DL405 Family of Products

This page provides an overview of the variety of products found in the DL405 family.

CPUs

D4–450 – 110/220VAC P/S
D4–450DC–1 – 24VDC P/S
D4–450DC–2 – 125VDC P/S
30.8K total memory
(7.5K built-in flash program memory or use optional memory cartridge)
16 PID loops with auto-tune
D4–440 – 110/220VAC P/S
22.5K total memory
(memory cartridge required)
D4–440DC–1 – 24VDC P/S
22.5K total memory
(memory cartridge required)
D4–440DC–2 – 125VDC P/S
22.5K total memory
(memory cartridge required)
D4–430 – 110/220VAC P/S
6.5K total memory

Memory cartridges

CMOS RAM - 7.5K (D4-RAM-1)
CMOS RAM - 15.5K (D4-RAM-2)
UVPROM - 7.5K (D4-UV-1)
UVPROM - 15.5K (D4-UV-2)
EEPROM - 15.5K (D4-EE-2)

Programming

Handheld programmer (D4-HPP-1)
DirectSOFT32 Programming for Windows (PC-PGM-SW)

Bases

4-slot base (D4-04B-1)
6-slot base (D4-06B-1)
8-slot base (D4-08B-1)

Local expansion base power supplies

110/220VAC P/S (D4-EX)
24VDC P/S (D4-EXDC)
125VDC P/S (D4-EXDC-2)

Discrete input modules

DC input
8pt. 24-48VDC (D4-08ND3S)
16pt. 12-24VDC (D4-16ND2)
16pt. 12-24VDC (1 ms response) (D4-16ND2F)
32pt. 24VDC (D4-32ND3-1)
32pt. 5-12VDC (D4-32ND3-2)
64pt. 24VDC (D4-64ND2)
AC input modules
8pt. 110/220VAC (D4-08NA)
16pt. 110VAC (D4-16NA)
16pt 220VAC (D4-16NA-1)
AC/DC input modules
8pt 90-150VAC/DC (isolated) (F4-08NE3S)
16pt 12-24VAC/DC (D4-16NE3)

Discrete output modules

DC output modules
8-pt. 12-24VDC (D4-08TD1)
8-pt. 24-150VDC (F4-08TD1S)
16-pt. 5-24VDC (D4-16TD1)
16-pt. 12-24VDC (D4-16TD2)
32-pt. 5-15VDC D4-32TD1-1)
32-pt. 5-24VDC (D4-32TD1)
32-pt. 12-24VDC (D4-32TD2)
64-pt. 5-24 VDC (D4-64TD1)
AC output modules
8-pt. 18-220VAC (D4-08TA)
16-pt. 18-220VAC (D4-16TA)
Relay output modules
8-pt. 2A (D4-08TR)
8-pt. 5A/pt (isolated) (F4-08TRS-2)
8-pt. 10A/pt (isolated) (F4-08TRS-1)
16-pt. 1A/pt (D4-16TR)

Analog modules (12-bit)

Analog input
4-ch in, current/voltage (F4-04AD)
4-ch in, current/voltage (isolated) (F4-04ADS)
8-ch in, current/voltage (F4-08AD)
16-ch in, current (F4-16AD-1)
16-ch in, voltage (F4-16AD-2)
Analog output
4-ch out, current (F4-04DA-1)
4-ch out, voltage (F4-04DA-2)
8-ch out, current (F4-08DA-1)
8-ch out, voltage (F4-08DA-2)
16-ch out, current (F4-16DA-1)
16-ch out, voltage (F4-16DA-2)

Analog modules (16-bit)

Temperature input
8-ch in, RTD (F4-08RTD)
8-ch in, thermocouple (F4-08THM)
Analog output
4-ch out, current (isolated) (F4-04DAS-1)
4-ch out, voltage (isolated) (F4-04DAS-2)

Communications/ networking modules

Ethernet communications (H4-ECOM(-F))
Data communications (D4-DCM)
MODBUS master (F4-MAS-MB(R))

Specialty modules

8-pt. interrupt input (D4-INT)
High-speed counter I/O (H4-CTRIO)
High-speed counter (D4-HSC)
8-pt. magnetic pulse input (F4-8MPI)
16-loop PID (w/ software) (F4-16PID)
8/16-pt. input simulator (D4-16SIM)
4-loop temperature controller (F4-4LTC)
BASIC CoProcessor modules
128K triple port (F4-CP128-1)
128K telephone modem (F4-CP128-T)

CPU-Slot slave controllers

Ethernet base controller (H4-EBC(-F))

Remote I/O modules

Ethernet
Ethernet remote Master Module (H4-ERM(-F))
Ethernet base Controller (Slave) (H4-EBC(-F))
Remote I/O protocol (serial)
Remote I/O Master Module (D4-RM)
Remote I/O Slave 110/220VAC (D4-RS)
Remote I/O Slave 24VDC (D4-RSDC)

Operator interface

See the Operator Interface section in this catalog for a complete line of text and touch panels and configuration software to connect to to DL405 system.

Connection systems

See the Connection Systems section in this catalog for information on ***DIN***nector terminal blocks and ***ZIP***Link connection systems.

DL405 CPUs

System capacity

System capacity is the ability of the CPU to accommodate a variety of applications. Here are a few key considerations when determining system capacity:

How much memory do you need? Consider both ladder memory and data registers (V-memory). 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 locations are 16-bit words and are useful for data storage, etc.

What type of memory do you need? The D4-430 only has built-in EEPROM memory for the ladder program. The D4-440 requires a memory cartridge, and you have a choice of several sizes and memory types. The D4-450 has 7.5K of built-in flash ladder memory, but you can also use a memory cartridge instead of the built-in memory.

How many I/O points are required? You will need to know how many field devices are required. Each CPU supports a different amount of local, expansion, and remote I/O. Check the Specifications tables on the next page to determine which CPU meets your application requirements.

Are there any remote I/O points? In many applications, the wiring cost of bringing the individual control wiring back to the PLC control panel can be reduced by the use of remote I/O. All DL405 CPUs can support remote I/O. The D4-450 CPU has built-in serial remote I/O connections on the bottom 25-pin port; or use Ethernet Remote I/O for fast and easy set-up and communications.

Performance

If you have a time-critical application where every millisecond is important, then choose the CPU with the fastest overall scan time. For applications that only require boolean instructions (contacts and coils), the D4-440 is the fastest. However, if you use a few simple math or data instructions, then choose the D4-450. The D4-450 is considerably faster at performing even the most basic of math or data instructions and will provide a faster overall scan time.

Programming and diagnostics

Our CPUs offer an incredible array of instructions and diagnostic features that can save you many hours of program and debug time. From basic boolean contact logic to PID and floating point math, we have it covered! The chart on the next page covers some of the basic instruction categories, but for more details, see our complete list of instructions at the end of this section.

Built-in CPU communications

Every DL405 CPU provides at least two built-in communications ports. Each DL405 CPU supports our *Direct*NET protocol on the bottom port for easy, economical networking. Need MODBUS? Then, check our D4-450 CPU, which has built-in MODBUS RTU Master and Slave capability. Of course, we also offer a wide array of communications, such as our Ethernet Communications Module, Data Communications Module and MODBUS Master module.

Specialty I/O modules

In addition to our cost-effective discrete and analog I/O, we also offer a wide array of specialty modules to solve the really tough applications. Our D4-430 and D4-440 only support specialty modules in the local base (CPU base). Our D4-450 CPU supports specialty modules in the local CPU base, but it can also support selected specialty modules in expansion bases if you use our D4-xxB-1 bases (xx is the number of slots). If you are considering a D4-450 CPU, there may be some restrictions on using speciality modules. See the chart on page 6-26 for complete information.

DL405 CPU Comparisons

DL405 CPU Specifications			
	D4-430	***D4-440***	***D4-450***
System Capacity			
Total memory available (words)	6.5K	22.5K	30.8K
Ladder memory (words)			
built-in memory	3.5K EEPROM	None, requires MC	7.5K flash
with memory cartridge	N/A	up to 15.5K	up to 15.5K
V-memory (words)	3.0K	7.0K	15.3K
Battery backup	Yes	Yes	Yes
Total CPU memory I/O pts. available ***(actual I/O points depend on I/O configuration selected)***	1664 (X+Y+CR+GX)	2688 (X+Y,+CR+GX)	8192 (X+Y+GX+GY)
I/O module point density	2/4/8/16/32/64	2/4/8/16/32/64	2/4/8/16/32/64
I/O module slots per base	4/6/8	4/6/8	4/6/8
Local/local expansion	320 in/320 out	320 in/320 out	1024 in/1024 out
Serial remote I/O (including local & exp. I/O	1664 max.	1664 max.	4224 max.
Remote I/O Channels	2	2	3
I/O pts. per remote module channel	512	512	512; 2048 (port 3)
Ethernet Remote I/O (including local/exp. I/O)	Yes	Yes	Yes
discrete I/O pts.	1664 max. (Including local and exp.I/O)	2688 max. (Including local and exp.I/O)	8192 max. (Including local and exp.I/O)
Analog I/O channels			
Remote I/O channels	map into V-memory	map into V-memory	map into V-memory
I/O per remote channel	Limited by power budget	Limited by power budget	Limited by power budget
	16,384 (limited to 1664)	16,384 (limited to 2688)	16,384 (16 fully expanded H4-EBC slaves using V-memory and bit-of-word instructions)
Performance			
Contact execution (boolean)	3.0µs	0.33µs	0.96µs
Typical scan (1K boolean)	8-10ms	2-3ms	4-5ms
Programming and Diagnostics			
RLL ladder style	Yes	Yes	Yes
RLL PLUS/flowchart style (Stages)	Yes/384	Yes/1024	Yes/1024
Run time editing	No	Yes	Yes
Variable/fixed scan	Variable	Variable	Fixed or variable
Instructions	113	170	210
Control relays	480	1024	2048
Timers	128	256	256
Counters	128	128	256
Immediate I/O	Yes	Yes	Yes
Subroutines	No	Yes	Yes
For/next loops	No	Yes	Yes
Timed interrupt	No	Yes	Yes
Integer math	Yes	Yes	Yes
Floating-point math	No	No	Yes
Trigonometric functions	No	No	Yes
Table instructions	No	Yes	Yes
PID	No	No	Yes
Drum sequencers	No	No	Yes
Bit of word	No	No	Yes
Real-time clock/calendar	No	Yes	Yes
Internal diagnostics	Yes	Yes	Yes
Password security	No	Yes	Multi-level
System and User error log	No	Yes	Yes
CPU Ports Communications			
Built-in ports	2 ports	2 ports	4 ports
K-sequence (proprietary protocol)	Yes	Yes	Yes
DirectNET	Yes	Yes	Yes
MODBUS master/slave	No	No	Yes
ASCII out (Print)	No	No	Yes
Maximum baud rate	19.2K	19.2K	38.4K

D4-450 KEY FEATURES

D4-450 CPU

The D4-450 provides all the capabilities of the D4-430 and D4-440 CPUs, plus several additional features. It offers an incredible array of features for a CPU that costs so little.

Built-in CPU communications ports

The D4-450 offers four built-in ports for extra convenience. The 15-pin port offers our proprietary K-sequence protocol and is primarily used for programming connections to a D4-HPP-1 handheld programmer or to a PC running *Direct*SOFT32 software. It can also be used to connect to an EZText/Touch panel or other operator interfaces. The 6-pin phone jack also supports K-sequence; plus, it can be a *Direct*NET slave port or an ASCII output port. The bottom 25-pin port contains two logical ports with different pins for each port. It is primarily a networking port that supports *Direct*NET master/slave or MODBUS master/slave protocols. The bottom port can be used as an ASCII output port for connections to printers or other devices that can accept ASCII input. It can also be used as a remote I/O Master. The Communications Ports table on the next page has a complete description of each port.

16 PID loops

The D4-450 CPU can process up to 16 PID loops directly in the CPU. You can select from various control modes including automatic control, manual control, and cascade control. There are a wide variety of alarms including Process Variable, Rate of Change, and Deviation. The various loop operation parameters are stored in V-memory, which allows easy access from operator interfaces. Setup is accomplished with our *Direct*SOFT32 Programming Software. An overview of the various loop specifications and features is on page 6-17.

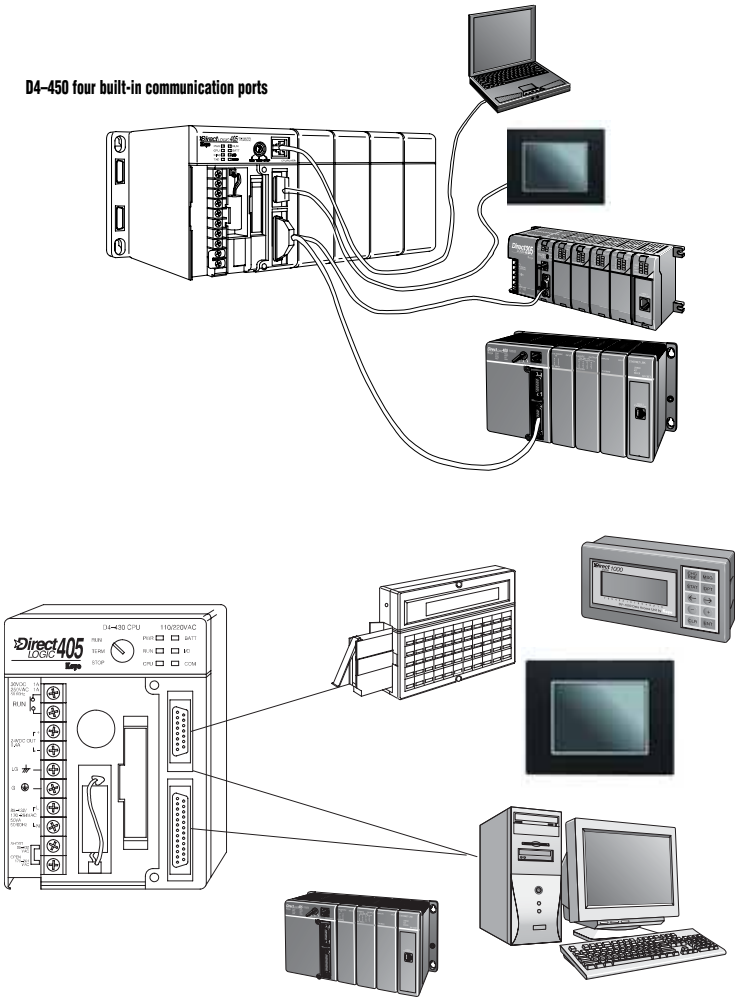
Floating-point math

The D4-450 CPU supports IEEE format floating-point math calculations. This feature means the D4-450 includes full trigonometric functions and various forms of integer/floating point number conversions.

Power supplies

We offer a choice of three power supplies for the DL450 CPU. The power supplies are built into the CPU. Available power supplies are:

- 110/220VAC version - D4-450
- 24VDC version - D4-450DC-1
- 125VDC version - D4-450DC-2



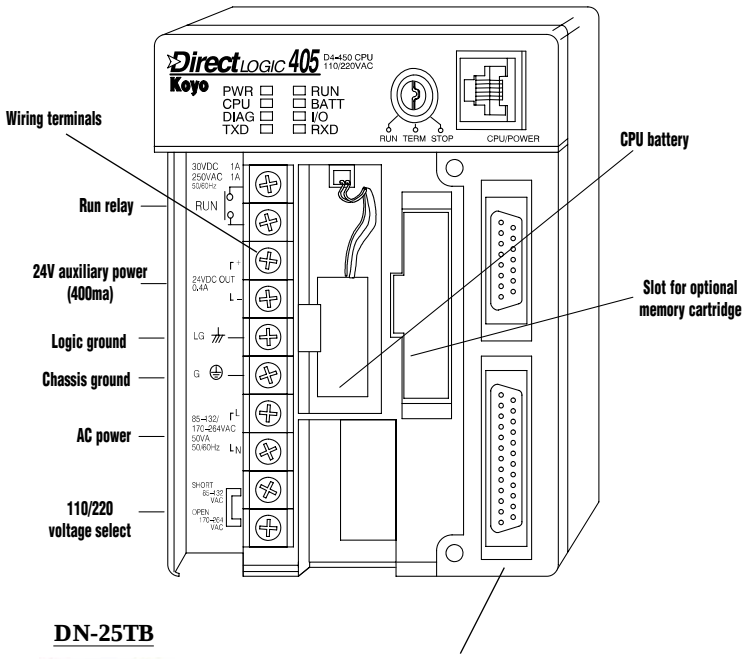
Note: if you are considering a D4-450 CPU to replace a CPU in an existing system, and the system uses specialty modules with an F4 prefix, then these modules may require an upgrade to operate with the D4-450. Contact our Technical Services group prior to placing your order for more information. (This note does not apply to analog modules.)

D4-450 Features

The diagrams on this page show the various hardware features found on the D4-450 CPU.

CPU Keyswitch		
RUN	Forces CPU to RUN mode. Locks Comm port - will not receive incoming data.	
TERM	Allows peripherals (HPP, DCM, *Direct*SOFT32, etc.) to select operating mode	
STOP	Forces CPU out of RUN	
CPU Status Indicators		
PWR	ON OFF	CPU power good CPU power failure
RUN	ON OFF	CPU is in RUN mode CPU is in STOP mode
CPU	ON OFF	CPU self-diagnostics error CPU self-diagnostics good
BATT	ON OFF	CPU battery is low CPU battery is good or disabled
DIAG	ON OFF	CPU diagnostics or local bus error CPU diagnostics or local bus good
I/O	ON OFF	I/O self-diagnostics error I/O self-diagnostics good
TXD	ON OFF	Data is being transmitted No data is being transmitted
RXD	ON OFF	Data is being transmitted No data is being transmitted
Communications Ports		
Phone Jack Port 2	Programming Port, RS232C, baud rate selectable up to 38.4Kb. Connects to *Direct*SOFT32 DV-1000, EZTouch/EZText panels, network, etc. K-sequence protocol *Direct*NET protocol (slave only). ASCII out	
15-pin Port 0	Programming port, RS232C, 9600 baud, connects to HPP, *Direct*SOFT32, DV-1000, EZTouch/EZText panels, etc. K-sequence protocol (fixed station address=1)	
25-pin Ports 1 and 3	General purpose port for RS232C and RS422. (RS485 Remote I/O Master available on Port 3 only.) Baud rate selectable via software up to 38.4K baud. Connects to *Direct*SOFT32, EZTouch/EZText panels, network, etc. Two logical ports (separate pins on connector). Software selectable protocol includes:	

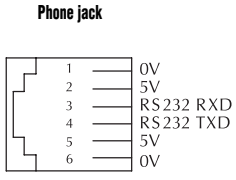
Protocol	*Port 1*	*Port 3*
K-sequence	✓	✓
DirectNETMaster/Slave	✓	✓
MODBUS Master/Slave	✓	✓
MODBUS Master/Slave	✓	✓
Remote I/O	n/a	✓
ASCII Out	✓	✓

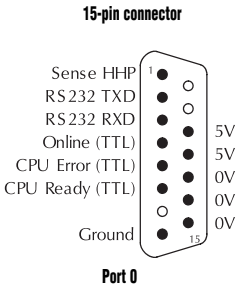


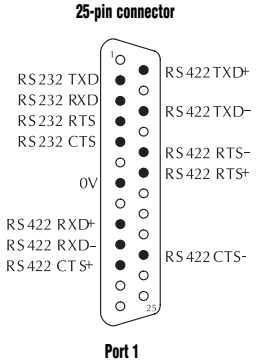
DN-25TB

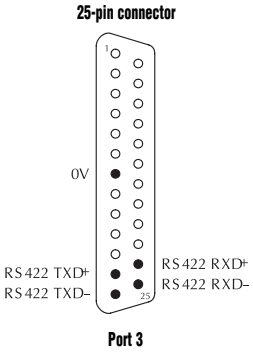
*ZIP*Link cables and communications adapter modules offer fast and convenient screw terminal connections for the D4-450 lower port. RS232/422 DIP switch selectable. See the Connection Systems section in this desk reference for part numbers and descriptions.

D4-450 communications ports pin-out









D4-450 Fixed or Variable Scan

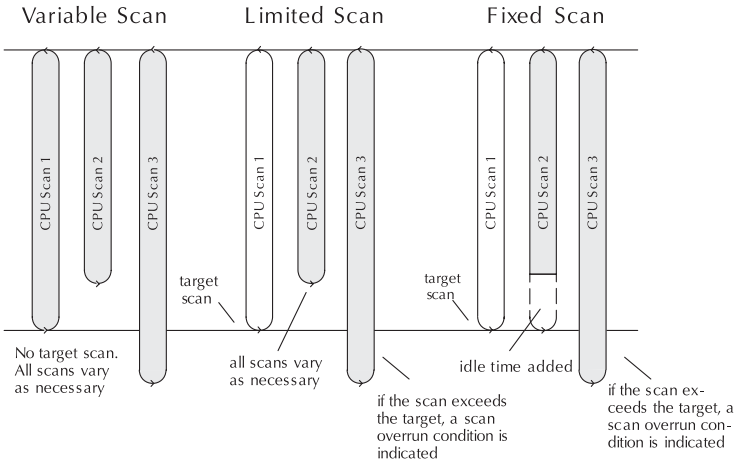
D4-450 Scan control

The D4-450 CPU provides several scan control options, which are useful in some high-speed machine control applications.

Variable — The scan varies as necessary from scan to scan. The actual scan time depends on the instructions being executed.

Limited — This is similar to a variable scan in that the scan varies as necessary. However, if the actual scan time exceeds a specified target scan time, then a scan overrun condition is indicated.

Fixed — If the scan is finished before the time specified, idle time is added to ensure a fixed scan period. If the scan exceeds the time specified, the scan is extended to ensure all instructions are executed. A scan overrun condition is also reported.



Rel. 2.1 of DirectSOFT, is required to program the D4-450.

Memory

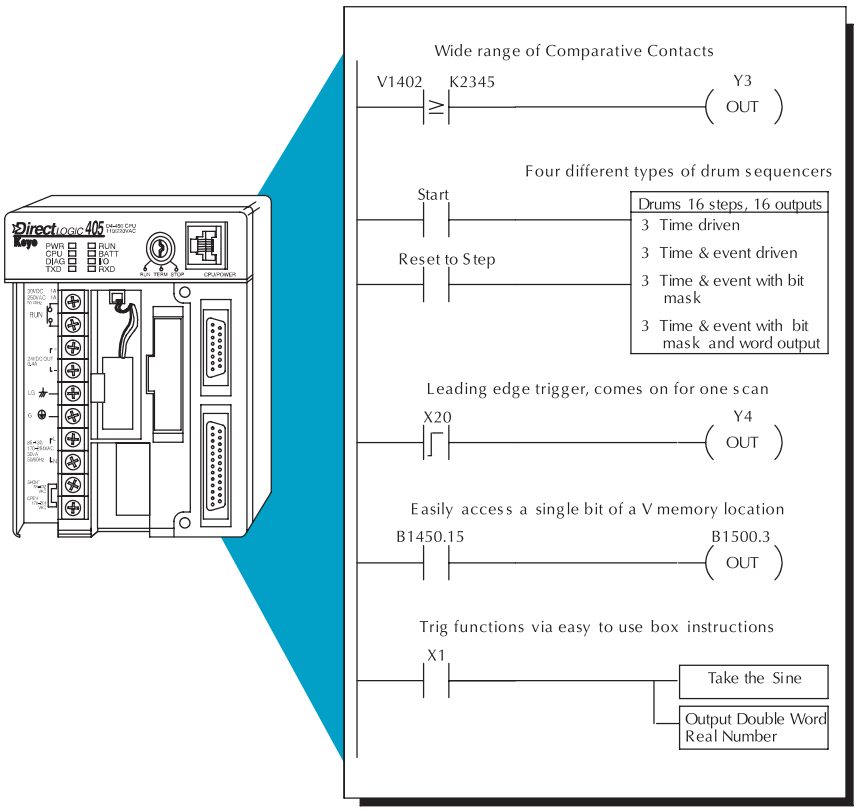
The D4-450 has 7.5K of flash memory on board. Upgrade to 15.5K by choosing an optional memory cartridge. The memory cartridge is recommended since it is removable in the event of problems.

Full array of instructions

Imagine if someone asked you to write a book, but then told you that you could only use 50 different words? That would be a tough job! The same is true for writing a PLC program. The right instruction can greatly simplify your control program.

The D4-450 supports over 200 powerful instructions. These include:

- Four types of drum sequencers, each with 16 steps and up to 16 outputs
- Leading and trailing edge triggered one-shots
- Bit of word manipulation (bit set, reset, etc.)
- Trigonometric functions
- Floating point conversions

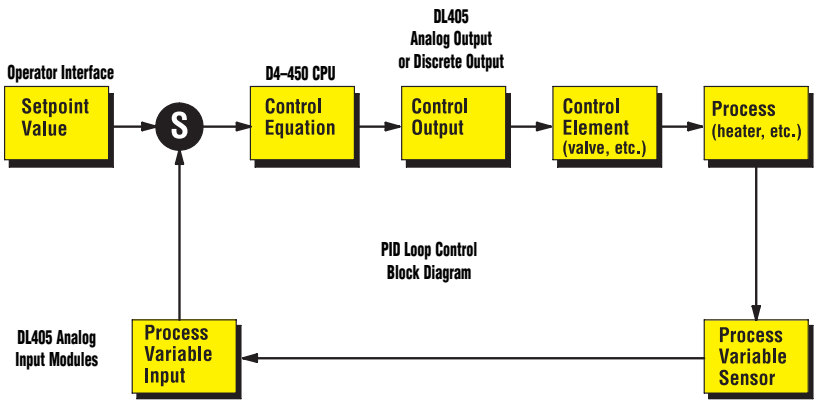


Note: if you are considering a D4-450 CPU to replace a CPU in an existing system, and the system uses specialty modules with an F4 prefix, then these modules may require an upgrade to operate with the D4-450. Contact our Technical Services group prior to placing your order for more information. (This note does not apply to Analog modules.)

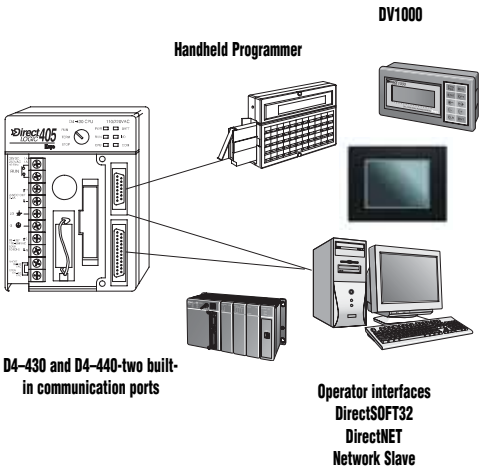
D4-450 PID LOOPS

PID Loop Specifications and Key Features	
Number of Loops	Selectable, 16 maximum
CPU V Memory Required	32 V locations per loop selected (An additional 32 V locations per loop required if using Ramp/Soak)
PID Algorithm	Position or velocity form of the PID equation. Optionally specify direct or reverse acting, square root of the error and error squared control.
Auto Tuning	Open loop step response method and closed loop limit cycle method.
Sample Rate	Specify the time interval between PV samples, 0.05 to 99.99 in units of seconds or minutes. If using all 16 loops, the smallest sample rate is limited to either 0.2 seconds or (PLC scan time x number of loops).
Loop Operation Modes	Loop can be in automatic control, manual (operator) control, or cascade control. PV alarm monitoring continues when loops are in manual mode.
Ramp/Soak	Up to 16 steps (8 ramp, 8 soak) per loop, with indication of Ramp/Soak step.
Square Root PV	Specify a square root of the PV for a flow control application.
Limit SP	Specify a maximum and minimum value for allowable setpoint changes.
Limit OUT	Specify a maximum and minimum value for the output range.
Gain	Specify proportional gain of 0.01 to 99.99.
Reset	Specify integral time of 0.1 to 99.98 in units of seconds or minutes.
Rate	Specify the derivative time, 0.00 to 99.99 seconds.
Rate Limiting	Specify a derivative gain limiting coefficient to filter the PV used in calculating the derivative term (0 to 20).
Bumpless Transfer I	Bias and setpoint are initialized automatically when the loop is switched from manual to automatic. This provides for a bumpless transfer, which reduces the chance of sharp changes in the output as a result of entering automatic mode.
Bumpless Transfer II	Bias is set equal to the Output when the module is switched from manual to automatic. This allows switching in and out of automatic mode without having to re-enter the setpoint.
Step Bias	Provides proportional bias adjustment for large setpoint changes. This may stabilize the loop faster and reduce the chance of the output going out of range. Step bias should be used in conjunction with the normal adjusted bias operation.
Anti-windup	If the position form of the PID equation is specified, the reset action is stopped when the PID output reaches 0 or 100%. Select adjusted bias or freeze bias operation.
Error Deadband	Specify an incremental value above and below the setpoint in which no change in output is made.
Error Squared	Squaring the error minimizes the effect a small error has on the Loop output, however, both Error Squared and Error Deadband control may be enabled.
Alarm Specifications	
Deadband	Specify 0.1% to 5% alarm deadband on all alarms except Rate of Change.
PV Alarm Points	Specify PV alarm settings for low-low, low, high, and high-high conditions. You can also specify a deadband to minimize the alarm cycles when the PV approaches alarm limits.
PV Deviation	Specify alarms to indicate two ranges of PV deviation from the setpoint value (yellow and red deviation).
Rate of Change	Specify a rate-of-change limit for the PV.

Need Temperature Control?
If you're only interested in controlling temperature, then there may be a better solution than the D4-450 CPU. Check out the F4-4LTC module. This module has the capabilities of our single loop controllers built into one economical module! Detailed specifications can be found later in this section. This module can directly control up to four loops and it even includes built-in relay outputs for heater or chiller control! If you use the built-in PID capability of the D4-450 CPU, you still have to purchase the analog input modules and the output modules (either discrete or analog) in order to complete the loop.
This can result in a much higher overall cost when compared to the F4-4LTC.



D4-440/430 KEY FEATURES



D4-440 CPU

The D4-440 provides a subset of the D4-450's capabilities. If you need fast boolean execution, good communications, and complex math or PID isn't required, this is the CPU for you!

Instruction set

The D4-440 instruction set includes most of the capabilities of the D4-450. The D4-440 does not support some of the more advanced instructions such as PID, floating point math, drum sequencers, trig. functions, etc.

Two built-in communication ports

D4-440 offers two communication ports. The top port can be used for a direct connection to a personal computer for programming, to our handheld programmer, to our DV-1000, or to operator interfaces and touch panels. The bottom port is a slave-only port and supports our *Direct*NET or K-sequence protocol at speeds up to 19.2K baud.

Range of power supplies

The D4-440 provides a wide range of power supply options. A 110/220VAC version, a 24 VDC version, and a 125VDC version are available.

Memory cartridges

The table below shows the memory cartridges available for the D4-440 and D4-450. The D4-440 requires a memory cartridge for program storage. The D4-450 has 7.5K of built-in FLASH program memory. However, you can use a memory cartridge instead of the built-in memory if you need more program space. (The D4-430 has built-in program memory and cannot use a memory cartridge.)

D4-430 CPU

The D4-430 is the most economical CPU in the DL405 product family. If you are primarily looking at the DL405 because of I/O form factor or reasons that don't require tons of CPU horsepower, try the D4-430.

Two built-in communication ports

The D4-430 also offers two communication ports. The top port can be used for a direct connection to a personal computer for programming, to our handheld programmer, to the DV-1000, or to operator interfaces and touch panels. The bottom port is a slave-only port and supports *Direct*NET protocol at speeds up to 19.2K.

Built-in EEPROM memory

One advantage of the D4-430 is 3.5K of built-in EEPROM program memory. A memory cartridge is not required.

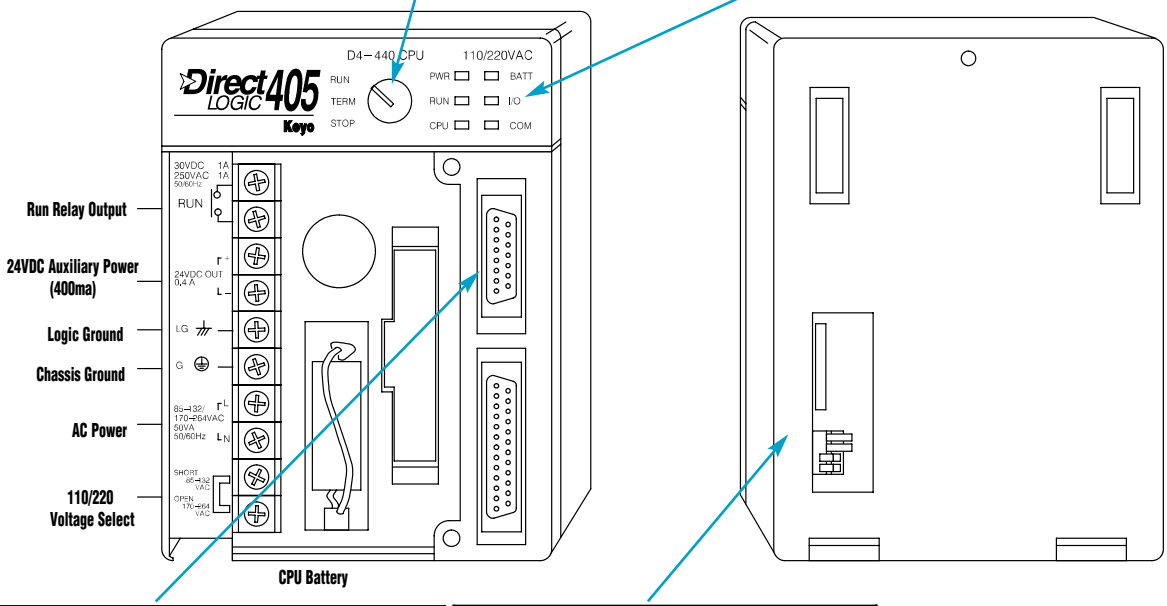
	D4-RAM-1 <--->	D4-RAM-2 <--->	D4-UV-1 <--->	D4-UV-2 <--->	D4-EE-2 <--->
Program Storage Capacity	7.5K	15.5K	7.5K	15.5K	15.5K
Cartridge Battery Type	Lithium	Lithium	None	None	None
Writing Cycle Life	N/A	N/A	1,000	1,000	>10,000
Write Inhibit	Internal jumper	Internal jumper	N/A	N/A	Internal jumper
Memory Clear Method	Electrical	Electrical	Ultraviolet light	Ultraviolet light	Electrical

D4-440/430 Features

The following diagram shows the various hardware features found on the D4-440 CPU. The D4-430 looks the same, except that the memory cartridge slot can not be used.

CPU Keyswitch	
RUN	Forces CPU to RUN mode
TERM	Allows peripherals (HPP, DCM, *Direct*SOFT32, etc.) to select operating and TEST modes.
STOP	Forces CPU to STOP mode

CPU Status Indicators					
PWR	ON OFF	CPU power good CPU power failure	***BATT***	ON OFF	CPU battery low CPU battery good
RUN	ON OFF	CPU in RUN mode CPU in STOP mode	***I/O***	ON OFF	I/O diagnostics error I/O diagnostics OK
CPU	ON OFF	CPU diagnostic error CPU diagnostics OK	***COM***	ON OFF	Communication error Communication OK

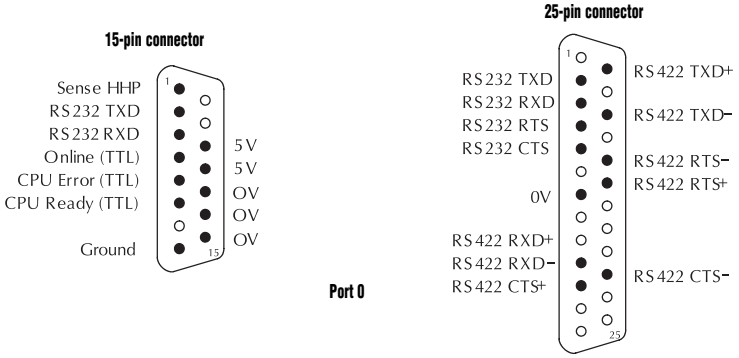


Communication Ports	
15 Pin	Programming port, RS232C, 9600 Baud, K-sequence protocol, connects to HPP, *Direct*SOFT32, DV-1000 and some operator interfaces
25 Pin	Auxiliary port, R232C or RS422, Baud rate selectable via CPU dipswitch, K-sequence protocol, *Direct*NET protocol (slave only) connects to *Direct*NET, *Direct*SOFT32, and other operator interfaces

CPU Dipswitch		
SW1	ON OFF	CPU battery disabled CPU battery enabled
SW2	ON OFF	Station address is 1 Station address set by HPP

SW3	SW4	Baud
OFF	OFF	300
OFF	ON	1,200
ON	OFF	9,600
ON	ON	19,200

D4-430/D4-440 communications ports pin-outs



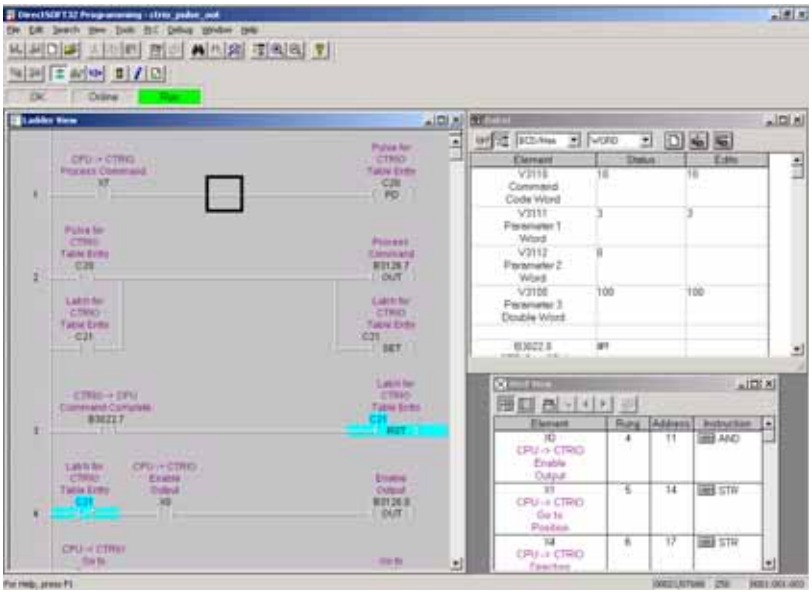
DN-25TB

Communication adapter modules provide a fast, convenient method for field wiring through the use of screw terminals. See the Connection Systems section of this desk reference for more information.

DL405 PROGRAMMING TOOLS AND CABLES

Select a programming device

There are two tools for programming the DL205 CPUs: *Direct*Soft32 PC-based programming software and the D4-HPP-1 handheld programmmer.



*Direct*SOFT32 programming software

Our powerful Windows-based programming packages make it easy for you to program and monitor your DL405 PLC system. The version of the software that supports the DL405 CPUs is described in the table below. See the Software section in the desk reference for detailed information on *Direct*Soft32.

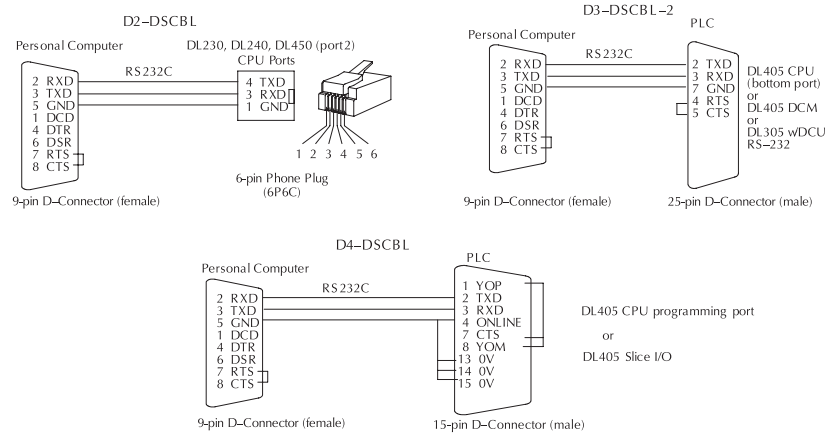
*Direct*Soft32 Part Number	Price	Description
PC-PGMSW	<--->	Programs all PLC families DL05/06/105/205/305/405

DL405 programming cables

Choose the proper cable to connect the DL405 CPU to your PC running *Direct*Soft32.

