DL405 Family of Products

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

CPUs

- D4-454 – 110/220 VAC P/S
- D4-454DC-1 – 24VDC P/S
  30.8K total memory
  16 PID loops with auto-tune

Memory cartridges

- UVPROM - 15.5K (D4-UV-2)
- EEPROM - 15.5K (D4-EE-2)

Programming

- DirectSOFT Programming for Windows (PC-DSOFT6)
  Handheld programmer (D4-HPP-1)

Bases

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

Local expansion base power supplies

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

Discrete input modules

- DC input
- 16-point 12–24 VDC (D4-16ND2)
- 16-point 12–24 VDC (1ms response) (D4-16ND2F)
- 32-point 24VDC (D4-32ND3-1)
- 64-point 20–28 VDC (D4-64ND2)
  AC input modules
- 8-point 110/220 VAC (D4-08NA)
- 16-point 110VAC (D4-16NA)
- AC/DC input modules
- 16-pt 12–24 VAC/DC (D4-16NE3)

Discrete output modules

- DC output modules
- 16-point 5–24 VDC (D4-16TD1)
- 16-point 12–24 VDC (D4-16TD2)
- 32-point 5–26 VDC (D4-32TD1)
- 32-point 12–24 VDC (D4-32TD2)
- 64-point 5–26 VDC (D4-64TD1)
- AC output modules
- 8-point 18–220 VAC (D4-08TA)
- 16-point 18–220 VAC (D4-16TA)
- Relay output modules
- 8-point 2A (D4-08TR)
- 8-point 5A/pt (isolated) (F4-08TRS-2)
- 8-point 10A/pt (isolated) (F4-08TRS-1)
- 16-point 1A/pt (D4-16TR)

Analog modules(12-bit)

- Analog input
- 4-channel in, current/voltage (F4-04AD)
- 4-channel in, current/voltage (isolated) (F4-04ADS)
- 8-channel in, current/voltage (F4-08AD)
- 16-channel in, current (F4-16AD-1)
- 16-channel in, voltage (F4-16AD-2)
- Analog output
- 4-channel out, current (F4-04DA-1)
- 4-channel out, voltage (F4-04DA-2)
- 8-channel out, current (F4-08DA-1)
- 8-channel out, voltage (F4-08DA-2)
- 16-channel out, current (F4-16DA-1)
- 16-channel out, voltage (F4-16DA-2)
- Temperature Input
- 8-channel in, type J thermocouple (F4-08THM-J)

Analog modules(16-bit)

- Temperature Input
- 8-channel in, RTD (F4-08RTD)
- 8-channel in, thermocouple (F4-08THM)
- Analog output
- 4-channel out, current (isolated) (F4-04DAS-1)
- Communications/ networking modules
- Ethernet communications [H4-ECOM100]
- Data communications (D4-DCM)
- Modbus Client (F4-MAS-MB)

Specialty modules

- High-speed counter I/O (H4-CTRIO)
- 8/16 channel input simulator (D4-16SIM)
- 4-loop temperature controller (F4-4LTC)
- BASIC CoProcessor Module
- 128K triple port (F4-CP128-1)

CPU-Slot Server controllers

- Ethernet base controller (H4-EBC)

Remote I/O modules

- Ethernet
- Ethernet remote Client Module (H4-ERM100)
- Ethernet base Controller (Server) (H4-EBC)
- Remote I/O protocol (serial)
- Remote I/O Client Module (D4-RM)
- Remote I/O Server 110/220 VAC (D4-RS)

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 D4-454 has 15.5K of built in M-RAM ladder memory and no memory cartridge is needed.

How many I/O points are required? You will need to know how many field devices are required. Compare the D4-454 specifications tables on the next page with your application requirements.

Are there any remote I/O points? In many applications, the cost of bringing the individual control wiring back to the PLC control panel can be reduced by the use of remote I/O. The D4-454 CPU has built-in serial remote I/O connections on the lower 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 the D4-454 CPU, with the fastest overall scan time, is the right choice. The D4-454 is very fast at performing even the most basic of math or data instructions and will provide a faster overall scan time.

D4-454 Parameters	
Features	D4-454
Total Memory	46.8K
Ladder Memory	31.5K
DirectSOFT	Yes, version 6.1 or later
Memory Cartridge	No, (same amount of memory as the largest memory cartridge)
Battery	D2-BAT-1 (CR2354)
Mode Switch	Toggle Switch (Same position/ function)
Port 1 and 3 Baud Rate	2400, 4800, 9600, 19200, 38400
Port 1 and 3 Settings	8 data bits, 1 start bit, 1 stop bit, Odd, Even or No parity
Port 2 Protocol	DirectNet (Client/Server), K-sequence, Non-procedure, Modbus RTU (Client/ Server)
Firmware Update	Supported from all ports

D4-454 Unsupported Modules Table	
Bases	Retired
D4-04B, D4-04BNX	Yes
D4-06B, D4-06BNX	Yes
D4-08B, D4-08BNX	Yes
Input Modules	
D4-32ND3-2	Yes
D4-16NA-1	Yes
Output Modules	
D4-08TD1	Yes
Comm Modules	
H4-ECOM	Yes
Remote I/O Modules	
D4-ERM	Yes
D4-ERM-F	Yes
Specialty Modules	
D4-PULS	Yes
F4-CP128-R	Yes
F4-CP512-1	Yes

NOTE: Any hardware with a date code less than 09X0 or with a first digit that is not 0, 1, or 2 may not work with the D4-454. We suggest that any hardware older than ten years and not currently sold on the AutomationDirect.com website be upgraded to a newer version.

DL405 CPU Specifications

DL405 CPU Specifications	
	D4-454
System Capacity	
Total memory available (words)	46.8K
Ladder memory (words)	
built-in memory	31.5K
with memory cartridge	N/A
V-memory (words)	15.3K
Battery backup	Yes, MRAM*
Total CPU memory I/O pts. available	8192 (X+Y+GX+GY)
(actual I/O points depend on I/O configuration selected)	2/4/8/16/32/64
I/O module point density	4/6/8
I/O module slots per base	1024 in/1024 out
Local/local expansion	4224 max.
Serial Remote I/O (including local & exp. I/O	3
Remote I/O Channels	512, 2048
I/O pts. per remote module channel	Yes,
Ethernet Remote I/O (including local/exp. I/O)	8192 max. (Including local and exp. I/O)
discrete I/O pts.	Map into V-memory Limited by power budget
Analog I/O channels	16,384 (16 fully expanded H4-EBC Servers using
Remote I/O channels	V-memory and bit-of-word
I/O per remote channel	instructions)
Performance	
Contact execution (boolean)	0.96 µs
Typical scan (1K boolean)	4–5 ms
Programming and Diagnostics	
RLL ladder style	Yes
RLL PLUS/flowchart style (Stages)	Yes/1024
Run time editing	Yes
Supports Overrides	Yes
Variable/fixed scan	Fixed or variable
Instructions	210
Control relays	2048
Timers	256
Counters	256
Immediate I/O	Yes
Subroutines	Yes
For/next loops	Yes
Timed interrupt	Yes
Integer math	Yes
Floating-point math	Yes
Trigonometric functions	Yes
Table instructions	Yes
PID	Yes
Drum sequencers	Yes
Bit of word	Yes
Real-time clock/calendar	Yes
Internal diagnostics	Yes
Password security	Multi-level
System and User error log	Yes
IBox instructions	Yes
CPU Ports Communications	
Built-in ports	4 ports
K-sequence (proprietary protocol)	Yes
DirectNET	Yes
Modbus Client/Server	Yes
ASCII out (Print)	Yes
Maximum baud rate	38.4K
*Battery used for Real Time Clock backup	

D4-454 Key Features

D4-454 CPU

D4-454 $1,071.00

D4-454DC-1 $1,232.00

16 PID Loops

The D4-454 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 DirectSOFT6 Programming Software. An overview of the various loop specifications and features is on page tDL4-7.
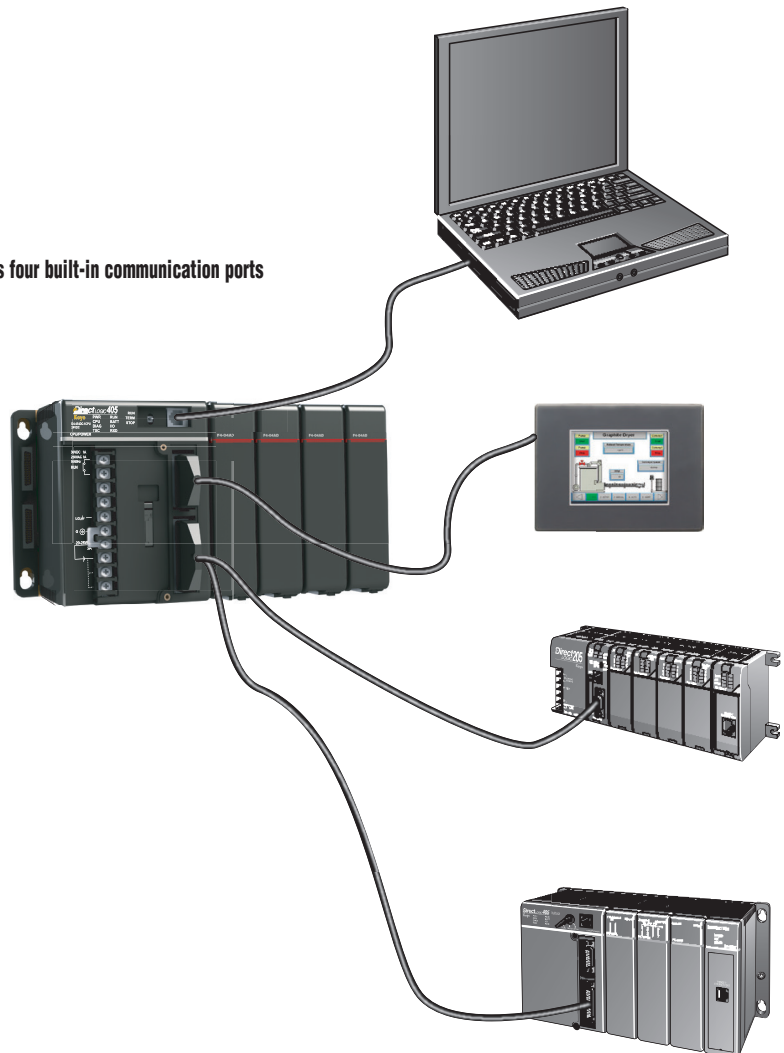
Floating-point Math

The D4-454 CPU supports IEEE format floating-point math calculations. This feature means the D4-454 includes full trigonometric functions and various forms of integer/floating point number conversions.

Power Supplies

We offer a choice of two built-in power supplies for the D4-454 CPUs. Available choices are an AC source or DC source:

- 110/220 VAC version - D4-454
- 24VDC version - D4-454DC-1

D4-454 CPU*

The D4-454 CPUs provides tremendous capability using updated microprocessor technology allowing the D4-454 to be the CPU of choice for the DL405 family.

Built-in CPU Communications Ports

The D4-454 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 PC running DirectSOFT6 programming software (version 6.1 or later) or to a D4-HPP-1 handheld programmer. It can also be used to connect to a *C-more* panel or other operator interfaces. The 6-pin phone jack supports K-sequence; DirectNET Client/Server, ASCII output and Modbus RTU Client/Server protocols. The bottom 25-pin port contains two logical ports with different pins for each port. It is primarily a networking port that supports DirectNET Client/Server or Modbus Client/Server protocols. The bottom port can be used as an ASCII output port for connections to devices that can accept ASCII input. It can also be used as a remote I/O Client. The Communications Ports table on the next page has a complete description of each port.

* The D4-454 CPU is a direct replacement for the retired D4-450 CPU.

D4–454 offers four built-in communication ports

NOTE: Any hardware older than tens years old may not work with the D4-454. We suggest that any hardware older than ten years and not currently sold on the AutomationDirect.com website be upgraded to a newer version.
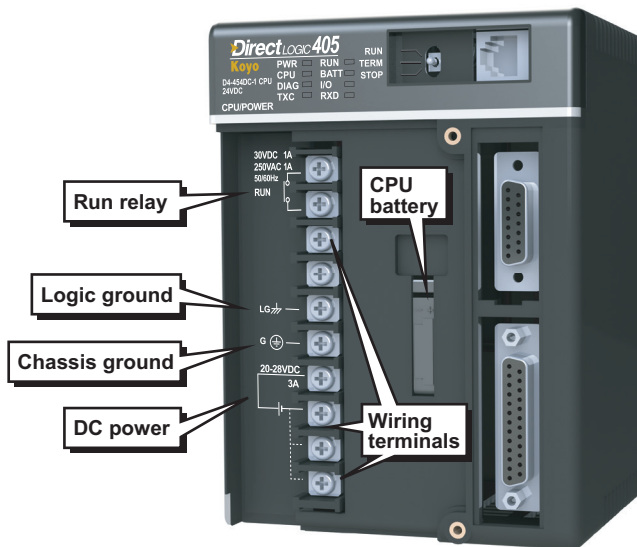
D4-454 Features

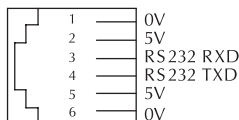The diagram on this page shows the various hardware features found on the D4-454 CPU.

