit binary value (0-31) in the accumulator by setting the appropriate bit position to 1 in the accumulator.

Interrupt Instructions

Interrupt Routine / Return (INT / IRT)
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 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 (EN)
Enable hardware and software interrupt to be acknowledged.

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

CPU Control Instructions

No Operation (NOP)
Inserts a N.O. 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 mode of the CPU from Run to Program (Stop).

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.

RLLPLUS Stage / Drum Programming/

Stage 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 program. They are program segments which can be activated or deactivated with control logic.

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

Master Line Set/Master Line Reset (MLS/MLR)
Allows the program to control sections of 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.

Drum Instructions: Time and 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 ms). 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.

Message Instructions

Fault/Data Label (FAULT/DLBL)
Displays a V-memory value or a Data label constant to the handheld programmer or personal computer using **Direct**SOFT.

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