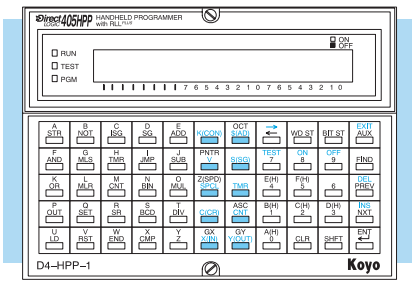
CPU	Price	Port	Cable	Price
D4-430/ D4-440	<--->	Top port (15 pin)	***D4-DSCBL***	<--->
	<--->	Lower port (25 pin)	***D3-DSCBL-2***	<--->
D4-450	<--->	Top port (15 pin)	***D4-DSCBL***	<--->
		Lower port (25pin)	***D3-DSCBL-2***	<--->
		Phone jack (RJ12)	***D2-DSCBL***	<--->

Pin labeling conforms to IBM DTE and DCE standards



Handheld programmer

The D4-HPP-1 handheld programmer connects to the 15-pin port on any of the DL405 CPUs. A memory cartridge is located on the side of the handheld programmer. This slot allows you to copy memory cartridges (including UV PROMs) and transfer data/programs between the CPU and a memory cartridge.



There are three optional connecting cables available for use with the D4-HPP-1 programmer:

- D4-HPCBL-1: 3m cable
- D4-HPCBL-2: 1.5m cable
- D4-CASCBL: cassette cable

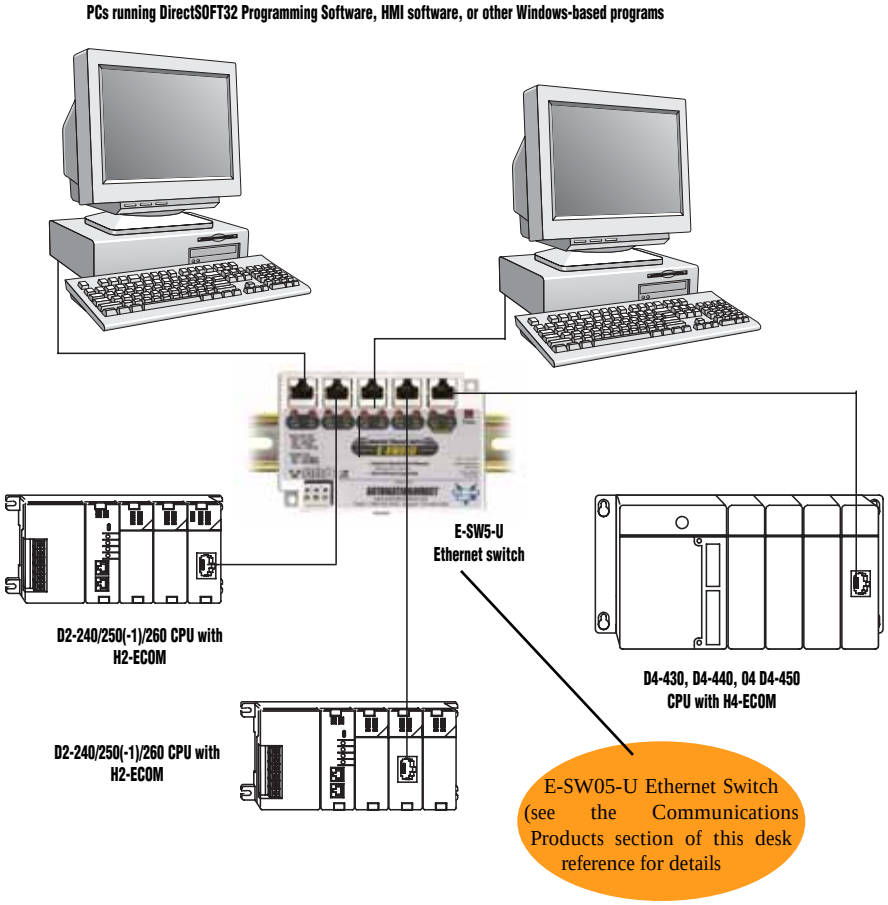
Need additional Communications Ports?

Do you need communications ports in addition to the built-in CPU communications ports to connect to an operator interface or HMI? Would you like to connect to a network of other AutomationDirect products, or a MODBUS RTU or Ethernet network? If yes, then choose between the H4-ECOM Ethernet communications module or the D4-DCM serial data communications module. Both modules' specifications and communications details are covered later in this section.

Note: The DL405 CPUs also support a MODBUS RTU master module for connection to a MODBUS RTU network. This module is listed later in this section.

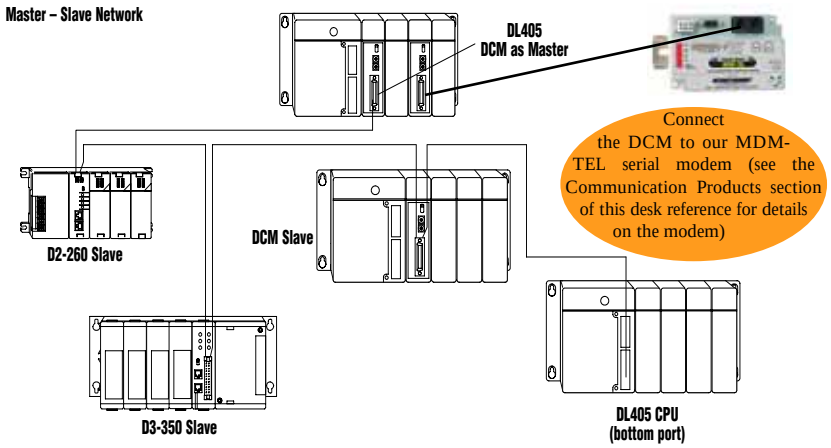
Ethernet networking with the H4-ECOM

All DL405 CPUs support the H4-ECOM module, which makes Ethernet networking a snap. The H4-ECOM module supports industry-standard 10BaseT networking with an RJ45 port. The H4-ECOM-F has ST-style bayonet connectors for 10BaseFL fiber optic connections. The ECOM modules use standard cables, hubs and repeaters, which are available from a large number of suppliers. A virtually unlimited number of PLCs can be connected to an Ethernet network using ECOM modules. This is the fastest data transfer rate we offer for your HMI or other Windows-based software. Use *Direct*SOFT32 to program any PLC on the network, and when monitoring your operating PLC, you will see much faster updates with Ethernet and the ECOM module.



Serial networking with the D4-DCM

All DL405 CPUs support the D4-DCM Data Communications Module that can serve as a *Direct*Net master/slave, *Direct*Net peer, or a MODBUS RTU slave. The D4-DCM supports RS-232C and RS-422 communications. You can program the CPU through the DCM locally, or if a PC is the RS-422 master, you can use *Direct*Soft32 to program any PLC on the network.



SELECT THE I/O MODULES

There are several factors you should consider when choosing an I/O module.

1. Environmental specifications: What environmental conditions will the I/O modules be subjected to?

2. Hardware specifications: Does this product have the right features, performance, and capacity to adequately serve your application?

3. Field termination: How does this module connect to your field devices? For DC modules, do you need a sinking or sourcing module?

4. Power budget: It is very important that your module selections operate within the base power budget. Refer to the power budget description later in this section.

Check the environmental specifications

The following table lists environmental specifications that globally apply to the DL405 system (CPU, Expansion Unit, Bases, and I/O modules). Be sure the modules you choose are operated within these environmental specifications.

Specification	Rating
Storage Temperature	-4°F - 158°F (-20°C to 70°C)*
Ambient Operating Temperature	32°F - 140°F (0° to 60°C)*
Ambient Humidity	5% - 95% relative humidity (non-condensing)**
Vibration Resistance	MIL STD810C, Method 514.2
Shock Resistance	MIL STD810C, Method 516.2
Noise Immunity	NEMA(ICS3-304)
Atmosphere	No corrosive gases

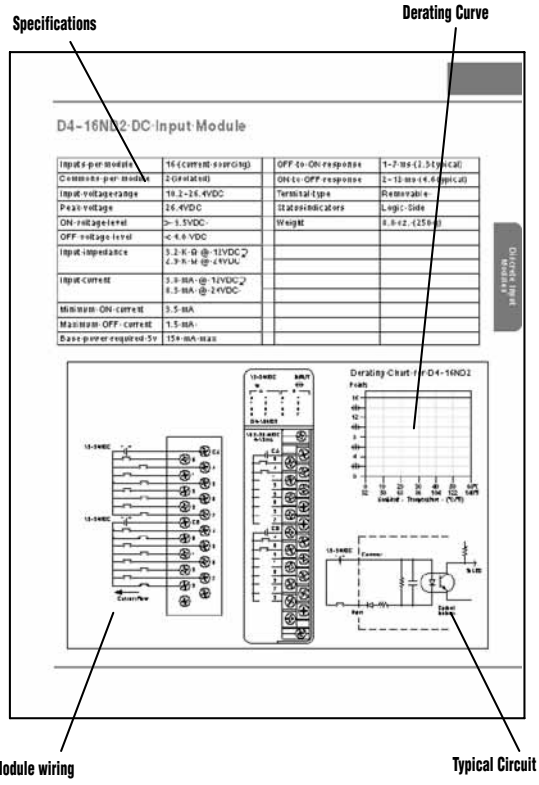
*Storage temperature for the Handheld Programmer is 14° to 149°F (-10° to 65°C).
Storage temperature for the DV-1000 is -4 to 158°F (-20 to 70°C).
Operating temperature for the DV-1000 is 32° to 122° F (0° to 50°C).
**Ambient humidity for the Handheld Programmer is 20% to 90% non-condensing.
Ambient humidity for the DV-1000 is 30% to 95% non-condensing.

Review hardware specifications

The hardware specifications for every DL405 module are described later in this section. Discrete module specifications are in a format similar to the example shown. Take time to understand the specification chart, the derating curve, and the wiring diagram. The specialty modules specifications are shown in a format relevant for each module. All of these module specifications should help you determine if the module is right for your application.

Understand the factors affecting field termination

Physical wire terminations: In general, DL405 modules use four types of field terminations. They include: removable terminal blocks (included on all 8 and 16 point modules), specialty D-sub connectors (used on 32 and 64 point modules), standard D-sub connectors (used on most specialty intelligent modules), and phone jack style (used on some specialty modules and included in the universal cable kit).



High-density modules do not come with connectors. To create a custom cable, solder or ribbon-style connectors are sold two per pack, and must be ordered separately. See the individual I/O specification sheets for the part numbers. The easiest way to wire high-density modules is with pre-wired *ZIP*Link cables and connector modules.

Sinking and sourcing for DC field devices: If you are using a DC-type of field device, you should determine whether the device is a sinking or sourcing configuration. This may affect your module selection since it determines the manner in which the device must be wired to the module.

AUTOMATIONDIRECT offers both sinking and sourcing modules. Refer to the Appendix for a complete explanation on sinking and sourcing and how this could affect your system.

I/O Modules

H4-CTRIO high-speed counter module vs. D4-HSC high speed counter module

Select the H4-CTRIO instead of the D4-HSC if your application requires:

- More than one quadrature encoder
- More than one single up counter
- Pulse outputs
- Output operations on the module based on counts, without interaction with the CPU scan

The CTRIO is configured using a Windows-based "Wizard" utility, eliminating the need for ladder logic programming to configure the module. Multiple CTRIO modules can be used in a base to support additional input/output pulse trains.

Analog module selection tips

If you're going to control the speed of an AC inverter or drive with the DL405 analog module, make sure you select either the current sourcing F4-04DAS-1 or voltage sourcing F4-04DAS-2 isolated analog output module. Complete module specifications are listed later in this section.

*ZIP*Link connection systems

*ZIP*Links consist of PLC interface cables and connector modules that offer "plug and play" capability by plugging one end of the *ZIP*Link cable into an I/O module and the other end into the *ZIP*Link connector module. This eliminates the tedious process of wiring PLC I/O to terminal blocks. For more information, refer to the Connection Systems section of this desk reference catalog to determine compatibility among PLCs, cables and I/O modules.

DIN*nectors* terminal blocks

DIN*nectors* are DIN rail mounted connectors or terminal blocks. All DIN*nectors* are UL, CSA, VDE, SEV, RINA and IEC approved. Refer to the Connection Systems section of this desk reference for details.

Need spare parts?

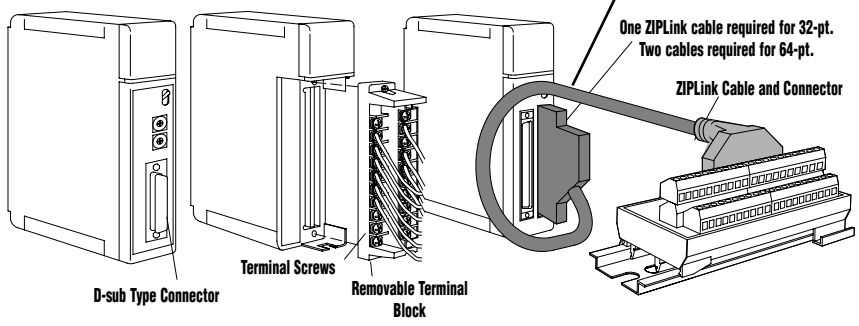
Sometimes it is helpful to have extra I/O module connectors or spare fuses. The DL405 spare parts and accessories are listed below:

D4-FUSE-2 (<--->)	Fuses for F4-08TRS-2
D4-ACC-1 (<--->)	CPU spare kit (covers and screws)
D4-ACC-2 (<--->)	Screws for 8-pt. I/O module terminals
D4-ACC-3 (<--->)	Screws for 16-pt. I/O module terminals
D4-FILL (<--->)	Filler module to cover empty I/O slots
D4-8IOCON (<--->)	8-pt. module terminal blocks
D4-16IOCON (<--->)	16-pt. module terminal blocks
D4-IOCVR (<--->)	Replacement terminal block covers
D4-IO3264R (<--->)	32/64-pt. ribbon-style connectors
D4-IO3264S (<--->)	32/64-pt. solder-style connectors

Now that you understand the factors affecting your choice of I/O modules, it's time to choose the ones that best fulfill your needs. Review the module specifications later in this section. (See the DL405 Price List for a complete list of part numbers.) If you have any questions, give us a call. When you have selected the modules you need, proceed to the next section to choose an I/O configuration scheme that best suits your application.

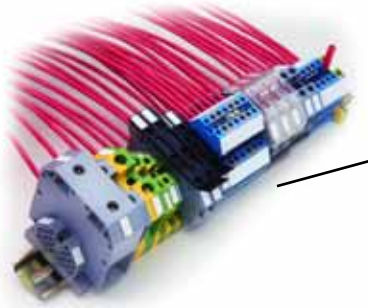
*ZIP*Links eliminate the tedious process of wiring the PLC I/O to terminal blocks. See the Connection Systems section of this desk reference for details.

*ZIP*Link connection system



This logo is placed by each I/O module that supports *ZIP*Link connection systems. (The I/O modules are listed at the end of this section). See the Connection Systems sections of this desk reference for complete information on *ZIP*Links.

DIN*nectors* terminal blocks



DIN*nectors* provide a means of connecting and identifying two or more wires within the demands of an industrial environment. See the Connection Systems section of this desk reference for details.

SELECT AN I/O CONFIGURATION

Four configurations for system flexibility

The DL405 system offers four major configurations of I/O. The choices are described on the following two pages. Keep these choices in mind as you plan your I/O system.

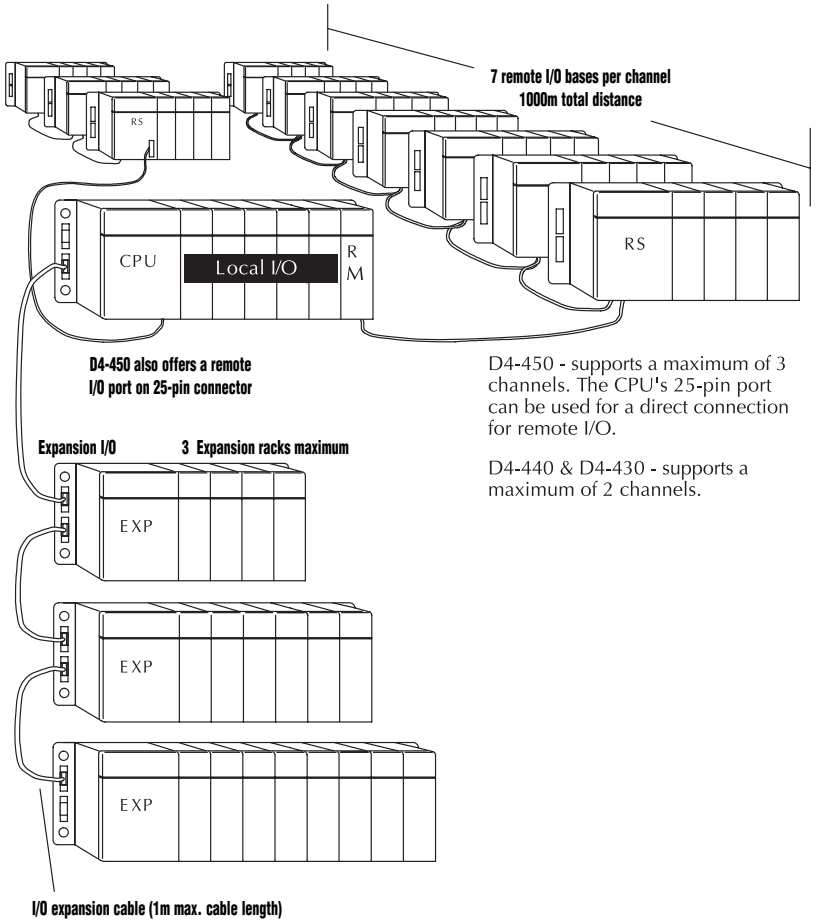
Local I/O

The local base is the base that holds the CPU. The term "local I/O" refers to the modules that reside in the base with the CPU. Each local I/O point is updated on every CPU scan. Up to 512 points are available in the local base by using 64-point modules (requires a D4-440 or D4-450).

Expansion I/O

Expansion bases are commonly used when there are not enough I/O slots available in the local base, or when the power budget for the base will be exceeded with the addition of I/O. This configuration requires additional base(s), each of which require a D4-EX Local Expansion Unit in place of the CPU, and a cable to connect the expansion bases to the local CPU base. Up to three expansion bases can be connected to a local CPU base, for a total of four bases. The CPU updates expansion I/O points on every scan. The total number of local and expansion I/O points for the D4-450 is 2048 points. The total for the D4-430 and D4-440 is 640 I/O.

Example of I/O system configurations



D4-450 - supports a maximum of 3 channels. The CPU's 25-pin port can be used for a direct connection for remote I/O.

D4-440 & D4-430 - supports a maximum of 2 channels.

I/O Configurations

Ethernet remote I/O

The DL405 Ethernet Remote I/O system allows you to locate I/O bases at a remote distance from the CPU. For many applications, this can reduce wiring costs by allowing I/O points to be located near the devices they are controlling.

The Ethernet Remote Master module (H4-ERM) is placed in an I/O slot of the local CPU base. Ethernet Base Controller (EBC) modules serve as the Remote Slave Units and are placed in the CPU slot of one or more remote bases. You can use standard DL405 modules in the remote bases. The Remote Slaves are connected to the Master using Category 5 UTP cables for cable runs up to 100 meters. Use repeaters to extend distances and hubs to expand the number of nodes. Our fiber optic version uses industry standard 62.5/125 ST-style fiber optic cables and can be run up to 2,000 meters.

Each H4-ERM module can support up to 16 slaves: 16 H2-EBC systems, 16 Terminator I/O EBC systems, or 16 fully expanded H4-EBC systems.

The PLC, ERM and EBC slave modules work together to update the remote I/O points. These three scan cycles are occurring at the same time, but asynchronously. It is recommended that critical I/O points that must be monitored every scan be placed in the CPU base.

ERM Workbench is an easy-to-use Windows-based software utility that is used to configure the ERM and its remote slaves.

It is highly recommended that a dedicated Ethernet remote I/O network be used for the ERM and its slaves. While Ethernet networks can handle a very large number of data transactions, and normally handle them very quickly, heavy Ethernet traffic can adversely affect the reliability of the slave I/O and the speed of the I/O network. Keep ERM networks, multiple ERM networks and ECOM/office networks isolated from one another.

I/O Configuration Specifications		D4-450	D4-440	D4-430
Total Channels Available	Total number of Remote channels available	3	2	2
Remote I/O	Maximum number of D4-RM per system	2	2	2
	Number of masters built into CPU port	1	0	0
	Maximum I/O points supported per channel	512	512	512
	Maximum I/O points supported	1536	1024	512
	Maximum number of remote I/O bases per channel	7	7	7

Serial remote I/O

Remote I/O solutions allow you to place I/O points at some remote distance from the CPU. The remote I/O points are updated asynchronously to the CPU scan. For this reason, remote I/O applications should be limited to those that do not require the I/O points to be updated on every scan.

Remote I/O requires a remote master to control the remote I/O channel. This master can be a module (D4-RM) in the local CPU base, or the D4-450 CPU (through the 25-pin port). For the D4-RM solution, the CPU updates the remote master, then the remote master handles all communication to and from the remote I/O base by communicating to the remote slave module (D4-RS) installed in each remote base. If you use the D4-450 CPU, then it communicates directly with the D4-RS.

The maximum distance between a Remote Master and a Remote Slave is 3300 feet (1000 m).

MODULE PLACEMENT AND I/O USAGE TABLES

I/O module placement restrictions

The most commonly used I/O modules for the DL405 system (AC, DC, AC/DC, Relay, and Analog) can usually be used in any base you have in your local, expansion or remote system. However, some specialty modules (and the 64pt. discrete I/O modules) are limited to the CPU base, or our D4-xxB-1 bases. This table lists by category the valid locations for all modules/units in a DL405 system. Keep in mind the power budget may limit where some modules can be placed, since the necessary power may have been consumed.

I/O point usage table for modules

The bottom tables indicate the number of I/O points consumed by each module. Use this information to ensure you stay within the I/O count of the I/O configuration you have chosen. Remember, each CPU supports a different amount of I/O. Check the specifications to determine the I/O limits.

Module/Unit	Local CPU Base	Expansion Base	Remote Base
CPUs	Only		
Expansion Units		CPU slot only	
8/16/32pt DC Input	✔	✔	✔
64pt DC Input	✔1		
AC Input	✔	✔	✔
AC/DC Input	✔	✔	✔
8/16/32pt DC Input	✔	✔	✔
64pt DC Output	✔1		
DC Input	✔	✔	✔
Relay Output	✔	✔	✔
Analog Input and Output	✔	✔	✔
Thermocouple Input	✔	✔	✔
Remote I/O			
Remote Masters (serial / Ethernet)	✔	✔2	
Remote Slave Unit			
Communications and Networking Modules	✔		
CoProcessor Modules	✔		
Specialty Modules			
Interrupt			
with D4-430	Slot 0 only		
with D4-440/D4-450	Slot 0 and1		
PID	✔		
4-Loop Temp. Controller	✔		
High-speed Counter	✔	✔3	
Simulator	✔	✔	✔

1 – If you are using 64pt. modules, you cannot install any specialty modules in slots 5,6, or 7 of the local CPU base.
2 – Modules can be installed in expansion bases if you are using the D4-450 CPU and ALL bases in the system are D4-xB-1 bases.
3 - D4-HSC only

I/O points required per module

DC Input	I/O pt.
D4-08ND3S	8 in
D4-16ND2	16 in
D4-16ND2F	16 in
D4-32ND3-1	32 in
D4-32ND3-2	32 in
D4-64ND2	64 in
AC Input	
D4-08NA	8 in
D4-16NA	16 in
D4-16NA-1	16 in
AC/DC Input	
D4-16NE3	16 in
F4-08NE3S	8 in

DC Output	I/O pt.
D4-08TD1 (S)	8 out
D4-16TD1	16 out
D4-16TD2	16 out
D4-32TD1, (-1)	32 out
D4-32TD2	32 out
D4-64TD1	64 out
AC Output	
D4-08TA	8 out
D4-16TA	16 out
Relay Output	
D4-08TR	8 out
F4-08TRS-1	8 out
F4-08TRS-2	8 out
D4-16TR	16 out

Analog	I/O pt.
F4-04AD	16 or 32 in
F4-04ADS	16 in
F4-08AD	16 in
F4-16AD -1,(-2)	16 in
F4-04DA-1, (-2)	16 out
F4-04DAS-1, (2)	32 out
F4-08DA-1, (-2)	16 out
F4-16DA-1, (-2)	32 out
F4-08RTD	32 in
F4-08THM-n	16 in
F4-08THM	32 in
Communications/Networking	
All modules	0
CoProcessors	
All modules	0

Remote I/O	I/O pt.
H4-ERM	0
D4-RM	0
D4-RS	0
D4-RSDC	0
Specialty Modules	
D4-INT	16 in
H4-CTRIO	0
D4-HSC	16 in/32 out
F4-16PID	0
F4-8MPI	0
D4-16SIM	8 or 16 in
F4-4LTC	0

DL405 I/O Addressing

Many of our customers were familiar with other PLC systems prior to trying *Direct*LOGIC products. One of the key differences between various PLC systems is how they treat the I/O module addressing. This section will describe how we address the individual I/O points in a DL405 system.

Octal addressing

The DL405 uses octal addressing. That is, the I/O point addresses do not include any "8s" or "9s". The I/O points start at 0 and continue in increments of 8, 16, 32, or 64 points, depending on the modules being used. We use the designator "X" for inputs and "Y" for outputs.

Automatic addressing

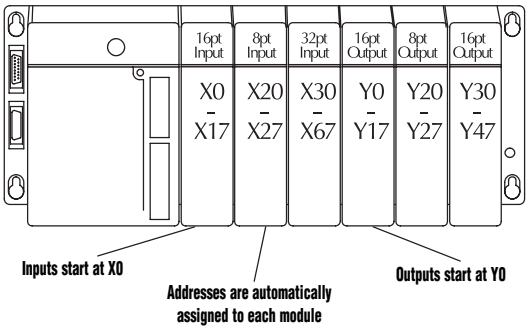
The DL405 CPUs automatically examine any I/O modules in the local CPU and expansion bases to establish the correct I/O configuration and addressing on power-up. The modules don't have to be grouped by type and the discrete input and output modules can typically be mixed in any order. However, there may be restrictions placed on some specialty modules or combinations of modules (Check the Module Placement restrictions). The following diagram shows sample addresses for a simple system containing discrete I/O modules.

For most applications, you never have to change or adjust the configuration. However, if you use automatic addressing and you add modules in between existing modules, the I/O addresses may be subject to renumbering. If you want to add modules in the future, add them to the right of any existing modules to avoid any re-addressing of your I/O points, or use manual addressing.

Manual addressing

The D4-440 and D4-450 CPUs allow you to manually assign I/O addresses for any or all I/O slots on the local or expansion bases. This feature is useful if you have a standard configuration that you must sometimes change slightly to accommodate special requests.

It is also useful if you have to leave empty slots in between I/O modules and you do not want an added module to cause addressing problems. In automatic configuration, the addresses are assigned on 8-point boundaries. Manual configuration assumes that all modules are at least 16 points, so you can only assign addresses that are a multiple of 20 (octal). This does not mean you can only use 16, 32, or 64-point modules with manual configuration. You can use 8-point modules, but 16 addresses will be assigned and 8 are unused.

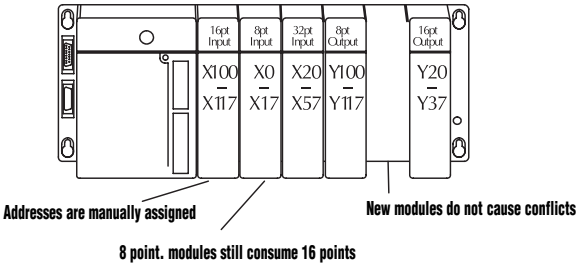


Remote I/O addressing

Remote I/O is very flexible when it comes to I/O addressing. For example, you specify the starting addresses, number of total points, etc. when you set up the system.

Manual addressing and choice of data type designators

With Remote I/O, you can choose the designator type that is used for the addresses. For example, you could choose to map the remote points into GX data types or GY data types or even into control relays. This can be very helpful in those situations where the local and expansion I/O have consumed all of the X inputs or Y outputs. You make these various choices when you define the setup logic for the remote I/O.



CHECK THE POWER BUDGET

Verify your power budget requirements

Your I/O configuration choice can be affected by the power requirements of the I/O modules you choose. When determining the types and quantity of I/O modules you will be using, it is important to remember there is a limited amount of power available from the power supply.

The chart on the opposite page indicates the power supplied and used by each DL405 device. The adjacent chart shows an example of how to calculate the power used by your particular system. These two charts should make it easy for you to determine if the devices you have chosen fit within the power budget of your system configuration.

If the I/O you have chosen exceeds the maximum power available from the power supply, you can resolve the problem by shifting some of the modules to an expansion base or remote I/O base (if you are using remote I/O).

Warning: It is extremely important to calculate the power budget correctly. If you exceed the power budget, the system may operate in an unpredictable manner which may result in a risk of personal injury or equipment damage.

Calculating your power usage

The following example shows how to calculate the power budget for the DL405 system.

The example is constructed around a single 8-slot base using the devices shown. It is recommended you construct a similar table for each base in your DL405 system.

A				
	Base Number 0	***Device Type***	***5 VDC (mA)***	***External 24 VDC Power (mA)***
B	**CURRENT SUPPLIED**			
	CPU/Expansion Unit /Remote Slave	D4-440 CPU	3700	400
C	**CURRENT REQUIRED**			
	SLOT 0	D4-16ND2	+150	+0
	SLOT 1	D4-16ND2	+150	+0
	SLOT 2	D4-02DA	+250	+300
	SLOT 3	D4-08ND3S	+100	+0
	SLOT 4	D4-08ND3S	+100	+0
	SLOT 5	D4-16TD2	+100	+0
	SLOT 6	D4-16TD2	+100	+0
	SLOT 7	D4-16TR	+1000	+0
D	**OTHER**			
	BASE	D4-08B	+80	+0
	Handheld Programmer	D4-HPP	+320	+0
E	**Maximum Current Required**		***2950***	***300***
F	**Remaining Current Available**		***3700-2950=750***	***400-300=100***

1. Using a chart similar to the 3one above, fill in column 2.
2. Using the tables on the opposite page, enter the current supplied and used by each device (columns 3 and 4). Pay special attention to the current supplied by the CPU, Expansion Unit, and Remote Slave since they differ. Devices which fall into the "Other" category (Row D) are devices such as the Base and the Handheld programmer, which also have power requirements, but do not plug directly into the base.
3. Add the current used by the system devices (columns 3 and 4) starting with Slot 0 and put the total in the row labeled "maximum current required" (Row E).
4. Subtract the row labeled "Maximum current required" (Row E), from the row labeled "Current Supplied" (Row B). Place the difference in the row labeled "Remaining Current Available" (Row F).
5. If "Maximum Current Required" is greater than "Current Supplied" in either column 3 or 4, the power budget will be exceeded. It will be unsafe to use this configuration and you will need to restructure your I/O configuration. Note the auxiliary 24 VDC power supply does not need to supply all the external power. If you need more than the 400mA supplied, you can add an external 24VDC power supply. This will help keep you within your power budget for external power.

DL405 CPU power supply specifications and power requirements

Specification	AC Powered Units	24 VDC Powered Units	125 VDC Powered Units
Part Numbers	D4-450, D4-440, D4-430, D4-EX (expansion unit)	D4-440DC-1, D4-EXDC (expansion unit) D4-450DC-1	D4-440DC-2 D4-450DC-2
Voltage Withstand (dielectric)	1 minute @ 1,500 VAC between primary, secondary, field ground, and run relay		
Insulation Resistance	> 10MΩ at 500VDC		
Input Voltage Range	85-132 VAC (110 range) 170-264 VAC (220 range	20-28 VDC (24 VDC) with less than 10% ripple	90-146 VDC (125 VDC) with less than 10% ripple
Maximum Inrush Current	20 A	20 A	20 A
Maximum Power	50 VA	38 W	30 W

Power Requirements

Power Supplied

CPUs/Remote Units/ Expansion Units	5 VDC Current Supplied in mA	24V Aux Power Supplied in mA	CPUs/Remote Units/Expansion Units	5V Current Supplied in mA	24VAux. Power Supplied in mA
D4-430 CPU	3700	400	D4-EX	4000	400
D4-440 CPU	3700	400	D4-EXDC	4000	NONE
D4-440DC-1 CPU	3700	NONE	D4-EXDC-2	3700	NONE
D4-440DC-2 CPU	3700	NONE	D4-RS	3700	400
D4-450 CPU	3100	400	D4-RSDC	3700	NONE
D4-450DC-1 CPU	3100	NONE	H4-EBC	3470	400
D4-450DC-2 CPU	3100	NONE	H4-EBC-F	3300	400

Power Consumed

Power-consuming Device	5V Current Consumed	External 24VD Current Required	Power-consuming Device	5V Current Consumed	External 24VDC Current Required
I/O Bases			**Analog Modules (continued)**		
D4-04B, D4-04B-1	80	NONE	F4-16AD-1	75	100
D4-06B, D4-06B-1	80	NONE	F4-16AD-2	75	100
D4-08B, D4-08B-1	80	NONE	F4-04DA	120	100
			F4-04DA-1	70	75+20per circuit
DC Input Modules			F4-04DA-2	90	90
			F4-04DAS-1	60	60 per circuit
D4-08ND3S	100	NONE	F4-04DAS-2	60	60 per circuit
D4-16ND2	150	NONE	F4-08DA-1	90	100+20 per circuit
D4-16ND2F	150	NONE	F4-08DA-2	80	150
D4-32ND3-1	150	NONE	F4-16DA-1	90	100+20 per circuit
D4-32ND3-2	150	NONE	F4-16DA-2	80	25 max.
D4-64ND2	300 max.	NONE	F4-08RTD	80	NONE
			F4-08THM-n	120	50
AC Input Modules			F4-08THM	110	60
D4-08NA	100	NONE	**Remote I/O**		
D4-16NA	150	NONE			
AC/DC Input Modules			H4-ERM	320	NONE
D4-16NE3	150	NONE	H4-ERM-F	450	NONE
F4-08NE3S	90	NONE	D4-RM	300	NONE
DC Output Modules			**Communications and Networking**		
D4-08TD1	150	35			
F4-08TD1S	295	NONE	H4-ECOM	320	NONE
D4-16TD1	200	125	H4-ECOM-F	450	NONE
D4-16TD2	400	NONE	D4-DCM	500	NONE
D4-32TD1	250	140	F4-MAS-MB	235	NONE
D4-32TD1-1	250	140 (15V)	FA-UNICON	NONE	65
D4-32TD2	350	120 (4A max including loads)	**CoProcessors**		
D4-64TD1	800	NONE	F4-CP128-1	305	NONE
AC Output Modules			F4-CP128-T	350	NONE
D4-08TA	250	NONE	**Specialty Modules**		
D4-16TA	450	NONE			
Relay Output Modules			H4-CTRIO	400	NONE
			D4-INT	100	NONE
D4-08TR	550	NONE	D4-HSC	300	NONE
F4-08TRS-1	575	NONE	F4-16PID	160	NONE
F4-08TRS	575	NONE	F4-08MPI	225	170
D4-16TR	1000	NONE	D4-16SIM	150	NONE
			F4-4LTC	280	75
Analog Modules			**Programming**		
			D4-HPP-1 (Handheld Prog.)	320	NONE
F4-04AD	85	100	**Operator Interface**		
F4-04ADS	270	120	DV-1000	150	NONE
F4-08AD	75	90			

DIMENSIONS AND INSTALLATION

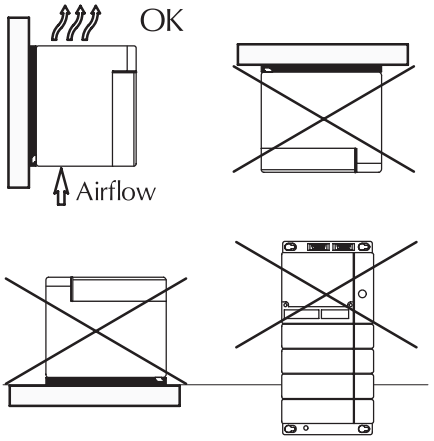
It is important to understand the installation requirements for your DL405 system. This will help ensure that the DL405 products operate within their environmental and electrical limits.

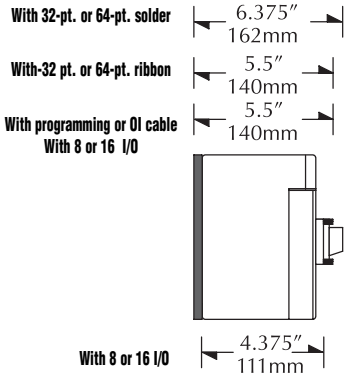
Plan for safety

This catalog should never be used as a replacement for the user manual. The user manual, D4-USER-M, contains important safety information that must be followed. The system installation should comply with all appropriate electrical codes and standards.

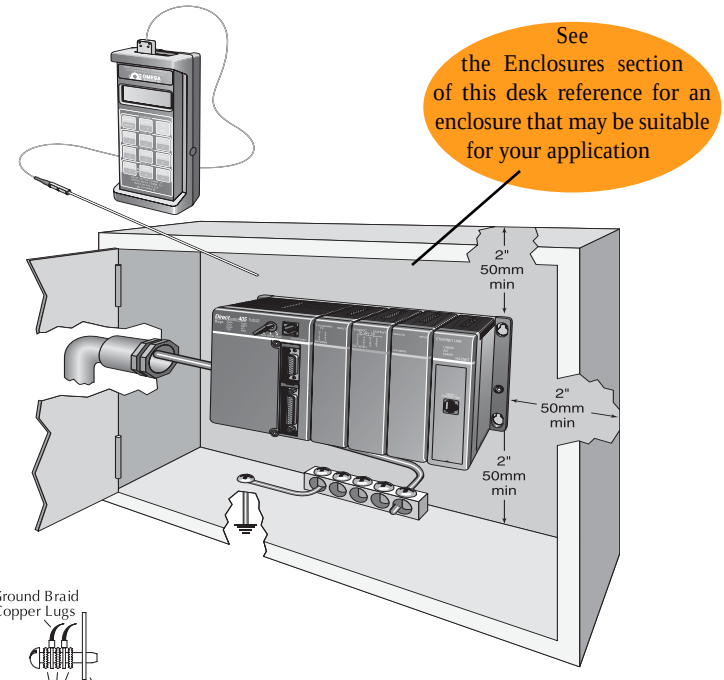
Base dimensions and mounting orientation

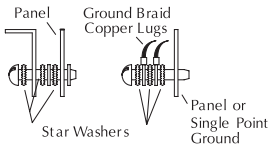
Use the diagrams to the right to make sure the DL405 system can be installed in your application. To ensure proper airflow for cooling purposes, DL405 bases must be mounted horizontally. It is important to check these dimensions against the conditions required for your application. For example, it is recommended that you leave 1.5" 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.





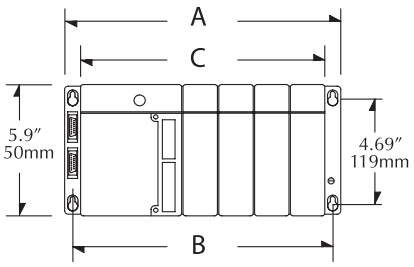
Specification	Rating
Storage temperature	-4°F - 158°F (-20°C to 70°C)
Ambient operating temperature	32°F - 140°F (0° to 60°C)
Ambient humidity	30% - 95% relative humidity (non-condensing)
Vibration resistance	MIL STD 810C, Method514.2
Shock resistance	MIL STD810C, Method516.2
Noise immunity	NEMA(ICS3-304)
Atmosphere	No corrosive gases





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 DL405 component.