CPU Keyswitch	
RUN	Forces CPU to RUN mode. Locks Comm port - will not receive incoming data.
TERM	Allows peripherals (HPP, DCM, DirectSOFT, etc.) to select operating mode
STOP	Forces CPU out of RUN
CPU Status Indicators		
---	---	---
PWR	ON	CPU power good
	OFF	CPU power failure
RUN	ON	CPU is in RUN mode
	OFF	CPU is in STOP mode
CPU	ON	CPU self-diagnostics error
	OFF	CPU self-diagnostics good
BATT	ON	CPU battery is low
	OFF	CPU battery is good or disabled
DIAG	ON	CPU diagnostics or local bus error
	OFF	CPU diagnostics or local bus good
I/O	ON	I/O self-diagnostics error
	OFF	I/O self-diagnostics good
TXD	ON	Data is being transmitted
	OFF	No data is being transmitted
RXD	ON	Data is being transmitted
	OFF	No data is being transmitted

Communications Ports	
Phone Jack Port 2	General purpose port for RS232. Baud rate is selectable up to 38.4Kb. Connects to DirectSOFT programming software, *C-more* panels, network, etc. Supports K-sequence protocol, DirectNET (Client or Server) protocol, Non-squence (ASCII out), and Modbus RTU (Client or Server) protocol.
15-pin Port 0	Programming port, RS232, 9600 baud, connects to HPP, DirectSOFT, DV-1000, *C-more* panels, etc. K-sequence protocol (fixed station address=1)
25-pin Port 1 and Port 3	General purpose port for RS232 and RS422 (RS485 Remote I/O Client available on Port 3 only.) Baud rate selectable via software up to 38.4K baud. Connects to DirectSOFT, *C-more* panels, network,etc Two logical ports (separate pins on connector). Software selectable protocol includes:

Protocol	Port 1	Port 3
K-sequence	3	3
DirectNETClient/Server	3	3
Modbus Client/Server	3	3
Remote I/O	n/a	3
ASCII Out	3	3

D4-454 CPU Hardware Features

D4-454 communications ports pin-out

Phone jack

1	0V
2	5V
3	RS232 RXD
4	RS232 TXD
5	5V
6	0V

Port 2

15-pin connector

Sense HHP
RS232 TXD
RS232 RXD
Online (TTL)
CPU Error (TTL)
CPU Ready (TTL)
5V
5V
0V
0V
0V
Ground

Port 0

25-pin connector

RS232 TXD — RS422 TXD+
RS232 RXD — RS422 TXD−
RS232 RTS
RS232 CTS — RS422 RTS−
RS422 RTS+
0V
RS422 RXD+
RS422 RXD− — RS422 CTS−
RS422 CTS+

Port 1

25-pin connector

0V
RS422 TXD+ — RS422 RXD+
RS422 TXD− — RS422 RXD−
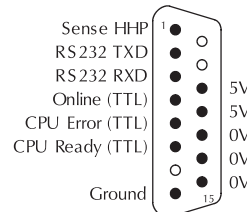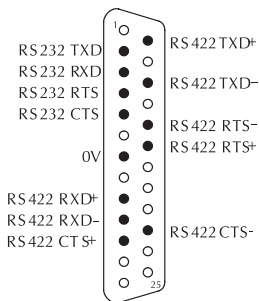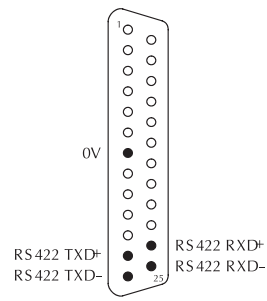
Port 3

D4-454 Features

D4-454 Scan control

The D4-454 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.
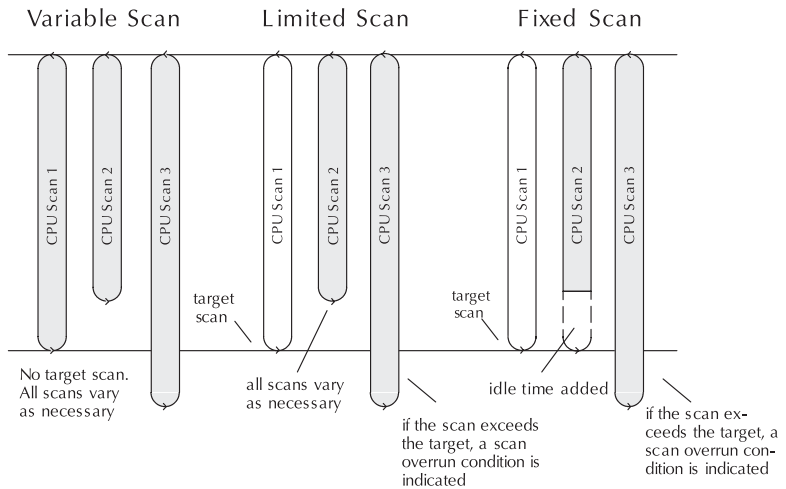
Memory — The memory of the D4-454 is fully contained in the CPU and stored in MRAM which is a non-volatile form of memory. No memory card is required. The battery is used for retention of the Real Time Clock.
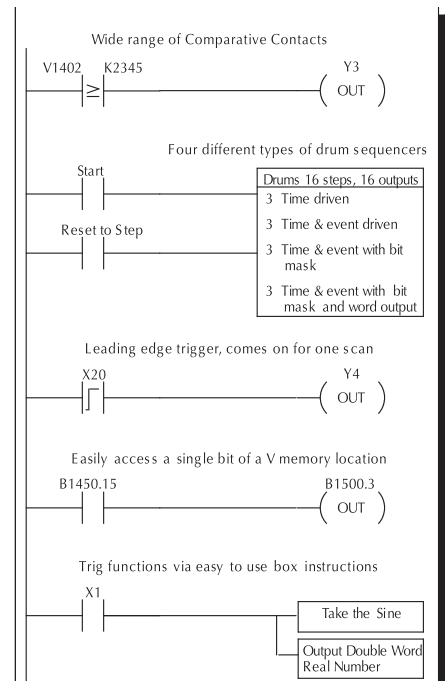
Full array of instructions
Imagine if someone asked you to write a book, but then told you that you could only use 50 different words? That would be a tough job! The same is true for writing a PLC program. The right instruction can greatly simplify your control program.

The D4-454 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 oneshots
- Bit of word manipulation (bit set, reset, etc.)
- Trigonometric functions
- Floating point conversions
- Ibox instructions that simplify tasks such as configuring analog modules or performing complex math equations

Variable Scan   Limited Scan   Fixed Scan

No target scan. All scans vary as necessary

all scans vary as necessary

if the scan exceeds the target, a scan overrun condition is indicated

idle time added

if the scan exceeds the target, a scan overrun condition is indicated

target scan

target scan

DirectSOFT 6.1 or later, is required to program the D4-454.

Wide range of Comparative Contacts

V1402   K2345   Y3
≥   OUT

Four different types of drum sequencers

Start

Reset to Step

Drums 16 steps, 16 outputs
3 Time driven
3 Time & event driven
3 Time & event with bit mask
3 Time & event with bit mask and word output

Leading edge trigger, comes on for one scan

X20   Y4
OUT

Easily access a single bit of a V memory location

B1450.15   B1500.3
OUT

Trig functions via easy to use box instructions

X1

Take the Sine

Output Double Word Real Number

D4-454 PID loops

PID Loop Specifications and Key Features	
Number of Loops	Selectable, 16 maximum
CPU V-memory Required	32 V-memory locations per loop selected (An additional 32 V-memory 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 D4-454 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 D4-454 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.*	

PID Loop Control
Block Diagram
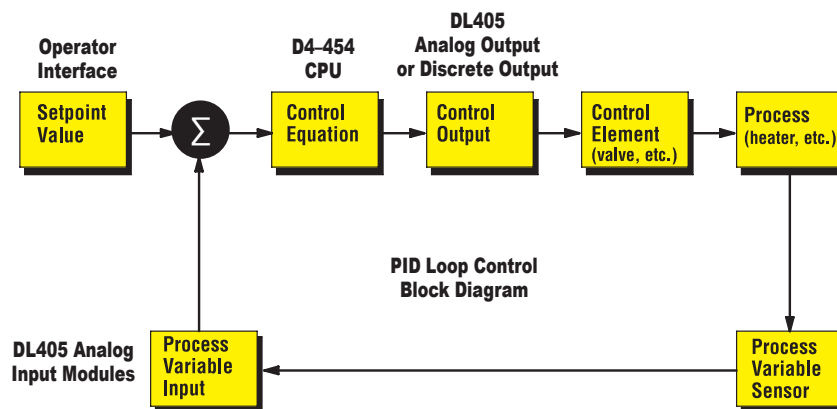
DL405 Programming Tools and Cables

Select a programming device

There are two tools for programming the DL405 CPUs: DirectSOFT PC-based programming software and the D4-HPP-1 handheld programmer.

DirectSOFT 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 DirectLOGIC Overview Section DL in this catalog for detailed information on DirectSOFT.

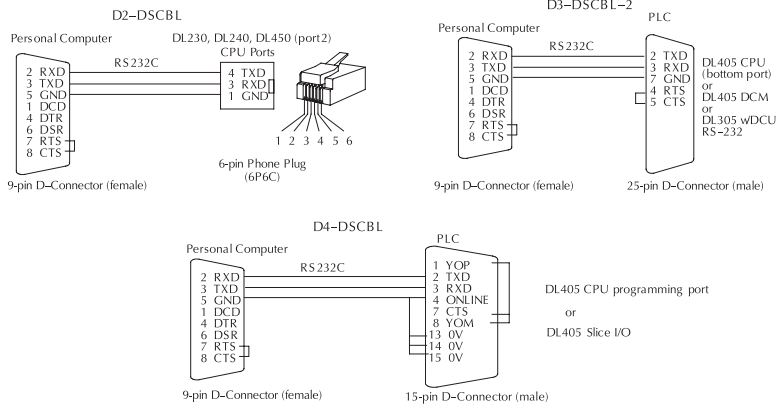| Direct Soft Part Number	Price	Description
D4-HPP-1	Retired	Handheld Programmer
PC-DSOFT6	$462.00	Programs all PLC families DL05/06/105/205/305/405
PC-DS100	Free	Free version of DirectSOFT; programs all DirectLOGIC PLC CPUs; limited to 100 word program
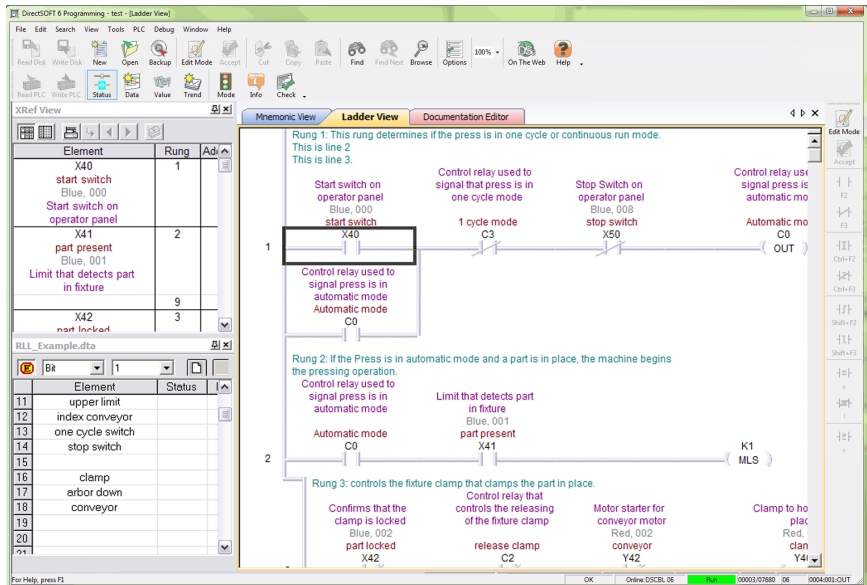
DL405 programming cables

Choose the proper cable to connect the DL405 CPU to your PC running DirectSOFT.

CPU	Price	Port	Cable	Price
D4-454	$1,071.00	Top port (15 pin)	D4-DSCBL	$74.00
		Lower port (25pin)	D3-DSCBL-2	$66.00
		Phone jack (RJ12)	D2-DSCBL	$35.00

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.

Pin labeling conforms to IBM DTE and DCE standards
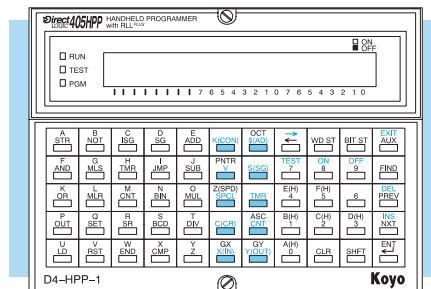
# Need Additional Communications Ports?

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-ECOM100 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 D4-454 CPU also supports a Modbus RTU Client module for connection to a Modbus RTU network. This module is listed later in this section.

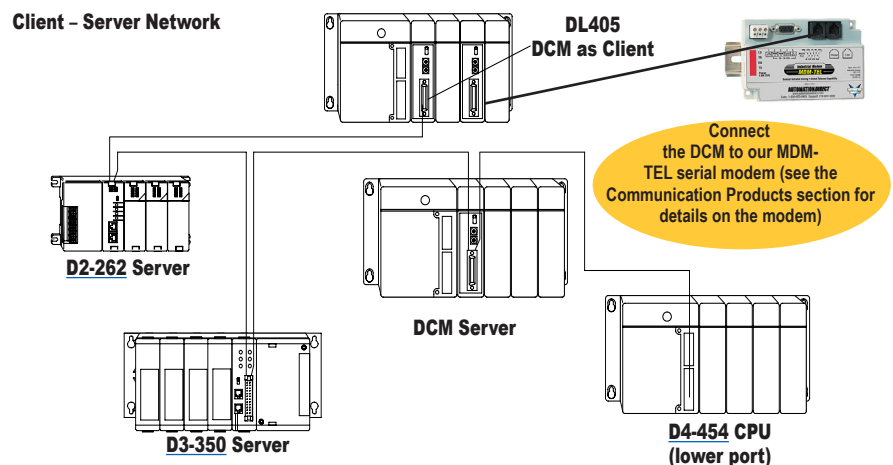## Ethernet networking with the H4-ECOM100

All DL405 CPUs support the H4-ECOM100 module, which makes Ethernet networking a snap. The H4-ECOM100 module supports industry-standard 10/100Base-T networking with an RJ45 port. The ECOM100 module works with standard cables, switches and repeaters. 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 DirectSOFT to program any PLC on the network, and when monitoring your operating PLC, you will see much faster updates with Ethernet and the ECOM modules.
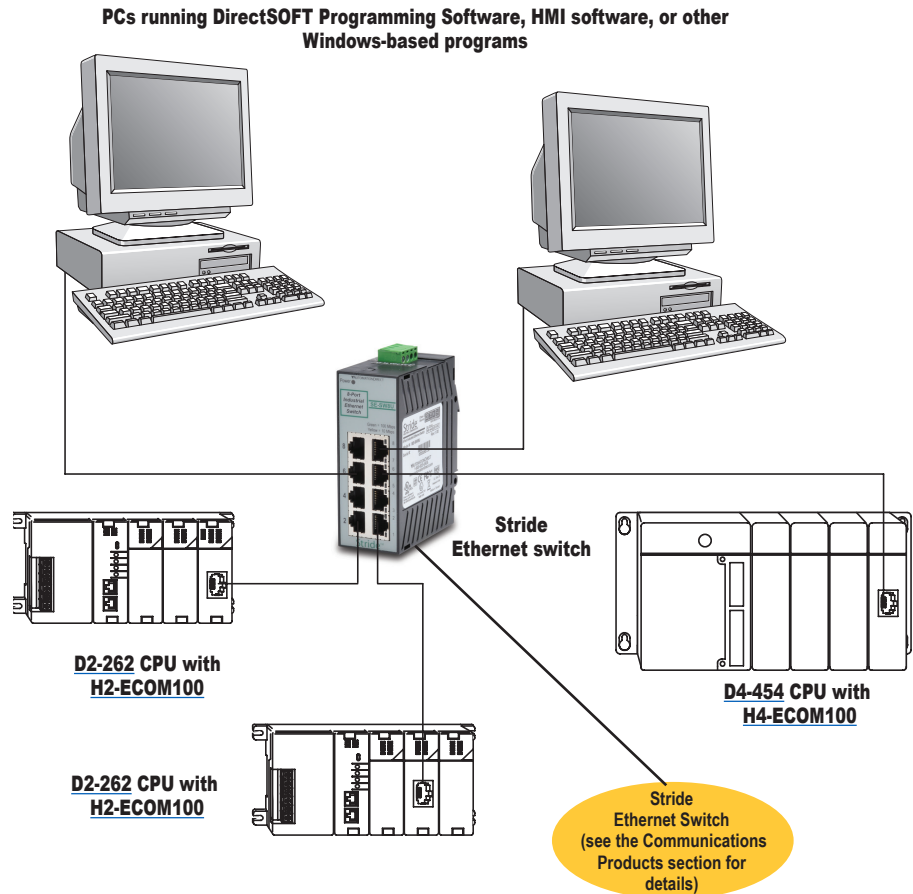
Serial networking with the D4-DCM

All DL405 CPUs support the D4-DCM Data Communications Module that can serve as a DirectNet Client/Server, DirectNet peer, or a Modbus RTU Server. The D4-DCM supports RS-232 and RS-422 communications. You can program the CPU through the DCM locally, or if a PC is the RS-422 Client, you can use DirectSOFT to program any PLC on the network.

NOTE: Any hardware with a date code less than 09X0 or with a first digit that is not 0, 1, or 2 may not work with the D4-454. We suggest that any hardware older than ten years and not currently sold on the AutomationDirect.com website be upgraded to a newer version.

PCs running DirectSOFT Programming Software, HMI software, or other Windows-based programs

Stride Ethernet switch

D2-262 CPU with H2-ECOM100

D4-454 CPU with H4-ECOM100

D2-262 CPU with H2-ECOM100

Stride Ethernet Switch (see the Communications Products section for details)

Client – Server Network

DL405 DCM as Client

Connect the DCM to our MDM-TEL serial modem (see the Communication Products section for details on the modem)

D2-262 Server

DCM Server

D3-350 Server

D4-454 CPU (lower port)

Select the I/O Modules

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

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

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). **Ambient humidity for the Handheld Programmer is 20% to 90% 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.

NOTE: Any hardware with a date code less than 09X0 or with a first digit that is not 0, 1, or 2 may not work with the D4-454. We suggest that any hardware older than ten years and not currently sold on the AutomationDirect.com website be upgraded to a newer version.

Specifications

Derating Curve

Module wiring

Typical Circuit
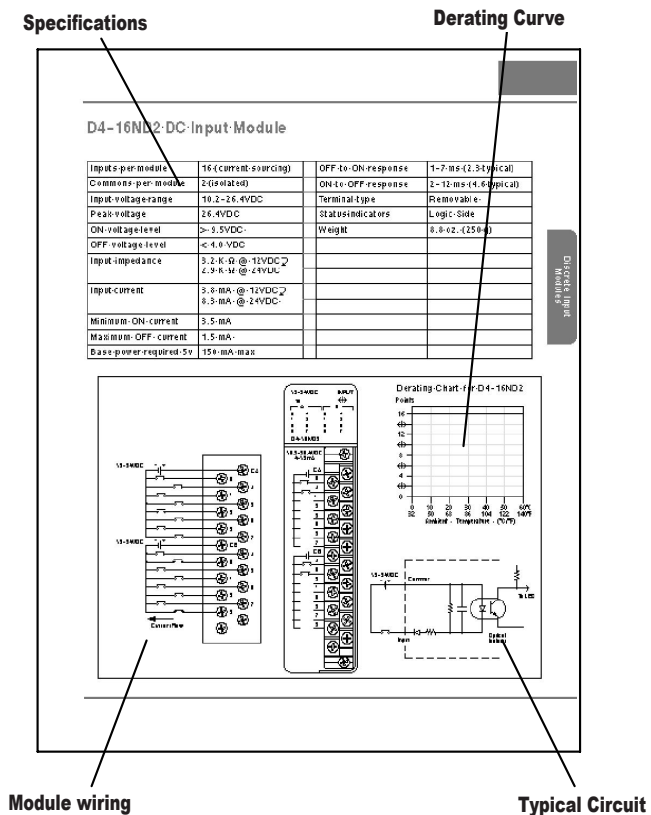
I/O Modules

H4-CTRIO high-speed counter module

Select the H4-CTRIO 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 a DL405 analog module, make sure you select the current sourcing F4-04DAS-1 isolated analog output module. Complete module specifications are listed later in this section.

ZIPLink connection systems

ZIPLinks consist of PLC interface cables and connector modules that offer "plug and play" capability by plugging one end of the ZIPLink cable into an I/O module and the other end into the ZIPLink connector module. This eliminates the tedious process of wiring PLC I/O to terminal blocks. For more information, refer to Wiring System for DL405 PLCs later in this chapter or the Wiring Solutions section in this catalog.

DINnectors terminal blocks

DINnectors are DIN rail mounted connectors or terminal blocks. All DINnectors are UL, CSA, VDE, SEV, RINA and IEC approved. Refer to the Terminal Blocks section of this catalog for details.
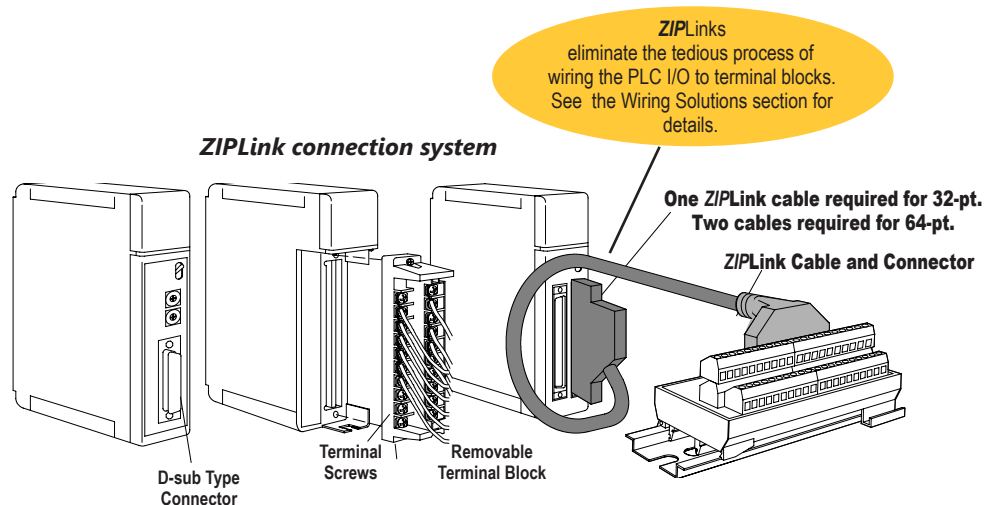
Need spare parts?

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 ($23.00)   Fuses for F4-08TRS-2
• D4-FILL ($27.00)   Filler module to cover empty I/O slots
• (retired)   16-pt. module terminal blocks
• D4-IOCVR ($11.00)   Replacement terminal block covers
• ZL-D24-CON-R (Retired)   32/64-pt. ribbon-style connectors
• ZL-D24-CON-X ($89.00)   32/64-pt. solder-style connectors

Next steps?

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. 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.

ZIPLinks eliminate the tedious process of wiring the PLC I/O to terminal blocks. See the Wiring Solutions section for details.

ZIPLink connection system

One *ZIP*Link cable required for 32-pt. Two cables required for 64-pt.

*ZIP*Link Cable and Connector

D-sub Type Connector

Terminal Screws

Removable Terminal Block

This logo is placed by each I/O module that supports ZIPLink connection systems. (The I/O modules are listed at the end of this section). See the Wiring Solutions section of this catalog for complete information on ZIPLinks.

DINnectors terminal blocks
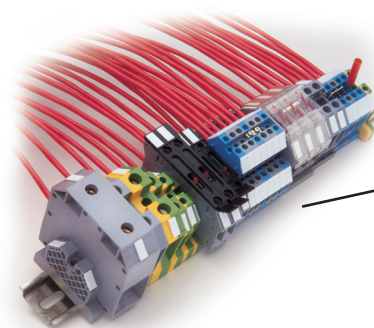
DINnectors provide a means of connecting and identifying two or more wires within the demands of an industrial environment. See the Terminal Blocks section for details.

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.
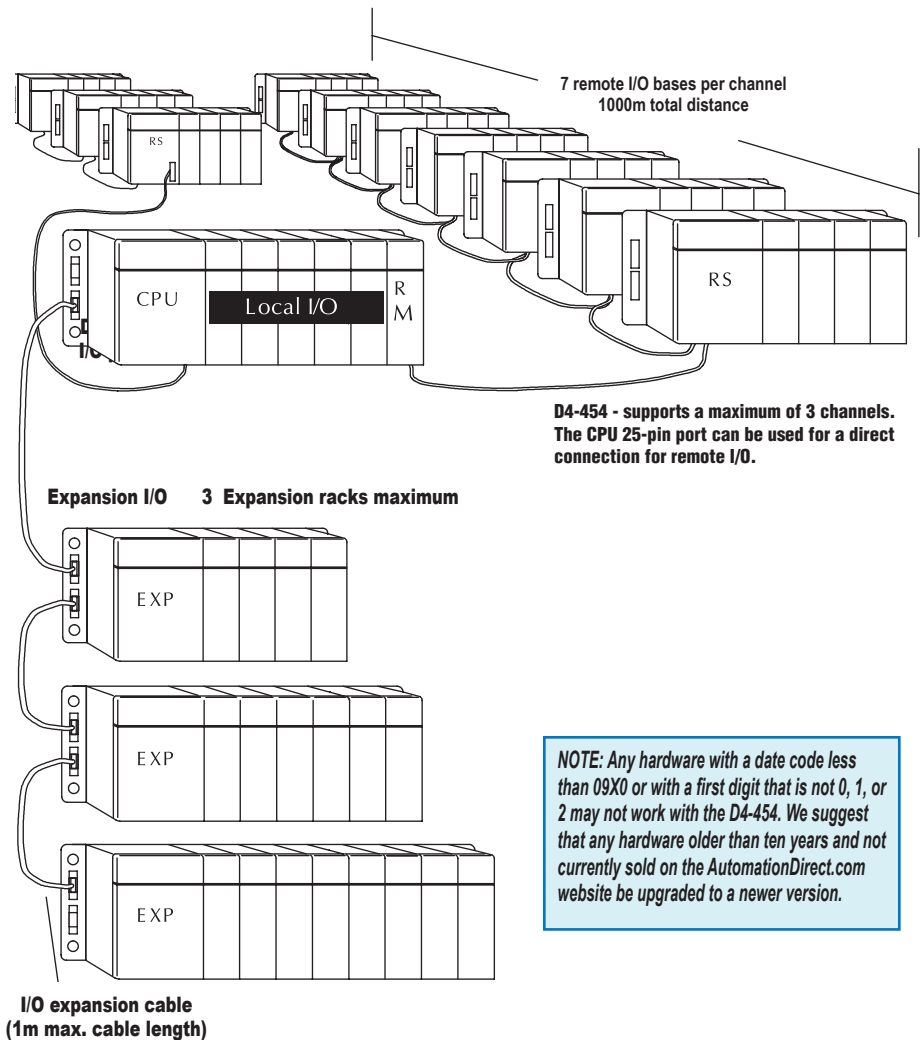
Local I/O

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.