DL405 base



BASE	PRICE	A		B		C	
D4-04B-1	<--->	11.53"	293mm	10.82"	275mm	10.50"	267mm
D4-06B-1	<--->	14.44"	367mm	13.74"	349mm	13.42"	341mm
D4-08B-1	<--->	17.36"	441mm	16.65"	423m	16.32"	423mm

Base Configurations

Four, six, and eight-slot bases

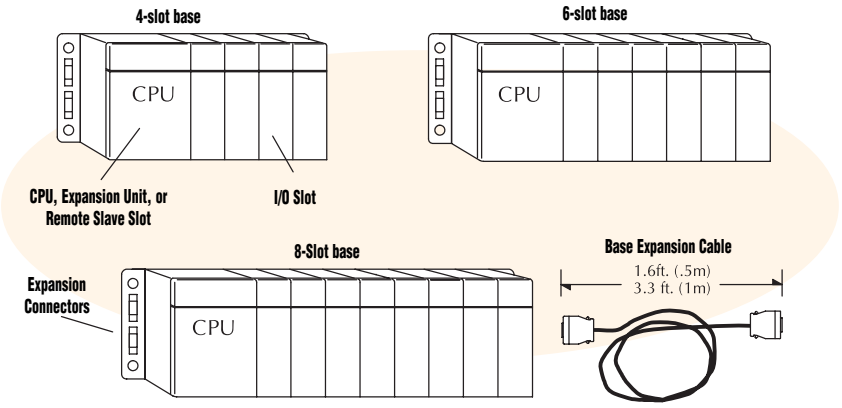
The DL405 product family offers four, six, and eight-slot I/O bases.

Expansion units

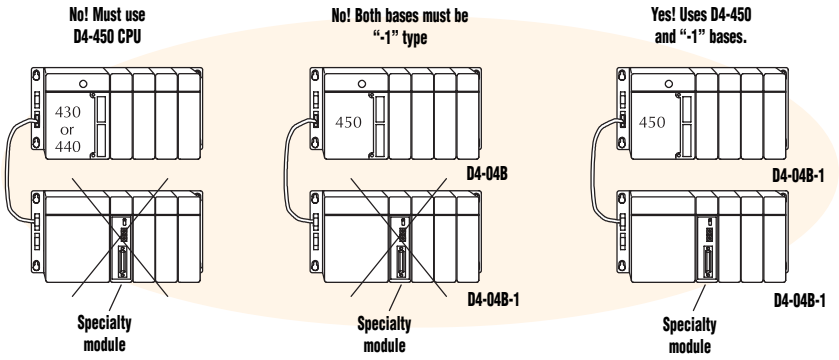
The expansion units are only necessary when you want to use local expansion. They are installed in the CPU slot of the expansion bases. They appear very similar to CPUs, but they only contain a power supply. One of the most often asked questions for the DL405 family is, "Does the CPU consume an I/O slot?" The answer is no. The CPU has a special slot in the base and does not consume any of the available I/O slots. The same is true for Expansion Units (D4-EX, D4-EXDC and D4-EXDC-2) and the Remote Slave Units (D4-RS). An expansion cable is required to connect each of the expansion bases to the CPU base (D4-EXCBL).

D4-450 and –1 bases

In the past, a DL405 system has been limited to only accepting specialty modules in the local CPU base. The –1 bases must be used with the D4-450 CPU to remove this limitation. The part numbers for the bases are D4-04B-1, D4-06B-1, and D4-08B-1. (Note: you cannot simply add a –1 base to an existing system to gain specialty modules in expansion bases. Instead, you must replace the CPU base and all other expansion bases as well.) You can add the –1 bases in an older system, but they are subject to the limitations of the regular bases.



Specialty modules in expansion bases



SERIAL DATA COMMUNICATIONS MODULE

Data Communications Module
D4-DCM <--->

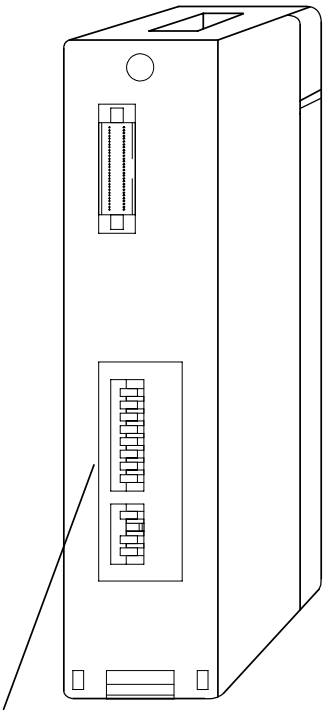
Overview

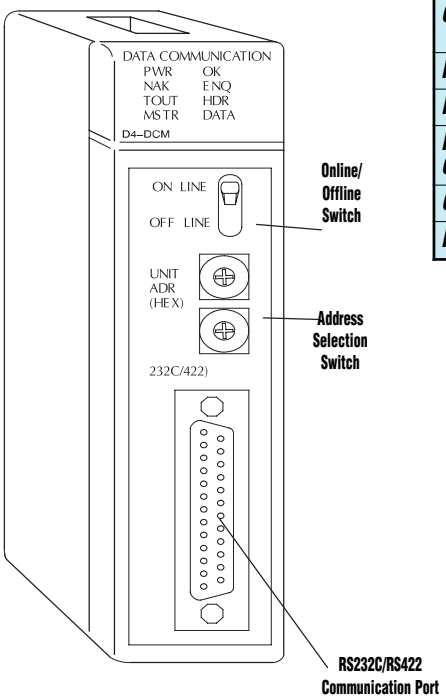
The DL405 Data Communication Module (DCM) is a general purpose communications interface for the DL405 family of PLCs. This module is primarily used for three reasons:

- Extra general purpose communications port to connect a personal computer, operator interface, etc.
- Network interface to a ***Direct***NET network
- Network interface to a MODBUS network using the RTU protocol as slave.

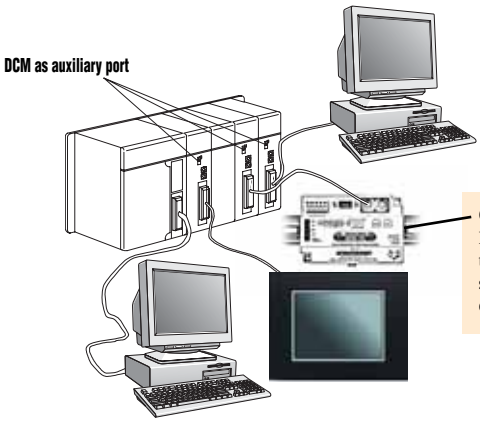
Extra communications port

All DL405 CPUs offer at least two built-in communication ports. (The D4-450 even has four ports.) However, if even more communication ports are needed, additional Data Communication Modules can be added. As an extra communication port, the DCM has specifications identical to port 1 on the DL405 CPUs. Whatever can be connected to port 1 of the DL405 CPU can be connected to the DCM, just make sure the device has a DL405 compatible driver. This allows additional connections of devices, such as operator interfaces, personal computers, etc. Since the DCM does not require any programming, you can set the DCM communication parameters, connect the cables, and start transferring data.





Specifications	
Module Type	Intelligent
Modules per CPU	7 Maximum, any slot in CPU Base
Communications	RS232C/422, ***Direct***NET, SIMATIC®TI405™, or MODBUS (slave only) RTU protocol. Baud rate selectable from 300 to 38.4K baud. Odd or no parity. HEX or ASCII mode
Recommended Cable	Belden 9729 or equivalent (for RS422)
Field Wiring Connector	25 Pin D-shell connector
Internal Power Consumption	500mA maximum at 5VDC, (supplied by base power supply)
Operating Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Manufacturer	Koyo Electronics



Connect the DCM to our MDM-TEL serial modem. See the Communication Products section of this desk reference for details on the modem.

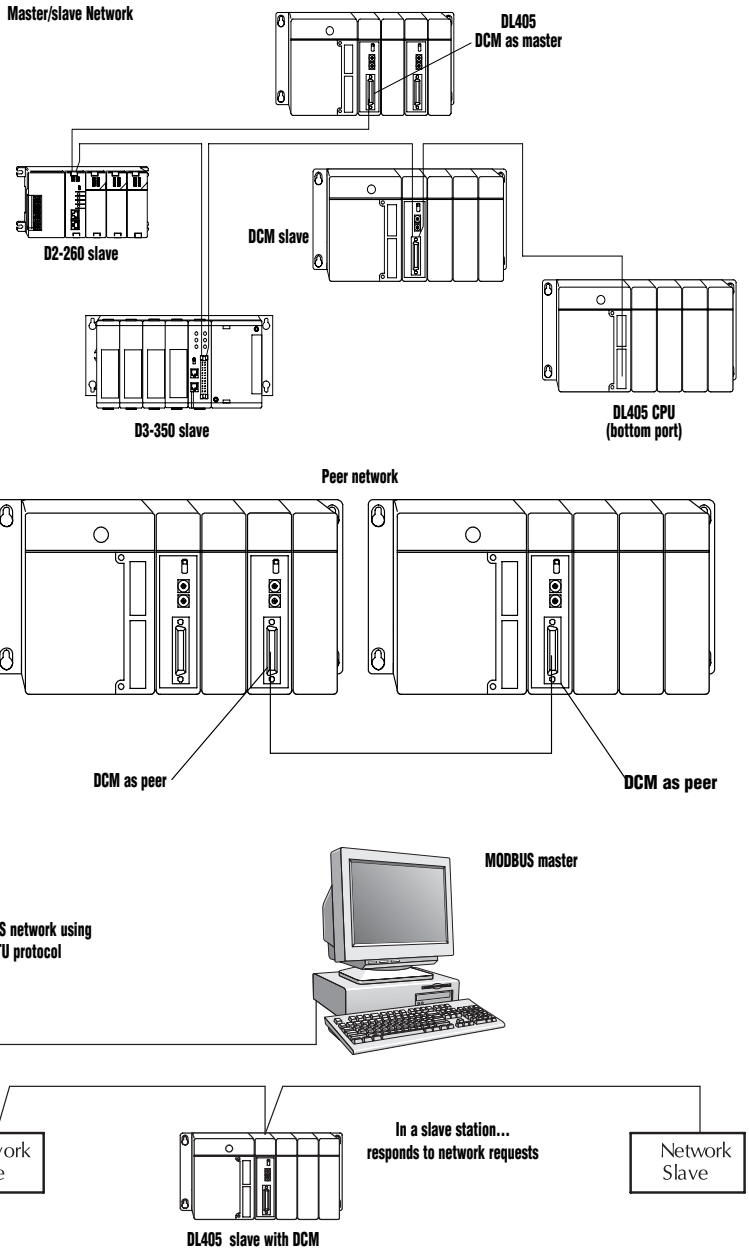
Serial Data Communications Module

*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 computer. The DCM connects easily to *Direct*NET. This network 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 of our PLCs or compatible PLC. The DCM allows the DL405 PLC to function as a master or a slave of *Direct*NET.

Network Master - The DCM allows the DL405 to serve as a master of a *Direct*NET Network. The DCM takes communication requests issued from the PLC program (the network part of the program can be very simple, as few as seven words) and automatically converts these requests into network commands to read data from or write data to another PLC on the network. This capability also allows a peer to peer configuration of two DL405 systems with DCMs. For other options, consider the H4-ECOM module.

Network Slave - All DL405 CPUs have a built-in network slave port. If this port is occupied, a DCM can be added to provide an additional network slave port. In this case, the DCM "listens" to the network for any messages containing the DCM's address. The DCM deciphers the network commands, carries out the request to read or write data, and sends confirmation and/or information to the master station. Since the DCM does not require any programming, you can set the DCM communication parameters, connect the cables and start transferring data.



MODBUS interface

The DCM can be used as a slave station interface to connect your DL405 system to the MODBUS network using the MODBUS RTU protocol. The host system must be capable of issuing the MODBUS commands to read or write the appropriate data.

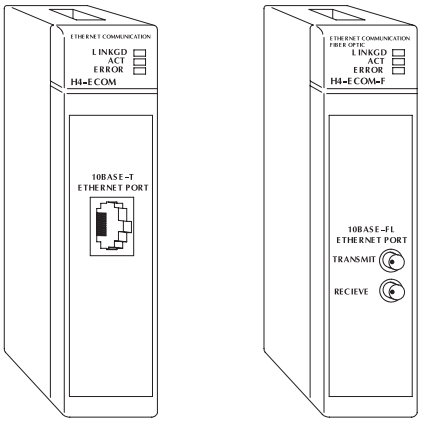
ETHERNET COMMUNICATION MODULES

Ethernet speed at an incredible price

- High-speed peer-to-peer networking of PLCs
- Ultrafast updates when using *Direct*SOFT32 Programming Software
- High-performance access for Human Machine Interface (HMI) or other Windows-based software when using our data acquisition software, such as DataWorx and KepDirect
- Free SDK for custom driver development
- Virtually unlimited number of network nodes are possible
- Simple set-up using DIP switches or NetEdit software

The Ethernet Communication Modules (ECOM) 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 cables, hubs, and repeaters. Or, use our data acquisition software, such as DataWorx and KepDirect OPC Server, to link Human Machine Interface (HMI) software to *Direct*LOGIC PLCs.

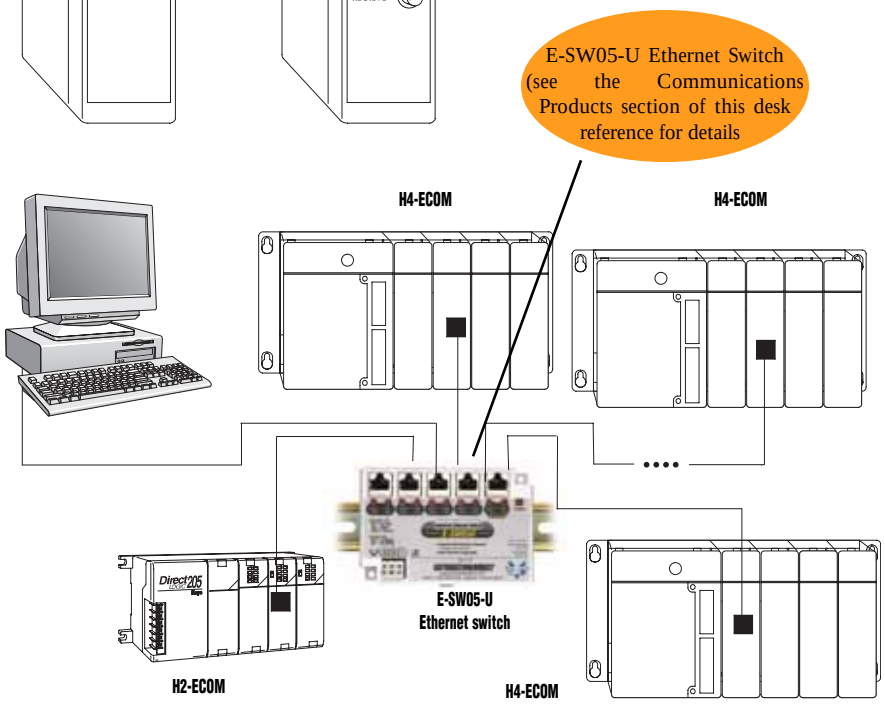
Our *Direct*SOFT32 Programming Software can be used to monitor or update the RLL program in any *Direct*LOGIC PLC on the network. Walk to each PLC to make programming changes, or do it all from one PC.



Simple connections

Use Category 5, UTP cables or 62.5/125 fiber optic cables depending on the requirements of your application. UTP cables can be run 100 meters between nodes and fiber optic cables can be run 2,000 meters.

Use repeaters to extend distances and expand the number of nodes. UTP cables are inexpensive, and fiber optic cables virtually eliminate electrical noise problems. We let you choose the connection that fits your needs!

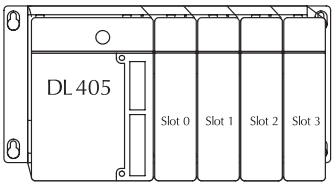


Specifications	H4-ECOM	H4-ECOM-F
Communications	10Base T Ethernet	10BaseFL Ethernet
Data Transfer Rate	10Mbps	10Mbps
Link Distance	100 meters (328 ft)	2,000 meters (6,560 ft)
Ethernet Port	RJ45	ST-style fiber optic
Ethernet Protocols	TCP/IP, IPX	TCP/IP, IPX
Power Consumption	530mA @ 5VDC	670mA @ 5VDC
Manufacturer	Host Automation Products, L.L.C.	Host Automation Products, L.L.C.

Ethernet Communication Modules

The H4-ECOM (-F) modules plug into any I/O slot of any local DL405 I/O base, including expansion bases*. The module maintains the identification data, descriptive information, and communication parameters for PLC-to PLC communications in flash memory. Disconnect power before installing or removing any PLC module.

Note: All DL405 series (and compatible) CPUs support the H4-ECOM (-F) modules.

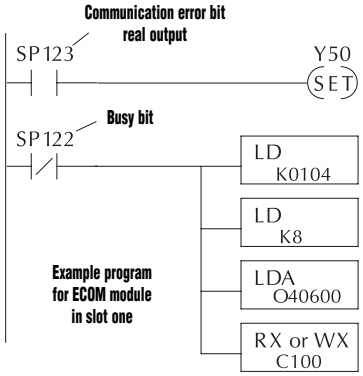


NetEdit software

Free NetEdit software ships with the ECOM User Manual. Use NetEdit 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. Two protocols are available for PC-to-PLC communications: IPX and TCP/IP. Select the one you want to use, or use them both. The NetEdit screen displays all identifiers and troubleshooting information for each module on the network. You can use NetEdit to adjust parameters for PLC-to-PLC communications by clicking on Advanced Settings. The network identifiers can also be changed using *Direct*SOFT32 Programming Software.

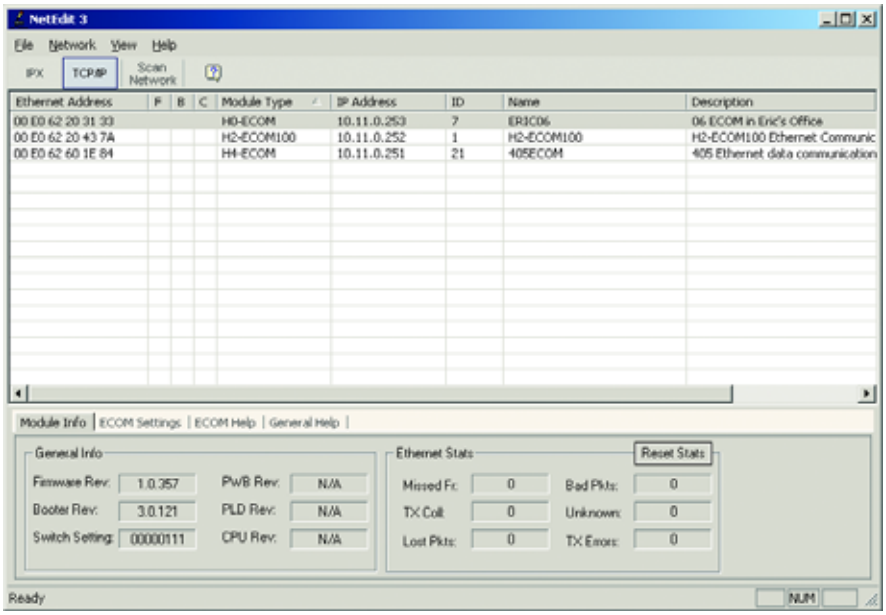
PLC-to-PLC communications

PLC-to-PLC 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. The second LD instruction contains the number of bytes being transferred. You can transfer up to 256 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 it is an RX or WX instruction that is being executed. The RX or WX instruction contains the beginning address in the responding PLC.



ECOM Starter Kit

The H4-ECOM-START gives you everything you need to make your first Ethernet network simple to build. It contains an ECOM module and instruction manual, a network adapter card for your PC, a crossover cable, and a *Direct*SOFT32 Showcase Demo CD. See our Web site for more details.



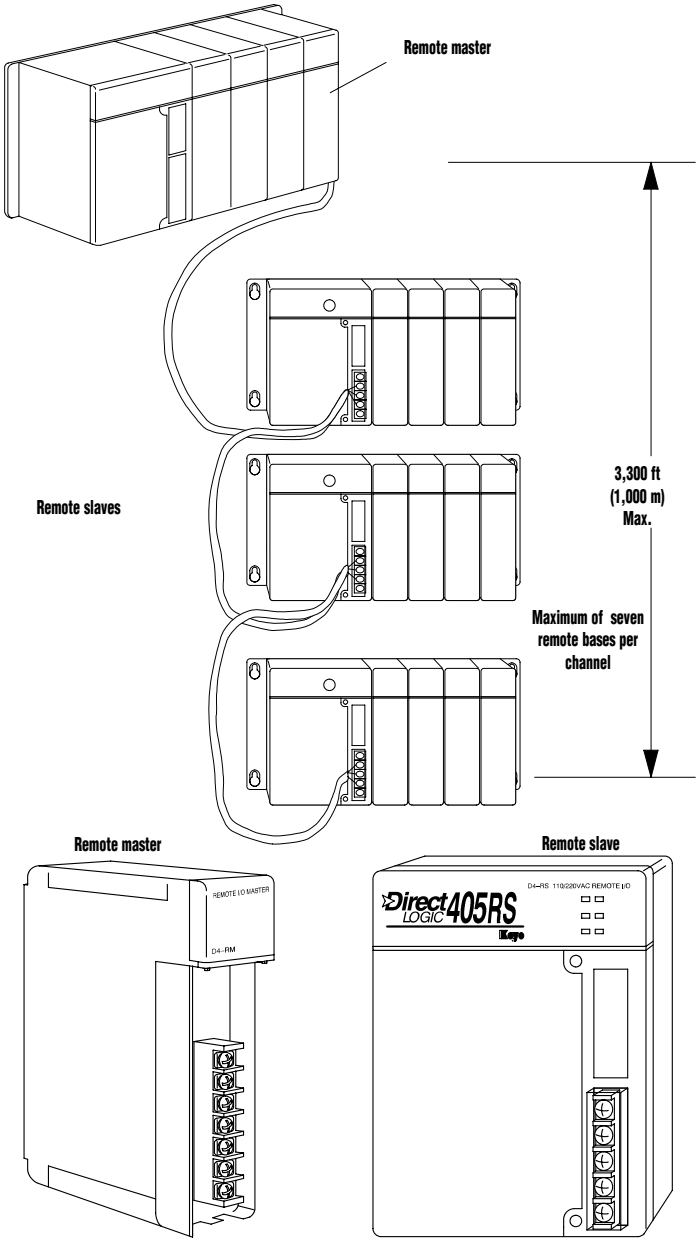
SERIAL REMOTE I/O MASTER/SLAVE MODULES

Remote I/O Master Module

D4-RM <--->

Remote I/O Slave Module

D4-RS <--->
D4-RSDC <--->



Overview

The DL405 offers full-size remote I/O. The goal of remote I/O is to reduce wiring costs by allowing I/O points to be located near the devices they are controlling. The chart at the bottom of this page shows the capacity for each CPU. The D4-450 has the D4-RM functionality built into the 25-pin port directly on the CPU. However, you can also choose to use the D4-RM discussed here. Here's how it works: A special module called the Remote Master is placed in the CPU base. This Master module controls up to seven Remote Slaves. The Remote Slaves are connected to the Master in a daisy-chain manner over a twisted pair communication cable (maximum length of 3300 feet or 1000m). Each Remote Slave attaches to a DL405 base (any size). Standard DL405 modules populate the remote bases.

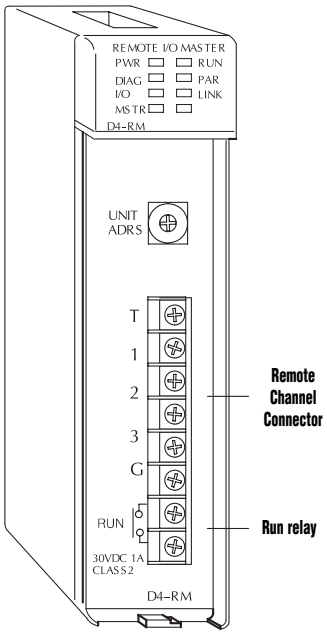
	D4-450	D4-440	D4-430
Maximum number of remote masters supported	3*	2	2
Maximum I/O points supported	1536	1024	512
Maximum I/O points supported per channel	512	512	512
Maximum number of remote I/O bases per channel	7	7	7

*max. of 2 D4-RM, 1 channel is via 25-pin CPU port

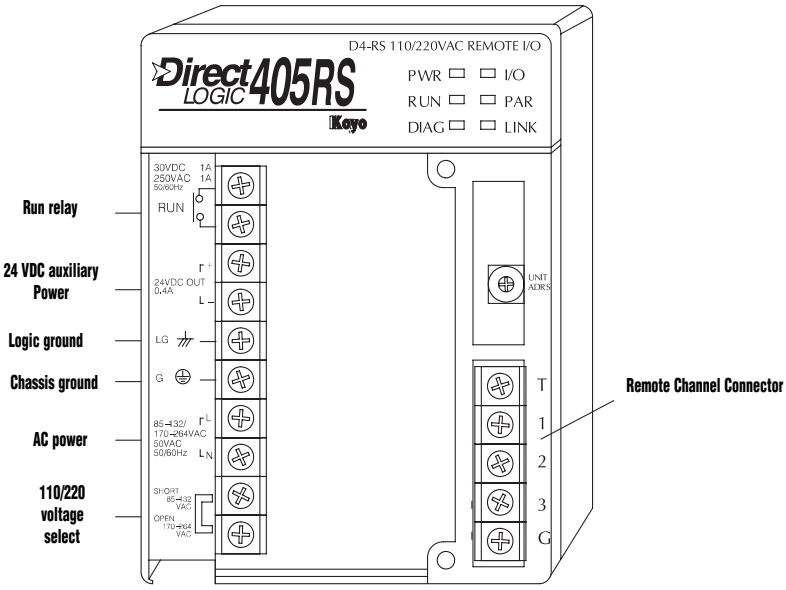
You can assign normal input and output addresses to the remote points, or you can assign special remote I/O addresses. The Remote Master sends the remote I/O information to the CPU. The communication between the Remote Master and the CPU is asynchronous to the CPU scan. For this reason, remote I/O applications should be limited to those that do not require the remote I/O points to be updated with every CPU scan.

Serial Remote I/O Master/Slave Modules

Remote Master



Remote Slave



Remote Master Specifications	
Module Type	Intelligent device
Number of Master per CPU	Two maximum for D4-430 and D4-440 Three maximum for D4-450 (max. number must include both Remote Master modules and Slice Master modules)
Maximum Slaves Supported	Seven slaves per channel
Communication to Slaves	RS485 via twisted pair with shield @ 38.4K baud
Recommended Cable	Belden 9841 or equivalent
Transmission Distance	3,300 ft. maximum
Terminal Type	Fixed
Operating Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Internal Power Consumption	300 mA maximum
Manufacturer	Koyo Electronics

Remote Slave Specifications	
Maximum Slave Points per CPU	512 for D4-430 1024 for D4-440 1536 for D4-450
I/O Addresses Used	I/O modules in slave bases do not automatically consume any standard input and output points. They consume remote I/O points at a rate equal to the number of I/O points in each base. However, you can choose to use standard I/O addresses as an option.
Terminal Type	Fixed
Operating Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Power required	110VAC/220 VAC (D4-RS) 24VDC (D4-RSDC)
Manufacturer	Koyo Electronics

ETHERNET REMOTE I/O MASTER MODULES

Ethernet remote I/O master

The Ethernet Remote Master H4-ERM (-F) connects DL430, DL440 and DL450 CPU systems to slave I/O over a high-speed Ethernet link.

Need a lot of I/O?

Each ERM module can support up to 16 H2-EBC systems, 16 Terminator I/O EBC systems, or 16 fully expanded H4-EBC systems (see next page for more information). Of course, combinations are fine, too. The ERM also supports Edrives. See the Drives section for details.

Note: Applications requiring an extremely large number of T1H-EBC analog I/O or H4-EBC 16-channel analog I/O, could exceed the buffer capacity of a single H4-ERM module. In these cases, an additional H4-ERM may be required.

Simple connections

The ERM connects to your control network using Category 5 UTP cables for cable runs up to 100 meters. Use repeaters to extend distances and expand the number of nodes. Our fiber optic version uses industry standard 62.5/125 ST-style fiber optic cables and can be run up to 2,000 meters.

The CPU, ERM and EBC slave modules work together to update the remote I/O points. These three scan cycles are occurring at the same time, but asynchronously. It is recommended that critical I/O points that must be monitored every scan be placed in the CPU base.

Networking ERMs with other Ethernet devices

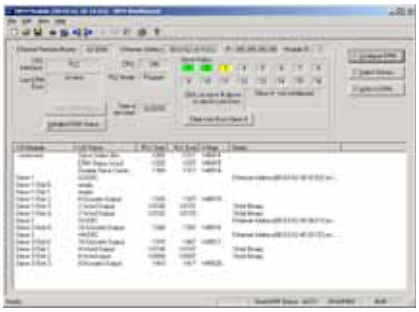
It is required that a dedicated Ethernet remote I/O network be used for the ERM and its slaves. While Ethernet networks can handle a very large number of data transactions, and normally handle them very quickly, heavy Ethernet traffic can adversely affect the reliability of the slave I/O and the speed of the I/O network. Keep ERM networks, multiple ERM networks and ECOM/office networks isolated from one another.

Software configuration

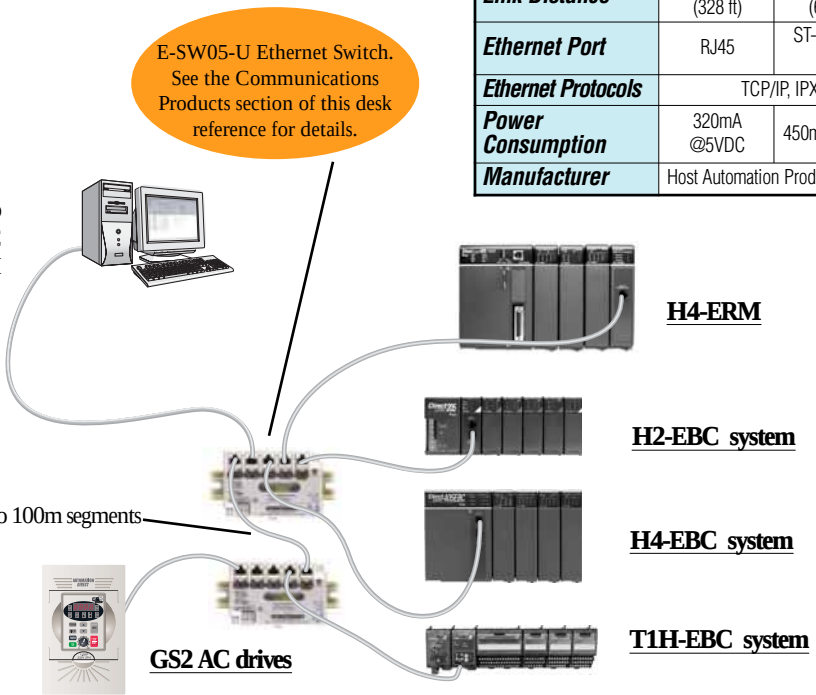
ERM Workbench is a software utility that must be used to configure the ERM and its remote Ethernet slaves. ERM workbench supports two methods of configuring the ERM I/O network:

- ERM Workbench PLC Wizard - greatly simplifies the configuration procedure when a PLC is used as the CPU interface.
- ERM Workbench - configures the I/O network whether the CPU interface is a PLC or WinPLC, and allows access to all ERM I/O network parameters.

ERM Workbench Software



Specifications	H4-ERM	H4-ERM-F
Communications	10BaseT Ethernet	10BaseFL Ethernet
Data Transfer Rate	10Mbps	
Link Distance	100 meters (328 ft)	2K meters (6560 ft)
Ethernet Port	RJ45	ST-style fiber optic
Ethernet Protocols	TCP/IP, IPX	
Power Consumption	320mA @5VDC	450mA @5VDC
Manufacturer	Host Automation Products, L.L.C.	

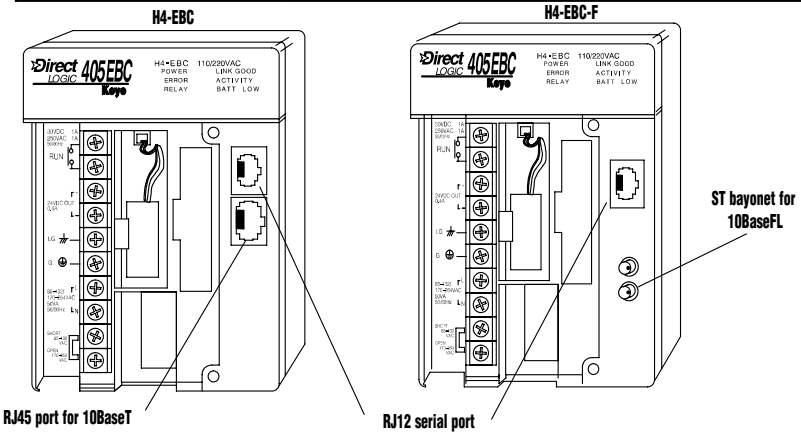


Ethernet Base Controller Modules

Ethernet Base Controller Module

H4-EBC <--->
H4-EBC-F <--->

Specifications	H4-EBC	H4-EBC-F
Communications	10BaseT Ethernet	10BaseFL Ethernet
Data Transfer Rate	10Mbps	10Mbps
Link Distance	100 meters (328 ft)	2,000 meters (6,560 ft)
Ethernet Port	RJ45	ST-style fiber optic
Ethernet Protocols	TCP/IP, IPX	TCP/IP, IPX
Serial Port	RJ12, K-sequence, ASCII IN/OUT	RJ12, K-sequence, ASCII IN/OUT
Power Supplied	3470mA @ 5VDC 400mA @ 24VDC	3300mA @ 5VDC 400mA @ 24VDC
Manufacturer	Host Automation Products, L.L.C.	Host Automation Products, L.L.C.



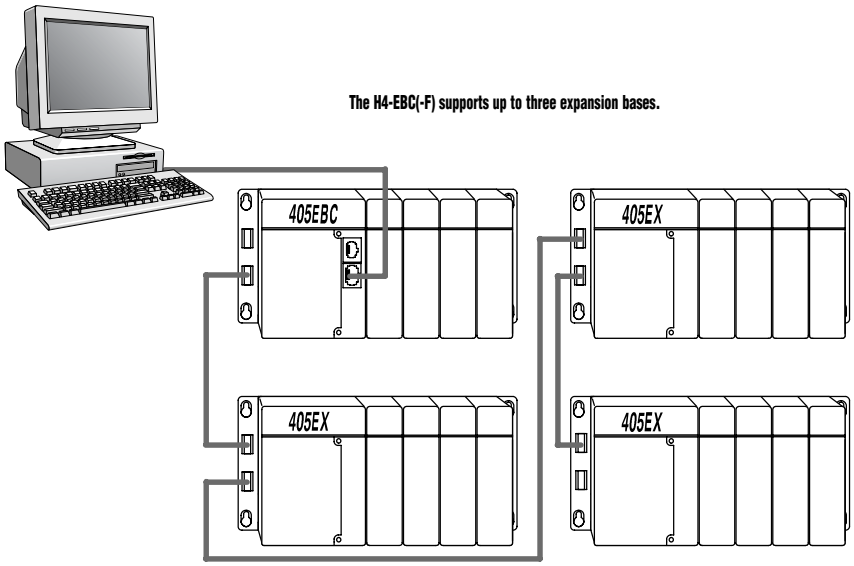
Use EBCs for PC-based control and for H4-ERM remote I/O slaves

The H4-EBC and H4-EBC-F Ethernet Base Controller modules provide a high-performance, low-cost Ethernet link between your PC-based control system or H4-ERM Ethernet remote I/O system and DL405 I/O. The H4-EBC module supports industry standard 10Base-T Ethernet communications, and the H4-EBC-F module supports 10Base-FL (fiber optic) Ethernet standards. Both modules offer 10Mbps transfer rates between your PC application and your DL405 I/O base. The EBC modules are compatible with TCP/IP and IPX protocols for flexible PC communications. Four addressing schemes make it easy to identify the module on the network using the method that works best for you. EBCs also offer:

- Virtually unlimited number of I/O points
- I/O updates on dedicated networks
- Use off-the-shelf networking components to connect to your existing network
- Fast I/O updates (<1ms per base possible based on IO)
- On-board serial port for operator interface, etc. when used with a PC-based program like TnD Live. (serial port not supported when used with the Hx-ERM module).

Easy to use, reliable and fast

The H4-EBC(-F) module plugs into the CPU slot of any DL405 I/O base. The 10BaseT or 10BaseFL port can be networked using commercially available cabling, hubs, and repeaters. The H4-EBC(-F) module supports all DL405 discrete and analog I/O modules. The H4-EBC module also supports the H4-CTRIO and D4-HSC, but no other intelligent modules are supported.



The H4-EBC(-F) supports up to three expansion bases.

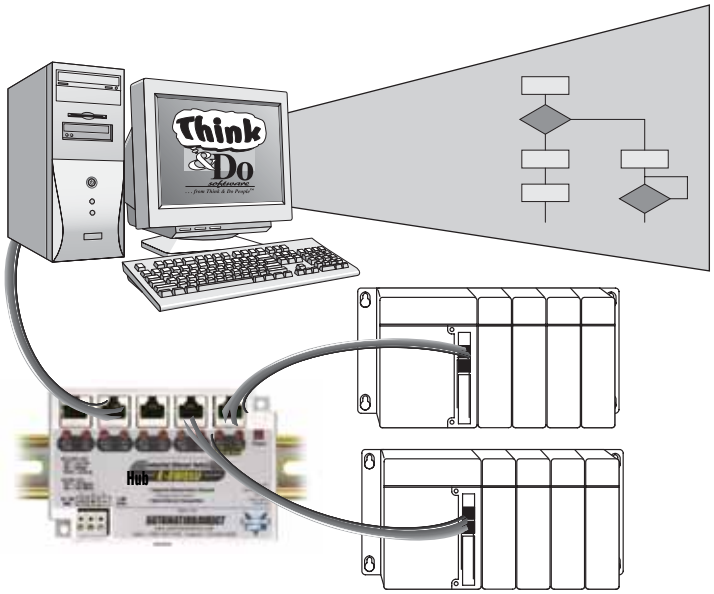
ETHERNET BASE CONTROLLER MODULES

Off-the-shelf solutions

You can purchase PC-based control software that is ready to use with the H4-EBC(-F) module. PC-based control packages are equipped with compatible I/O device drivers, program development tools, and run-time environments. See the PC-based Control Products section for a integrated PC-based Control solution to make your PC into an industrial controller.

Software developers

For programmers developing custom drivers for our I/O, we offer a free Ethernet Software Development Kit (SDK). The SDK provides a simplified API for interfacing with the H4-EBC(-F). The software interface libraries are provided for WIN32, WIN16, and DOS operating systems. The source code is available to developers under a non-disclosure agreement. Visit the technical support link at our Web site for more information.



The following vendors have PC-based Control products ready to control our I/O, or they have compatible products to be released in the future.