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 D4-454 is 2048 points.

Example of I/O system configuration

7 remote I/O bases per channel
1000m total distance

CPU   Local I/O   R M

I/O

D4-454 - supports a maximum of 3 channels.
The CPU 25-pin port can be used for a direct connection for remote I/O.

Expansion I/O   3 Expansion racks maximum

EXP

EXP

EXP

NOTE: Any hardware with a date code less than 09X0 or with a first digit that is not 0, 1, or 2 may not work with the D4-454. We suggest that any hardware older than ten years and not currently sold on the AutomationDirect.com website be upgraded to a newer version.

I/O expansion cable
(1m max. cable length)

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 Client module (H4-ERM100) is placed in an I/O slot of the local CPU base. Ethernet Base Controller (EBC) modules serve as the Remote Server 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 Servers are connected to the Client 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.

Each H4-ERM100 module can support up to 16 Servers: 16 H2-EBC systems, 16 Terminator I/O EBC systems, or 16 fully expanded H4-EBC systems.

The PLC, ERM and EBC Server 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 Servers.

It is highly recommended that a dedicated Ethernet remote I/O network be used for the ERM and its Servers. 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 Server 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		D4-454
Total Channels Available	Total number of Remote channels available	3
Remote I/O	Maximum number of D4-RM per system	2
	Number of Clients built into CPU port	1
	Maximum I/O points supported per channel	512
	Maximum I/O points supported	1536
	Maximum number of remote I/O bases per channel	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 Client to control the remote I/O channel. This Client can be a module (D4-RM) in the local CPU base, or the D4-454 CPU (through the 25-pin port). For the D4-RM solution, the CPU updates the remote Client, then the remote Client handles all communication to and from the remote I/O base by communicating to the remote Server module (D4-RS) installed in each remote base. The D4-454 CPU communicates directly with the D4-RS.

The maximum distance between a Remote Client and a Remote Server is 3,300 feet (1000 meters).

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 1	Remote Base
CPUs	CPU slot only		
Expansion Units		CPU slot only	
8/16/32pt DC Input	✓	✓	✓
64pt DC Input	✓ 2		
AC Input			
AC/DC Input	✓	✓	✓
8/16/32pt DC Input	✓	✓	✓
64pt DC Output	✓ 2	✓	✓
DC Input	✓	✓	✓
Relay Output	✓	✓	✓
Analog Input and Output	✓	✓	✓
Thermocouple Input	✓	✓	✓
Remote I/O	✓		
Remote Clients (serial / Ethernet)			
Remote Server Unit	✓	✓	CPU slot only
Communications and Networking Modules	✓		
Coprocessor Modules	✓		
Specialty Modules	✓		
Interrupt w/D4-454			
PID	✓		
4-Loop Temp. Controller	✓		
High-speed Counter	✓	✓	
Simulator	✓	✓	✓

1 – H4-CTRIO may not be installed in a CPU expansion base.
2 – If your are using 64pt modules, you cannot install any specialty modules in slots 5,6, or 7 of the local base.

I/O points required per module

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

DC Output	I/O pt.
D4-16TD1	16 out
D4-16TD2	16 out
D4-32TD1, (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	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-ERM100	0
D4-RM	0
D4-RS	0
Specialty Modules	
H4-CTRIO	0
D4-16SIM	8 or 16 in
F4-4LTC	0

DL405 I/O Addressing

Many of our customers are familiar with other PLC systems prior to trying DirectLOGIC 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.
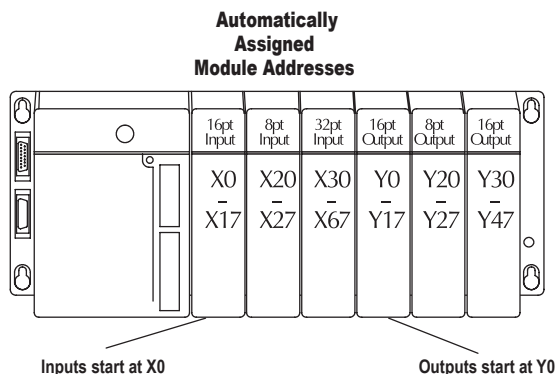
Manual addressing

The D4-454 CPU allows 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, however 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.

Automatically Assigned Module Addresses

		16pt Input	8pt Input	32pt Input	16pt Output	8pt Output	16pt Output
		X0 – X17	X20 – X27	X30 – X67	Y0 – Y17	Y20 – Y27	Y30 – Y47

Inputs start at X0   Outputs start at Y0

Manually Assigned Module Addresses

		16pt Input	8pt Input	32pt Input	8pt Output	16pt Output
		X100 – X117	X0 – X17	X20 – X57	Y100 – Y117	Y20 – Y37

New modules do not cause conflicts

8-point modules still consume 16 points

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.

Use *ZIP*Links to reduce power requirements

If your application requires a lot of relay outputs, consider using the ZipLink AC or DC relay output modules. These modules can switch high current (10A) loads without putting a load on your base power budget. Refer to Wiring System for DL405 PLCs later in this section for more information.

This logo is placed next to I/O modules that are supported by the ZipLink connection systems.

See the I/O module specifications at the end of this section.

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 system.

	Base Number 0	Device Type	5 VDC (mA)	External 24 VDC Power (mA)
A				
B	CURRENT SUPPLIED			
	CPU/Expansion Unit /Remote Server	D4-454 CPU	3700	400
C	CURRENT REQUIRED			
	SLOT 0	D4-16ND2	+150	+0
	SLOT 1	D4-16ND2	+150	+0
	SLOT 2	F4-04DA-2	+90	+90
	SLOT 3	D4-08NA	+100	+0
	SLOT 4	D4-08NA	+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-1	+80	+0
	Handheld Programmer	D4-HPP-1	+320	+0
E	Maximum Current Required		2190	90
F	Remaining Current Available		3700-2190=1510	400-90=310

1. Using a chart similar to the one 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 Server 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 24VDC 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
Part Numbers	D4-454, D4-EX (expansion base unit), D4-RS (remote Server unit)	D4-454DC-1, D4-EXDC (expansion base unit)
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 (110V range) 170-264 VAC (220V range)	20-28 VDC (24VDC) with less than 10% ripple
Maximum Inrush Current	20A	20A
Maximum Power	50VA	38W

Power Requirements

Power Supplied					
CPUs/RemoteUnits/ Expansion Units	**5 VDC Current Supplied in mA**	**24V Aux Power Supplied in mA**	**CPUs/Remote Units/ Expansion Units**	**5V Current Supplied in mA**	**24V Aux Power Supplied in mA**
D4-454 CPU	3100	400	D4-EX	4000	400
D4-454DC-1	3100	NONE	D4-EXDC	4000	NONE
			D4-RS	3700	400
			H4-EBC	3470	400

Power Consumed					
Power-consuming Device	**5V Current Consumed**	**External 24VDC Current Required**	**Power-consuming Device**	**5V Current Consumed**	**External 24VDC Current Required**
I/O Bases			*Analog Modules (continued)*		
D4-04B-1	80	NONE	F4-16AD-1	75	100
D4-06B-1	80	NONE	F4-16AD-2	75	100
D4-08B-1	80	NONE	F4-08DA-1	70	75+20 per circuit
DC Input Modules			F4-08DA-2	90	90
			F4-04DAS-1	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
D4-64ND2	300 max.	NONE	F4-16DA-2	80	25 max.
			F4-08RTD	80	NONE
			F4-08THM-J(-n)	120	50
			F4-08THMF4-08THM	110	60
AC Input Modules			*Remote I/O*		
D4-08NA	100	NONE	H4-ERM100	320(300)	NONE
D4-16NA	150	NONE	H4-ERM-F	450	NONE
			D4-RM	300	NONE
AC/DC Input Modules					
D4-16NE3	150	NONE	*Communications and Networking*		
DC Output Modules			H4-ECOM100	300	NONE
D4-16TD1	200	125	D4-DCM	500	NONE
D4-16TD2	400	NONE	F4-MAS-MB	235	NONE
D4-32TD1	250	140	*CoProcessors*		
D4-32TD2	350	120 (4A max including loads)			
D4-64TD1	800	NONE	F4-CP128-1	305	NONE
AC Output Modules			*Specialty Modules*		
D4-08TA	250	NONE	H4-CTRIO	400	NONE
D4-16TA	450	NONE	D4-16SIM	150	NONE
Relay Output Modules			F4-4LTC	280	75
D4-08TR	550	NONE			
F4-08TRS-1	575	NONE			
F4-08TRS-2	575	NONE			
D4-16TR	1000	NONE	*Programming*		
Analog Modules			D4-HPP-1 (Handheld Prog.)	320	NONE
			Operator Interface		
F4-04AD	150	100			
F4-04ADS	370	120	**C-more** Micro-Graphic	210	NONE
F4-08AD	75	90			

Dimensions and Installation

Local base expansion unit, includes 110/220 VAC power supply, requires local I/O expansion cable D4-EXCBL-1 or D4-EXCBL-2. 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.
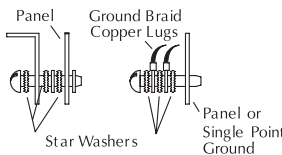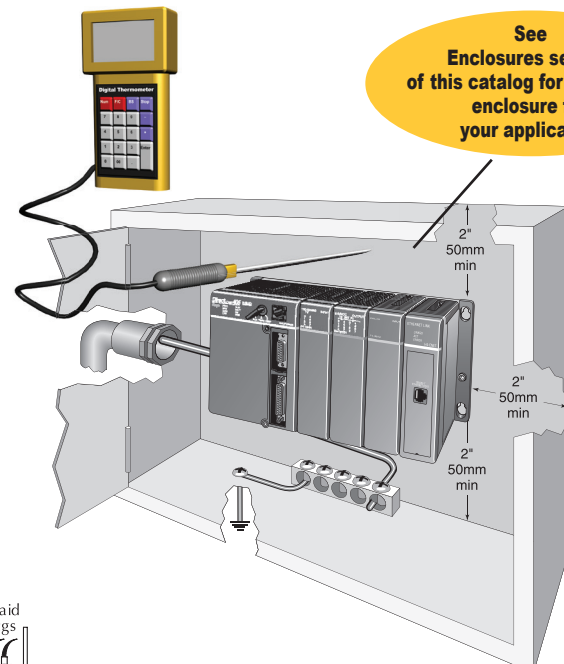
Plan for safety

This catalog should never be used as a replacement for the user manual. The user manuals, D4-USER-M and D4-454-M, contain 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 as a guide 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 2" depth for ease of access and cable clearance. However, your distance may be greater or less. Also, check the installation guidelines for the recommended cabinet clearances.
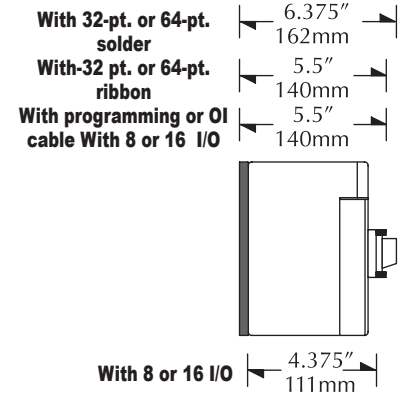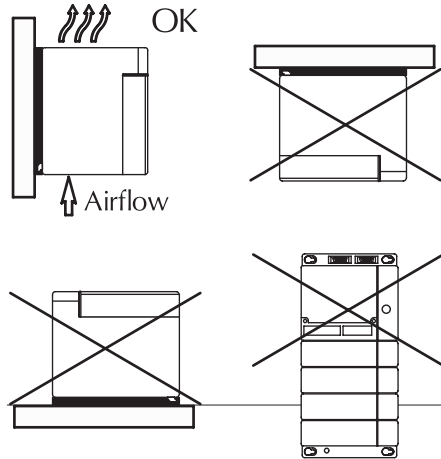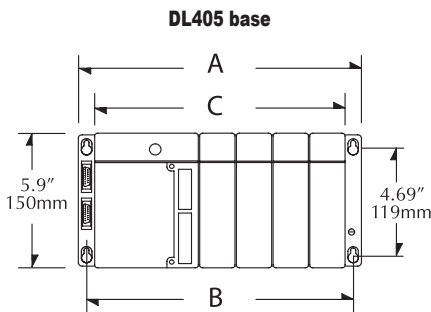
OK
Airflow

With 32-pt. or 64-pt. solder — 6.375" 162mm
With-32 pt. or 64-pt. ribbon — 5.5" 140mm
With programming or OI cable With 8 or 16 I/O — 5.5" 140mm

With 8 or 16 I/O — 4.375" 111mm

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, Method 514.2
Shock Resistance	MIL STD810C, Method 516.2
Noise Immunity	NEMA(ICS3-304)
Atmosphere	No corrosive gases

DL405 base

A
C
5.9" 150mm
4.69" 119mm
B

See Enclosures section of this catalog for a suitable enclosure for your application

2" 50mm min
2" 50mm min
2" 50mm min

Panel   Ground Braid Copper Lugs

Star Washers   Panel or Single Point Ground

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.

Base	Price	A		B		C	
D4-04B-1	$202.00	11.53"	293mm	10.82"	275mm	10.50"	267mm
D4-06B-1	$241.00	14.44"	367mm	13.74"	349mm	13.42"	341mm
D4-08B-1	$282.00	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.
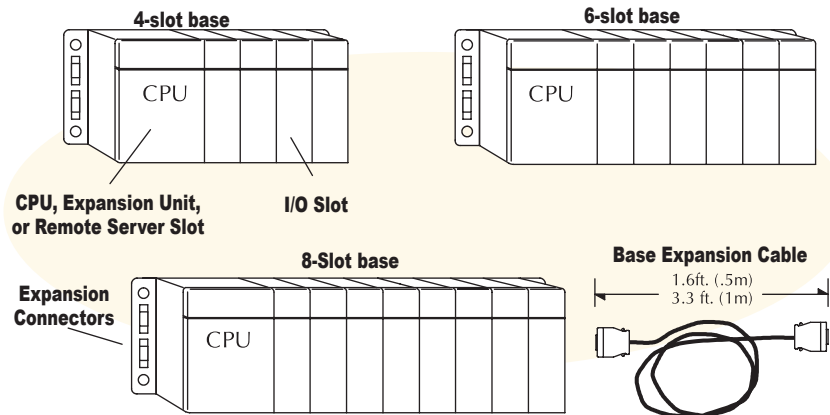
- D4-EX 110/220 VAC power supply
- D4-EXDC 24 VDC power supply

  and the Remote Server Units
- D4-RS 110/220 VAC power supply

An expansion cable is required to connect each of the expansion bases to the CPU base

- D4-EXCBL-1 3.08 ft (1m) cable
- D4-EXCBL-2 1.54 ft (0.5m) cable

D4-454 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 D4-454 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.

4-slot base

6-slot base

CPU, Expansion Unit, or Remote Server Slot

I/O Slot

8-Slot base

Expansion Connectors

Base Expansion Cable
1.6ft. (.5m)
3.3 ft. (1m)

Specialty modules in expansion bases

No! Must use D4-454 CPU
430 or 440
Specialty module

No! Both bases must be "-1" type
454
D4-04B
D4-04B-1
Specialty module

Yes! Uses D4-454 and "-1" bases.
454
D4-04B-1
D4-04B-1
Specialty module
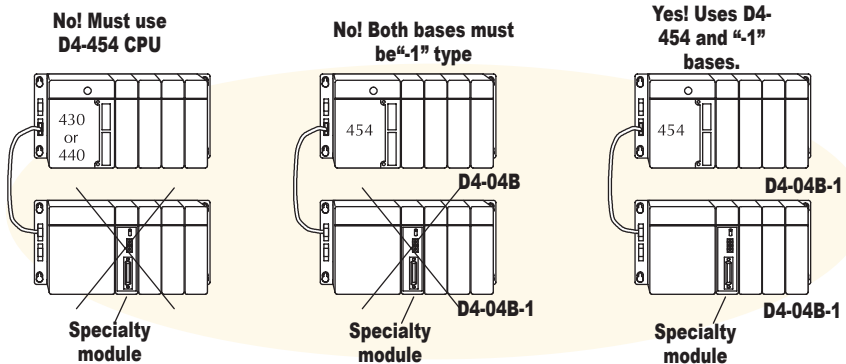
Part	Description	Price
D4-EX	Local base expansion unit, includes 110/220 VAC power supply, requires local I/O expansion cable D4-EXCBL-1 or D4-EXCBL-2	$271.00
D4-EXDC	Local base expansion unit, includes 24 VDC power supply, requires local I/O expansion cable D4-EXCBL-1 or D4-EXCBL-2	$256.00
D4-RS	Serial remote I/O Server unit (used with D4-RM), includes 110/220 VAC power supply, uses shielded twisted pair (24 AWG minimum)	$710.00
D4-EXCBL-1	Base expansion cable, 3.08 ft. (1m)	$97.00
D4-EXCBL-2	Base expansion cable, 1.54 ft. (0.5m)	$93.00

Expansion Unit Wiring
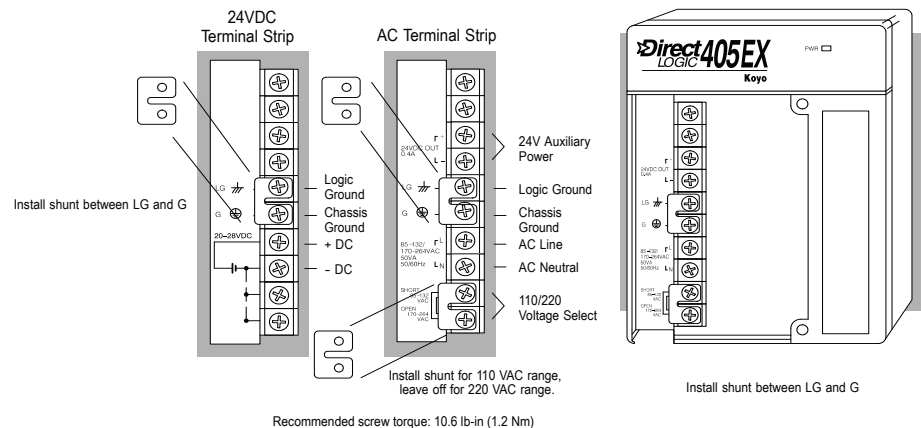
24VDC Terminal Strip

AC Terminal Strip

*Direct*LOGIC 405EX
Koyo
PWR

Install shunt between LG and G

Logic Ground
Chassis Ground
+ DC
– DC
20–28VDC

24V Auxiliary Power
Logic Ground
Chassis Ground
AC Line
AC Neutral
110/220 Voltage Select

Install shunt for 110 VAC range, leave off for 220 VAC range.

Install shunt between LG and G

Recommended screw torque: 10.6 lb-in (1.2 Nm)

Serial Data Communications Module

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 DirectNET network
- Network interface to a Modbus network using the RTU protocol as Server.

Extra communications port

All DL405 CPUs offer four built-in communication 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.
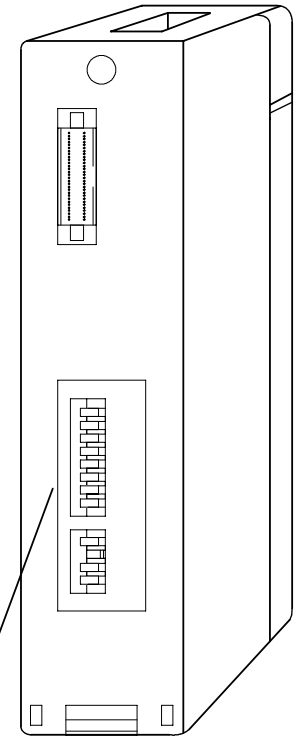
DIP Switches for communications and Protocol Setup
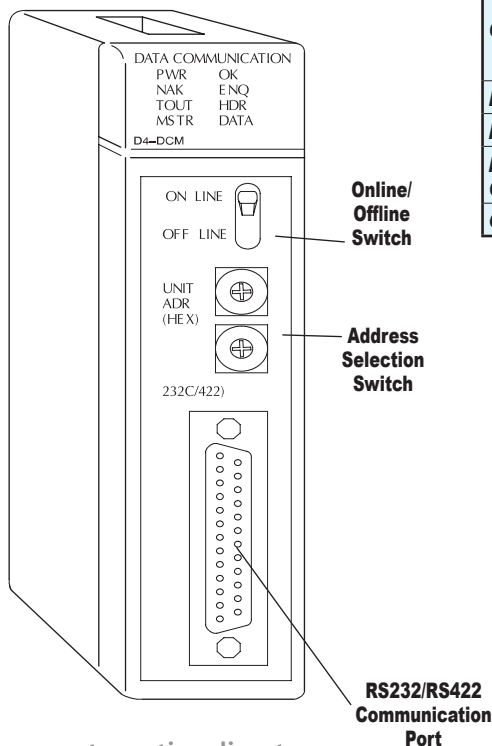
Specifications	
Module Type	Intelligent
Modules per CPU	7 Maximum, any slot in CPU Base
Communications	RS232/422, DirectNET, SIMATIC®TI405™, or Modbus (Server only) RTU protocol. Baud rate selectable from 300 to 38.4K baud. Odd or no parity. HEX or ASCII mode
Recommended Cable	Belden 9729 or equivalent (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)

DATA COMMUNICATION
PWR   OK
NAK   ENQ
TOUT   HDR
MSTR   DATA
D4–DCM

ON LINE
OFF LINE
Online/ Offline Switch

UNIT ADR (HEX)
Address Selection Switch

232C/422)

RS232/RS422 Communication Port

DCM as auxiliary port

Connect the DCM to our MDM-TEL serial modem.
See the Communication Products section of this catalog for details on the modem.
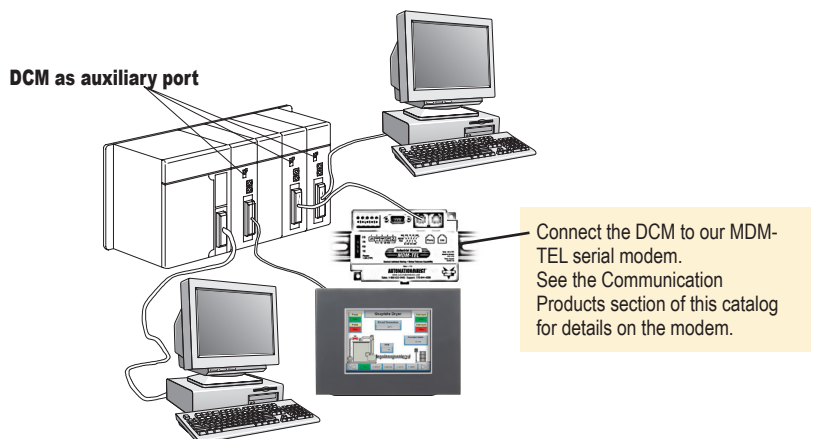
Serial Data Communications Module

DirectNET 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 DirectNET. 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 Client or a Server of DirectNET.

Network Client - The DCM allows the DL405 to serve as a Client of a DirectNET 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-ECOM100 module.

Network Server - The DL405 CPUs have a built-in network Server port. If this port is occupied, a DCM can be added to provide an additional network Server 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 Client station. Since the DCM does not require any programming, you can set the DCM communication parameters, connect the cables and start transferring data.