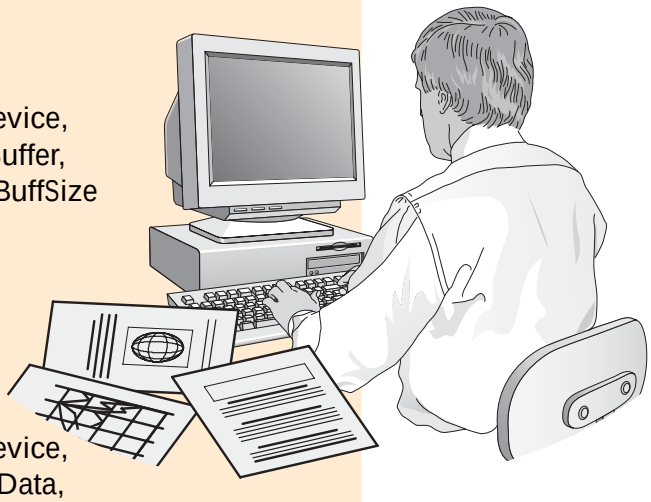
Vendor	Product	Web Address
AUTOMATIONDIRECT	KEP*Direct* EBC I/O Server	www.automationdirect.com
Entivity	Think & Do Live Entivity Studio Steeplechase	www.entivity.com
KEPware	KEPServerEX	www.kepware.com
Wonderware	InControl	www.wonderware.com

READ I/O

```
int HEIReadIO
        (
        HEIDevice *pDevice,
                Byte *pBuffer,
                WORD BuffSize
        );
```

WRITING I/O

```
int HEIWriteIO
        (
        HEIDevice *pDevice,
                BYTE *pData,
                WORD SizeofData,
                BYTE *pReturnData,
                WORD *pSizeofReturnData
        );
```



Ethernet Remote I/O Kits

Overview

The DL405 PLC Ethernet Remote I/O system is available at prices that are better than many Serial (master/slave) Remote I/O combinations. This means you can make the switch from Serial PLC Remote I/O to Ethernet Remote I/O and gain all the ease-of-use, diagnostics, and performance of Ethernet connectivity, for little or no additional installation cost.

Additionally, the Ethernet Remote I/O kits are offered at a considerable savings when compared to purchasing the Ethernet Remote Master (ERM) and Slaves (EBC) separately.

The Ethernet Remote I/O kits are offered to provide an easy way to choose the Ethernet Remote I/O products that best fit your application.

T14-ERKIT-x Ethernet Remote I/O Kits

A T14-ERKIT-x Ethernet Remote I/O Kit includes one H4-ERM Ethernet Remote Master module and up to "x" number of T1H-EBC Ethernet Base Controller modules by adding -1, -2, -3, etc. as the part number suffix. (See the table below.) A T14-ERKIT-2 is shown below, which includes one H4-ERM and two T1H-EBC modules. All other necessary hardware, including the CPU, I/O modules, bases, cables and Ethernet hub (if required), is sold separately.

Example kit: T14-ERKIT-2 includes one H4-ERM and two T1H-EBCs.

T14-ERKIT-x Ethernet Remote I/O Kits		
Kit Number	*Kit Contents*	*Price*
T14-ERKIT-1	1 H4-ERM + 1 T1H-EBC	<--->
T14-ERKIT-2	1 H4-ERM + 2 T1H-EBCs	<--->
T14-ERKIT-3	1 H4-ERM + 3 T1H-EBCs	<--->
T14-ERKIT-4	1 H4-ERM + 4 T1H-EBCs	<--->
T14-ERKIT-5	1 H4-ERM + 5 T1H-EBCs	<--->
T14-ERKIT-6	1 H4-ERM + 6 T1H-EBCs	<--->
T14-ERKIT-7	1 H4-ERM + 7 T1H-EBCs	<--->
T14-ERKIT-8	1 H4-ERM + 8 T1H-EBCs	<--->
T14-ERKIT-9	1 H4-ERM + 9 T1H-EBCs	<--->
T14-ERKIT-10	1 H4-ERM + 10 T1H-EBCs	<--->

Example of an Ethernet remote I/O system using a T14-ERKIT-2. CPU, bases, I/O modules, Ethernet hub, etc. are sold separately.

MODBUS NETWORK MASTER

Specifications	
Modules/CPU	Eight maximum, any slot in CPU base
F4-MAS-MB	Ports 1 and 2, RS232C/422/485 selectable, maximum baud rate of 115.2K baud. **Note:** Select port 1 or port 2 as the MODBUS port (only one can be configured as a MODBUS port.) If port 2 is configured as the MODBUS port, then port 1 can be configured as a debug port.
Recommended Cable	Belden 9841 or equivalent (RS485) Belden 9729 or equivalent (RS422)
Power Required	235mA max at 5VDC (supplied by base power supply); 350mA for F4-MAS-MBR
Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Manufacturer	FACTS Engineering

Overview

Our MODBUS Master module allows you to use a DL405 PLC as the network master for a MODBUS RTU network. The module communicates with any network slave by using high level MODBUS commands.

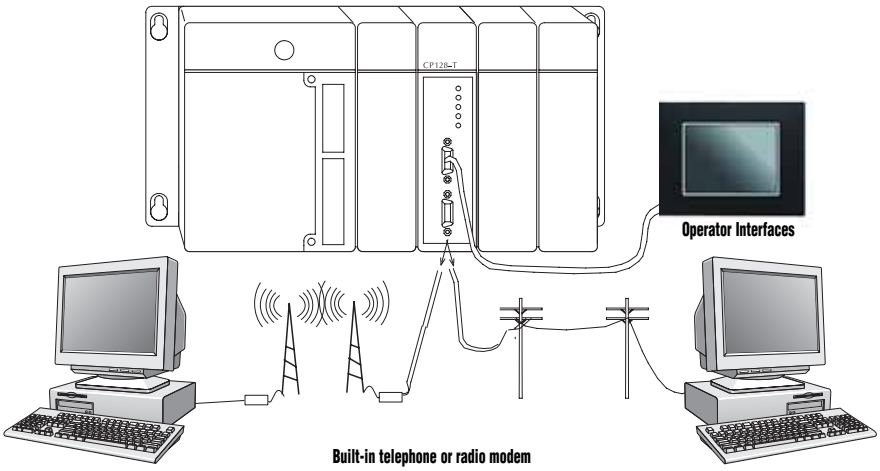
Easy setup and operation

Module setup is accomplished by loading values into special V-memory locations inside the DL405 CPU. The data read or written is also stored in the CPU's V-memory area, which makes it easily accessible for use in control schemes. If simplicity is your primary concern, you can use the DL405 RX and WX instructions in your ladder program to initiate read and write requests. Minimal setup is required with this option and it is especially useful for event-triggered data exchanges. If you have more complex data requirements, you can use the Table Read/Write capability. By filling in a special block of the CPU's V-memory, you can specify a slave address, starting data address, and number of bytes to transfer. This option requires more setup, but it is also more useful if you need to constantly exchange data with several slave stations.

CoProcessor Modules

Basic CoProcessor Modules

F4-CP128-1 <--->
F4-CP128-T <--->



Overview

The FACTS CoProcessor Module interfaces the *Direct*LOGIC 405 family of programmable controllers with bar code readers, operator interface terminals, instrumentation equipment, computers, and other serial devices. The three ports offer a range of communication interfaces and baud rates. Please consult the port descriptions to see which module is best suited for your needs.

Features

- FACTS Extended BASIC and ABM Commander for Window software makes program development fast and simple. Allows ONLINE, full-screen BASIC program editing and the ability to save programs on disk (software on CD included with each module)
- Non-volatile memory of up to 512K bytes allows multiple program storage and execution, DL405 register expansion, and retentive data storage and retrieval
- 16MHz or 26MHz CoProcessor provides fast program execution independent of the DL405 CPU scan
- Three buffered ports permit communication from module to three or more external devices
- Programmable from either port for complete serial port utilization without having to switch cables
- A real-time clock/calendar maintains time/date with battery backup when power outages occur. Programmable time-based BASIC interrupts to .005 of a second
- Directly access up to 254 bytes of DL405 CPU memory per scan. No supporting ladder logic is required
- Floating point math solves complex formulas to eight significant digits
- Options include a built-in 300/1200/2400 baud telephone modem or a leased-line radio modem
- Includes Modbus master/slave BASIC examples and other application examples on CD

CoProcessor applications

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

- Barcode readers
- Welders
- Board level controllers
- Serial printers
- Intelligent sensors
- Almost any device with an RS-232C/422/485 port

CoProcessors are also good solutions for applications requiring large amounts of complex math.

CoProcessor Modules

Specifications	
Module Type	CoProcessor, intelligent
Modules per CPU	Eight maximum, any slot in CPU base
Communication	256 character type-ahead input buffer on all ports. Ports are independently programmed by software. Seven or eight data bits, 1 or 2 stop bits, even, odd or no parity. XON/XOFF software flow control and RTS/CTS handshake.
F4-CP128-1	128K bytes of battery-backed RAM. 26MHz clock rate. Runs BASIC programs two to three times faster than 16MHz CoProcessors. Port 1, RS232C/422/485 selectable, maximum baud rate of 115.2K baud. Port 2, RS232C/422/485 selectable, maximum baud rate 57.6K baud. Port 3, RS232C, maximum baud rate of 19.2K baud. Port 3 is available by using the RTS/CTS pins on Port 1. If you use these lines on Port 1, then Port 3 is not available.
F4-CP128-T	128K bytes of battery-backed RAM, 16 MHz clock rate. Port 1, RS232C/422/485 selectable, maximum baud rate of 57.6K baud. Port 2, RS232C, maximum baud rate 9600 baud. An optional use for port 2 is a built-in full-duplex, 300/1200/2400 baud PSK/FSK, asynchronous telephone modem. The modem is Bell 212A/103 & CCITT V.22/V.21 compatible. Automatic dialer with call progress monitoring detects no dial tone, ring and busy. Automatically answer calls. Can be used for remote data acquisition and diagnostics. Allows remote reprogramming of both BASIC CoProcessor and DirectLOGIC 405 CPUs. Exceeds FCC part 68 hazard protection requirements. Port 3, RS232C, maximum baud rate of 9600 baud. Port 3 is available by using the RTS/CTS pins on Port 1. If you use these lines on Port 1, then Port 3 is not available.
ABM Commander for Windows (CD-ROM included with module)	Programming/documentation software for FACTS Engineering BASIC module. Key features include: • Runs under Windows 95/98/2000 or Windows NT 3.51 or later. • Command Mode allows the user to program and debug with a "Point and Click" or Command Line Interface. • Uses standard Windows applications for off-line edited (Notepad) and terminal emulation (Hyperterminal) • Text Upload and Download BASIC programs • Binary Upload and Download BASIC programs • Extensive help file contains full user manual information • Includes Modbus master and Modbus slave BASIC programs and other application examples
Field Termination	9 pin D-sub connectors for port 1 and port 2. Port 3 uses electrical connections from port 1. (F4-CP128-T uses an RJ12 phone jack located under the module)
Power Consumption	F4-CP128-1 — 305mA maximum at 5VDC, (supplied by base power supply) F4-CP128-T — 350mA maximum at 5VDC, (supplied by base power supply)
Operating Environment	0°C-60°C (32°F-140°F), 5% to 95% humidity (non-condensing)
Manufacturer	FACTS Engineering

16 Loop PID CoProcessor

16 Loop PID CoProcessor Module
F4-16PID <--->

Overview

The F4-16PID is a Proportional Integral Derivative (PID) CoProcessor designed to execute up to 16 PID loops independent of the DL405 CPU. Using the high-speed Intelligent Bus Interface, the F4-16PID reads the process variable and writes the PID output directly into V-memory of the DL405 CPU. Software is provided to configure the PID loops via simple menus.

Minimal ladder logic is required in the CPU therefore, the floating point math-intensive PID calculations in the CoProcessor have little effect on the CPU scan time. As a result, the CPU can perform high-speed discrete control while the CoProcessor performs high-speed PID.

Operation

The process variable (PV) comes from an input module, usually an analog input or thermocouple. The user ladder logic copies the input value to the Process Variable location.

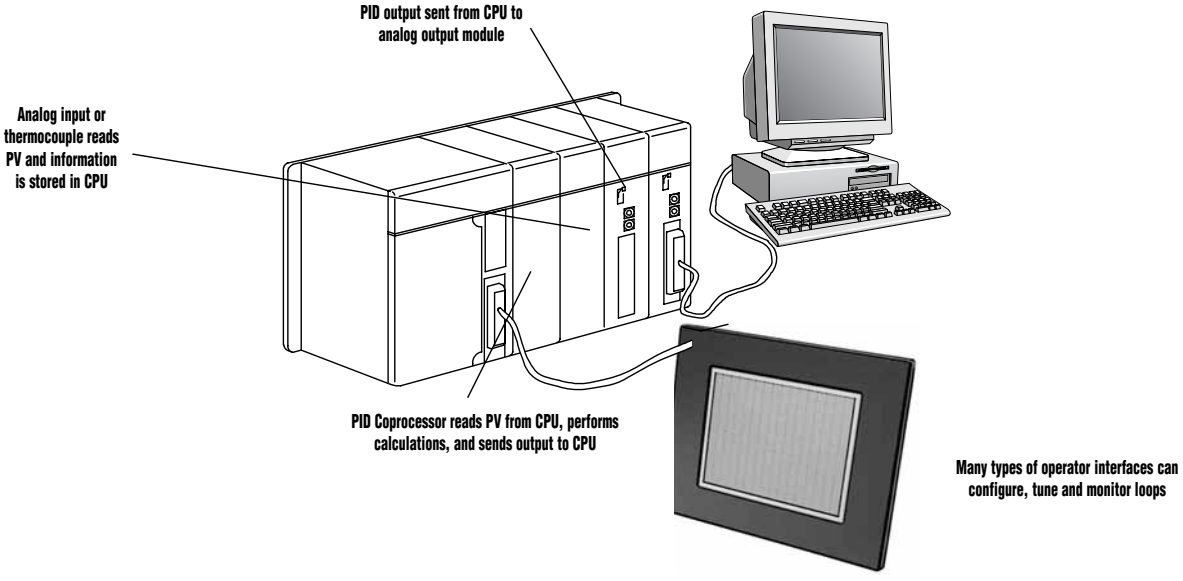
The PID module calculates the loop output value and places it at the Output location. The user can write this value to an analog output channel, use it as a time proportion for a discrete output, or send it to the setpoint or another loop for cascading loops.

All loop information is read from and written to a user specified block of V-memory. Each loop that is enabled requires 32 V-memory locations. Since all loop parameters are stored in V-memory, any device capable of reading and writing DL405 V-memory can be used to configure, tune, and monitor loops. The information included in each loop's block of V-memory includes:

- Bit Mapped Mode Word
- Process Variable (PV)
- Setpoint (SP)
- Bias
- Output
- Bit mapped Alarm word
- Sample Rate (.1 to 999.9 Sec. or Min.)
- Gain
- Reset
- Rate
- PV Low Low Alarm
- PV Low Alarm
- PV High Alarm
- PV High High Alarm
- PV Yellow Deviation Limit
- PV Orange Deviation Limit
- Alarm Deadband
- Error Deadband Below SP
- Error Deadband Above SP
- Derivative Gain Limiting Coefficient
- Setpoint Low Limit
- Setpoint High Limit
- Maximum Output Clamp
- Minimum Output Clamp

Some variations of PID control are done with supporting ladder logic. Examples that are included in the PID manual are:

- Auto/Manual Mode Control
- Setpoint Ramp and Soak
- Alarm Word Decoding
- Time Proportioning Control Loops
- Cascading Loops
- Positioning Actuator Control Loops



16 Loop PID CoProcessor

Specifications and Key Features	
Module Type	CoProcessor, Intelligent
Number of Loops	16 maximum
Modules per CPU	Six maximum, any slot in CPU base
PID Algorithm	Position or Velocity form of the PID equation. Optionally specify direct or reverse acting, square root of the error and error squared control.
Sample Rate	Specify the time interval between PV samples, 0.1 to 999.9 in units of seconds or minutes
Auto/Manual	A control relay, CR, which when energized places the corresponding loop into automatic mode. PV alarm monitoring continues when loops are in manual mode.
Square Root PV	Specify a square root of the PV for a flow control application.
Limit SP	Specify a high and low limit for allowable setpoint changes.
Gain	Specify proportional gain of 0.00 to 99.99.
Reset	Specify reset time of 0.1 to 999.9 minutes, seconds, milliseconds, or microseconds
Bumpless Transfer I	Bias and setpoint are initialized automatically when the module is switched from manual to automatic. This provides for a bumpless transfer.
Bumpless Transfer II	Bias is set equal to the Output when the module is switched from manual to automatic. This allows switching in and out of automatic mode without having to re-enter the setpoint.
Limit Output	Optionally specify maximum and minimum output values
Step Bias	Provides proportional bias adjustment for large setpoint changes. This may stabilize the loop faster and reduce the chance of the output going out of range. Step bias should be used in conjunction with the normal adjusted bias operation.
Anti-windup	If the position form of the PID equation is specified, the reset action is stopped when the PID output reaches 0 or 100%. Select adjusted bias or freeze bias operation.
Rate	Specify the derivative time, 0 to 999.9 in units of minutes or seconds.
Rate Limiting	Specify a derivative gain limiting coefficient to filter the PV used in calculating the derivative term (99.99 to 00.01).
Error Deadband	Specify an incremental value above and below the setpoint in which no change in output is made.
Error Squared	Squaring the error minimizes the effect a small error has on the Loop output, however; both ErrorSquared and ErrorDeadband control may be enabled
20% offset of PV	Specify a 20% offset of the PV to input a 4-20mA transmitter using a 0-20mA analog input module range.
Internal Power Consumption	160mA at +5VDC, (supplied by base power supply)
Operating Environment	0°C to 60°C (32°F to 140°F) 5% to 95% humidity (non-condensing)
Manufacturer	FACTS Engineering
Alarm Specifications	
Deadband	Specify 0.1% to 5% alarm deadband on all alarms except Rate of Change.
PV Alarm Points	A Y output or CR may be activated based on four PV alarm points.
PV Deviation	A Y output or CR may be activated based on four PV alarm points. Specify an alarm for PV deviation above or below the setpoint (Yellow Deviation) and an alarm for greater PV deviation from the setpoint (Orange Deviation).
Rate of Change	A Y output or CR may be activated when the PV changes faster than a specified rate of change limit.
Broken Transmitter	Monitor the PV for a broken transmitter.

Four Loop Temperature Controller

Overview

The F4-4LTC combines the features of four single loop temperature controllers into one inexpensive module. The module has four asynchronous, configurable PID loops, with built-in temperature inputs and control outputs so that precision temperature control is maintained, even while the PLC is in program mode. This module can control temperatures up to ±3276.7°C/°F and accepts either thermocouple or RTD inputs. By simply changing a jumper setting, you can choose the one that is best suited for your application. In addition, both versions have solid-state relay outputs for heater or chiller control.

Operation

The temperature is read directly into the F4-4LTC with the on-board RTD or thermocouple inputs. If the temperature is not at the target value (setpoint), then the control outputs are automatically activated. The F4-4LTC also provides automatic tuning of the control loops, so the module can easily adapt to changing temperature and process conditions. And since the F4-LTC is an intelligent DL405 module, you can easily use simple ladder logic in a DL405 CPU for ramp and soak setpoint changes.

Minimal setup ladder logic is required in the CPU, and since the floating point calculations are performed in the temperature controller, there is little effect on the CPU scan time. The temperature controller also provides alarm and diagnostic capabilities by monitoring Low Alarm, High Alarm, Deviation Alarm, Heater Burn-out, and broken transmitter conditions.

All information from the F4-4LTC can be mapped directly into the DL405 CPU memory. As a result, information is freely accessible through the CPU for coordinated control, operator interface usage, or data collection.

The operating characteristics for each loop are programmed into a user-defined block of V-memory in the DL405 CPU. The temperature controller accesses this memory area to determine the operating parameters for each loop. Each loop that is enabled requires 24 V-memory locations. Since all loop parameters are stored in V-memory, any device capable of reading and writing DL405 V-memory can be used to configure or monitor loops. The temperature controller reads/writes data within the CPU. This data includes:

Read continually

- Mode word
- Temperature setpoint

Written after loop update

- Output (0.0-100.0% or 0-4095)
- Alarm word
- Process temperature

Read setup/write after auto tune

- Gain
- Reset, Integral time (0-999.9s)
- Rate, Derivative time (0-999.9s)

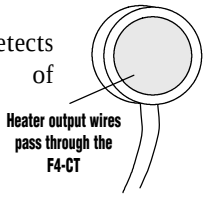
Read for setup

- Temperature Low Alarm
- Temperature High Alarm
- Temperature Deviation Alarm
- Alarm Deadband
- Setpoint Low Limit
- Setpoint High Limit
- Input Type (for Thermocouple)
- PID Control Period
- On/Off Hysteresis

RTD or thermocouple inputs

The F4-4LTC can accept either RTD or Thermocouple inputs. See the specifications table on the following page.

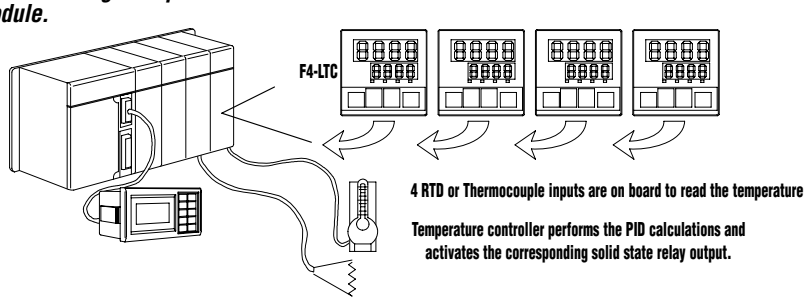
Current transformer



The F4-CT detects the presence of current flow and is very useful in detecting heater burnout conditions. One F4-CT is included with the 4-loop Temperature Controller Module. The F4-4LTC has four inputs that can be used with these current transformers:

Leads:	2, approx. 4"
Ratio:	400:1
Inductance:	300mH (min.)
DC resistance:	8 (max.)

Combines four single loop controllers into one module.



FOUR LOOP TEMPERATURE CONTROLLER

General Specifications	
Module Type	CoProcessor, Intelligent
Number of Loops	Four maximum
Modules per CPU	Eight maximum, CPU base, any slot
I/O Points Required	None
V Memory Required	24V-memory locations per loop
Input Type	RTD or Thermocouple
Controller Output	Open collector, high-current solid state relays, 5-26.4VDC @ 0.15A
Converter Type	Charge Balancing, 24-bit
Notch Filter	>100dB at 50Hz and 60Hz (f_{-3db}=13.1Hz)
Common Mode Rejection	90dB minimum at DC, 150dB minimum at 50Hz and 60Hz
Sampling Rate	Selectable per module 800ms (10Hz filter) 160ms (50Hz filter)
Current Transformer	0.5A to 50A sense range
Minimum Output On Time	300ms to sense heater current
Operating Environment	0°C to 60°C (32°F to 140°F) 5-95% humidity (non-condensing)
Power Requirements	280mA at +5VDC, (base power) 75mA at +24VDC external ±10%
Manufacturer	FACTS Engineering

Thermocouple Specifications	
Temperature Ranges	J, -190/760 °C (-310/1400 °F) E, -210/1000 °C (-346/1832 °F) K, -150/1372 °C (-238/2502 °F) R, 65/1768 °C (149/3214 °F) S, 65/1768 °C (149/3214 °F) T, -230/400 °C (-382/752 °F) B, 529/1820 °C (984/3308 °F) N, -70/1300 °C (-94/2372 °F) C, 65/2320 °C (149/4208 °F)
Input Fault Protection	60Vrms or 50 VDC max
Cold Junction	Automatic compensation
Input Impedance	20MΩ DC
Resolution	±0.1°C (relative accuracy)
Maximum Inaccuracy	±3°C exc. thermocouple error
RTD Specifications	
Temperature Ranges	PT100 -200/850 °C (-328/1562 °F) PT1000 -200/595°C (-328/1103 °F) jPT100 -35/450°C (-36/842 °F) 10Ω -200/260°C (328/500 °F) 25Ω -200/260°C (328/500 °F)
Input Fault Protection	50VDC maximum
RTD Excitation Current	200µA
Resolution	±0.1°C
Maximum Inaccuracy	±1°C

Loop Specifications	
Loop Operating Modes	PID control - computes and controls the outputs based on the PID parameters stored in V memory. If auto tuning is enabled, the module uses PID parameters calculated during the auto tuning process. ON/OFF Control - the outputs turn on, then off based on only the Process Temperature, Setpoint On/Off Hysteresis, and control type (heating or cooling).
PID Control Period	Specifies the sample rate and the time period the output is applied to (0.5 to 99.9 seconds)
Limit SP	Specify a high and low limit for allowable setpoint changes
Scaling	Automatically converts temperature to engineering units
Gain	Specify proportional gain of 0.0 to 6553.5. Gain may also be determined automatically by using the auto tuning feature.
Reset	Specify reset time of 0 to 65535 seconds. Reset may also be determined automatically by using the auto tuning feature.
Anti-windup	Stops the reset action when the PID output reaches 0 or 100%. Bias is automatically adjusted when the process temperature begins to respond.
Rate	Specify the derivative time, 0 to 65535 seconds. Rate may also be determined automatically by using the Auto Tuning feature.
Alarm Specifications	
Deadband	Specifies the temperature deadband on alarms. The alarm will remain active while the temperature is outside the alarm limit minus the deadband.
Temperature High	Temperature has risen above the programmed limit.
Temperature Low	Temperature has fallen below the programmed limit.
Deviation	A Y output or CR may be activated when the high or low temperature is further from the Setpoint than the programmed deviation limit.
Broken Transmitter	This alarm is turned on when the RTD of Thermocouple is burned out or missing.

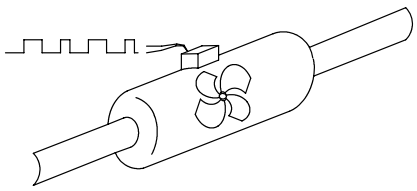
Magnetic Pulse Input Module

Magnetic Pulse Input Module
F4-8MPI <--->

Overview

The F4-8MPI is an eight-channel Magnetic Pulse Input CoProcessor Module. It is designed to take input pulses from Hall effect type magnetic pick-ups, (typically found on turbine meters, tachometers and signal generators), and perform calculations. Up to eight differential inputs from magnetic pickups are wired directly to the terminal block on the front of the module.

The Magnetic Pulse module is based on the FACTS Engineering CoProcessor design. Therefore, it offers a built-in real-time battery-backed clock/calendar and a very fast floating point processor. Because of this powerful design, it can easily support Indicated Volume, Gross Volume, Volume Logging, Flow rate, and Tachometer modes. These operational modes are explained in the adjacent chart.



Specifications	
Module Type	CoProcessor, Intelligent
Number of Channels	Eight Differential per module
Modules per CPU	Eight Maximum, any slot in CPU base
Input Voltage Range	±10mV to ±10VDC peak
Input Frequency Range	DC to 5.0kHz (channels 1 to 4) DC to 2.5kHz (channel 5 to 8)
Maximum Continuous Overload	-150 to +150VDC, 220 Vrms
Input Impedance	100KΩ
Differential Low – Pass Filter	f_{-3db} = 20kHz, 6db per octave roll-off
Common Mode Voltage Range	±15VDC
Common Mode Rejection	Over common mode input voltage range
Update Time	3 PLC scans minimum
Isolation	750VDC, channels to PLC
LED Status Indicators	Power ON, Input Pulse (8 LEDs)
Field Termination	20 position removable terminal block 16 positions, ±CHn, Pulse inputs 2 positions, 24 VDC power supply
External Power Required	170mA maximum, +18 to +25VDC
Internal Power Consumption	225mA from 5VDC maximum
External Power Required	170mA maximum, +18 to +25VDC
Internal Power Consumption	225mA from 5VDC maximum
Operating Environment	0°C to 60°C (32°F to 140°F)/5% to 95% humidity (non-condensing)
Manufacturer	FACTS Engineering

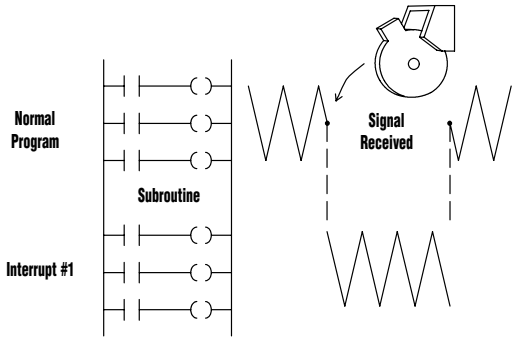
Modes	
Indicated and Gross Volume	
Configuration	The module calculates Indicated Volume of flow given a K Factor. The K Factor is the nominal pulses per unit for the flow meter. This is the factory calibration number normally stamped on the flow meter housing. Indicated volume may be in pulses, gallons, dm^3 , or barrels depending on the K Factor. Gross Volume may also be calculated by substituting for the K Factor, the K Factor divided by the Meter Factor (Meter Factor is the calibration factor derived at the installation).
Output Data	Total volume of flow is output to the PLC in engineering units. The formulas used to calculate volume are: Indicated Volume = Total Pulses ÷ K Factor Gross Volume = Total Pulses ÷ (K Factor/Meter Factor)
Flow Rate	
Configuration	The flow rate calculation uses the same configuration information as the Volume calculation. The sample rate may range from .1 to 999.9 seconds, or minutes.
Output Data	Flow rate is output to the PLC in engineering units. The formula used to calculate flow rate is: (Volume last sample time – Current Volume) ÷ Sample Rate.
Volume Logging	
Configuration	Indicated or gross volume may be logged at either a particular time or at periodic intervals throughout the day. If desired, the counters may be automatically reset when the data is logged. The built-in real time battery-backed clock calendar must be set before volume logging is enabled.
Output Data	Indicated or gross volume is output to the PLC in engineering units. A one-shot flag is also set to indicate to the PLC that new data has been logged.
Tachometer	
Configuration	Tachometer applications are simply a variation of the flow rate calculation. To calculate revolutions per minute, set the K Factor equal to the number of pulses per revolution multiplied by 60. Set the Sample Rate equal to one second. To calculate pulses per second (PPS), set the K Factor equal to one and the Sample Rate equal to one second.
Output Data	RPM or PPS

INTERRUPT INPUT MODULE

Module Specifications	
Modules per CPU	One for DL430, 2 for DL440 & DL450 (modules must be in 1st then 2nd slot of the CPU base)
Input Points	8 (requires 16 points from I/O)
Input Voltage Range	10.20-26.4VDC
Maximum Input Current	10.0mA
Impedance	~ 2.7Kohm
Input Current	4.4mA at 12VDC, 9.0 mA at 24VDC
ON Level Voltage	9.5VDC
OFF Level Voltage	3.0VDC
Maximum OFF Current	1.5mA
Minimum ON Current	4.0mA
OFF to ON Response	0.08 - 0.59ms or 0.88 - 6.47ms
ON to OFF Response	0.15 - 0.89ms or 1.64 - 9.81ms
Terminal Type	Removable connector
Operating Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Internal Power Consumption	100mA max
Manufacturer	Koyo Electronics

Overview

The D4-INT is an 8-point interrupt module. This module is intended for applications that have a high-priority event that requires special operations to be performed. When this high priority event occurs, the interrupt module senses a DC level input signal. The module automatically informs the CPU to interrupt its present operation. The CPU immediately suspends its routine scan cycle and jumps to a subroutine identified with that particular interrupt input signal point. The CPU then executes the logic in the subroutine (subroutines can even use immediate I/O instructions to immediately read and write I/O points if a time-critical update is necessary). When the subroutine is complete, the CPU automatically resumes its routine scan cycle starting at the exact location where it was interrupted. The CPU continues the routine scan until another interrupt signal is sensed.



Hardware features

The D4-INT is designed to accept eight input signals. These inputs are labeled 0-7. If multiple inputs are received at the same time, they are prioritized by their respective label number, 0 being first and 7 being last.

Input points not used as interrupt points can be used as normal DC input points. This is accomplished with an 8-bit dipswitch located on the back of the module.

Interrupt signals can be triggered with a rising or falling edge signal. This is selectable via a dipswitch.

Two ranges of input filtering for response times are available via a dipswitch.

High-Speed Counter Module

High-Speed Counter I/O Module
H4-CTRIO <--->

Overview

The High-Speed Counter I/O (H4-CTRIO) module is designed to accept high-speed pulse-type input signals for counting or timing applications and designed to provide high-speed pulse-type output signals for stepper/servo motor control, monitoring, alarm or other discrete control functions. The H4-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 H4-CTRIO module has its own microprocessor and operates asynchronously with respect to the PLC/Controller. This means that 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 H4-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:

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

Inputs supported:

- 2 quadrature encoders counters up to 100kHz, or 4 single channel counters up to 100kHz using module terminals Ch1A, Ch1B, Ch2A and Ch2B
- High-speed edge timers, dual edge timers, pulse catch, count reset, count inhibit count capture or home search limits using module terminals Ch1C, Ch1D, Ch2C or Ch2D

Outputs supported:

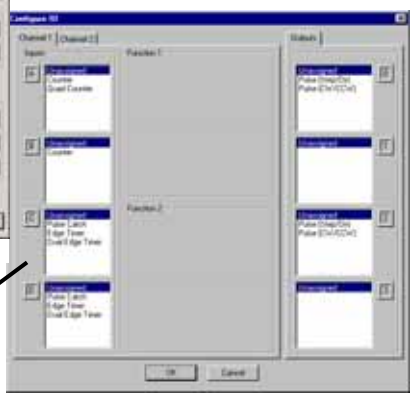
- 4 independently configurable high-speed discrete outputs or 2 channels pulse output control (20Hz-25KHz per channel)
- Pulse and direction or cw/ccw pulses supported for pulse output control
- Raw control of discrete outputs directly from the user control program

Software Configuration

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

CTRIO Workbench main configuration screen

Use Configure I/O dialog to assign the CTRIO input and output functions



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
- Less than10 µ sec pulse-catch capability for high-speed product detection
- Functions for level or flow

Supported systems

Multiple H4-CTRIO modules can reside in the same base provided that the backplane power budget is adequate.

*Direct*LOGIC DL405 PLC

You can use the H4-CTRIO module with the D4-450 CPU only. The D4-430 and D4-440 CPUs do not support the CTRIO module. The module plugs into any I/O slot of any *Direct*LOGIC 405 base. The CTRIO cannot be used in local expansion bases or in serial remote I/O bases.

PC-based Ethernet I/O control systems

The H4-CTRIO module can be used in PC-based control systems using the H4-EBC interface module. H4-EBCs support the use of the H4-CTRIO in DL405 local expansion bases.

ERM to EBC systems

The H4-CTRIO module is supported in the H4-EBC slaves in H*-ERM systems.

HIGH-SPEED COUNTER MODULE

I/O Specifications

General Specifications	
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	400mA Max at +5V from Base Power Supply, Maximum of 6 Watts (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, L.L.C.
Isolation	2500V I/O to Logic, 1000V among Input Channels and All Outputs

H4-CTRIO Input Specifications	
Inputs	8 pts sink/source
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

H4-CTRIO Output Specifications	
Outputs	4 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.**

H4-CTRIO Input Resources	
Counter/Timer	4, (2 per 4 input channel group) up to 100KHz
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)

H4-CTRIO Output Resources	
Pulse output / Discrete outputs	Pulse outputs: 2 channels (2 outputs each channel) (20Hz-20KHz); Discrete outputs: 4 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: 4 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 Module

Status indicators

H4-CTRIO LED Descriptions	
OK	Module OK
ER	User Program Error
1A - 1D	Ch1A - Ch1D Input Status
2A - 2D	Ch2A - Ch2D Input Status
(Ch1) F1 - F2	Ch1 Resource State
(Ch2) F1 - F2	Ch1 Resource State
Y0 - Y3	Output Status

H4-CTRIO LED Diagnostic Definitions		
LED OK	***LED ER***	***Description***
ON	OFF	All is well - RUN Mode
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
TB		User Terminal Block is not Properly Installed

H4-CTRIO LED Diagnostic Definitions	
1A - 1D	Follow actual input state / Ch1
2A - 2D	Follow actual input state / Ch2
(Ch1) F1	blinks when Channel 1 Function 1 is counting or timing
(Ch1) F2	blinks when Channel 1 Function 2 is counting or timing
(Ch2) F1	blinks when Channel 2 Function 1 is counting or timing
(Ch2) F2	blinks when Channel 2 Function 2 is counting or timing
Y0 - Y3	Follow actual output state; ON = output is passing current

Installation and wiring

The H4-CTRIO module has two independent input channels, each consisting of 4 optically isolated input points (pts. 1A-1D on common 1M and pts. 2A-2D on common 2M). The inputs can be wired to either sink or source current.

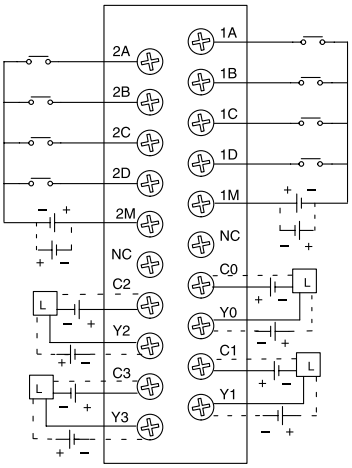
The module has 4 optically isolated output points (pts. Y0-Y3 with isolated commons C0-C3, respectively). The outputs must be wired so positive current flows into Cn terminal and then out of the Yn terminal (see the diagram on the following page).

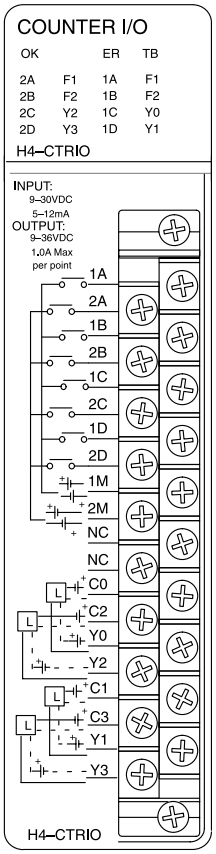
The module is configured, using CTRIO Workbench, to accommodate the user's application. The function of each input (counting, timing, reset, etc.) and output (pulse output, discrete output, etc.) is defined in the configuration of the module.

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

Notes:

1. ***Inputs (1A, 1B, 1C, 1D and 2A, 2B, 2C, 2D) require user-provided 9-30VDC power sources. Terminals 1M and 2M are the commons for Channel 1 and Channel 2 inputs. Maximum current consumption is 12mA per input point.***
2. ***Polarity of the input power sources (shown right) 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 (as shown) and are powered by user provided 5-36VDC power sources. The maximum allowable current per output circuit is 1A.***



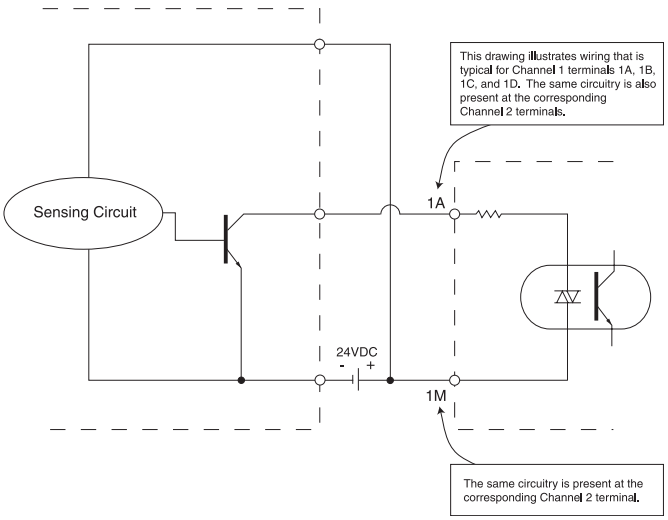


HIGH-SPEED COUNTER MODULE

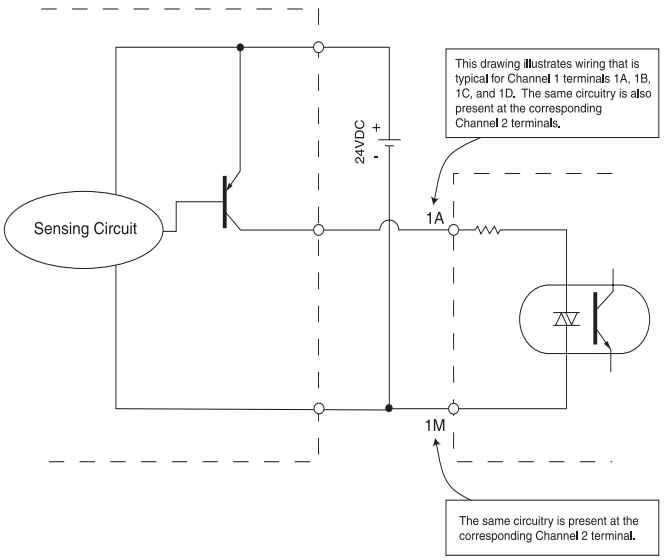
Solid state input wiring device

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 this desk reference for a complete explanation of sinking and sourcing concepts.