Client/Server Network

DL405 DCM as Client

DCM server

D2-260 server

D3-350 server

DL405 CPU (bottom port)

Peer network

DCM as client

DCM as server

Modbus client

Modbus network using RTU protocol

Network Server

In a server station... responds to network requests

Network Server

DL405 server with DCM
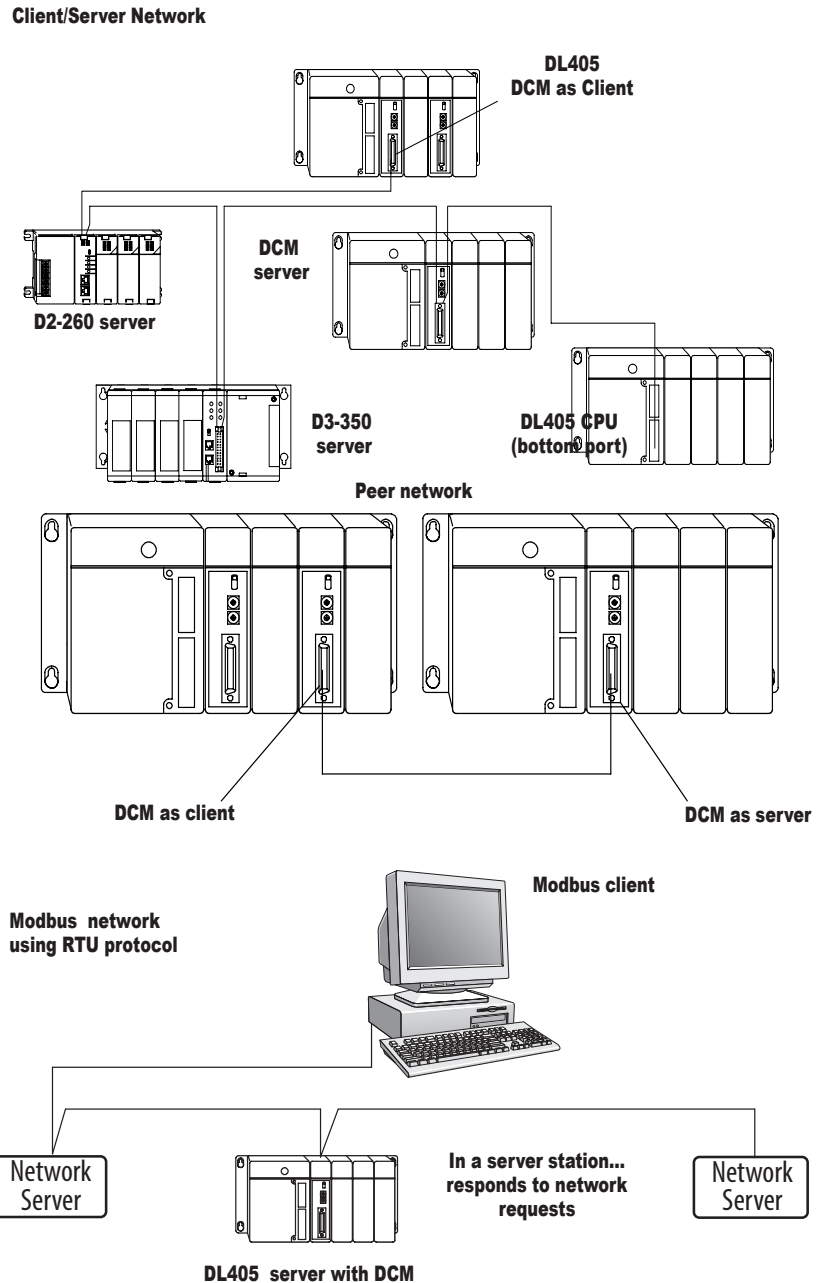
Modbus interface

The DCM can be used as a Server 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 COMMUNICATIONS MODULE

H4-ECOM100 $805.00

Overview

Ethernet Communications Modules offer features such as:

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

The Ethernet Communication Module (ECOM) supports high-speed peer-to-peer networking of PLCs. No longer are you forced to designate a single PLC to be the network Client. Any PLC can initiate communications with any other PLC. Link your PLCs with PCs using industry standard Modbus TCP/IP protocol connected through standard cables, hubs, and repeaters. Or, use KEPSeverEX* I/O Server to link to your favorite HMI/SCADA, data historian, MES or ERP software to DirectLOGIC PLCs. Our DataWorx data collection software includes ECOM drivers as well. DirectSOFT Programming Software can be used to monitor or update the program in any DirectLOGIC

PLC on the network.

* KEPSeverEX may be purchased from Kepware and will support any existing applications. (https://www.kepware.com/en-us/products/kepserverex)

Simple connections

Use Category 5 UTP cables or 62.5/125 ST-style fiber optic cables depending on the requirements of your application. Inexpensive UTP cables can be run up to 100 meters between nodes, and fiber optic cables can be run up to 2,000 meters. Fiber optic cables virtually eliminate electrical noise problems. Use repeaters to extend distances and expand the number of nodes.

Specifications	H4-ECOM100
Communications	10/100Base-T Ethernet
Data Transfer Rate	100Mbps max.
Link Distance	100 meters (328 ft)
Ethernet Port	RJ45
Ethernet Protocols	TCP/IP, IPX, MODBUS TCP/IP, DHCP, HTML configuration
Power Consumption	300mA @ 5VDC

H4-ECOM100

The H4-ECOM100 supports the Industry Standard Modbus TCP/IP Client/Server Protocol

H4-ECOM100 IBox communications instructions

Over 40 communications IBox instructions are available when using the H4-ECOM100 with D4-454 CPUs and DirectSOFT6 programming software. These easy-to-use instructions allow you to:

- Enable/disable module DHCP
- Read/write module IP, Gateway and Subnet Mask addresses
- Read/write module ID, Name and Description
- Send E-mail messages
- Read/Write PLC memory to networked Hx-ECOM100 modules

See the following page for example communications IBox instructions.

Ethernet Communication Modules

Modbus TCP/IP support

The H4-ECOM100 supports the industry standard Modbus TCP/IP Client/Server protocol in addition to the standard IP and IPX protocols. This allows the DL405 PLC with an H4-ECOM100 module to serve as a client (Client) or as a server (Server) on a Modbus TCP/IP Ethernet network. The H4-ECOM100 can actively issue Modbus commands to other nodes or devices on the Modbus TCP/IP network or simply respond to connected Modbus TCP/IP clients.

Modbus TCP/IP communications architecture
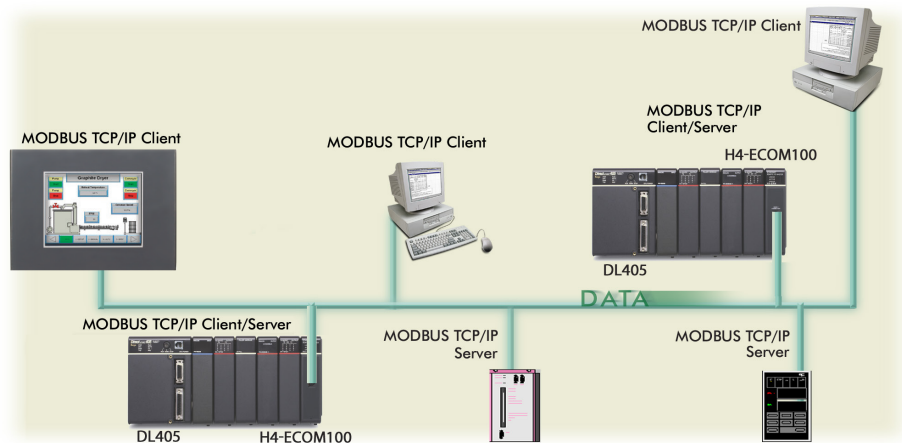
PLC-to-PLC communications

PLC-to-PLC or PLC to a Modbus TCP/IP device communications can be accomplished using standard Read from Network (RX) and Write to Network (WX) instructions (D4-454, all H4 series ECOMs and all DirectSOFT versions). If you're using our DirectSOFT6 programming software with a D4-454 PLC and an H4-ECOM100, you can use fill-in-the-blank IBox instructions to simplify your communications programming. The H4-ECOM100 supports the ECOM Configuration IBox for use with the ECRX and ECWX IBox instructions to read/write to other ECOMs. H4 series ECOM modules support the NETCFG Configuration IBox for use with the NETRX and NETWX IBox instructions to read/write to other ECOM modules. The communications IBox instructions execute with built-in interlocking to greatly simplify communications programming.

ECOM100 Configuration IBox

ECOM100 Read Network IBox

NetEdit3 software

NetEdit3 Software is installed with DirectSOFT and it can be downloaded on the AutomationDirect.com website. Use NetEdit3 to configure the ECOM modules for your network. Flexible addressing allows you to use your choice of protocols and identifying methods. Assign each module a number or a name or both. You don't have to use an IP address, but you can if it's necessary for your network. NetEdit3 uses two protocols for PC-to-PLC communications: IPX and TCP/IP. The NetEdit3 screen displays all identifiers and troubleshooting information for each module on the network. You can use NetEdit3 to adjust parameters for PLC-to-PLC communications by clicking on Advanced Settings. The network identifiers can also be changed from DirectSOFT Programming Software.

Choose your slot

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

H4-ECOM100 has e-mail capability!

The H4-ECOM100 Send EMail (ECEMAIL) IBox instruction will allow the module to behave as an e-mail client and send an SMTP request to your SMTP Server to send a specified e-mail message to the e-mail addresses in the IBox's To: field. The Body: field allows you to embed real-time data in your e-mail message. The D4-454 CPUs and DirectSOFT6.1 or later are required to use the IBox instructions.

ECOM100 Send EMail IBox

Serial Remote I/O Client/Server Modules

REMOTE I/O CLIENT MODULE

D4-RM $617.00

REMOTE I/O SERVER MODULE

D4-RS $710.00

Remote Client

Remote Servers

3,300 ft (1,000 m) Max.

Maximum of seven remote bases per channel

Remote Client

Remote Server
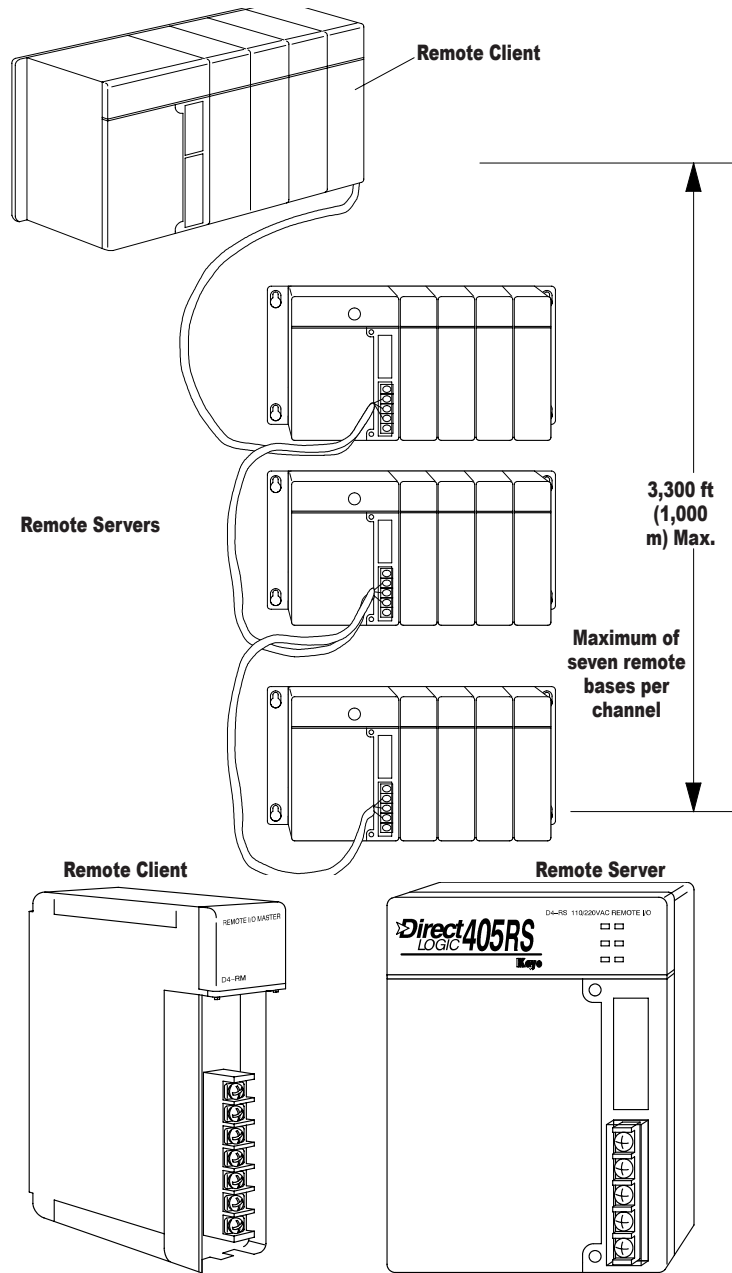
Overview

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 D4-454 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 Client is placed in the CPU base. This Client module controls up to seven Remote Servers. The Remote Servers are connected to the Client in a daisy-chain manner over a twisted pair communication cable (maximum length of 3,300 feet or 1000 meter). Each Remote Server attaches to a DL405 base (any size). Standard DL405 modules populate the remote bases.

You can assign normal input and output addresses to the remote points, or you can assign special remote I/O addresses. The Remote Client sends the remote I/O information to the CPU. The communication between the Remote Client 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.

	D4-454
Maximum number of remote Clients supported	3*
Maximum I/O points supported	1536
Maximum I/O points supported per channel	512
Maximum number of remote I/O bases per channel	7
*Max. of 2 D4-RM, 1 channel is via 25-pin CPU port	

Serial Remote I/O Client/Server Modules

Remote Client

Remote Server

Run relay

24 VDC auxiliary Power

Logic ground

Chassis ground

AC power

110/220 VAC select

Remote Channel Connector

Run relay

Remote Channel Connector
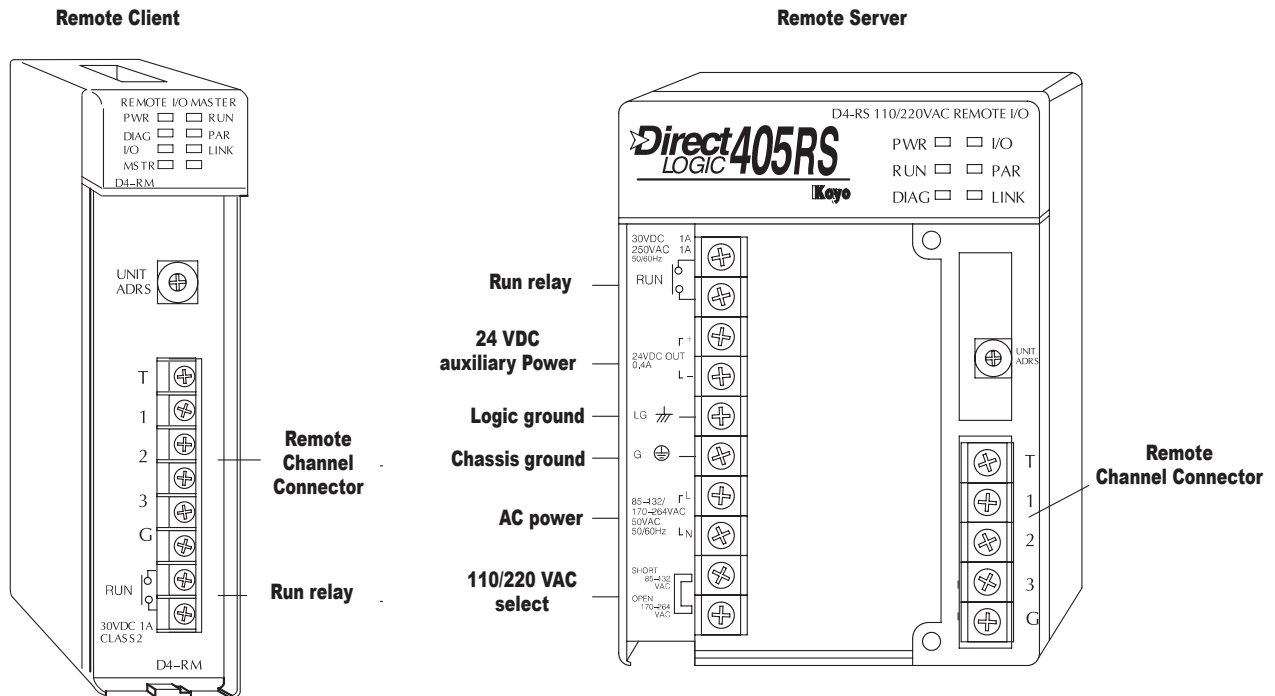
Remote Client Specifications

Module Type	Intelligent device
Number of Clients per CPU	Three maximum for D4-454
Maximum Servers Supported	Seven Servers per channel
Communication to Servers	RS485 via twisted pair with shield @ 38.4K baud
Recommended Cable	Belden 9841 or equivalent
Transmission Distance	3300 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	300mA maximum

Remote Server Specifications

Maximum Server Points per CPU	1536 for D4-454
I/O Addresses Used	I/O modules in Server 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 /220VAC (D4-RS)

Ethernet Remote I/O Client Modules

ETHERNET REMOTE I/O CLIENT MODULE

H4-ERM100 $410.00

The Ethernet Remote Client H4-ERM100 connects D4-454 CPU systems to Ethernet Base Controller (EBC) Server I/O over a high-speed Ethernet link.

Need a lot of I/O?
Each ERM module can support up to 16 DL205 EBC systems (SE-MC2U-SC), 16 Terminator I/O EBC systems (T1H-EBC100), or 16 fully expanded DL405 EBC systems (H4-EBC). See the next page for more information. Of course, combinations are fine, too. The ERM also supports E-drives. 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-ERM100 module. In these cases, an additional H4-ERM100 may be required.

Simple connections
The ERM connects to your control network using Category 5 UTP cables for cable runs up to 100 meters. Distances can be greatly extended with Ethernet/Fiber media converters like the SE-MC2U-ST.

Networking ERMs with other Ethernet devices
It is required that a dedicated Ethernet remote I/O network be used for the ERM and its Servers. 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 Server 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 Servers. 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
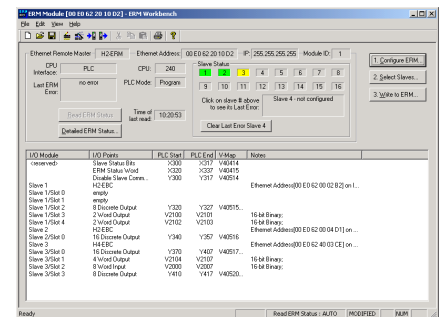
Specifications	H4-ERM100
Communications	10/100BaseT Ethernet
Data Transfer Rate	100 Mbps
Link Distance	100m (328ft)
Ethernet Port	RJ45
Ethernet Protocols	TCP/IP, IPX, Modbus TCP/IP, DHCP, HTML configuration
Power Consumption	300mA @ 5VDC

Stride Ethernet Switch. See the Communications Products section for details.

PC running ERM Workbench to configure the ERM network. PC may be removed once the H4-ERM100 and its Servers are configured.

H4-ERM100

Up to 100m segments*

GS-EDRV100

H2-EBC system

H4-EBC system

GS2 AC drives

T1H-EBC system
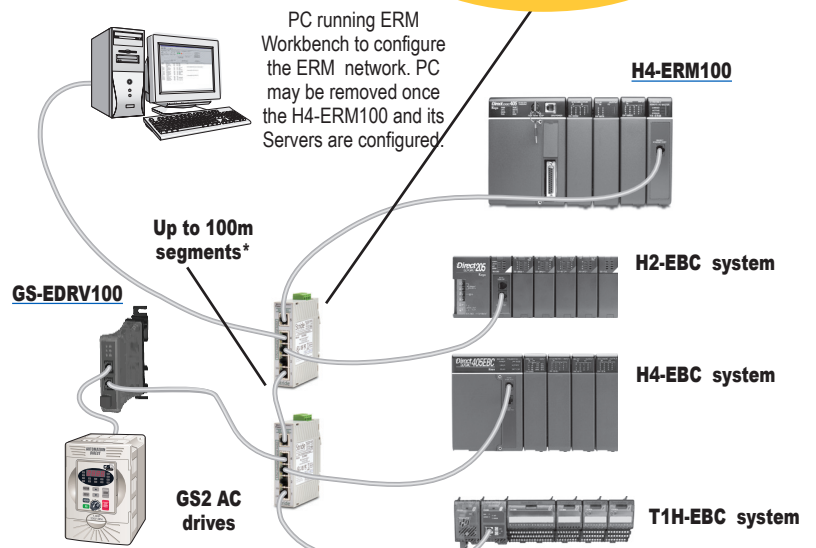
*Distances can be greatly extended with Ethernet/Fiber media converters like the SE-MC2U-ST.

Ethernet Base Controller Modules

ETHERNET BASE CONTROLLER MODULE

H4-EBC $836.00

Use EBCs for PC-based control and for H4-ERM100 remote I/O Servers

The H4-EBC Ethernet Base Controller modules provide a high-performance, low-cost Ethernet link between your PC-based control system or H4-ERM100 Ethernet remote I/O system and DL405 I/O. The H4-EBC module supports industry standard 10Base-T Ethernet communication. This module offers 10Mbps transfer rates between your PC application and your DL405 I/O base. The EBC module is 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 I/O)

• On-board serial port for operator interface, etc., when used with a PC-based program like Think and Do Live. (Serial port not supported when used with the H4-ERM100 module).

Specifications	H4-EBC
Communications	10Base-T Ethernet
Data Transfer Rate	10Mbps
Link Distance	100 meters (328 ft)
Ethernet Port	RJ45
Ethernet Protocols	TCP/IP, IPX
Serial Port	RJ12, K-Sequence, ASCII IN/OUT
Max. Expansion Bases	3
Max. Discrete I/O	1280
Max. Analog I/O	512
Power Supplied	3470mA @ 5VDC 400mA @ 24VDC

H4-EBC
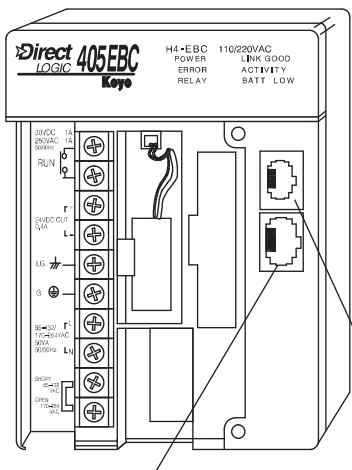
RJ45 port for 10BaseT   RJ12 serial port

Easy to use, reliable and fast

The H4-EBC module plugs into the CPU slot of any DL405 I/O base. The 10Base-T port can be networked using commercially available cabling, hubs, and repeaters.

The H4-EBC module supports all DL405 discrete and analog I/O modules. The H4-EBC module also supports the H4-CTRIO but no other intelligent modules.

The H4-EBC supports up to three expansion bases.
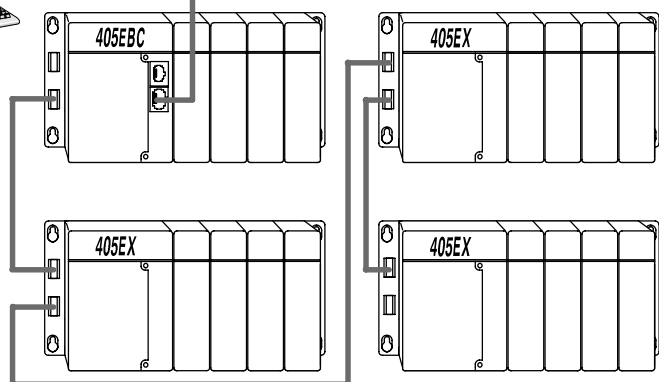
Ethernet Base Controller Modules

Off-the-shelf solutions

You can purchase PC-based control software that is ready to use with the H4-EBC 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 an 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. 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.

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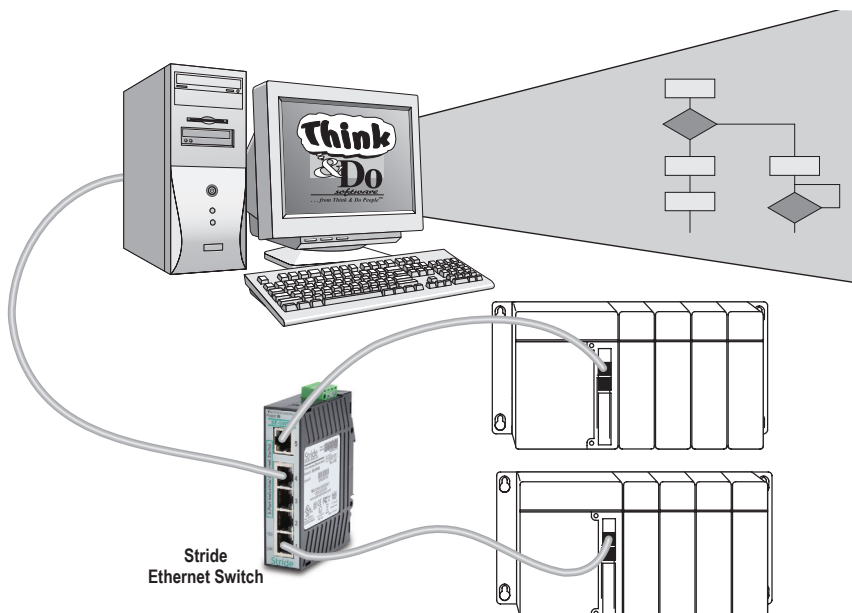
The following vendors have PC-based Control products ready to control our I/O, or they have compatible products to be released in the future.