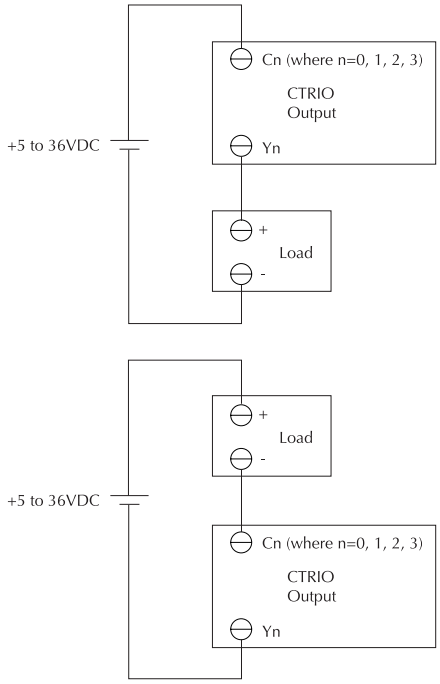
NPN Field Device (sink)



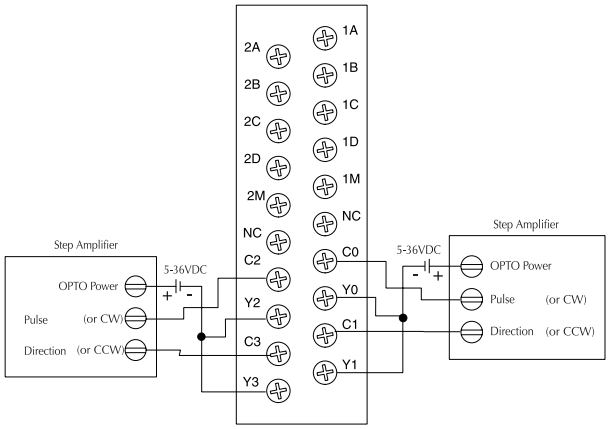
PNP Field Device (source)



Pulse output schematic



Stepper/Servo drive wiring example

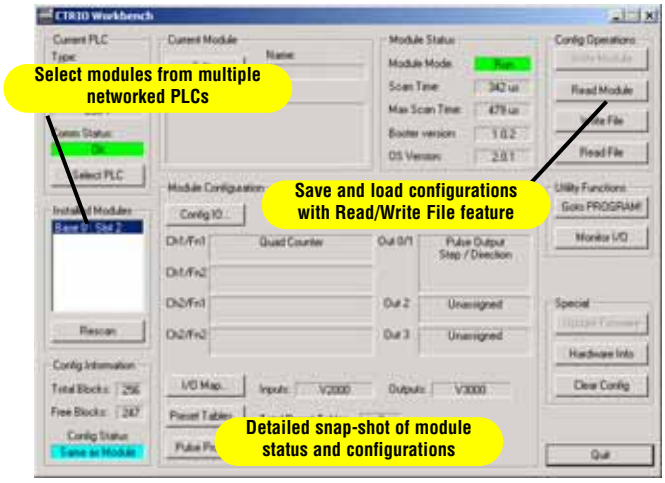


High-speed Counter Module

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.

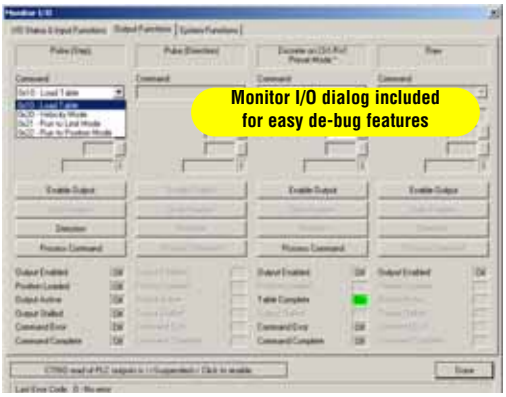
CTRIO Workbench main configuration screen



CTRIO Workbench diagnostics and monitoring

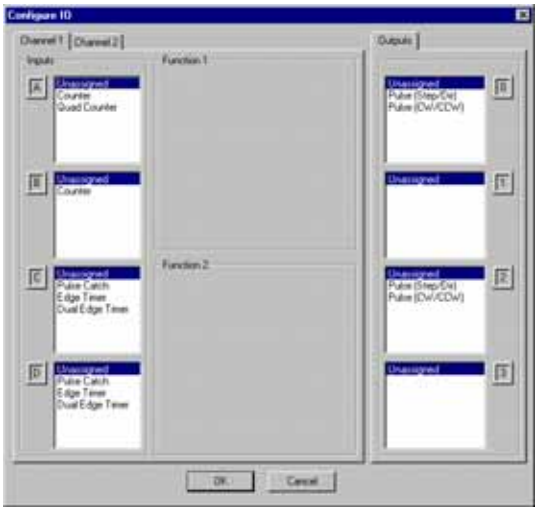
The Monitor I/O dialog is accessible from the main Workbench dialog when the module is in Run Mode. This allows for a convenient way to test and debug your configuration prior to installation. The Monitor I/O dialog is divided into three functional areas: Input Functions, Output Functions and System 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

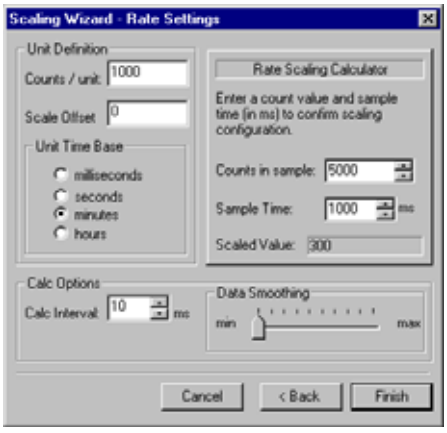
The Configure I/O dialog is the location where input and output functions are assigned to the module. The choice of input and output functions determines which options are available. The input function boxes prompt you with selections for supported functions. The Workbench software automatically disallows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



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 MODULE

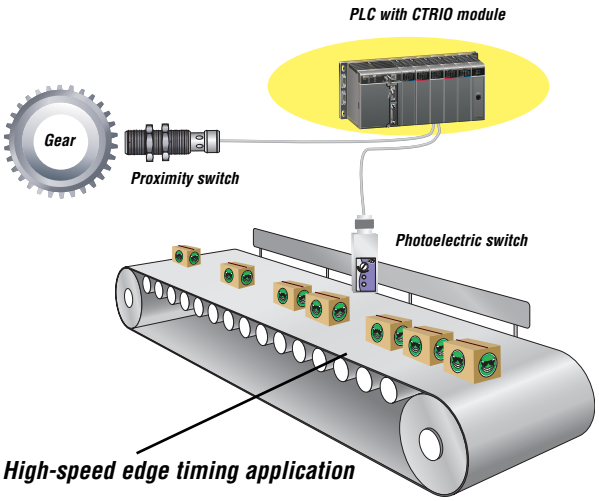
High-speed input operations

The CTRIO module is capable of a wide variety of high speed input and output operations all within one module. With its flexible 2-channel input and separate 2-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

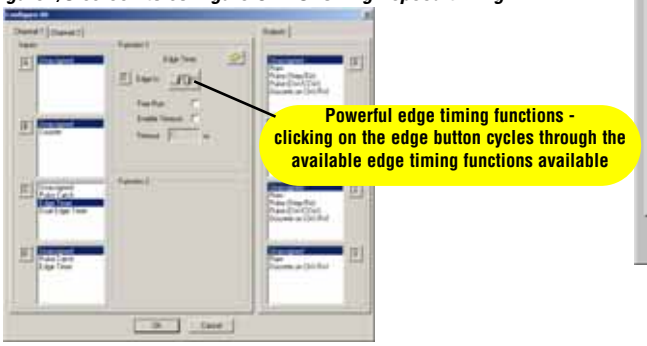
The CTRIO can be configured for timing functions based on both count or rate. Using a common configuration of a proximity switch sensing the teeth on a gear, the module is able to calculate the velocity of the gear based on the rate it receives its counts. This value can be scaled within the module to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

High-speed timing application



High-speed edge timing application

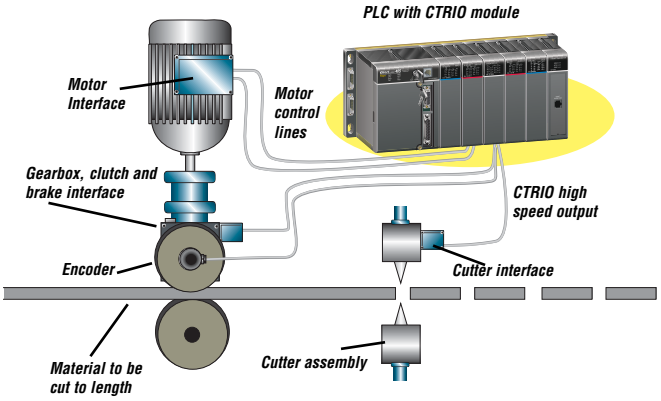
Using Configure I/O screen to configure CTRIO for high-speed timing



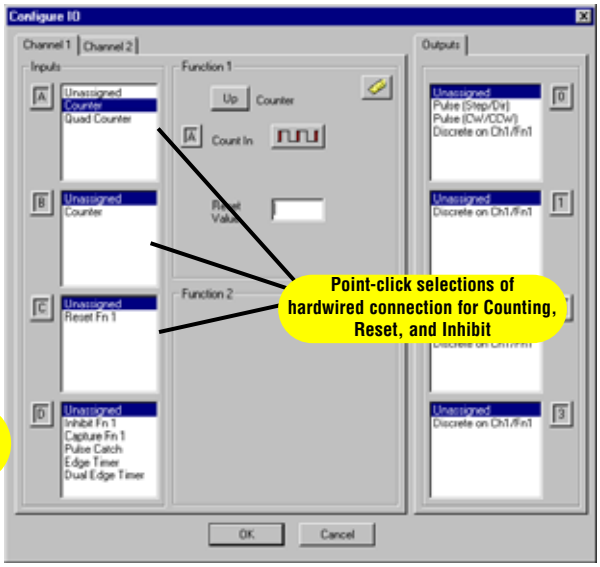
High-speed counting

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 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



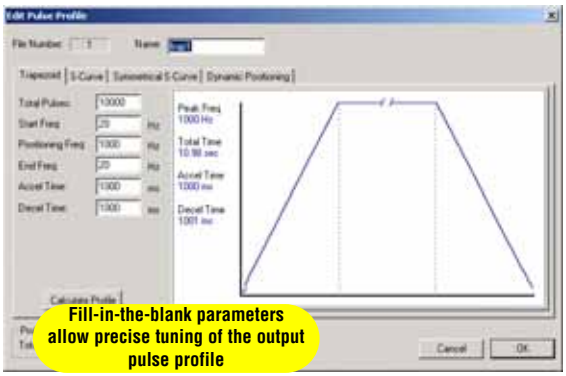
Using Configure I/O screen to configure CTRIO for high-speed counting

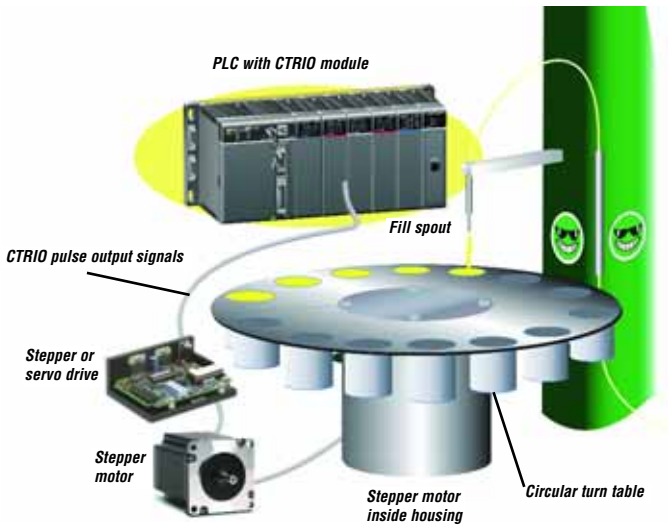


High-Speed Counter Module

Pulse output operations

Using Edit Pulse Profile screen to select Trapezoid pulse output profile





Rotary indexing liquid fill application

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 on two channels 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 which are completely controlled by the user program. They are Velocity Mode, Run to Limit Mode and Run to Position Mode.

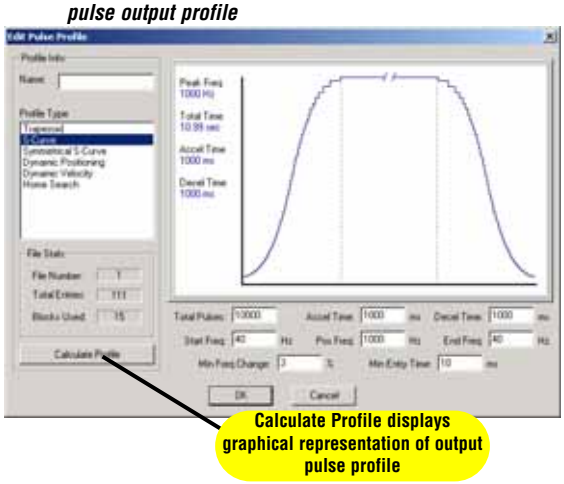
Example application

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 from the PLC CPU is the Enable Output signal to begin a movement.

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 or an external high speed discrete input wired to the module. This is popular in winding or web control with any dynamic registration mark or variable speed requirement.
- Home Search routines to seek a home position based on CTRIO discrete input limit(s).

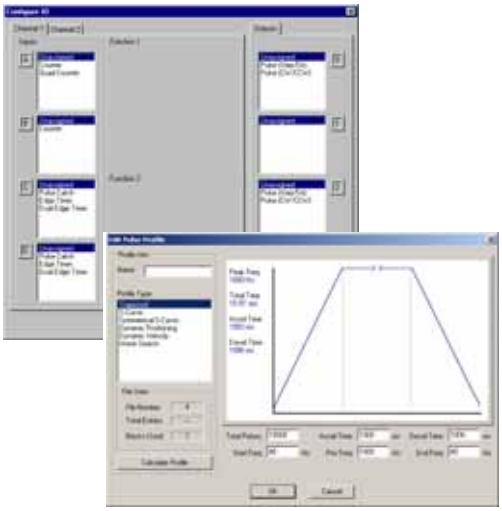
Example of S-Curve acceleration and deceleration pulse output profile



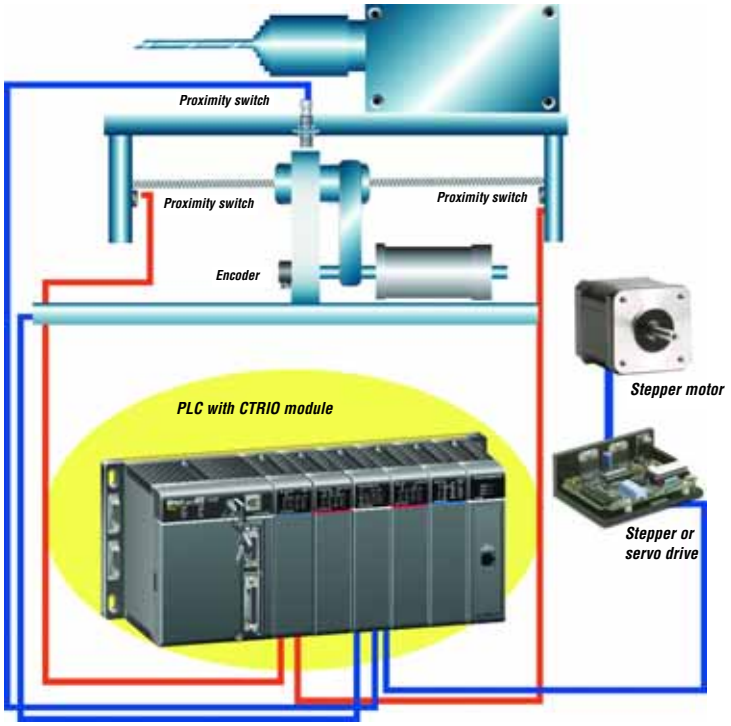
HIGH-SPEED COUNTER MODULE

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

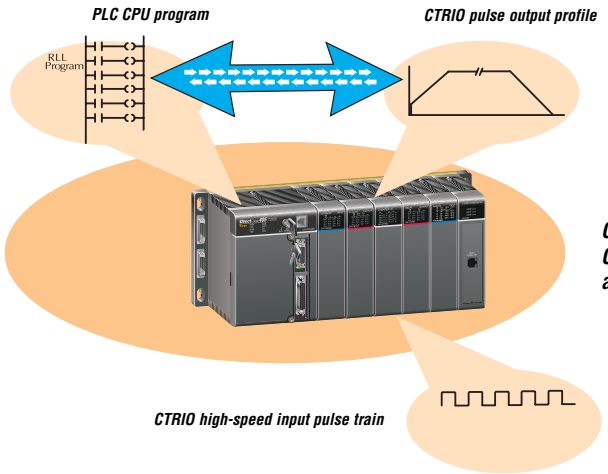


High-Speed inputs and pulse output combinations

The flexible design of the CTRIO module allows for combining high-speed inputs and delivering high-speed pulse outputs 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.

High-speed Counter Module

High-speed Counter Module
D4-HSC <--->

Specifications	
Module Type	Intelligent
I/O Points Assigned	16 X input, 32 Y output
Modules per CPU	Eight, in any local or expansion slot location
Field Wiring Connector	Removable terminal type
Count Signal Level	4.75VDC-30VDC less than 10mA
Maximum Count Speed	100kHz (50% duty cycle)
Minimum Input Pulse Width	5µs
Internal Power Consuption	300mA maximum at 5VDC (supplied by base power supply)
Operating Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Manufacturer	Koyo Electronics

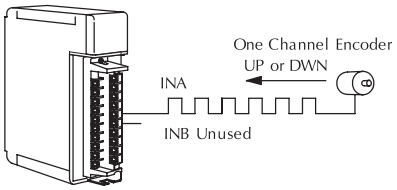
Overview

The DL405 high-speed counter provides high-speed up or down counting capability. It provides the user with count data and output signals such as Clockwise, Counter-clockwise, Decelerate, and Equal. The module functions asynchronously with the DL405 CPU, allowing fast response and control. This module is particularly well-suited for applications associated with an encoder (quadrature or up/down), and bidirectional motor.

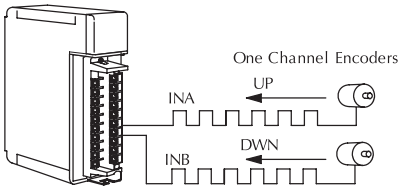
The D4-HSC module supports the following key features:

- Quadrature or up/down encoder input
- Maximum input pulse rate of 100kHz (50% duty cycle)
- Seven user control inputs
- Four external outputs for controlling motor velocity and direction
- Counting range from –8388608 to +8388607 with overflow
- Counter input multiplication of X1, X2, or X4
- User selectable count direction
- A or B mode selection
  A mode to reset counter at equal
  B mode to continue counting after equal
- Find "Home" mode to search home position automatically
- Sampling count to determine pulse rate

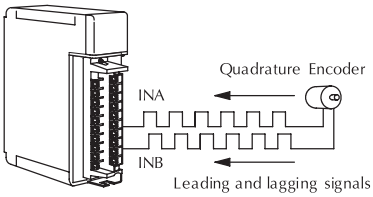
Standard counting using one input

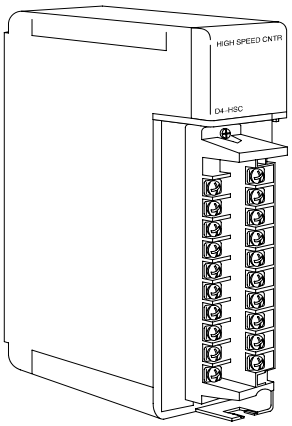


Standard counting using two inputs



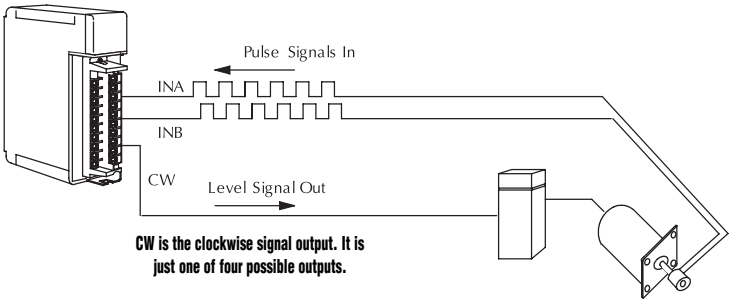
Quadrature counting





With a rotary encoder, the leading and lagging signal is determined by which direction the shaft is turning. This is how quadrature counting is able to sense direction.

Output control



CW is the clockwise signal output. It is just one of four possible outputs.

HIGH-SPEED COUNTER MODULE

External Module Input Descriptions	
IN A	Depending on mode chosen, this is either a standard UP/DOWN counter input, or one of the quadrature counter inputs.
IN B	Depending on mode chosen, this is either a standard UP/DOWN counter input, or one of the quadrature counter inputs.
IN Z	This input can be used to help you find home position for positioning control. It can also be used as an external means of resetting the counter.
LD (Load)	If you want to use an offset number with your counting, a rising edge signal at this terminal will copy the offset value into the current count.
RST (Reset)	A high (ON) signal at this terminal resets the counter to zero and it remains there until there is a transition to a low signal (OFF)
LATCH	You may want to store the current count. The rising edge of a signal at this terminal will store the current count in shared RAM. Counting continues with no interruption.
C.INH	You may want to temporarily ignore the count inputs coming in on INA and INB. A high (ON) signal at this terminal will inhibit the counting to accomplish this need. Current count is suspended until a transition to a low (OFF) signal is seen.
RUN	Not to be confused with Run mode of the DL405, a high (ON) signal here will activate HSC RUN. A low (OFF) signal will deactivate it.
LS1 and LS2	Either or both of these terminals can be connected to limit switches to help find home position, or they can merely be used as discrete inputs.

External Module Output Descriptions	
CW	Clockwise – Turns on when the optional HSC RUN mode is invoked and the current count is less than the preset value. It will reset when the current count equals the preset value. This output can also be controlled independently from the count values with an internal output bit allocated to the HSC.
CCW	**Counter Clockwise** – Turns on when the optional HSC RUN mode is invoked and the current count is greater than the preset value. It will reset when the current count equals the preset value. It can also be controlled independently from the count values with an internal output bit allocated to the HSC.
OUT1	**Deceleration** – If the optional HSC RUN mode is active, this output turns on when the current count equals the deceleration value. It is reset when HSC RUN mode is exited and re-entered, or when an internal output bit allocated to the HSC is enabled.
OUT2	**Brake** – If the optional HSC RUN mode is active, this output turns on when the current count equals the preset value. It is reset when HSC RUN mode is exited and re-entered, or when an internal output bit allocated to the HSC is enabled.

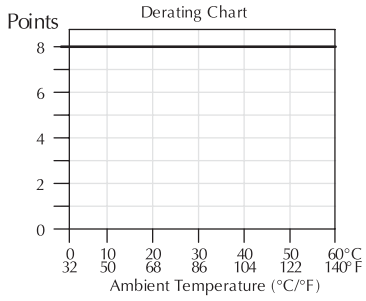
Internal Interface Signals from DL405 CPU to D4-HSC
Reset OUT 1 and OUT 2
Reset Overflow
Load Offset to Counter
Enabled HSC RUN
Enable CCW
Enable OUT2
Enable CW
Enable OUT1
Inhibit Counting
Latch Current Count
Reset Current Count
Select count Mode
Change Count Direction
Enable Home Search
Enable x2 Operation
Enable x4 Operation
Select Reset Operation
Enable Sampling
Copy Offset
Reset CW, CCW
Reset Home Search Error
Enable Reset with INZ
Enable OUT2 after Home Search

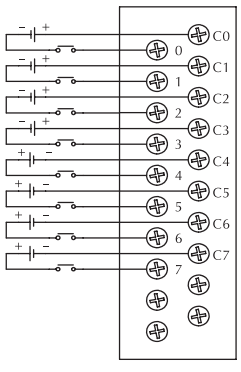
Internal Interface Signals from D4-HSC to DL405 CPU
Current Count > Preset Value
Current Count = Preset Value
Current Count < Preset Value
Count Overflow
CCW Status
OUT2 Status
CW Status
OUT1 Status
LS2 Status
LS1 Status
Home Search Executing
Sampling Executing
Missing Terminal Block
External Power Supply Failure
Internal HSC Error

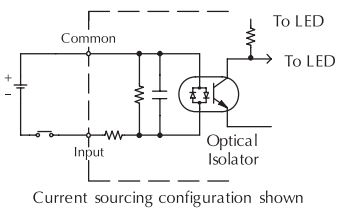
DC Input Modules

D4-08ND3S DC Input <--->	
Inputs per Module	8 (sink/source)
Commons per Module	8 (isolated)
Input Voltage Range	20- 52.8VDC
Peak Voltage	52.8VDC
ON Voltage Level	>18V
OFF Voltage Level	<7V
Input Impedance	4.8KΩ
Input Current	5mA @ 24VDC 10 mA @ 48VDC
Minimum ON Current	3.5mA
Maximum OFF Current	1.5mA
Base Power Required 5v	100mA max
OFF to ON Response	3-10ms
ON to OFF Response	3-12ms
Terminal Type	Removable
Status Indicators	Logic Side
Weight	8.8oz. (250g)

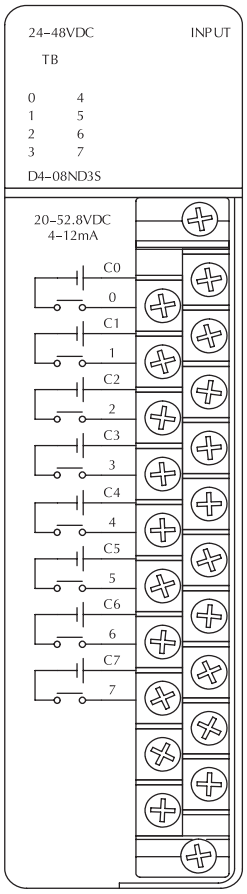
See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.





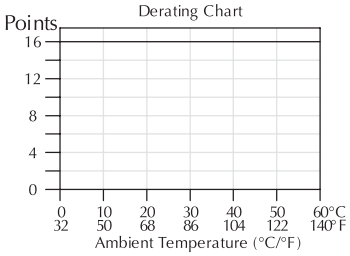


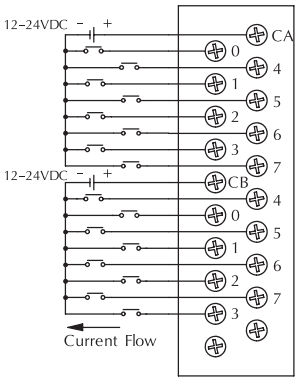
Current sourcing configuration shown

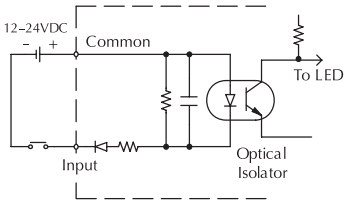


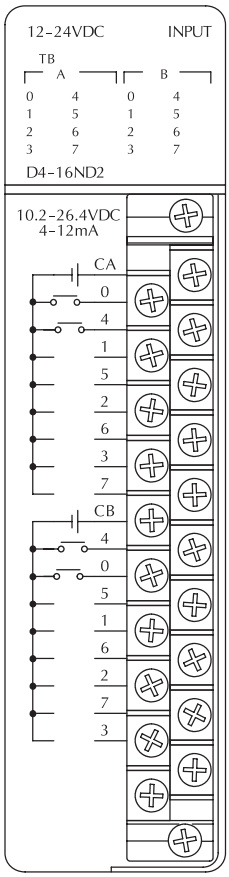
D4-16ND2 DC Input <--->	
Inputs per Module	16 (current sourcing)
Commons per Module	2 (isolated)
Input Voltage Range	10.2- 26.4VDC
Peak Voltage	26.4VDC
ON Voltage Level	>9.5V
OFF Voltage Level	<4.0V
Input Impedance	3.2KΩ @ 12VDC 2.9KΩ @ 24VDC
Input Current	3.8mA @ 12VDC 8.3mA @ 24VDC
Minimum ON Current	3.5mA
Maximum OFF Current	1.5mA
Base Power Required 5v	150mA max
OFF to ON Response	1-7ms (2.3 typical)
ON to OFF Response	2-12ms (4.6 typical)
Terminal Type	Removable
Status Indicators	Logic side
Weight	8.8oz. (250g)

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.





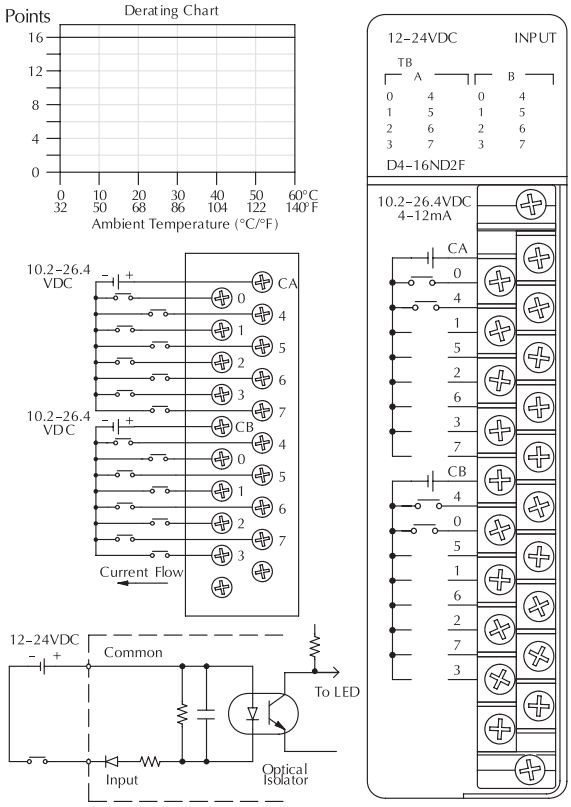




DC INPUT MODULES

D4-16ND2F DC Input <--->	
Inputs per Module	16 (current sourcing)
Commons per Module	2 (isolated)
Input Voltage Range	10.2- 26.4VDC
Peak Voltage	26.4VDC
ON Voltage Level	>9.5V
OFF Voltage Level	<4.0V
Input Impedance	3.2KΩ @ 12VDC 2.9KΩ @ 24VDC
Input Current	3.8mA @ 12VDC 8.3mA @ 24VDC
Minimum ON Current	3.5mA
Maximum OFF Current	1.5mA
Base Power Required 5v	150mA max
OFF to ON Response	1ms
ON to OFF Response	1ms
Terminal Type	Removable
Status Indicators	Logic side
Weight	8.8oz. (250g)

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.

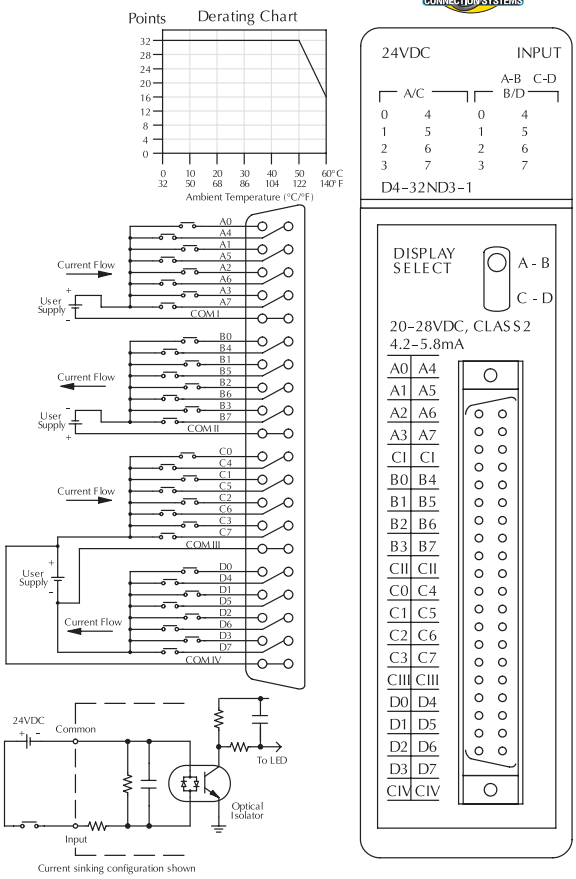


DC Input Modules

D4-32ND3-1 DC Input <--->	
Inputs per Module	32 (sink/source)
Commons per Module	4 (isolated)
Input Voltage Range	20- 28 VDC
Peak Voltage	30VDC
ON Voltage Level	>19V
OFF Voltage Level	<10V
Input Impedance	4.8KΩ
Input Current	5mA
Minimum ON Current	3.5mA
Maximum OFF Current	1.6mA
Base Power Required 5v	150mA max
OFF to ON Response	2-10ms
ON to OFF Response	2-10ms
Terminal type (See *ZIP*Links note below)	Connectors sold separately. See page 6-23.
Status Indicators	Logic side
Weight	6.6oz. (190g)

Only 16 status points can be displayed at one time on the front of the module. In the A-B position, the status of the first group of 16 input points (A0-A7, B0-B7) is displayed. In the C-D position, the status of the second group of 16 input points (C0-C7, D0-D7) is displayed.

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.

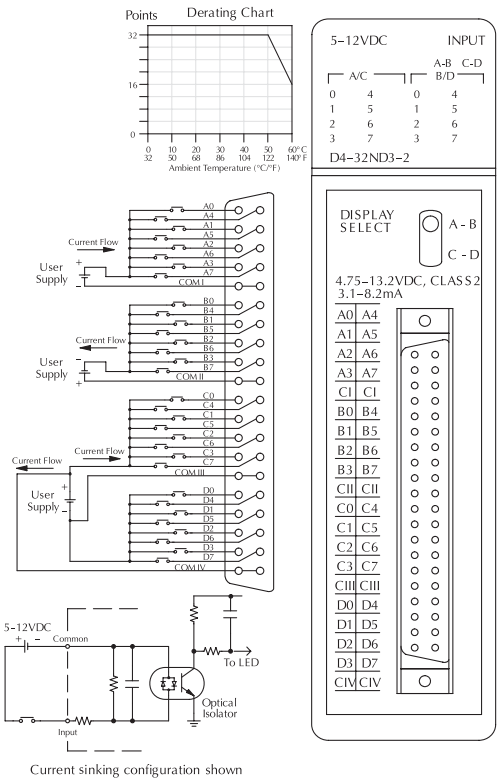


Current sinking configuration shown

D4-32ND3-2 DC Input <--->	
Inputs per Module	32 (sink/source)
Commons per Module	4 (isolated)
Input Voltage Range	4.75-13.2VDC
Peak Voltage	15VDC
ON Voltage Level	>4V
OFF Voltage Level	<2V
Input Impedance	2KΩ @ 5V 1.6MΩ @ 12VDC
Input Current	2.5mA @ 5V 7.5mA @ 12V
Minimum ON Current	1.8mA
Maximum OFF Current	0.8mA
Base Power Required 5v	150mA max
OFF to ON Response	1-4ms
ON to OFF Response	1-4ms
Terminal type (See *ZIP*Links note below)	Connectors sold separately. See page 6-23.
Status Indicators	Logic side
Weight	6.6oz. (190g)

Only 16 status points can be displayed at one time on the front of the module. In the A-B position, the status of the first group of 16 input points (A0-A7, B0-B7) is displayed. In the C-D position, the status of the second group of 16 input points (C0-C7, D0-D7) is displayed.

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.



Current sinking configuration shown

DC INPUT MODULES

D4-64ND2 DC Input <--->	
Module Location	CPU base only*
Inputs per Module	64 (current sourcing)
Commons per Module	Eight (isolated)
Input Voltage Range	20-28VDC
Peak Voltage	30VDC
ON Voltage Level	>20.0V
OFF Voltage Level	<13.0V
Input Impedance	4.8KΩ
Input Current	5.0mA @ 24VDC
Minimum ON Current	3.6mA
Maximum OFF Current	2.6mA
Base Power Required 5v	300mA max

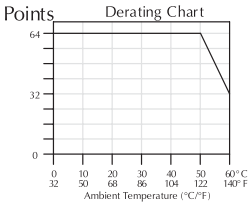
External Power Required (optional)	24VDC ± 10%, 320mA max
OFF to ON Response	2.5ms (typical)
ON to OFF Response	5ms (typical)
Terminal Type (See *ZIP*Links note below)	Connectors sold separately. See page 6-23.
Status Indicators	Logic side
Weight	7.8oz. (220g)

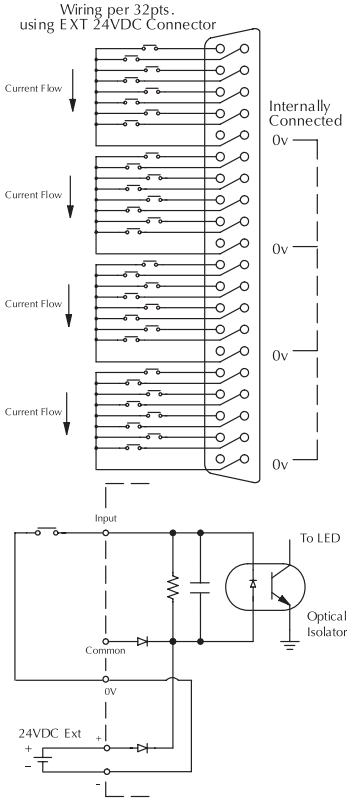
Since there are only 32 LED's on the module, you can only display the status for 32 points at one time. In the A – B position, the status of the first group of 32 input points (A0-A17, B0-B17) is displayed (connector 1). In the C – D position, the status of the second group of 32 input points (C0-C17, D0-D17) is displayed (connector 2).

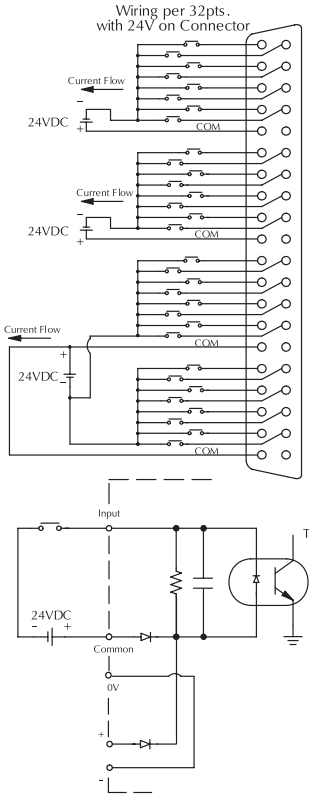
**** 1. If you are using 64-pt. modules, you cannot install any speciality modules in slots 5, 6, or 7 of the local CPU base.***

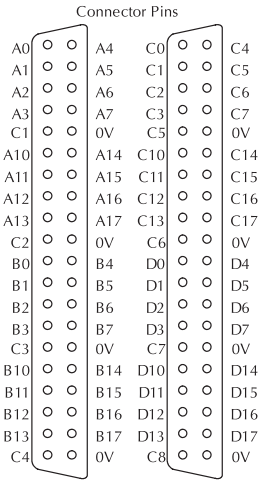
2. Modules are not allowed in expansion bases.

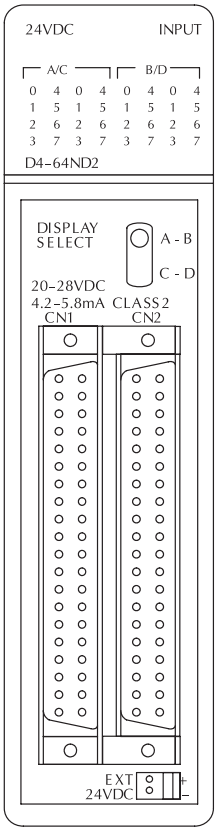
See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.









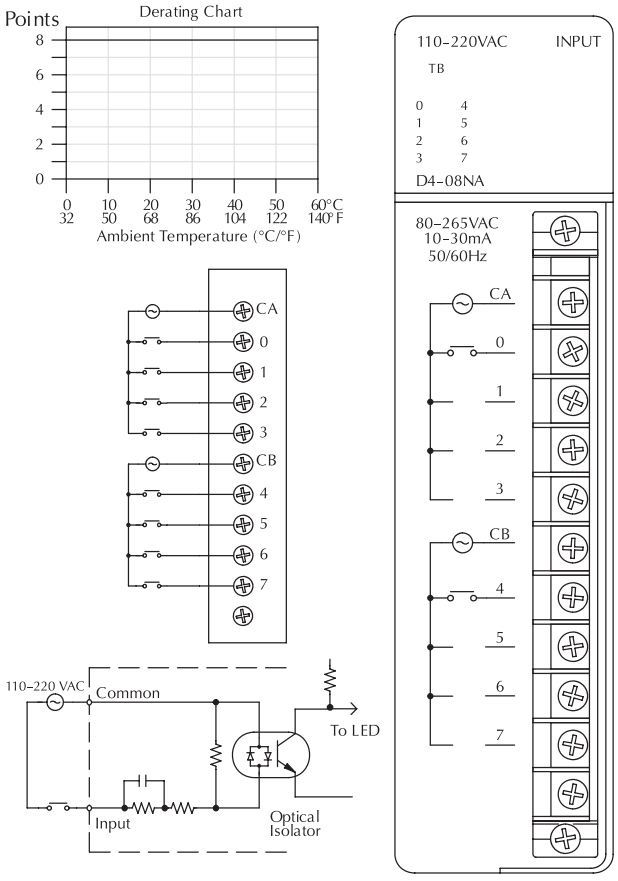


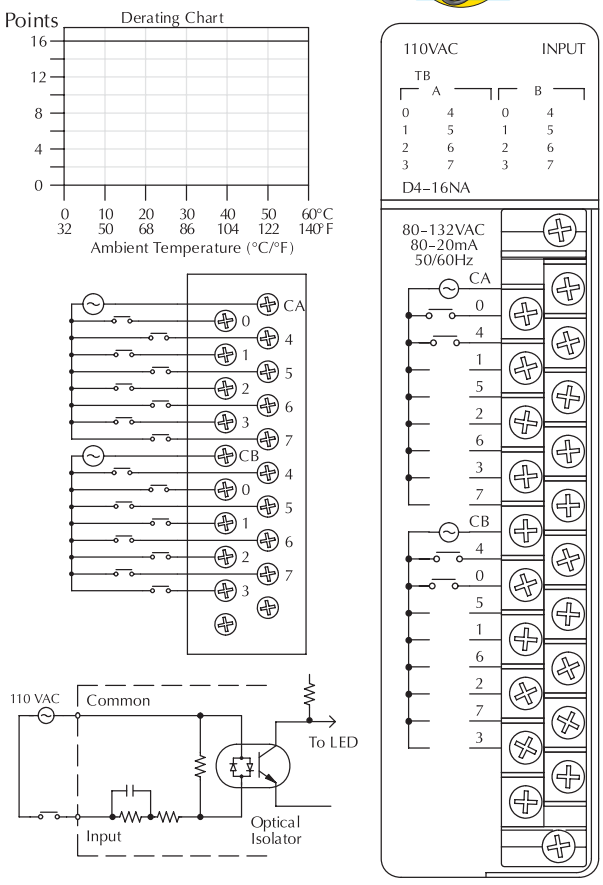
AC Input Modules

D4-08NA AC Input <--->	
Inputs per Module	8
Commons per Module	2 (isolated)
Input Voltage Range	80-265VAC
Peak Voltage	265VAC
AC Frequency	47-63Hz
ON Voltage Level	>70V
OFF Voltage Level	<30V
Input Impedance	12 KΩ
Input Current	8.5mA @ 100VAC 20mA @ 230VAC
Minimum ON Current	5mA
Maximum OFF Current	2mA
Base Power Required 5v	100mA max
OFF to ON Response	5-30ms
ON to OFF Response	10-50ms
Terminal Type	Removable
Status Indicators	265VAC Logic side
Weight	8.4oz. (240g)

D4-16NA AC Input <--->	
Inputs per Module	16
Commons per Module	2 (isolated)
Input Voltage Range	80-132VAC
Peak Voltage	132VAC
AC Frequency	47-63Hz
ON Voltage Level	>70V
OFF Voltage Level	<20V
Input Impedance	8KΩ
Input Current	14.5mA @ 120VAC
Minimum ON Current	7mA
Maximum OFF Current	2mA
Base Power Required 5v	150mA max.
OFF to ON Response	5-30ms
ON to OFF Response	10-50ms
Terminal Type	Removable
Status Indicators	Logic side
Weight	9.5oz. (270g)

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.

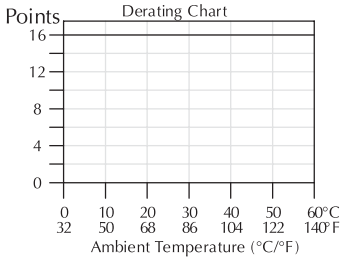


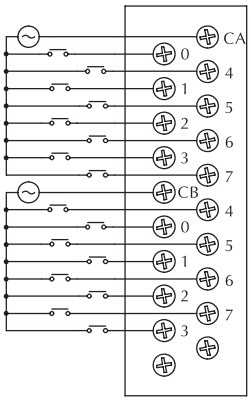


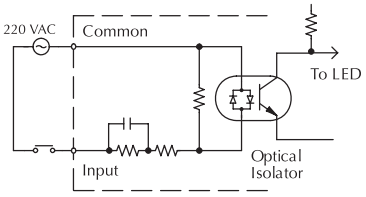
AC AND AC/DC INPUT MODULES

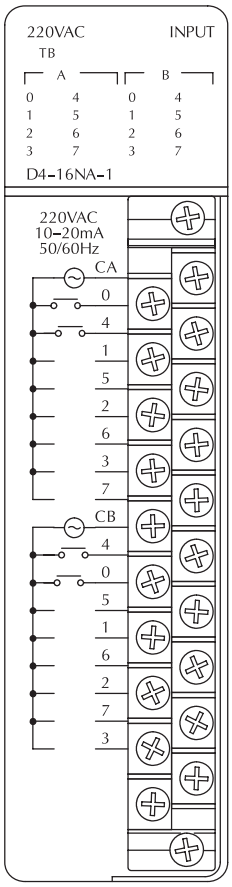
D4-16NA-1 AC Input <--->	
Inputs per Module	16
Commons per Module	2 (isolated)
Input Voltage Range	187-238VAC
Peak Voltage	265VAC
AC Frequency	47-63Hz
ON Voltage Level	>150V
OFF Voltage Level	<40V
Input Impedance	22KΩ
Input Current	10.0mA @ 220VAC
Minimum ON Current	7mA
Maximum OFF Current	2mA
Base Power Required 5v	150mA max
OFF to ON Response	5-30ms
ON to OFF Response	10-50ms
Terminal Type	Removable
Status Indicators	Logic side
Weight	9.2oz. (260g)

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.



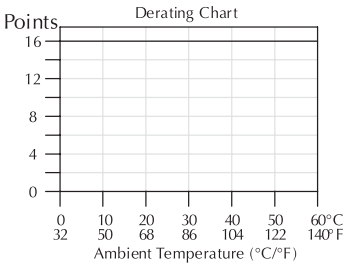


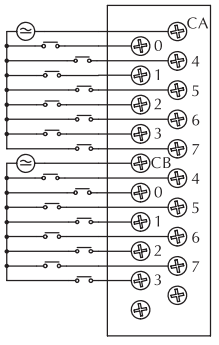


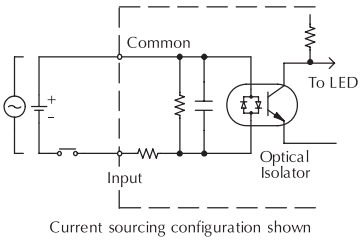


D4-16NE3 AC/DC Input <--->	
Inputs per Module	16 (sink/source)
Commons per Module	2 (isolated)
Input Voltage Range	10.2-26.4VAC/VDC
Peak Voltage	37.5VAC/VDC
AC Frequency	47-63Hz
ON Voltage Level	>9.5V
OFF Voltage Level	<3.0V
Input Impedance	3.2 KΩ @ 12V 2.9 KΩ @ 24V
Input Current	3.8mA @ 12V 8.3mA @ 24V
Minimum ON Current	4mA
Maximum OFF Current	1.5mA
Base Power Required 5v	150mA max
OFF to ON Response	5-40ms
ON to OFF Response	10-50ms
Terminal Type	Removable
Status Indicators	Logic side
Weight	8.8oz. (250g)

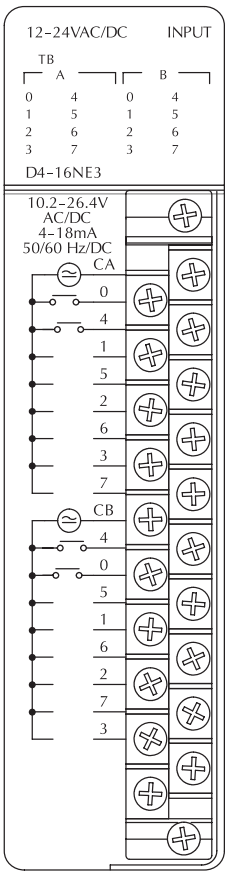
See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.







Current sourcing configuration shown



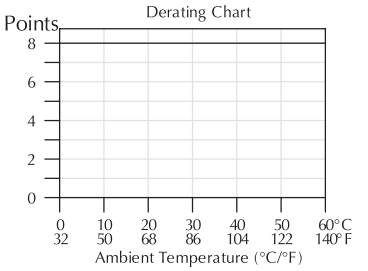
AC/DC Input and Simulator Modules

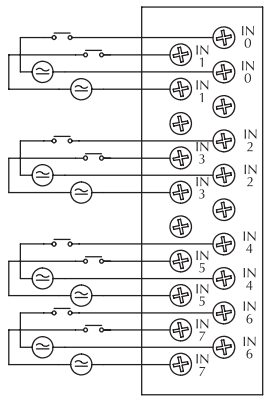
F4-08NE3S AC/DC Input <--->	
Inputs per Module	8 (sink/source)
Commons per Module	8 (isolated)
Input Voltage Range	90-150VAC/VDC
Peak Voltage	350 peak < 1ms
AC Frequency	47-63Hz
ON Voltage Level	>90VDC/75VAC
OFF Voltage Level	<60VDC/45VAC
Input Impedance	22KΩ
Input Current	5.5mA @ 120V
Minimum ON Current	4mA
Maximum OFF Current	2mA
Base Power Required 5v	90mA max
OFF to ON Response	8ms
ON to OFF Response	15ms
Terminal Type	Removable
Status Indicators	Logic side
Weight	9oz. (256g)

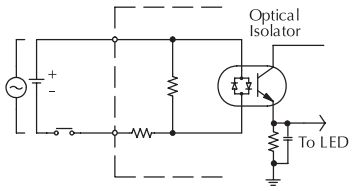
See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.

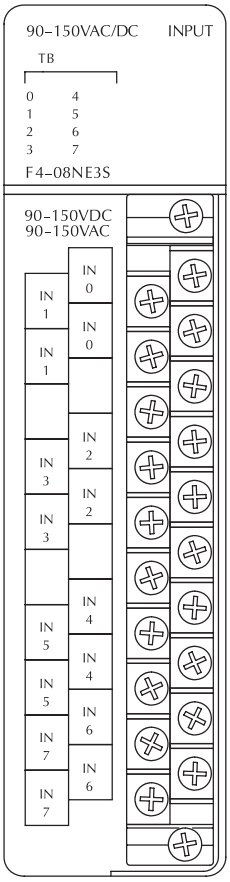
D4-16SIM Input Simulator <--->	
Inputs per Module	8 or 16 selectable by internal switch
Base Power Required 5v	150mA max
Terminal Type	None
Status Indicators	Logic side
Weight	8.8oz. (250g)

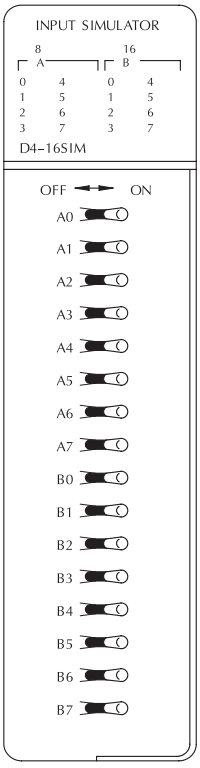
8 or 16 point selection switch is located on the back of the module
8 or 16 point selection is indicated by the LEDs above the input switch status







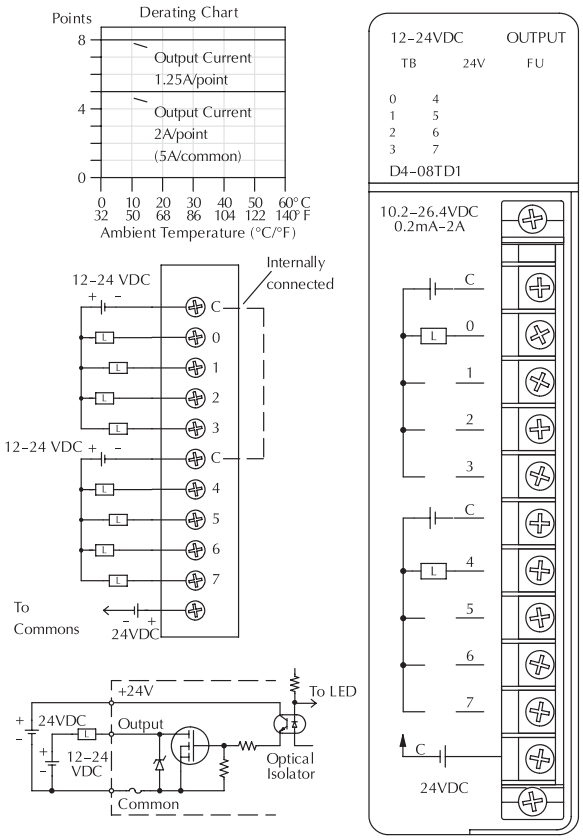


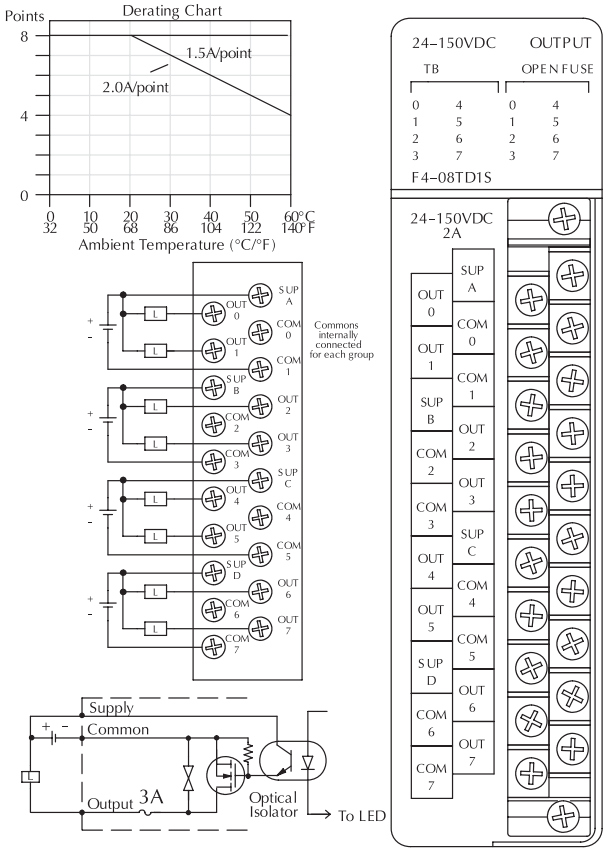


DC Output Modules

D4-08TD1 DC Output <--->	
Outputs per Module	8 (current sinking)
Commons per Module	2 internally connected
Operating Voltage	10.2-26.4VDC
Output Type	NMOS FET (open drain)
Peak Voltage	40VDC
ON Voltage Drop	0.5VDC @ 2A 0.2VDC @ 1A
Max Current (resistive)	2A/point 5A/common
Max Leakage Current	0.1mA @ 40VDC
Max Inrush Current	12A for 10ms 6A for 100ms
Minimum Load	0.2mA
Base Power Required 5v	150mA max
External DC Required	24VDC ± 10% @ 35mA
OFF to ON Response	1ms
ON to OFF Response	1ms
Terminal Type	Removable
Status Indicators	Logic side
Weight	8.4oz. (240g)
Fuses	1 (7A) per common Non-replaceable

F4-08TD1S DC Output <--->	
Outputs per Module	8 (current sinking)
Commons per Module	4 (isolated, 8 terminals)
Operating Voltage	24-150VDC
Output Type	MOS FET
Peak Voltage	200VDC < 1ms
ON Voltage Drop	0.5VDC @ 2A
Max Current (resistive)	2A/point 4A/common
Max Leakage Current	5µA
Max Inrush Current	30A for 1ms 19A for 10ms
Minimum Load	N/A
Base Power Required 5v	295mA max
External DC Required	None
OFF to ON Response	25µs
ON to OFF Response	25µs
Terminal Type	Removable
Status Indicators	Logic side
Weight	10oz. (282g)
Fuses	1 (3A) per output (see diagram) Non-replaceable

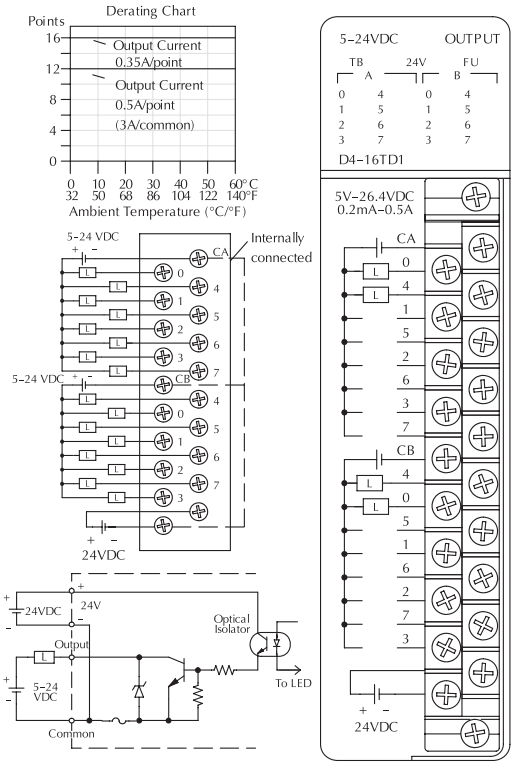




DC Output Modules

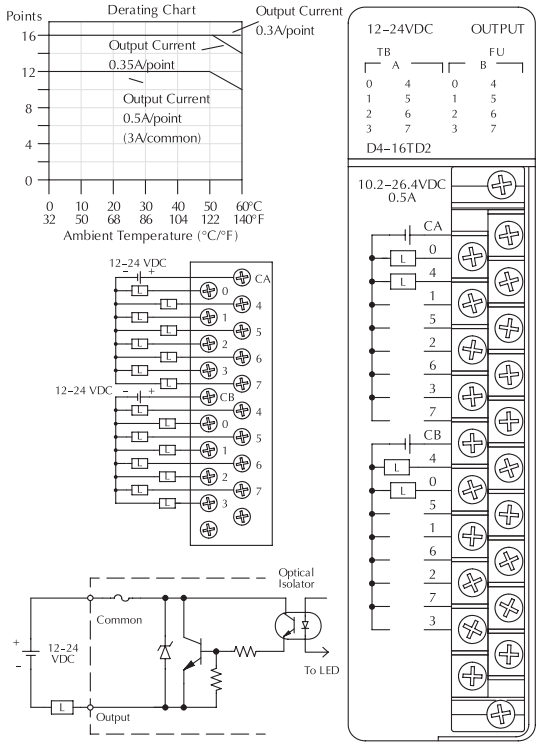
D4-16TD1 DC Output <--->	
Outputs per Module	16 (current sinking)
Commons per Module	2 internally connected
Operating Voltage	4.5-26.4VDC
Output Type	NPN Open collector
Peak Voltage	40VDC
ON Voltage Drop	0.5VDC @ 0.5A 0.2VDC @ 0.1A
Max Current (resistive)	0.5A/point - 3A/common
Max Leakage Current	0.1mA @ 40VDC
Max Inrush Current	2A for 10ms 1A for 100ms
Minimum Load	0.2mA
Base Power Required 5v	200mA max
External DC Required	24VDC ± 10% @ 125mA
OFF to ON Response	0.5ms
ON to OFF Response	0.5ms
Terminal Type	Removeable
Status Indicators	Logic side
Weight	9.5oz. (270g)
Fuses	1 (5A) per common Non-replaceable

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.



D4-16TD2 DC Output <--->	
Outputs per Module	16 (current sourcing)
Commons per Module	2 (isolated)
Operating Voltage	10.2-26.4VDC
Output Type	NPN Emitter Follower
Peak Voltage	40VDC
ON Voltage Drop	1.5VDC @ 0.5A
Max Current (resistive)	0.5A/point 3A/common @ 50° C 2.5A/common @ 60° C
Max Leakage Current	0.1mA @ 40VDC
Max Inrush Current	2A for 10ms 1A for 100ms
Minimum Load	0.2mA
Base Power Required 5v	400mA max
External DC Required	None
OFF to ON Response	1ms
ON to OFF Response	1ms
Terminal Type	Removeable
Status Indicators	Logic side
Weight	9.8oz. (280g)
Fuses	1 (5A) per common Non-replaceable

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.

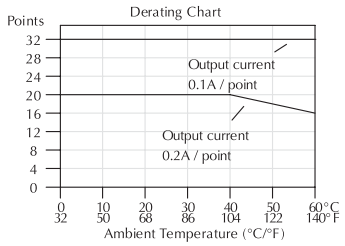


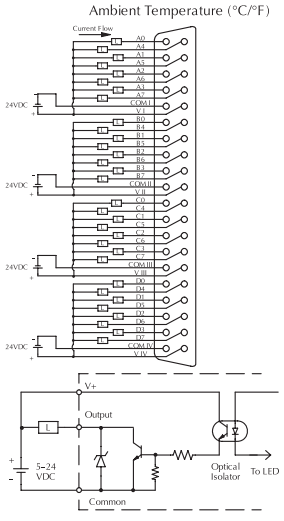
DC Output Modules

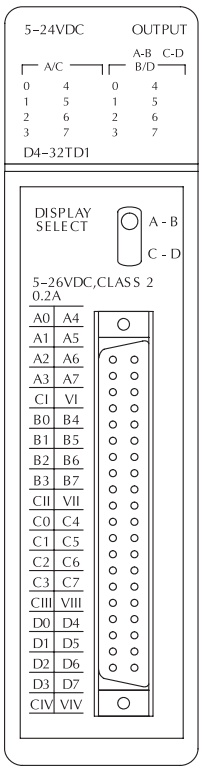
D4-32TD1 DC Output <--->	
Outputs per Module	32 (current sinking)
Commons per Module	4 (isolated)
Operating Voltage	4.75–26.4VDC
Output Type	NPN Open Collector
Peak Voltage	36VDC
ON Voltage Drop	0.6VDC @ 0.2A
Max Current (resistive)	0.2A/point 1.6A/common
Max Leakage Current	0.1mA @ 36VDC
Max Inrush Current	1A for 10ms 0.5A for 100ms
Minimum Load	0.1mA
Base Power Required 5v	250mA max
External DC Required	24VDC± 10%, 140mA max
OFF to ON Response	0.1ms
ON to OFF Response	0.1ms
Terminal Type (See *ZIP*Links note below)	Connectors sold separately. See page 6-23.
Status Indicators	Logic side
Weight	6.7oz. (190g)
Fuses	None

Only 16 status points can be displayed at one time on the front of the module. In the A - B position the status of the first group of 16 output points (A0–A7, B0–B7) is displayed. In the C - D position the status of the second group of 16 output points (C0–C7, D0–D7) is displayed.

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.







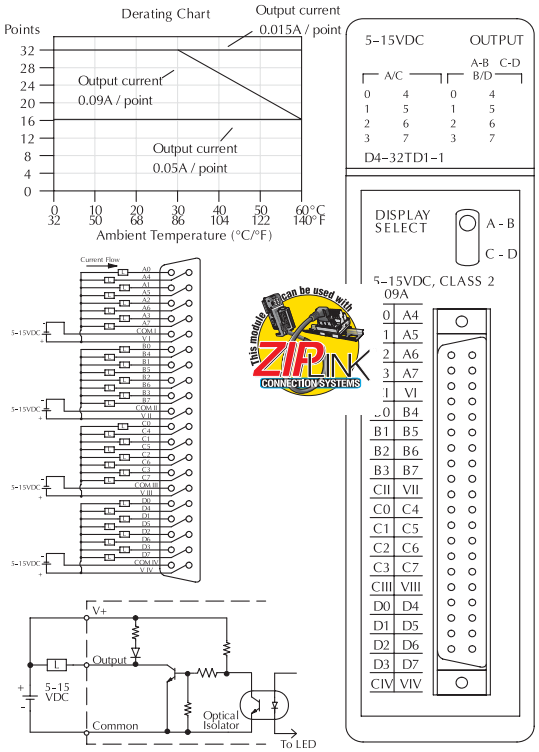
This circuit shows 24VDC used for the module and load. If load voltages less than 24VDC are required, you must use separate supplies.

DC Output Modules

D4-32TD1-1 DC Output <--->	
Outputs per Module	32 (current sinking)
Commons per Module	4 (isolated)
Operating Voltage	5-15VDC
Output Type	NPN Open Collector (with pull-up)
Peak Voltage	16.5VDC
ON Voltage Drop	0.4VDC @ 0.1A
Max Current (resistive)	0.9A/point 0.72A/common 2.88A/module
Max Leakage Current	0.01mA @ 16.5VDC
Max Inrush Current	0.5A for 10ms 0.2A for 100ms
Minimum Load	0.15mA
Base Power Required 5v	250mA max
External DC Required	5-15VDC ± 10%, 150mA max
OFF to ON Response	0.1ms
ON to OFF Response	0.1ms
Terminal Type (See *ZIP*Links note below)	Connectors sold separately. See page 6-23.
Status Indicators	Logic side
Weight	6.7oz. (190g)
Fuses	None

Only 16 status points can be displayed at one time on the front of the module.
In the A – B position, the status of the first group of 16 output points (A0-A7, B0-B7) is displayed.
In the C – D position, the status of the second group of 16 output points (C0-C7, D0-D7) is displayed.
This module operates on reverse logic -
(voltage present when output is OFF, no voltage when output is ON).

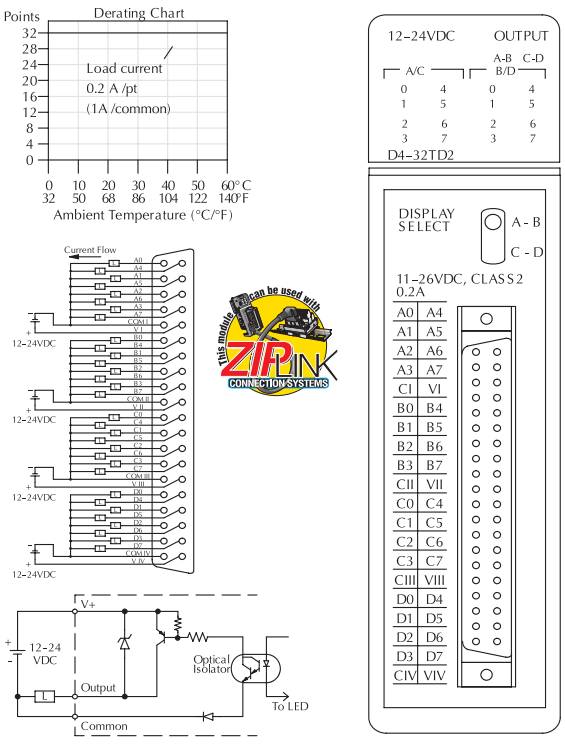
See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.



D4-32TD2 DC Output <--->	
Outputs per Module	32 (current sourcing)
Commons per Module	4 (isolated)
Operating Voltage	10.8-26.4VDC
Output Type	PNP Open Collector
Peak Voltage	30VDC
ON Voltage Drop	0.6VDC @ 0.2A
Max Current (resistive)	0.2A/point 1.0A/common 4.0A/module
Max Leakage Current	0.01mA @ 26.4VDC
Max Inrush Current	500mA for 10ms
Minimum Load	0.2mA
Base Power Required 5v	350mA max
External DC Required	10.8-26.4VDC 1A/common including load
OFF to ON Response	0.2ms
ON to OFF Response	0.2ms
Terminal Type (See *ZIP*Links note below)	Connectors sold separately. See page 6-23.
Status Indicators	Logic side
Weight	6.7oz. (190g)
Fuses	None

Only 16 status points can be displayed at one time on the front of the module.
In the A – B position, the status of the first group of 16 output points (A0-A7, B0-B7) is displayed.
In the C – D position, the status of the second group of 16 output points (C0-C7, D0-D7) is displayed.

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.



DC OUTPUT MODULES

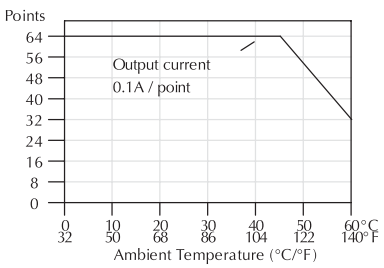
D4-64TD1 DC Output <--->	
Module Location	CPU base only*
Outputs per Module	64 (current sinking)
Commons per Module	8 (non-isolated)
Operating Voltage	4.75-26.5VDC
Output Type	NPN Open Collector
Peak Voltage	36VDC
ON Voltage Drop	0.6VDC @ 0.1A
Max Current (Resistive)	0.1A/point, 1A/common, 7A per module total
Max Leakage Current	0.01mA @ 36VDC
Max Inrush Current	1A for 1ms, 700mA for 100ms
Minimum Load	0.1mA

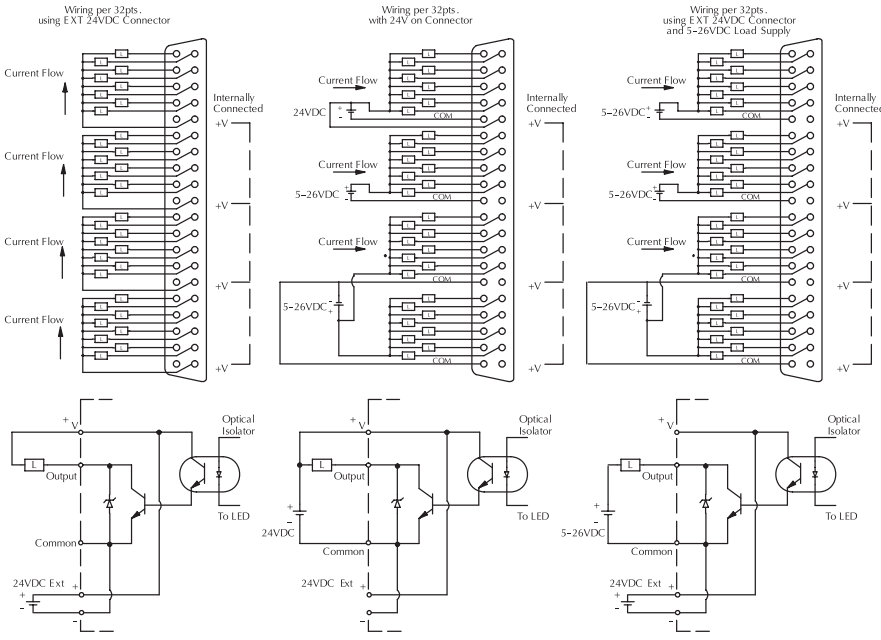
Base power Required 5v	800mA max
External DC Required	24VDC ± 10 % (850mA per common) 7.0A total max
OFF to ON Response	0.1ms
On to OFF Response	0.2ms
Terminal type (See *ZIP*Links note below)	Connectors sold separately. See page 6-23.
Status Indicators	Logic side
ON Voltage Drop	1.5VAC @ 2A
Weight	7.4oz. (210g)
Fuses	None

Only 32 status points can be displayed at one time on the front of the module. In the A-B position, the status of the first group of 32 output points (A0-A17, B0-B17) is displayed (connector 1). In the C-D position, the status of the second group of 32 output points (C0-C17, D0-D17) is displayed (connector 2).

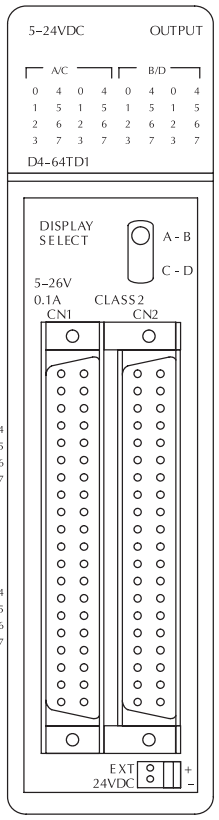
**** 1. If you are using 64-pt. modules, you cannot install any speciality modules in slots 5, 6, or 7 of the local CPU base.***

2. Modules are not allowed in expansion bases.





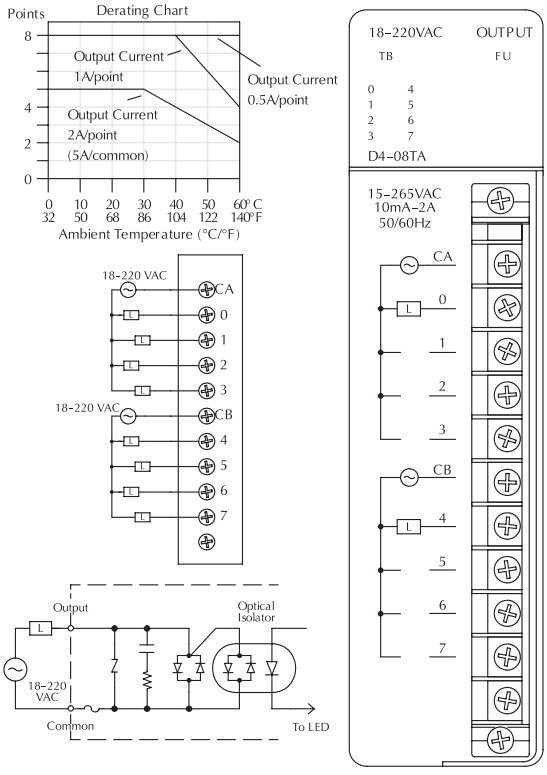
See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.



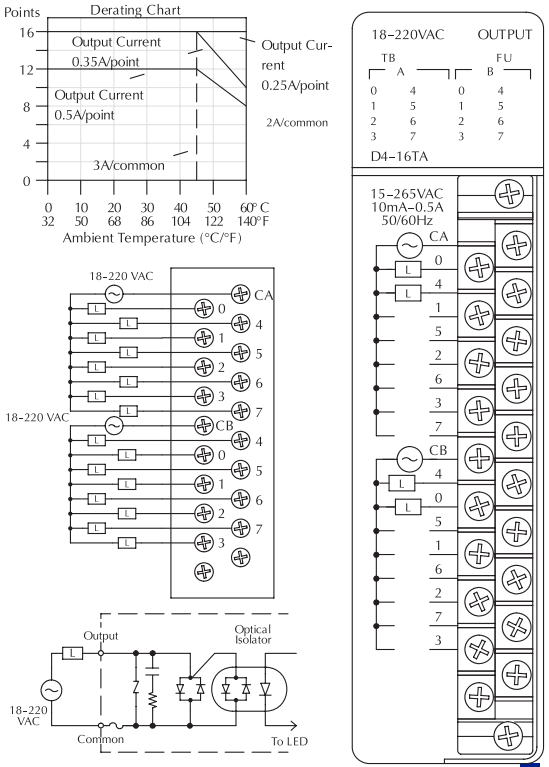
AC Output Modules

D4-08TA AC Output <--->	
Outputs per Module	8
Commons per Module	2 (isolated)
Operating Voltage	15-265VAC
Output Type	SSR (triac)
Peak Voltage	265VAC
AC Frequency	47-63Hz
ON Voltage Drop	1.5VAC @ 2A
Max Current	2A/point 5A/common @ 30° C 2A/common @ 60° C
Max Leakage Current	5mA @ 265VAC
Max Inrush Current	30A for 10ms 10A for 100ms
Minimum Load	10mA
Base Power Required 5v	250mA max
OFF to ON Response	1ms
ON to OFF Response	1ms + 1/2 cycle
Terminal Type	Removable
Status Indicators	Logic side
Weight	11.6oz. (330g)
Fuses	1 (8A) per common, non-replaceable

D4-16TA AC Output <--->	
Outputs per Module	16
Commons per Module	2 (isolated)
Operating Voltage	15-265VAC
Output Type	SSR (triac)
Peak Voltage	265VAC
AC Frequency	47-63Hz
ON Voltage Drop	1.5VAC @ 0.5A
Max Current	0.5A/point 3A/common @ 45° C 2A/common @ 60° C
Max Leakage Current	4mA @ 265VAC
Max Inrush Current	15A for 10ms 10A for 100ms
Minimum Load	10mA
Base Power Required 5v	450mA max
OFF to ON Response	1ms
ON to OFF Response	1ms + 1/2 cycle
Terminal Type	Removable
Status Indicators	Logic Side
Weight	12.2oz. (350g)
Fuses	1 (5A) per common, non-replaceable



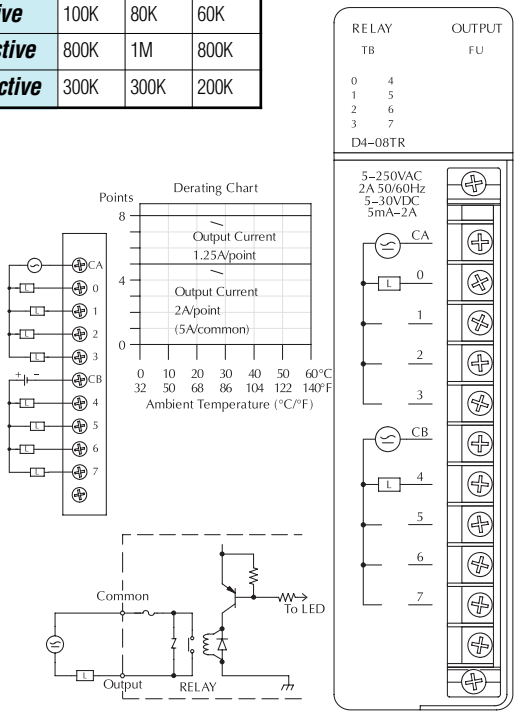
See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.



RELAY OUTPUT MODULES

D4-08TR Relay Output <--->	
Outputs per Module	8 relays
Commons per Module	2 (isolated)
Operating Voltage	5-30VDC/5-250VAC
Output Type	Form A (SPST-NO)
Peak Voltage	30VDC/256VAC
AC Frequency	47-63Hz
ON Voltage Drop	N/A
Max Current	2A/point 5A/common
Max Leakage Current	0.1mA @ 265VAC
Max Inrush Current	2A
Minimum Load	5mA
Base Power Required 5v	550mA max
External DC Required	None
OFF to ON Response	12ms
ON to OFF Response	12ms
Terminal Type	Removable
Status Indicators	Logic side
Weight	9.1oz. (260g)
Fuses	1 (8A) per common Non-replaceable

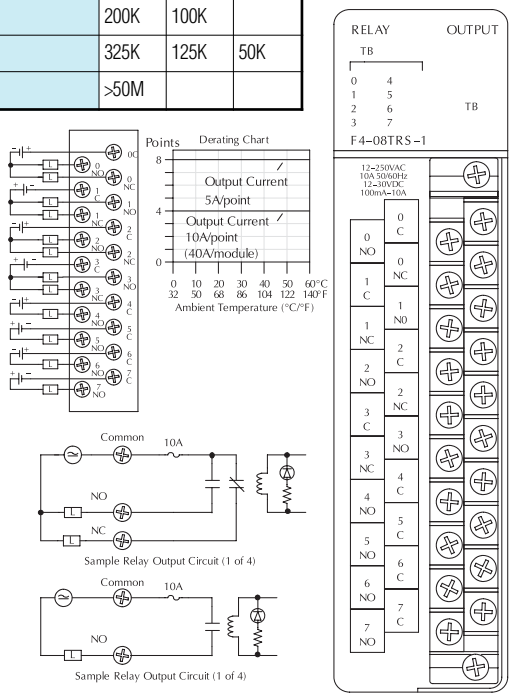
Typical Relay Life (Operations)			
Maximum Resistive or Inductive Inrush Load Current	***Operating Voltage***		
	30 VDC	***120 VAC***	***250 VAC***
2A resistive	100K	300K	200K
2A inductive	100K	80K	60K
0.5A resistive	800K	1M	800K
0.5A inductive	300K	300K	200K



F4-08TRS-1 Relay Output <--->	
Outputs per Module	8 relays
Commons per Module	8 (isolated)
Operating Voltage	12-30VDC/12-125VAC *125VAC-250VAC
Output Type	4, Form C (SPST) 4, Form A (SPST-NO)
Peak Voltage	30VDC/250VAC @ 10A
AC Frequency	47-63Hz
ON Voltage Drop	N/A
Max Current (Resistive)	10A/point 40A/module
Max Leakage Current	N/A
Max Inrush Current	10A
Minimum Load	100mA @ 12 VDC
Base Power Required 5v	575mA max
External DC Required	None
OFF to ON Response	7ms
ON to OFF Response	9ms
Terminal Type	Removable
Status Indicators	Logic side
Weight	13.2oz. (374g)
Fuses	1 (10A) per common Non-replaceable

Maximum DC voltage rating is 120 VDC @ 0.5A @ 30,000 cycles typical. Motor starters up to and including NEMA size 4 can be used with this module.

Typical Relay Life (Operations)			
Maximum Resistive or Inductive Inrush Load Current	***Operating Voltage***		
	28 VDC	***120 VAC***	***250 VAC***
1/4HP		25K	
10.0A	50K	50K	
5.0A	200K	100K	
3.0A	325K	125K	50K
.05A	>50M		

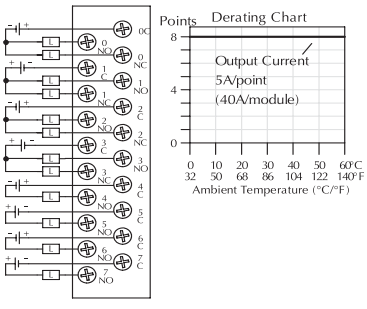


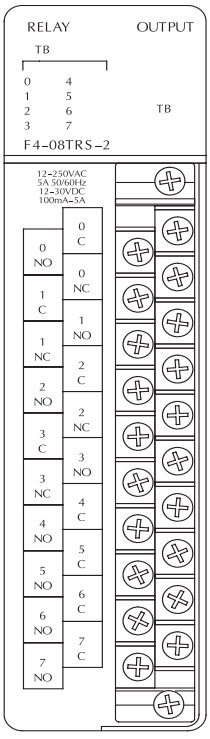
Relay Output Modules

F4-08TRS-2 Relay Output <--->		
Outputs per Module	8 relays	
Commons per Module	8 (isolated)	
Operating Voltage	12-30VDC-12-250VAC	
Output Type	4, Form C (SPDT) 4, Form A (SPST-NO)	
Peak Voltage	30VDC/250VAC @ 5A	
AC Frequency	47-63Hz	
ON Voltage Drop	N/A	
Max Current (Resistive)	5A/point 40A/module	
Max Leakage Current	N/A	
Max Inrush Current	10A	
Minimum Load	100mA @ 12VDC	
Base Power Required 5v	575mA max, 60mA/point	
External DC Required	None	
OFF to ON Response	7ms	
ON to OFF Response	9ms	
Terminal Type	Removable	
Status Indicators	Logic side	
Weight	13.8oz. (390g)	
Fuses 19379-K- Wickman	1 (10A 250V) per common User replaceable	
Replacement Fuse	D4-FUSE-2	<--->

Maximum DC voltage rating is 120 VDC @ 0.5A @ 30,000 cycles typical. Motor starters up to and including NEMA size 3 can be used with this module.

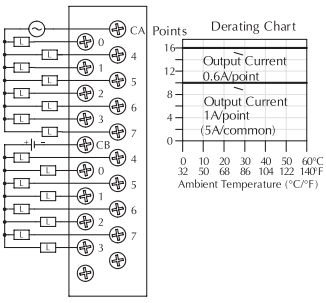
Typical Relay Life (Operations)			
Maximum Resistive or Inductive Inrush Load Current	Operating Voltage		
	28 VDC	120 VAC	240 VAC
5.0A	200K	100K	
3.0A	325K	125K	50K
.05A	>50M		

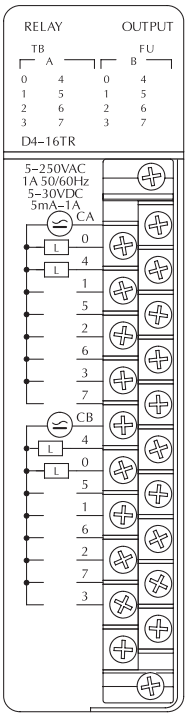




D4-16TR Relay Output <--->	
Outputs per Module	16 relays
Commons per Module	2 (isolated)
Operating Voltage	5-30VDC-5-250VAC
Output Type	Form A (SPST-NO)
Peak Voltage	30VDC/250VAC
AC Frequency	47-63Hz
ON Voltage Drop	N/A
Max Current (Resistive)	1A/point 5A/common
Max Leakage Current	0.1mA @ 265VAC
Max Inrush Current	4A
Minimum Load	5mA
Base Power Required 5v	1000mA max, 60 mA/point
External DC Required	None
OFF to ON Response	10ms
ON to OFF Response	10ms
Terminal Type	Removable
Status Indicators	Logic side
Weight	10.9oz. (310g)
Fuses	1 (8A) per common (Non-replaceable)

Typical Relay Life (Operations)			
Maximum Resistive or Inductive Inrush Load Current	Operating Voltage		
	30 VDC	125 VAC	250 VAC
1A resistive	>1M	500K	300K
1 A inductive	400K	200K	100K
0.5A resistive	>2M	800K	500K
0.5A inductive	>1M	300K	200K



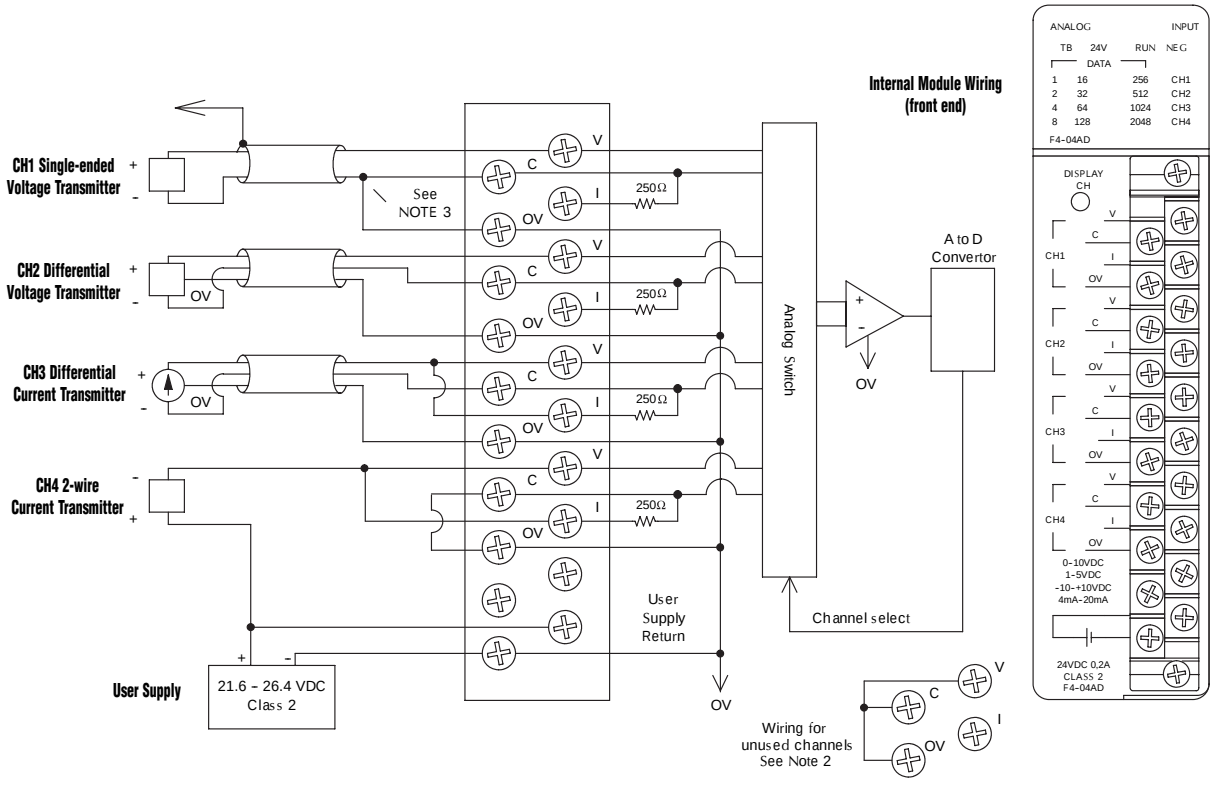


ANALOG INPUT MODULES

F4-04AD 4-Channel Analog Input <--->	
Number of Channels	4
Input Type	Single-ended or differential Voltage or current
Input Ranges	0-5V, 1-5V, 0-10V, ±5V, ±10V 0-20mA, 4-20mA
Channels Individually Configurable	Range is selected for all channels. Each channel can be wired for voltage or current
Resolution	12 bit (0 to 4095), unipolar 13 bit (-4095 to +4095), bipolar
Input Impedance	20MΩ- minimum, voltage input 250Ω- 1/2W, ± 0.1%, 25 ppm/°C current in
Max. Continuous Overload	±50VDC, voltage input, ±45mA, current input
Recommended External Fuse	0.32A, Series 217 fast acting, current inputs
Common Mode Voltage Range	± 10V maximum
Linearity	± 0.025% of span (± 1 count max. unipolar)
Input Stability	± 1/2 count
Cross Talk	-80dB, 1/2 count maximum
Full Scale Calibration Error	± 12 counts max., voltage input ± 16 counts max., at 20.0mA current input
Offset Calibration Error	± 1 count max., voltage input ± 2 counts max., at 4.0mA current input
Maximum Inaccuracy	0.4% max. @ 77°F (25°C) 0.55% max. @ 32 to 140°F (0 to 60°C)

Conversion Time	<6mS per selected channel
Noise Rejection Ratio	Normal mode: -3dB @ 50Hz, -6 dB/octave Common mode: -70dB, DC to 12 KHz
PLC Update Rate	1 channel per scan, min., 4 per scan, max.
Digital Input Points Required	16 (X) input points (12 binary data bits, 2 channel ID bits, 1 sign, 1 broken transmitter) Optional 32 input point operation for D4-04AD compatibility mode
Base Power Required 5V	85mA
External Power Supply	24VDC, ± 10%, 100 mA, class 2
Accuracy vs. Temperature	± 45 ppm/°C full scale calibration change (including maximum offset change of 2 counts)
Operating Temperature	32° to 140°F (0 to 60°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
Insulation Resistance	10M, 500VDC
Noise Immunity	NEMA ICS3-304

NOTE 1: Shields should be grounded at the signal source
NOTE 2: Unused channel should be shorted for the best noise immunity
NOTE 3: When a differential input is not used, 0V should be connected to C of the channel

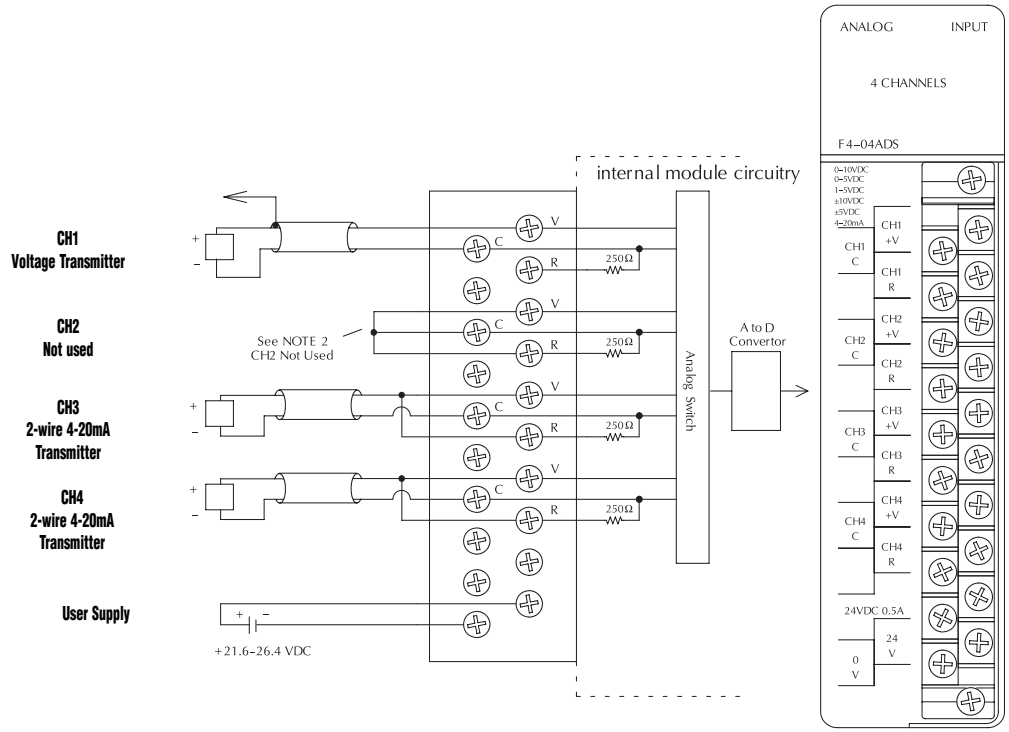


Analog Input Modules

F4-04ADS 4-Channel Isolated Analog Input <--->	
Number of Channels	4
Input Ranges	0-5V, 0-10V, 1-5V, ±5V, ±10V 0-20mA, 4-20mA
Channels Individually Configurable	Yes
Resolution	12 bit (1 to 4,096)
Conversion Method	Successive Approximation
Input Type	Differential
Max. Common Mode Voltage	± 750V peak continuous transformer isolation
Noise Rejection Ratio	Common mode: -100dB @ 60Hz
Active Low-pass Filtering	-3dB at 20Hz, -12 dB per octave
Input Impedance	250Ω ± 0.1%, 1/2W current input 200KΩ voltage point
Absolute Maximum Ratings	-45mA to + 45mA, current input ± 100V voltage input
Conversion Time	1ms per selected channel
Linearity Error: unipolar	± 1 count (0.025% of full scale) max.
bipolar	± 2 counts (0.025% of full scale) max.
Full Scale Calibration Error	± 8 counts maximum (V_{in} = 20mA)
Offset Calibration Error	± 8 counts maximum (V_{in} = 4mA)

PLC Update Rate	1 channel per scan
Digital Input Points Required	16 (X) input points (12 binary data bits, 4 active channel indicator bits)
Accuracy vs Temperature	± 100 ppm/ÞC maximum full scale (including maximum offset)
Base Power Required 5V	270mA
External Power Supply	24VDC, ± 10%, 120mA, class 2
Recommended Fuse	0.032 A, Series 217 fast-acting, current inputs
Operating Temperature	32° to 140°F (0 to 60°C)
Accuracy vs. Temperature	±100 ppm /°C maximum full scale (including maximum offset)
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

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4,096).
NOTE 1: Shields should be grounded at signal source
NOTE 2: Unused channels should have V & C & R of the channels jumpered

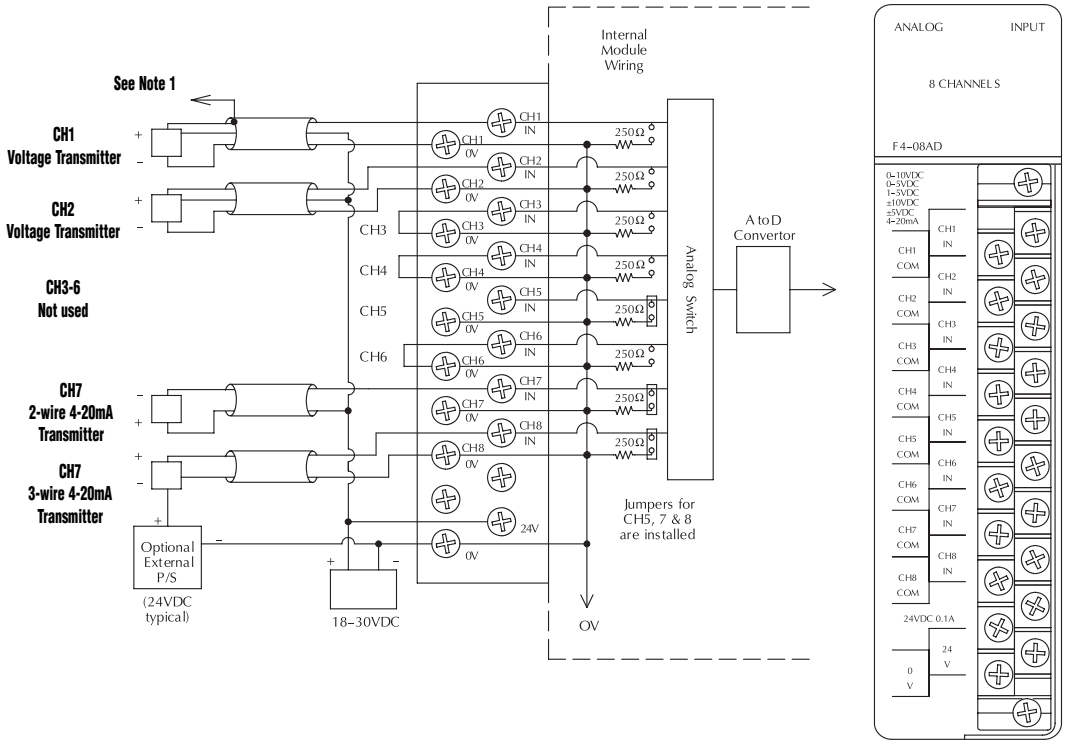


ANALOG INPUT MODULES

F4-08AD 8-Channel Analog Input <--->	
Number of Channels	8, single ended (one common)
Input Ranges	0-5V, 0-10V, 1-5V, ±5V, ±10V 0-20mA, 4-20mA
Channels Individually Configurable	No. Each channel can be configured for current or voltage but must be same range.
Resolution	12 bit (1 to 4,096)
Active Low-pass Filtering	-3dB at 20Hz, -12 dB per octave
Input Impedance	250Ω ± 0.1%, 1/2W current input >20MΩ voltage input 1 MΩ minimum
Absolute Maximum Ratings	-45mA to + 45mA, current input -75V to +75V, voltage input
Conversion Time	0.4ms per channel (module conversion) 1 ms per selected channel minimum (CPU)
Linearity Error (End to End)	± 1 count (0.025% of full scale) max.
Input Stability	± 1/2 count
Full Scale Calibration Error (Offset error not included)	± 12 counts voltage input ± 12 counts max. @ 20mA current input
Offset Calibration Error	± 2 counts max., unipolar voltage input ± 4 counts max., bipolar voltage input, ± 4 counts max., 4mA current input

PLC Update Rate	1 channel per scan min., 8 per scan, max.
Digital Input Points Required	16 (X) input points (12 binary data bits, 3 active channel bits, 1 bit unused)
Base Power Required 5V	75mA
External Power Supply	18-30VDC, 120mA, class 2
Recommended Fuse	0.032 A, Series 217 fast-acting, current inputs
Operating Temperature	32° to 140°F (0 to 60°C)
Accuracy vs. Temperature	± 50 ppm/°C maximum full scale (including maximum offset change of 2 counts)
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

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).
NOTE 1: Shields should be grounded at the signal source
NOTE 2: Unused channels should be connected to 0V or have current jumpers installed
More than one external power supply can be used (see channel 8)
A Series 217, 0.032A, fast-acting fuse is recommended for 4-20mA current loops.
If the power supply common of an external power supply is not connected to 0VDC on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20mA transmitter types are:
2 or 3 wire: Isolation between input signal and power supply.
4 wire: Isolation between input signal, power supply and 4-20mA output.

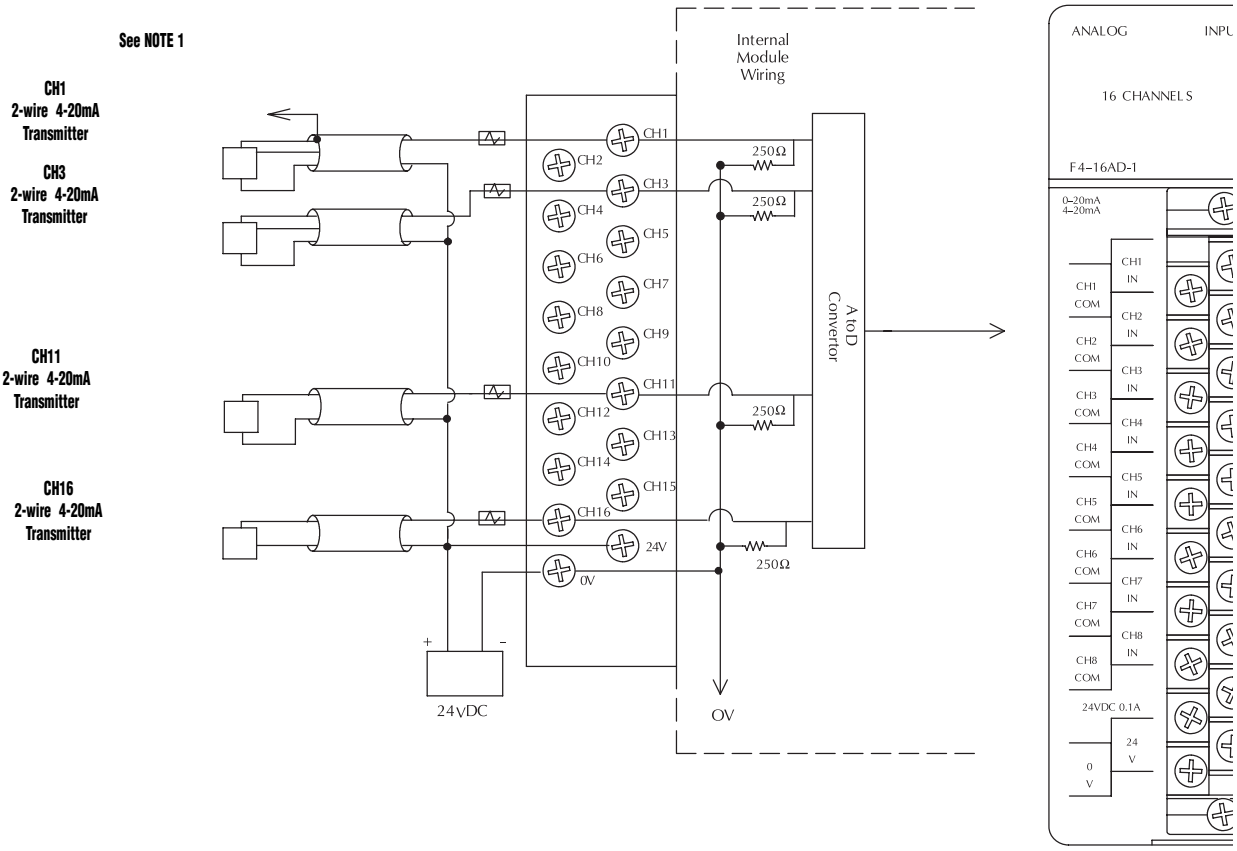


Analog Input Modules

F4-16AD-1 16-Channel Analog Input <--->	
Number of Channels	16, single ended (one common)
Input Ranges	0-20mA, 4-20mA
Channels Individually Configurable	No. Each channel can be configured for current or voltage but must be same range.
Resolution	12 bit (1 to 4,096)
Active Low-pass Filtering	-3dB at 20Hz, -12 dB per octave
Input Impedance	250Ω ± 0.1%, 1/2W current input >20MΩ voltage input 1 MΩ minimum
Absolute Maximum Ratings	-45mA to + 45mA, current input -75V to +75V, voltage input
Conversion Time	2ms per channel (module conversion)
Linearity Error (End to End)	± 2 count (0.025% of full scale) max.
Input Stability	± 1 count
Full Scale Calibration Error (Offset error not included)	± 12 counts max. @ 20mA current input
Offset Calibration Error	± 3 counts max., 4mA current input

PLC Update Rate	1 channel per scan min., 16 per scan, max.
Digital Input Points Required	16 (X) input points (12 binary data bits, 4 active channel bits)
Base Power Required 5V	100mA
External Power Supply	21.6-26.4VDC, 100mA, class2
Recommended Fuse	0.032 A, Series 217 fast-acting, current inputs
Operating Temperature	32° to 140°F (0 to 60°C)
Accuracy vs. Temperature	± 50 ppm/°C maximum full scale (including maximum offset change of 2 counts)
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

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).
NOTE 1: Shields should be grounded at the signal source.
A Series 217, 0.032A, fast-acting fuse is recommended for 4-20mA current loops.
If the power supply common of an external power supply is not connected to 0VDC on the module, then the output of the external transmitter must be isolated.
To avoid "ground loop" errors, recommended 4-20mA transmitter types are:
2 or 3 wire: Isolation between input signal and power supply.
4 wire: Isolation between input signal, power supply and 4-20mA output.

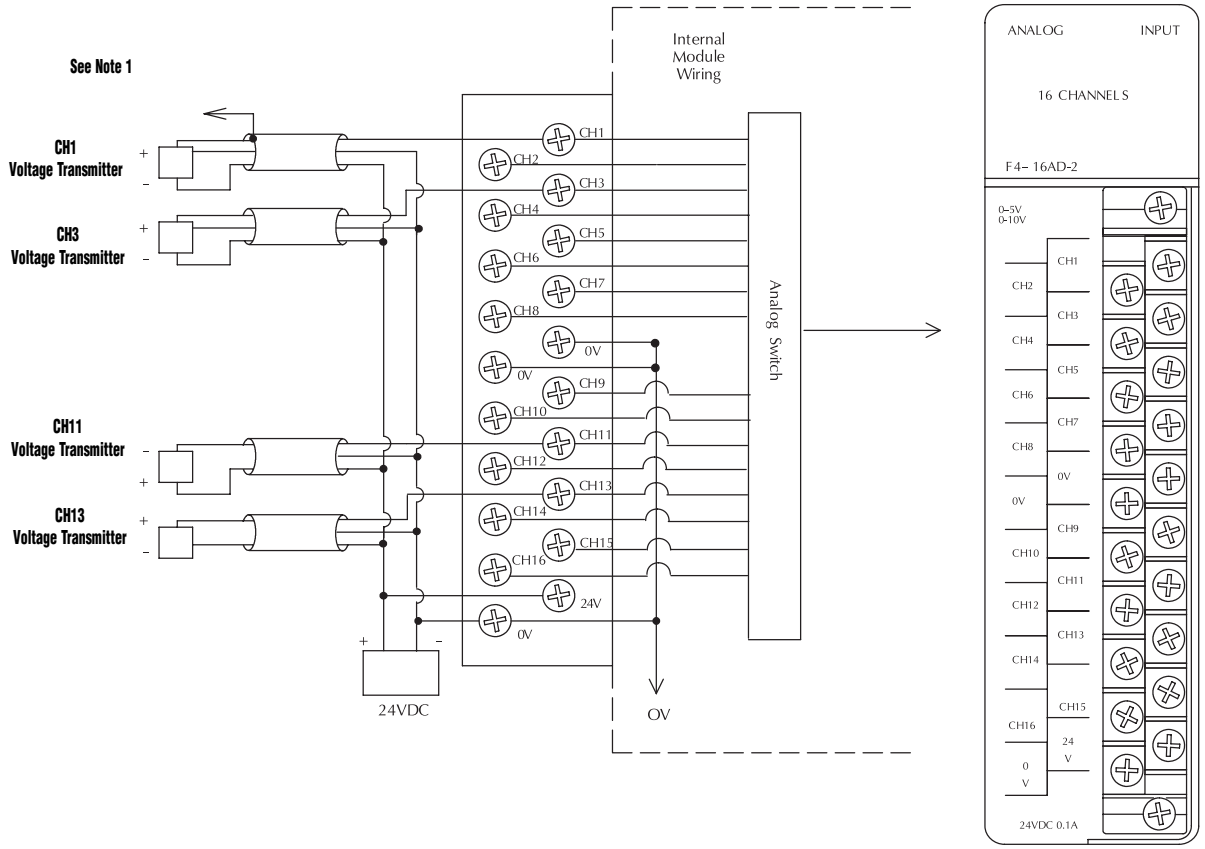


ANALOG INPUT MODULES

F4-16AD-2 16-Channel Analog Input <--->	
Number of Channels	16, single ended (one common)
Input Ranges	0-5V, 0-10V,
Channels Individually Configurable	No. Each channel can be configured for current or voltage but must be same range.
Resolution	12 bit (1 to 4,096)
Active Low-pass Filtering	-3dB at 20Hz, -12 dB per octave
Input Impedance	1MΩ minimum
Absolute Maximum Ratings	130VAC/100VDC,
Conversion Time	0.4ms per channel (module conversion) 2 ms per selected channel minimum (CPU)
Linearity Error (End to End)	± 2 count (0.050% of full scale) max.
Input Stability	± 1 count
Full Scale Calibration Error (Offset error not included)	± 12 counts voltage input
Offset Calibration Error	± 3 counts max., unipolar voltage input

PLC Update Rate	1 channel per scan min., 16 per scan, max.
Digital Input Points Required	16 (X) input points (12 binary data bits, 4 active channel bits,)
Base Power Required 5V	75mA
External Power Supply	21.6-26.4VDC, 100mA, class2
Operating Temperature	32° to 140°F (0 to 60°C)
Accuracy vs Temperature	± 50 ppm/°C maximum full scale (including maximum offset change of 2 counts)
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

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).
NOTE 1: Shields should be grounded at the signal source.
More than one external power supply can be used (see channel 8)
If the power supply common of an external power supply is not connected to 0VDC on the module, then the output of the external transmitter must be isolated.



Analog Output Modules

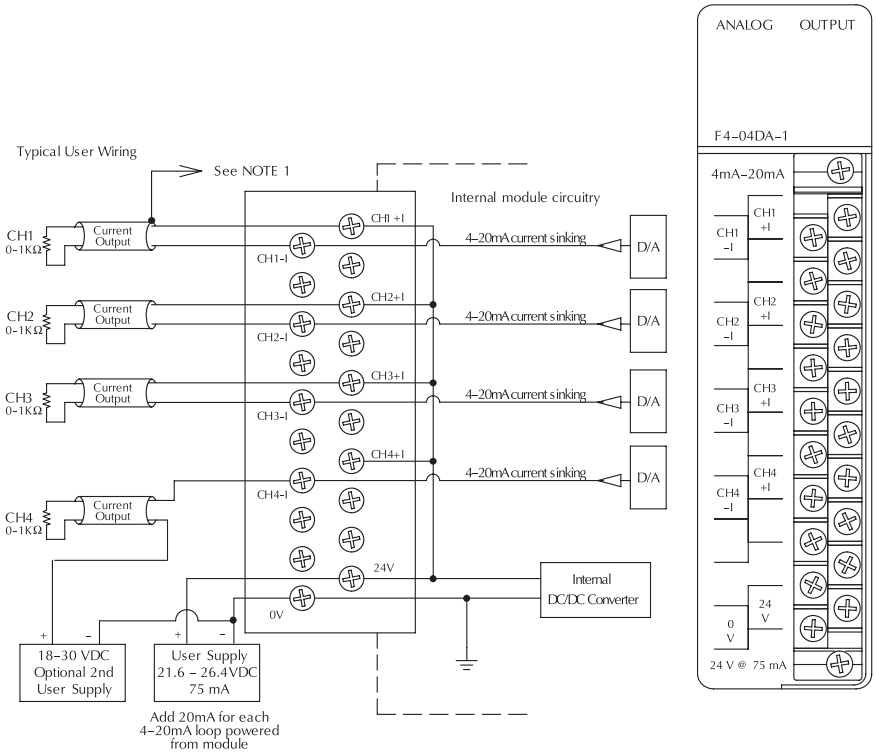
D4-02DA 2-Channel Analog Output Deleted from Catalog
1/31/06 per GECKO 1133.
Product is obsolete, and we don't have any stock.
Remove from documents and website.

ANALOG OUTPUT MODULES

F4-04DA-1 4-Channel Analog Current Output <--->	
Number of Channels	4, single-ended (one common)
Output Range	4-20mA current
Resolution	12 bit (1 to 4095)
Output Type	Outputs sink 4-20mA from external supply
External Load Resistance	0Ω minimum
Maximum Loop Supply	30VDC
Peak Output Voltage	40VDC (clamped, transient suppressor)
Maximum Load/Power Supply	620Ω/18V, 910Ω/24V, 1200Ω/30V
Linearity Error (best fit)	± 1count (±0.025%) maximum
Gain Calibration Error	± 5 counts maximum
Offset Calibration Error	± 3 counts maximum
Maximum Inaccuracy	±0.1% @ 77° F (25° C) ±0.3% @ 32 to 140° F (0 to 60° C)
Conversion Time	100µs max., settling time 2.0ms max., digital out to analog out

Digital Output Points Required	16 (Y) output points (12 bits binary data, 4 active channel bits)
Base Power Required 5V	70mA
External Power Supply	21.6-26.4VDC, 75mA, class 2 (add 20mA for each current loop used)
Accuracy vs. Temperature	± 57 ppm/°C full scale calibration range (including maximum offset change, 2 counts)
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

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4,096)
NOTE 1: Shields should be connected to the 0V of the User Power Supply at the module terminal block
NOTE 2: Unused current outputs should remain open (no connections)

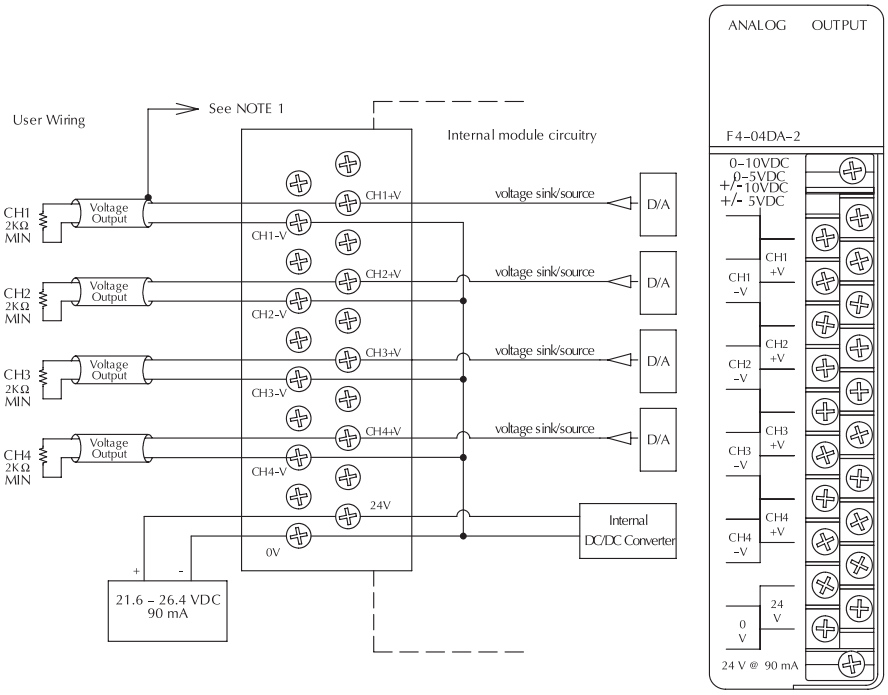


Analog Output Modules

F4-04DA-2 4-Channel Analog Voltage Output <--->	
Number of Channels	4, single ended (one common)
Output Ranges	0-5V, 0-10V, ±5V, ±10V
Channels Individually Configurable	Yes
Resolution	12 bit (1 to 4,095)
Load Impedance	2KΩ minimum
Load Capacitance	0.01µF maximum
Voltage Output Current	5.0mA sink or source
Short-circuit Current	15mA typical
Linearity Error (End to End) and Relative Accuracy	± 1count (±0.025%) maximum
Offset Calibration Error	± 3 counts maximum, unipolar ± 4 counts maximum, bipolar
Full Scale Calibration Error	± 8 counts maximum (offset error included)
Maximum Inaccuracy	± 0.2% @ 77° F (25° C) ± 0.4% @ 32 to 140° F (0 to 60° C)

Conversion Time	5µs maximum, settling time 2.0ms maximum, digital out to analog out
Digital Output Points Required	16 (Y) output points (12 bits binary data, 4 active channel bits or 2 active channel bits and 1 sign bit for bipolar)
Base Power Required 5V	90 mA
External Power Supply	21.6-26.4VDC, 90mA, class 2 (outputs fully loaded)
Accuracy vs. Temperature	± 57 ppm/°C full scale calibration change (including maximum offset change, 2 counts)
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

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).
NOTE 1: Shields should be connected to the 0V of the module or the 0V of the P/S
NOTE 2: Unused voltage outputs should remain open (no connections)

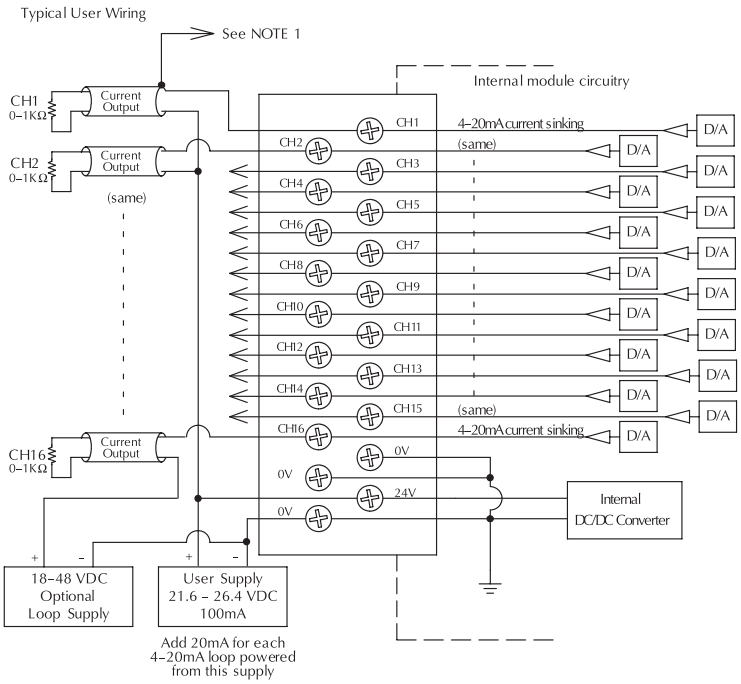


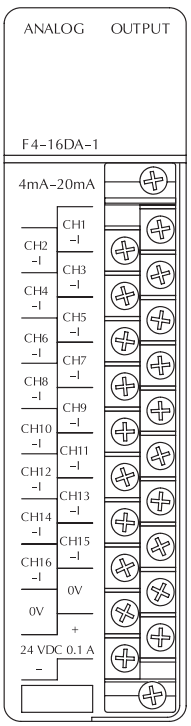
ANALOG OUTPUT MODULES

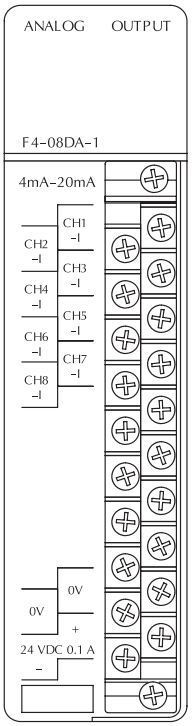
F4-08DA-1 8-Channel Analog Current Output <---> F4-16DA-1 16-Channel Analog Current Output <--->	
Number of Channels ***F4-08DA-1*** ***F4-16DA-1***	 8, single ended (one common) 16, single ended (one common)
Output Ranges	4-20mA current
Resolution	12 bit (1 to 4095)
Output Type	Outputs sink 4-20mA from external supply
Peak Output Voltage	40VDC (no transient voltage suppression)
External Load Resistance	0-480Ω @ 18V, 220-740Ω @ 24V, 1550-1760Ω @48V
Maximum Loop Supply	48VDC (with load resistance in proper range)
Crosstalk	-70dB, ± 1 count maximum
Linearity Error (End-to-End) & Relative accuracy	± 1 count maximum
Full Scale Calibration Error (offset error included)	±8 counts max. (20.0mA at 25° C)
Offset Calibration Error	± 3 counts max. (4.0mA at 25° C)
Maximum Inaccuracy	±0.2% @ 77° F (25° C) ±0.4% @ 32 to 140° F (0 to 60° C)

Conversion Time	400µs maximum, for full scale change 2.25 to 4.5 ms for digital out to analog out
Digital Output Points Required	**F4-16DA-1** 16 (Y) output points (12 bits binary data, 3 bits channel select , 1bit output enable) **F4-16DA-1** 32 (Y) output points 2 sets each (12 bits binary data, 3 bits channel select , 1bit output enable)
Base Power Required 5V	90mA
External Power Supply	21.6-26.4VDC, 100mA, class 2 (add 20mA for each current loop used)
Accuracy vs. Temperature	± 57 ppm/°C full scale calibration range (including maximum offset change, 2 counts)
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

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4,096).
NOTE 1: Shields should be connected to the 0V of the User Power Supply at the module terminal block.
NOTE 2: Unused current outputs should remain open (no connections)







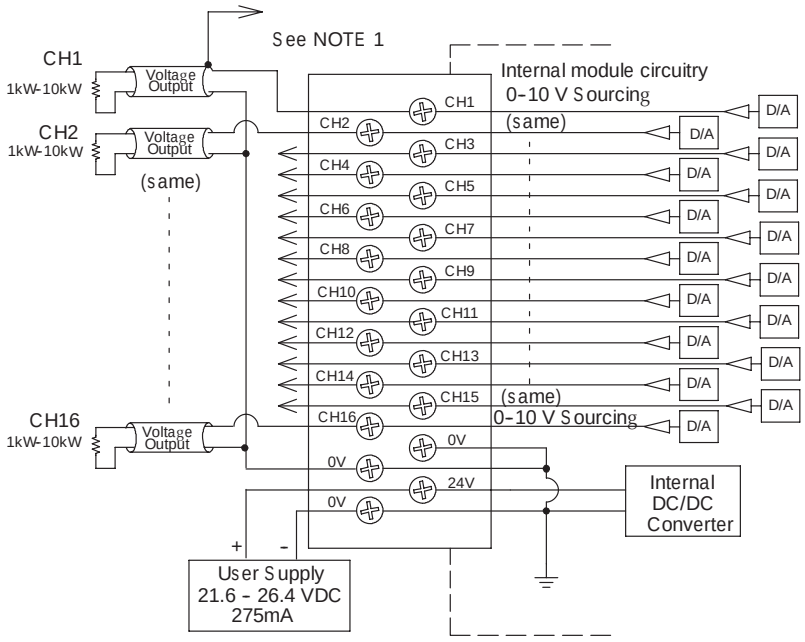
Analog Output Modules

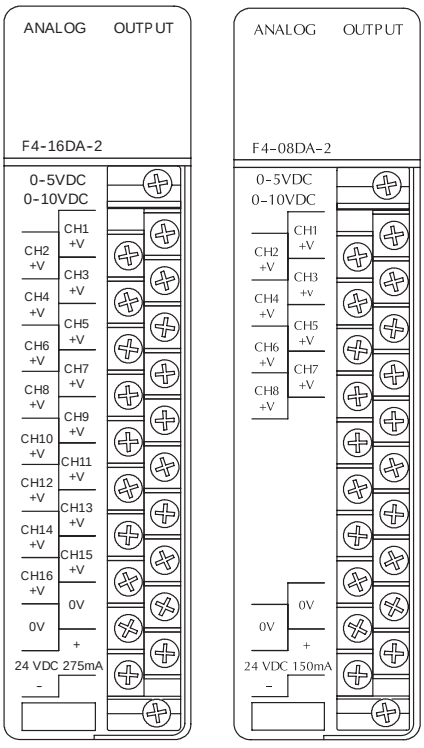
F4-08DA-2 8-Channel Analog Voltage Output <---> F4-16DA-2 16-Channel Analog Voltage Output <--->	
Number of Channels ***F4-08DA-2*** ***F4-16DA-2***	 8, single ended (one common) 16, single ended (one common)
Output Range	0-5VDC, 0-10VDC
Resolution	12 bit (1 to 4095)
Output Type	Voltage Sourcing 10mA max.
External Load Resistance	1KΩ max./10KΩ min. (example: 10volts@ 1KΩ = 10mA load)
Crosstalk	-70dB, ± 1 count maximum
Linearity Error (End-to-End) and Relative Accuracy	± 1count maximum (10VDC at 25°C)
Full Scale Calibration Error (Offset Error Included)	± 6 counts max. (10VDC at 25°C)
Offset Calibration Error	± 3 counts max. (0VDC at 25°C)
Maximum Inaccuracy	±0.2% @ 77°F (25°C) ±0.4% @ 32 to 140°F (0 to 60°C)

Conversion Time	400µs maximum, for full scale change 4.5 to 9ms for digital out to analog out
Digital Output Points Required	**F4-08DA-2** 16 (Y) output points 12 bits binary data, 3 bits channel select ,1 bit output enable) **F4-16DA-2** 32 (Y) output points (two sets each of 12 bits binary data, 3 bits channel select ,1 bit output enable)
Power Budget Require	80mA @ 5VDC (base power)
External Power Supply	21.6-26.4VDC, 150mA, class 2
Accuracy vs. Temperature	± 57 ppm/°C full scale calibration range (including maximum offset change, 2 counts)
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

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4,096).
NOTE 1: Shields should be connected to the 0V of the User Power Supply at the module terminal block.

Typical User Wiring



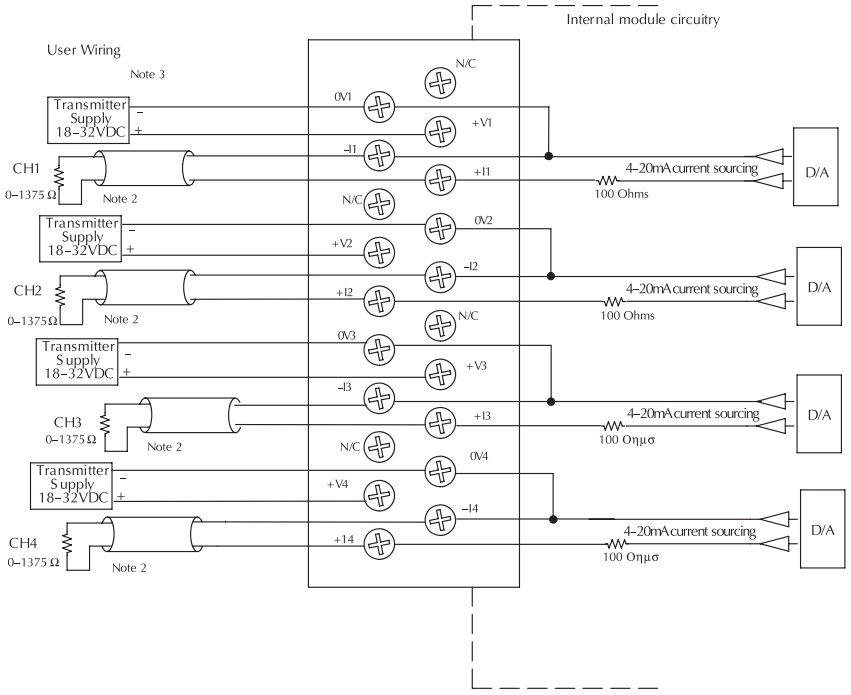


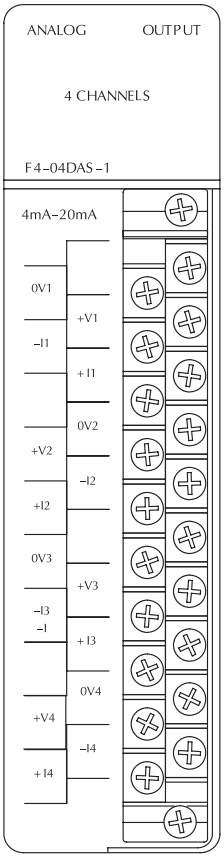
ANALOG OUTPUT MODULES

F4-04DAS-1 4-Ch. 4-20mA Isolated Analog Out <--->	
Number of Channels	4, isolated current sourcing
Output Range	4-20mA current
Resolution	16 bit (1 to 65536)
Output Type	Outputs source 4-20mA from external supply
Isolation Voltage	±750V continuous, channel to channel, channel to logic
Loop Supply	12-32VDC
Output Loop Compliance	Vin - 2.5V
Load Impedance	0-1375Ω (@ 32V)
Maximum Load/Power Supply	375Ω/12V, 975Ω/24V, 1375Ω/32V
PLC Update Rate	1 channel per scan min., 4 per scan max.
Digital Output Points Required	32 (Y) output points 16 binary data, 2 channel identification , 1bit output enable)
Power Budget Requirement	60mA @ 5VDC (supplied by base)
External Power Supply	50mA per channel

Linearity Error (End-to-End)	± 10 count maximum (0.015% of full scale)
Conversion Settling Time	3ms to 0.1% of full scale
Gain Calibration Error	± 32 counts (± 0.05%)
Offset Calibration Error	± 13 counts (± 0.02%)
Output Drift	50ppm/°C
Maximum Inaccuracy	±0.07% @ 77° F (25° C) ±0.18% @ 32 to 140° F (0 to 60° C)
Operating Temperature	0 to 60°C (32° to 140°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	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 65536).
NOTE 1: Shields should be connected to the 0V.
NOTE 2: Load must be within compliance voltage.
NOTE 3: For non-isolated outputs, connect all 0V's together (0V1…0V4) and connect all +V's together (+V1…+V4).



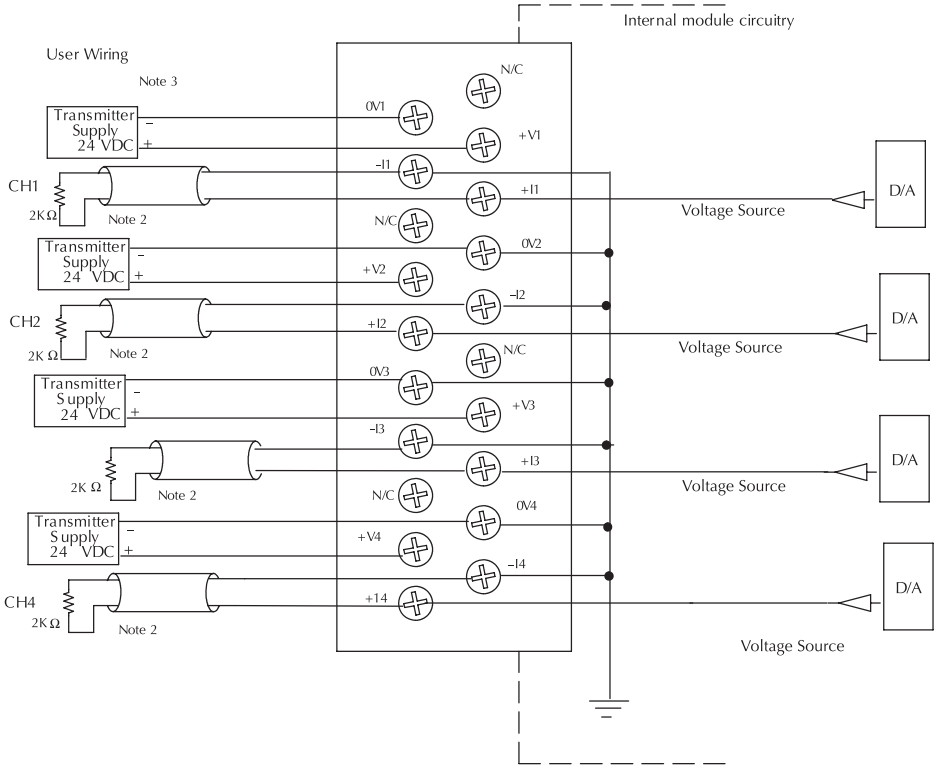


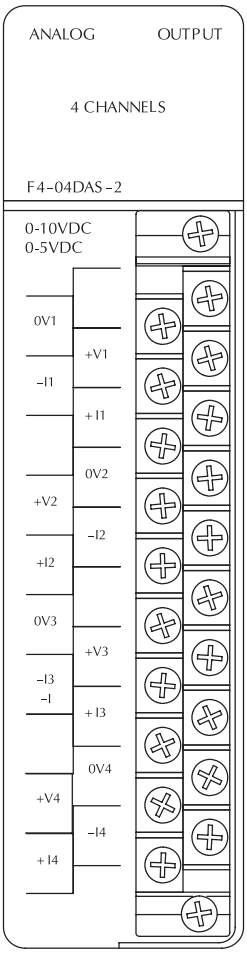
Analog Output Modules

F4-04DAS-2 4-Channel 0-5V/10V Isolated Analog Output <--->	
Number of Channels	4, isolated
Output Range	0-5VDC, 0-10VDC
Resolution	16 bit (1 to 65536)
Isolation Voltage	±750V continuous, channel to channel, channel to logic
Load Impedance	2kΩ min
PLC Update Rate	1 channel per scan min., 4 per scan max.
Digital Output Points Required	16 data bits, 2 channel ID, 1 output enable 32 (Y) output points
Power Budget Requirement	60mA @ 5VDC (supplied by base)
External Power Supply	60mA per channel, 21.6VDC-26.4VDC

Linearity Error (End-to-End)	± 10 count maximum (0.015% of full scale)
Conversion Settling Time	3ms to 0.1% of full scale
Gain Calibration Error	± 32 counts (± 0.05%)
Offset Calibration Error	± 13 counts (± 0.02%)
Maximum Inaccuracy	±0.07% @ 77° F (25° C) ±0.18% @ 32 to 140° F (0 to 60° C)
Operating Temperature	0 to 60°C (32° to 140°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	NEMA ICS3-304

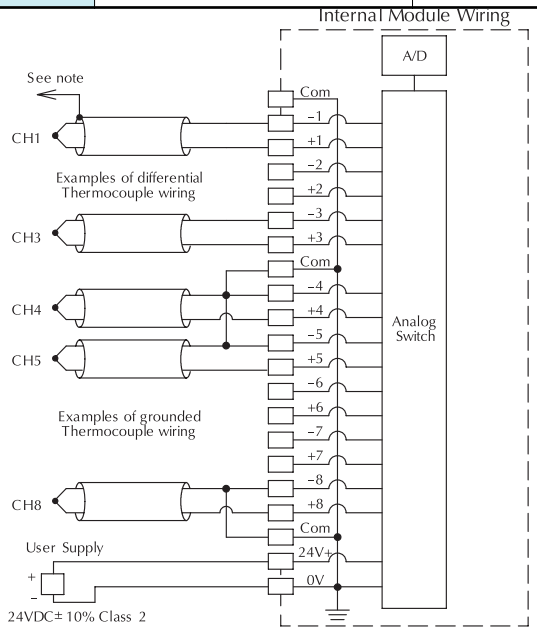
One count in the specification table is equal to one least significant bit of the analog data value (1 in 65536).
NOTE 1: Shields should be connected to the 0V.
NOTE 2: Load must be within compliance voltage.

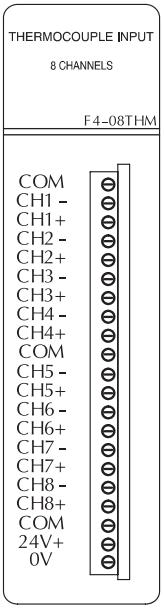




TEMPERATURE INPUT MODULES

F4-08THM 8-Channel Thermocouple Input <--->					
General Specifications		**Thermocouple Specifications**			
Number of Channels	8, differential	**Input Ranges***	Type J	-190 to 760°C	-310 to 1400°F
Common Mode Range	± 5VDC		Type E	-210 to 1000°C	-346 to 1832°F
Common Mode Rejection	90dB min. @ DC, 150dB min. @ 50/60Hz.		Type K	-150 to 1372°C	-238 to 2502°F
			Type R	65 to 1768°C	149 to 3214°F
			Type S	65 to 1768°C	149 to 3214°F
Input Impedance	1M Ω		Type T	-230 to 400°C	-382 to 752°F
			Type B	529 to 1820°C	984 to 3308°F
			Type N	-70 to 1300°C	-94 to 2372°F
			Type C	65 to 2320°C	149 to 4208°F
Absolute Maximum Ratings	Fault-protected inputs to ± 50VDC	**Display Resolution**	± 0.1°C or ± 0.1°F		
Accuracy vs. Temperature	± 5ppm/°C maximum full scale calibration (including maximum offset change)	**Cold Junction Compensation**	Automatic		
PLC Update Rate	8 channels per scan max	**Conversion Time**	100ms per channel		
Digital Inputs	16 binary data bits, 2 channel ID bits, 4 diagnostic bits	**Warn-Up Time**	30 minutes typically ± 1°C repeatability		
Input Points Required	32 points (X) input module	**Linearity Error (End to End)**	± .05°C maximum, ± .01°C typical		
External Power Supply	60mA maximum, 18 to 26.4VDC	**Maximum Inaccuracy**	± 3°C (excluding thermocouple error)		
Power Budget Requirements	110mA max., 5VDC (supplied to base)	**Voltage Input Specifications**			
Operating Temperature	0° to 60°C (32° to 140°F)	**Voltage Ranges**	0-5V, ± 5V, 0-156.25mV, ± 156.25mVDC		
Storage Temperature	-20° to 70°C (-4° to 158°F)	**Resolution**	16 bit (1 in 65535)		
Relative Humidity	5 to 95% (non-condensing)	**Full Scale Calibration Error (Offset error Included)**	± 13 counts typical, ± 33 maximum		
Environmental Air	No corrosive gases permitted	**Offset Calibration Error**	± 1 count maximum, @ 0V input		
Vibration	MIL STD 810C 514.2	**Linearity Error (End to End)**	± 1 count maximum		
Shock	MIL STD 810C 516.2	**Maximum Inaccuracy**	± 02% @ 25°C (77°F)		
Noise Immunity	NEMA ICS3-304	NOTE 1: Terminate shields at the respective signal source NOTE 2: Leave unused channels open (no connection) *Thermocouple type is selected by setting internal jumpers			





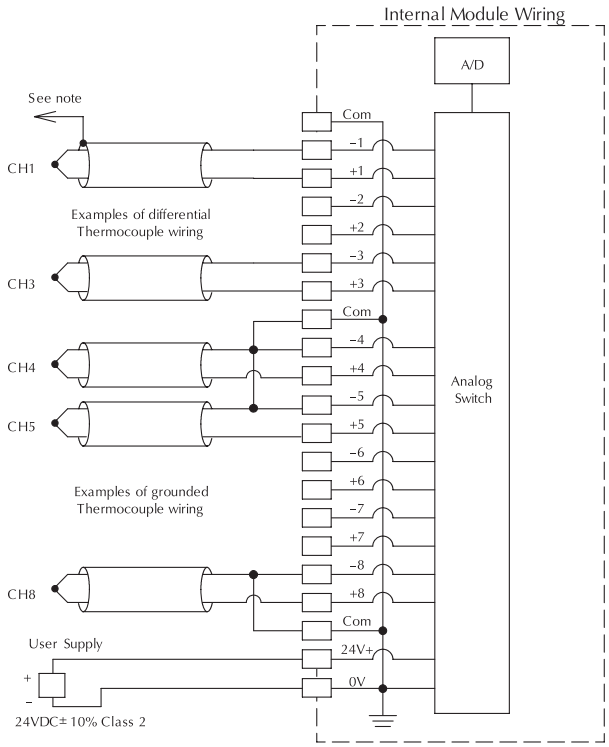
TEMPERATURE INPUT MODULES

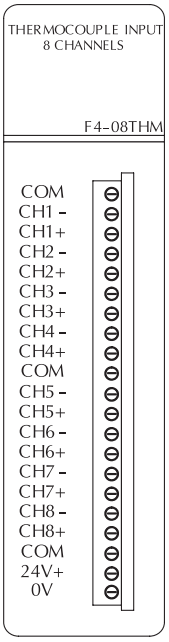
F4-08THM-n- 8-Channel Thermocouple Input <--->			
When you order the module, replace the "n" with the type of Thermocouple needed. For example, to order a Type J thermocouple module, order part number F4-08THM-J or part number F4-08THM-K for a Type K module.			
Number of channels	8, differential inputs		
Input Ranges	Type B	529/1820°C,	984/3308°F
	Type C	65/2320°C,	149/4208°F
	Type E	270/1000°C,	-450/1832°F
	Type J	-210/760°C,	-350/1390°F
	Type K	-270/1372°C,	-450/2502°F
	Type R	0/1768°C,	32/3214°F
	Type S	0/1768°C,	32/3214°F
	Type T	-270/400°C,	-450/752°F
		-1: 0-50 mV	
		-2: 0-100 mV	
		-3: 0-25mV	
Resolution	12 bit (1 in 4,096)		
Input Impedance	27KΩ		
Absolute Maximum Ratings	Fault protected input, 130 Vrms or 100VDC		
Cold Junction Compensation	Automatic		
Conversion Time	15ms per channel, minimum 1 channel per CPU scan		
Converter Type	Successive Approximation, 574		

Linearity Error	± 1 count (0.03% of full scale) maximum
Full Scale Calibration Error	± 0.35% of full scale
Maximum Inaccuracy*	± 1°C for type E, J, K, and T ± 3°C for type B, C, R, and S
PLC Update Rate	1 ch. per scan min., 8 per scan max.
Digital Input Points Required	16 (X) input points (12 binary data bits, 3 channel ID bits, 1 sign bit)
Base Power Required 5V	120mA
External Power Supply	24VDC ±10%, 50mA current
Operating Temperature	32 to 140°F (0 to 60°C)
Storage Temperature	-4 to 158°F (-20 to 70° C)
Accuracy vs Temperature*	57 ppm/°C maximum full scale
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 1: Terminate shields at the respective signal source
Note 2: Leave unused channels open (no connection)

***Max. inaccuracy is not guaranteed for temperatures lower than:**
-220°C for types E & T
-200°C for types J & K
+100°C for types R & S



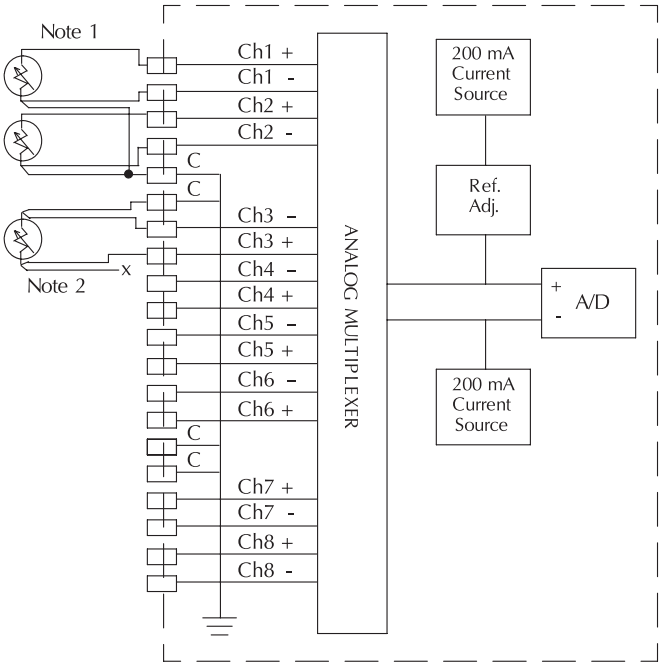


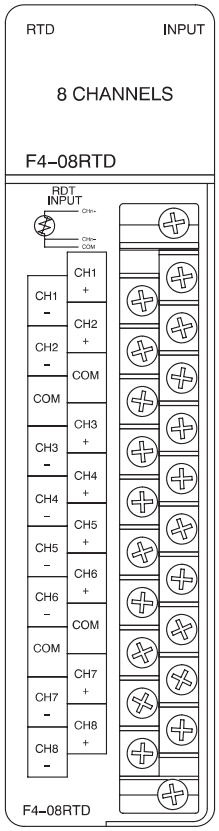
TEMPERATURE INPUT MODULES

F4-08RTD 8-Channel RTD Input <--->	
Number of Channels	8
Input Ranges	Type Pt100: -200/850°C, -328/1562°F Type Pt1000: -200/595°C, -328/1103°F Type jPT100: -38/450°C, -36/842°F Type CU-10/25W: -200/260°C, -328/500°F
Resolution	16 bit (1 in 65535)
Input Impedance	27K Ω
Display Resolution	± 0.1°C, ±0.1°F (±3276.7)
RTD Excitation Current	200µA
Input Type	Differential
Notch Filter	>100db notches at 50/60Hz -3db=13.1 Hz
Maximum Settling Time	100msec (full-scale step input)
Common Mode Range	0-5 VDC

Absolute Maximum Ratings	Fault protected inputs to ±50 VDC
Converter Type	Charge Balancing
Linearity Error	± 1°C maximum, ±.01°C typical
Full Scale Calibration Error	± 1°C
PLC Update Rate	1 ch. per scan min., 8 per scan max.
Digital Input Points Required	32 (X) input points (15 binary data bits, 3 channel ID bits, 1 sign bit, 8 fault bits)
Base Power Required 5V	80mA @ 5VDC
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

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. If an RTD sensor has 4 wires, the plus sense wire should be left unconnected as shown.





Instruction Set

Boolean Instructions

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

Store Not (STR NOT)
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 (OR NOT)
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 (AND NOT)
Logically ands a normally closed contact in series with another contact in a rung.

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

Or Store (OR STR)
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.

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

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 instructions.

Reset (RST)
An output that resets a point(s).

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

Comparative Boolean Instructions

Store if Equal (STR E)
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 (STR NOT E)
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 (OR E)
Connects a normally open comparative contact in parallel with another contact. The contact will be on when A=B.

Or if Not Equal (OR NOT E)
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 (AND E)
Connects a normally open comparative contact in series with another contact. The contact will be on when A=B.

And if Not Equal (AND NOT E)
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 contact will be on when A ≥ B.

Store Not (STR NOT)
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 (OR NOT)
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 (AND NOT)
Connects a normally open comparative contact in series with another contact. The contact will be on when A < B.

Bit of Word Boolean Instructions

Store Bit of Word (STRB)
DL450 Only Begins a new rung or an additional branch in a rung with a normally open contact that examines a single bit of a V-memory location.

Store Not Bit of Word (STRNB)
DL450 Only Begins a new rung or an additional branch in a rung with a normally closed contact that examines a single bit of a V-memory location.

Or Bit of Word (ORB)
DL450 Only Logically ors a normally open bit of word contact in parallel with another contact in a rung.

Or Not Bit of Word (ORNB)
DL450 Only Logically ors a normally closed bit of word contact in parallel with another contact in a rung.

And Bit of Word (ANDB)
DL450 Only Logically ands a normally open bit of word contact in series with another contact in a rung.

And Not Bit of Word (ANDNB)
DL450 Only Logically ands a normally closed bit of word contact in series with another contact in a rung.

Out Bit of Word (OUTB)
DL450 Only Reflects the status of the rung (on/off) and outputs the discrete (on/off) state to the specified bit of a V-memory location.

Set Bit of Word (SETB)
DL450 Only An output that turns on a single bit of a V-memory location. The bit remains on until it is reset. The reset bit of word instruction is used to turn off the bit.

Reset Bit of Word (RSTB)
DL450 Only An output that resets a single bit of a V-memory location.

Differential Instructions

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 (STRD)
DL450 Only 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)
DL450 Only 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 (ORD)
DL450 Only Logically ors a leading edge triggered one-shot contact in parallel with another contact in a rung.

Or Negative Differential (ORND)
DL450 Only Logically ors a trailing edge triggered one-shot contact in parallel with another contact in a rung.

And Positive Differential (ANDD)
DL450 Only Logically ands a leading edge triggered one-shot contact in series with another contact in a rung.

And Negative Differential (ANDND)
DL450 Only Logically ands a trailing edge triggered one-shot contact in series with another contact in a rung.

Immediate Instructions

Store immediate (STR I)
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 (STR NOT I)
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 (OR I)
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 (OR NOT I)
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 (AND I)
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 (AND NOT I)
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 (OUT I)
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 (OR OUTI)
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 (SET I)
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 I)
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)
DL450 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)
DL440&DL450 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 (OUTI)
DL450 Only Outputs the contents of the accumulator to a specified V-memory location. The status for each bit of the specified V-memory location will reflect the status of the lower 16 bits of the accumulator. Typically used for output module V-memory addresses. Allows you to specify the V location instead of the Y location and the number of points as with the OUTIF.

Out immediate Formatted (OUTIF)
DL440&DL450 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 (0-9999999.9 sec.). Time and enable/reset inputs control the timer.

Accumulating Fast Timer (TMRAF)
Two input incrementing timer with 0.01 second resolution (0-999999.99 sec.).Time input and enable/reset input 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)
Shifts data through a range of control relays with each clock pulse. The data, clock, and reset inputs control the shift register.

Accumulator/Data Stack Load and Output

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 Real Number (LDR)
DL 450 Only Loads a real number contained in two consecutive V-memory locations or an 8-digit constant into the accumulator.

Load Formatted (LDF)
DL440 & DL 450 Only 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)
Loads the accumulator with a V memory address to be offset by the value in the accumulator stack.

Load Accumulator indexed from Data Constants (LDSX)
DL440 & DL 450 Only Loads the accumulator with a offset constant value (ACON/NCON) from a data label area (DLBL).

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)
DL440 & DL 450 Only Outputs a specified number of bits (1-32) from the accumulator to the specified discrete memory locations.

Out Least (OUTL)
DL450 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)
DL450 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)
Copies a 16 bit value from the first level of the accumulator stack to a source address offset by the value in the accumulator.

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.

INSTRUCTION SET

Accumulator Logic Instructions

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.

And Formatted (ANDF)
DL440 & DL450 Only Logically ands the value in the accumulator and a specified range of discrete memory bits (1-32).

And with Stack (ANDS)
DL440 & DL450 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 two consecutive V memory locations.

Or Formatted (ORF)
(DL440 & DL450 Only) Logically ors the value in the accumulator with a range of discrete bits (1-32).

Or with Stack (ORS)
(DL440 & DL450 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 two consecutive V memory locations.

Exclusive Or Formatted (XORF)
DL440 & DL450 Only Performs an exclusive or of the value in the accumulator and a range of discrete bits (1-32).

Exclusive Or with Stack (XORS)
DL440 & DL450 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)
DL440 & DL450 Only Compares the value in the accumulator with a specified number of discrete bits (1-32).

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

Compare Real Number (CMPR)
DL450 Only Compares the real number in the accumulator with two consecutive V memory locations or a real number constant.

Math Instructions

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)
DL450 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 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)
Subtracts a BCD value, which is either two consecutive V memory locations or a real number constant, from a value in the accumulator. The result resides in the accumulator.

Subtract Real Number (SUBR)
DL450 Only Subtract 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 accumulator.

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)
DL450 Only 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)
DL450 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 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.

Divide Double (DIVD)
DL440 & DL450 Only Divides a BCD value in the accumulator by a BCD value in two consecutive V memory locations. The result resides in the accumulator.

Divide Real Number (DIVR)
DL450 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 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 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)
DL 440 & DL450 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)
DL440 & DL450 Only 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)
Multiplies a 16 bit binary value, which is either a V memory location or a 16 bits 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.

Add Formatted (ADDF)
DL440 & DL450 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)
DL440 & DL450 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)
DL440 & DL450 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)
DL440 & DL450 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)
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)
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)
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)
Divides the 8-digit BCD value in 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)
DL440 & DL450 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)
DL440 & DL450 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)
DL440 & DL450 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)
DL440 & DL450 Only Divide a value in the accumulator by the binary value in the top location of the stack. The accumulator contains the result.

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.

Number Conversion Instructions

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)
Takes the ten's complement of the BCD value in the accumulator. The result resides in the accumulator.

ASCII to HEX (ATH)
DL440 & DL450 Only Converts a ta ble of ASCII values to a table of hexadecimal values.

HEX to ASCII (HTA)
DL440 & DL450 Only Converts a table of hexadecimal values to a table of ASCII values.

Segment (SEG)
Converts a 4-digit HEX number in the accumulator to a corresponding bit pattern for interfacing to seven segment displays. The result resides in the accumulator.

Gray code to BCD (GRAY)
DL440 & DL450 Only Converts a 16 bit GRAY code value in the accumulator to a corresponding BCD value. The result resides in the accumulator.

Shuffle digits (SFLDGT)
DL440 & DL450 Only Shuffles a maximum of 8 digits, rearranging them in a specified order. The result resides in the accumulator.

Binary to Real Number (BTOR)
DL450 Only Converts the binary value in the accumulator into a real number. The result resides in the accumulator.

Real to Binary (RTOB)
DL450 Only Converts the real number in the accumulator into a binary value. The result resides in the accumulator.

Radian Real Conversion (RADR)
DL450 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)
DL450 Only Converts the real radian value in the accumulator to the equivalent real number of degrees. The result resides in the accumulator.

Trigonometric Instructions

Square Root Real (SQRTR)
DL450 Only Takes the square root of the real number stored in the accumulator. The result resides in the accumulator.

Sine Real (SINR)
DL450 Only Takes the sine of the real number stored in the accumulator. The result resides in the accumulator.

Cosine Real (COSR)
DL450 Only Takes the cosine of the real number stored in the accumulator. The result resides in the accumulator.

Tangent Real (TANR)
DL450 Only Takes the tangent of the real number stored in the accumulator. The result resides in the accumulator.

Arc Sine Real (ASINR)
DL450 Only Takes the inverse sine of the real number stored in the accumulator. The result resides in the accumulator.

Arc Cosine Real (ACOSR)
DL450 Only Takes the inverse cosine of the real number stored in the accumulator. The result resides in the accumulator.

Arc Tangent real (ATANR)
DL450 Only Takes the inverse tangent of the real number stored in the accumulator. The result resides in the accumulator.

Instruction Set

Bit Operation Instructions

Sum (SUM)
Counts the number of bits in 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.

Set Bit (SETBIT)
DL450 Only Sets a single bit (to a 1) in a V-memory location.

Reset Bit (RSTBIT)
DL450 Only Resets a single bit (to a 0) in a V-memory location.

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.

Table Instructions

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)
DL440 & DL450 Only Finds a value in a V memory table and returns the table position, containing the value, to the accumulator.

Find Greater Than (FDGT)
DL440 & DL450 Only 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)
DL450 Only 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.

Move (MOV)
DL440 & DL450 Only Moves the values from one V memory table to another V memory table.

Table To Destination (TTD)
DL440 & DL450 Only Moves a value from the top of a V memory table to a specified V memory location. The table pointer increments each scan.

Remove From Bottom (RFB)
DL440 & DL450 Only Moves a value from the bottom of a V memory table to a specified V memory location. The table pointer decrements each scan.

Source To Table (STT)
DL440 & DL450 Only Moves a value from a specified V memory location to a V memory table. The table pointer increments each scan.

Remove From Table (RFT)
DL440 & DL450 Only Pops a value from the top of a V memory table and stores it in a specified V memory location. The values in the V memory table are shifted up each time a value is moved.

Add To Top of Table (ATT)
DL440 & DL450 Only 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)
DL450 Only Shifts a specified number of bits to the left in a V-memory table.

Table Shift Right (TSHFR)
DL450 Only Shifts a specified number of bits to the right in a V-memory table.

Move Block (MOVBLK)
DL450 Only copies a specified number of words from a Data Label Area of program memory (ACON, NCON) to a V-memory area.

Move Memory Cartridge/Load Label (MOVMC/LDLBL)
DL440 & DL450 Only copies data between V memory and program ladder memory.

Program Control Instructions

Goto/Label (GOTO/LBL)
DL440 & DL450 Only Skips (does not execute) all instructions between the GOTO and the corresponding label (LBL) instruction.

For/Next (FOR/NEXT)
DL440 & DL450 Only Executes the logic between the FOR and NEXT instructions a specified number of times.

Goto Subroutine/Subroutine Return

Conditional/Subroutine Return (GTS/SBR w/RTC or RT)
DL440 & DL450 Only When a GTS instruction is executed, the program jumps to the SBR (subroutine). The subroutine is terminated with an RT instruction (unconditional return). An RTC (conditional return) can be used in conjunction with the RT. When a conditional/unconditional return is executed, the program continues from the instruction after the calling GTS instruction.

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.

Interrupt Instructions

Interrupt Routine/Interrupt Conditional/Interrupt Return (INT/IRTC/IRT)
When a hardware or software interrupt has occurred, 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). An IRTC (conditional interrupt return) can be used in conjunction with the IRT. When a conditional/unconditional 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)
DL440 & DL450 Only Displays a V memory value or a Data label constant to the handheld programmer or personal computer using DirectSOFT.

Fault (FAULT)
DL430 Only Display a V memory value to the handheld programmer or personal computer using DirectSOFT.

Numerical Constant/ASCII constant (NCON/ACON)
DL440 & DL450 Only Stores constants in numerical or ASCII form for use with other instructions.

Print Message (PRINT)
DL450 only Prints the embedded text or text / data variable message to the specified communications port. Maximum message length is 255 words.

Clock/Calendar Instructions

Date (DATE)
DL440 & DL450 Only Sets the date (year, month, day, day of the week) in the CPU calendar using two consecutive V memory locations.

Time (TIME)
DL440 & DL450 Only Sets the time (hour, seconds, and minutes) in the CPU using two consecutive V memory locations.

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).

Break (BREAK)
DL440 & DL450 Only Changes the operational mode of the CPU from Run to the Test Program mode.

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

Intelligent I/O Instructions

Read from Intelligent Module (RD)
Reads a block of data (1-128 bytes max.) from an intelligent I/O module.

Write to Intelligent Module (WT)
Writes a block of data (1-128 bytes max.) to an intelligent I/O module.

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.

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 no power flow to the coil.

Converge Stages (CV)
DL440 & DL450 Only 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)
DL440 & DL450 Only 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)
DL440 & DL450 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.

Drum Instructions

Timed Drum with Discrete Outputs (DRUM)
DL450 Only 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)
DL450 Only 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 & Event Drum with Discrete Outputs and Output Mask (MDRMD)
DL450 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 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.

Time & Event Drum with Word Output & Output Mask (MDRMW)
DL450 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.

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- Electrical Power Products
- Enclosures - Industrial (NEMA)
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- Field I/O (Terminator I/O)
- Industrial PC Products (monitors, cables...)
- Limit Switches
- Manuals
- Motor Controls/ Starters/ Contactors
- Operator Interfaces/ Touch Panels
- PC-based Control/ HMI
- Photoelectric Sensors
- Process Controllers
- Programmable Logic Controllers (PLCs)
- Proximity Sensors
- Pushbuttons / Switches / Lights
- Relays and Timers
- Software Products (config., program, server...)
- Sensors (photo, proximity, limit switches)
- Stacklights
- Tools (screwdriver, wire cutter, crimping...)

Support Resources

- Tech Support Home Page
- Technical Customer Forums
- Online Support Request
- Contact Technical Support (U.S. and CANADA)
- Contact Technical Support (MEXICO)
- Product FAQs
- Troubleshooting Guides
- Software / Firmware Downloads
- Technical / Application Notes
- Example Programs
- Customer Application Stories
- PLC Training Classes - Interconnecting Automation
- Product and Technology Web Seminars
- Self Study Tools

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- Documentation Home Page
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- Automation Terms Glossary
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