Vendor	Product	Web Address
Phoenix Contact	Think & Do Live!	www.phoenixcon.com/software
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
        );
```

Modbus Network Client

MODBUS RTU NETWORK CLIENT MODULE

F4-MAS-MB $562.00
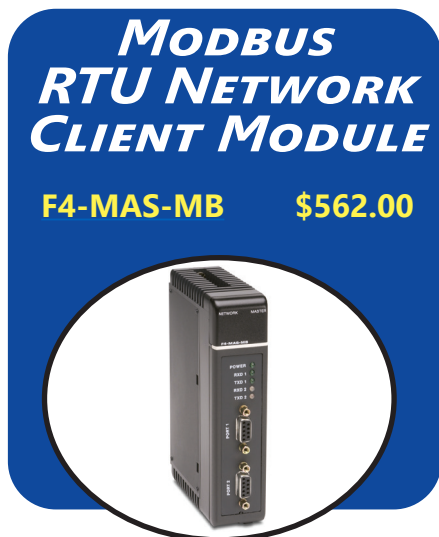
Specifications	
Modules per CPU	Eight maximum, any slot in CPU base
F4-MAS-MB	Ports 1 and 2, RS-232/422/485 selectable, maximum baud rate of 115.2K baud. Note: Select port 1 or port 2 as the Modbus port (only one can be configured as a Modbus port.) If port 2 is configured as the Modbus port, then port 1 can be configured as a debug port.
Recommended Cable	Belden 9841 or equivalent (RS-485) Belden 9729 or equivalent (RS-422)
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)

Overview

Our Modbus Client module allows you to use a DL405 PLC as the network Client for a Modbus RTU network. The module communicates with any network Server 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 Server 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 Server stations.

DL405 CPU with Modbus Client Module

Modbus Network using RTU protocol

Network Server   **Network Server**   **Network Server**
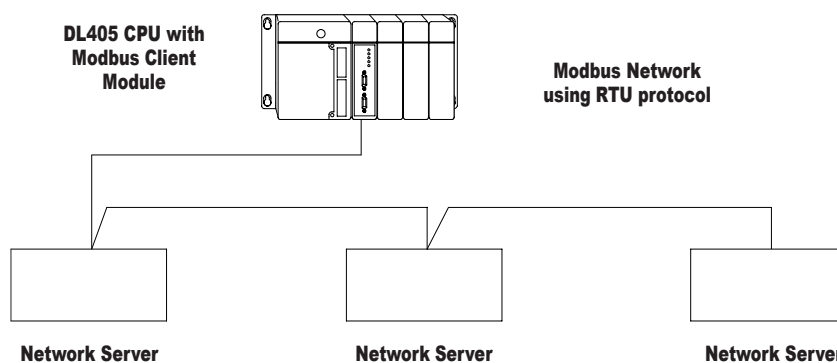
Typical network Servers might include PLCs, drives, PC, etc

CoProcessor Modules

BASIC COPROCESSOR MODULES

F4-CP128-1 **$738.00**

Operator Interfaces

Built-in telephone modem
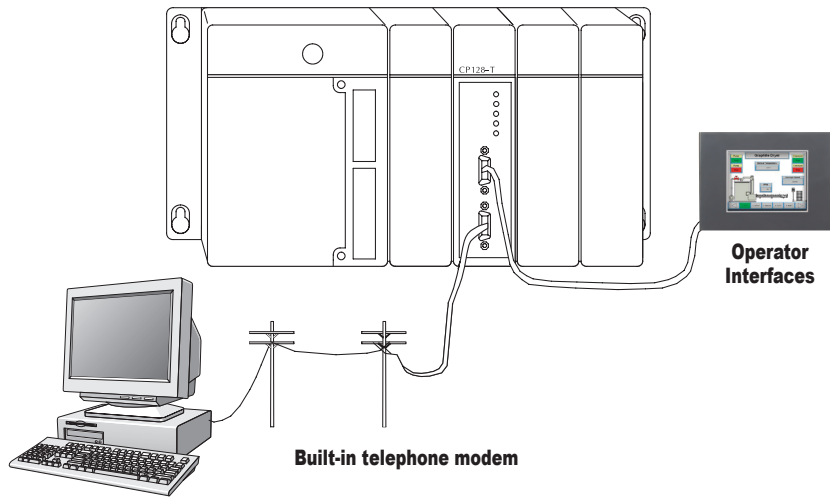
Overview

The FACTS CoProcessor Module interfaces the DirectLOGIC 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 128K bytes allows multiple program storage and execution, DL405 register expansion, and retentive data storage and retrieval

• 16 MHz or 26 MHz 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

• Includes Modbus Client/Server BASIC examples and other application examples on CD

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, RS232/422/485 selectable, maximum baud rate of 115.2 Kbaud. Port 2, RS232/422/485 selectable, maximum baud rate 57.6 Kbaud. Port 3, RS232, maximum baud rate of 19.2 Kbaud. 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 Client and Modbus Server 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.
Power Consumption	F4-CP128-1 — 305mA maximum at 5VDC, (supplied by base power supply)
Operating Environment	0°C–60°C (32°F–140°F), 5% to 95% humidity (non-condensing)

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-232/422/485 port

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

Four Loop Temperature Controller

FOUR LOOP TEMPERATURE CONTROLLER MODULE

F4-4LTC $966.00

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

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

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.

Combines four single loop controllers into one module.

F4-LTC

4 RTD or Thermocouple inputs are on board to read the temperature

Temperature controller performs the PID calculations and activates the corresponding solid state relay output.
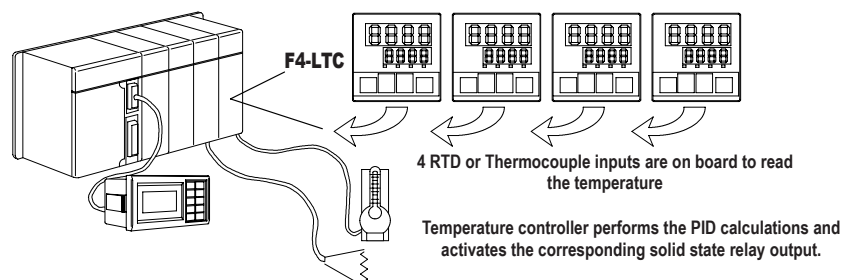
Four Loop Temperature Controller

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, 5–26.4 VDC @ 0.15 A
Converter Type	Charge Balancing, 24-bit
Notch Filter	>100dB at 50Hz and 60Hz
	(f_3db=13.1 Hz)
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	0.5 A 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%

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) 10q -200/260°C (328/500 °F) 25q -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.

High-speed Counter I/O Module

HIGH-SPEED COUNTER I/O MODULE

H4-CTRIO   **$527.00**

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, 9-30 VDC
- 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 100 kHz 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 (20 Hz-25 kHz 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
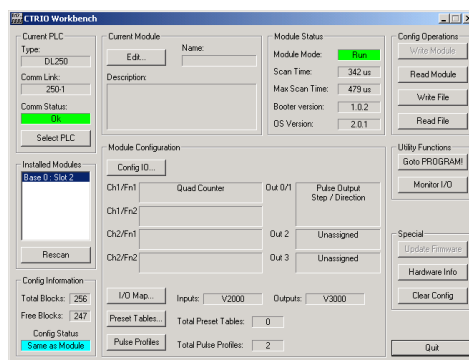
Use Configure I/O dialog to assign the CTRIO input and output functions

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 than 10µs 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.

DirectLOGIC DL405 PLC
You can use the H4-CTRIO module with the D4-454 CPU. The module plugs into any I/O slot of any DirectLogic 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 Servers in H2-ERM100 or H4-ERM100 systems.
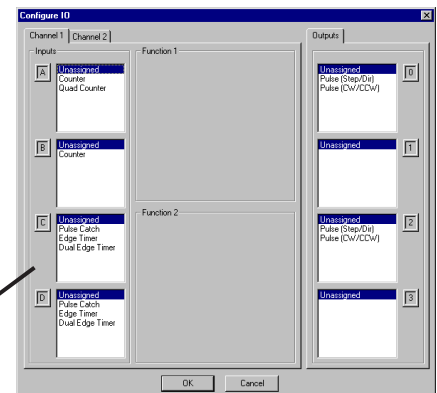
High-speed I/O Counter Module

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%
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	5µs
Input Voltage Range	9-30 VDC
Maximum Voltage	30VDC
Input Voltage Protection	Zener Clamped at 33VDC
Rated Input Current	8mA typical 12mA maximum
Minimum ON Voltage	9.0 VDC
Maximum OFF Voltage	2.0 VDC
Minimum ON Current	5.0 mA (9VDC required to guarantee ON state)
Maximum OFF Current	2.0 mA
OFF to ON Response	Less than 3µs
ON to OFF Response	Less than 3µs

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	≤ 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); 1µs
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–25KHz); 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 I/O 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 the 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 9-30 VDC 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 5-36 VDC power sources. The maximum allowable current per output circuit is 1A.
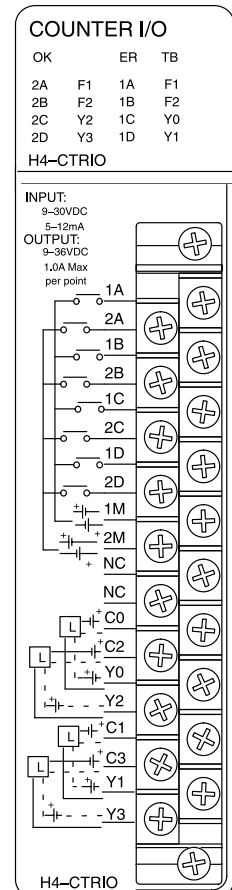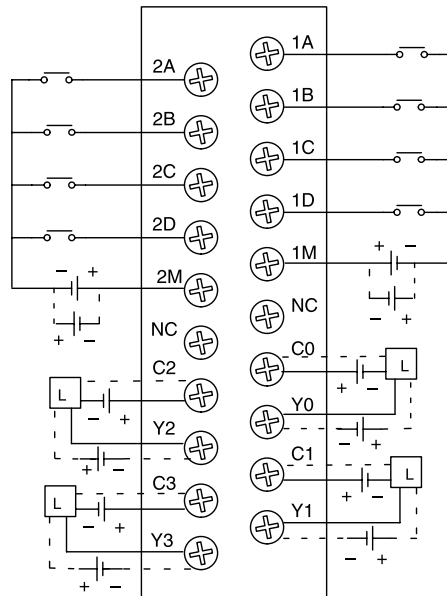
High-speed I/O Counter Module

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)

This drawing illustrates wiring that is typical for Channel 1 terminals 1A, 1B, 1C, and 1D. The same circuitry is also present at the corresponding Channel 2 terminals.

Sensing Circuit

24VDC

1A

1M

The same circuitry is present at the corresponding Channel 2 terminal.

PNP Field Device (source)

This drawing illustrates wiring that is typical for Channel 1 terminals 1A, 1B, 1C, and 1D. The same circuitry is also present at the corresponding Channel 2 terminals.

Sensing Circuit

24VDC

1A

1M

The same circuitry is present at the corresponding Channel 2 terminal.

Pulse output schematic

Cn (where n=0, 1, 2, 3)
CTRIO Output
Yn

+5 to 36VDC

+ Load -

+ Load -

+5 to 36VDC

Cn (where n=0, 1, 2, 3)
CTRIO Output
Yn

Stepper/Servo drive wiring example

Step Amplifier

OPTO Power
Pulse   (or CW)
Direction   (or CCW)

5-36VDC

2A   1A
2B   1B
2C   1C
2D   1D
2M   1M
NC   NC
C2   C0
Y2   Y0
C3   C1
Y3   Y1

5-36VDC

Step Amplifier

OPTO Power
Pulse   (or CW)
Direction   (or CCW)
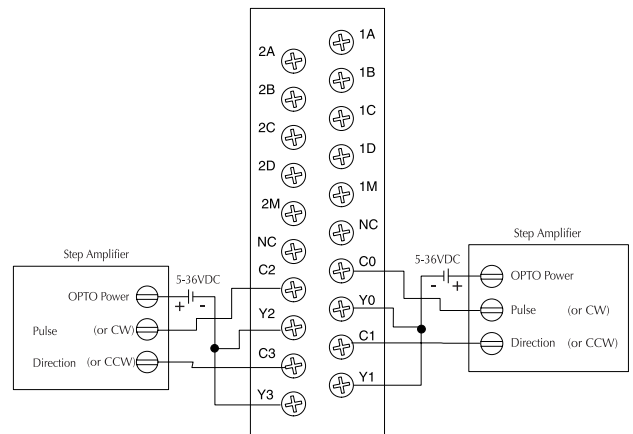
High-speed I/O Counter Module

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 latest version of the CTRIO Workbench utility can be downloaded for 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.

Configure I/O Screen

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

Scaling Wizard screen
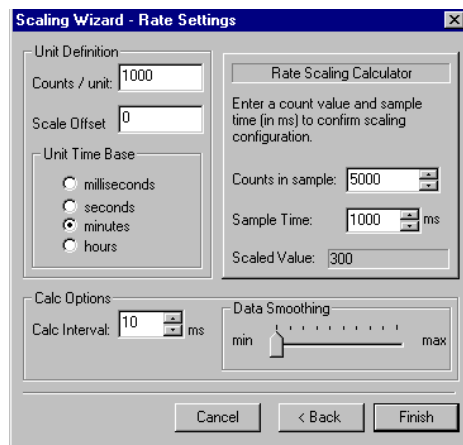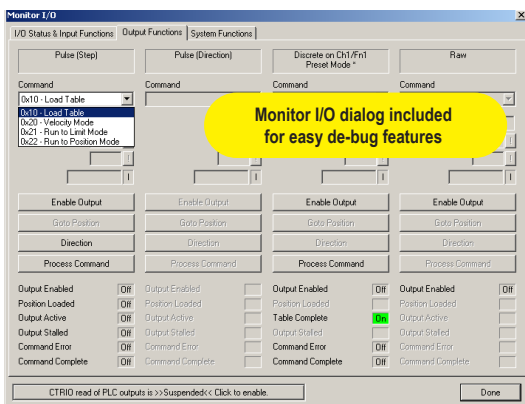
High-speed I/O Counter Module

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 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

PLC with CTRIO module

Motor Interface

Motor control lines

Gearbox, clutch and brake interface

CTRIO high speed output

Encoder

Cutter interface

Material to be cut to length

Cutter assembly

High-speed timing application

PLC with CTRIO module

Gear

Proximity switch

Photoelectric switch
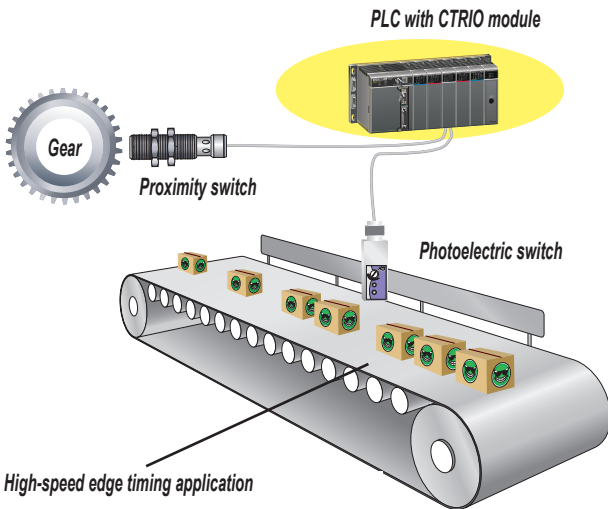
High-speed edge timing application

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

Powerful edge timing functions - clicking on the edge button cycles through the available edge timing functions available

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

Point-click selections of hardwired connection for Counting, Reset, and Inhibit
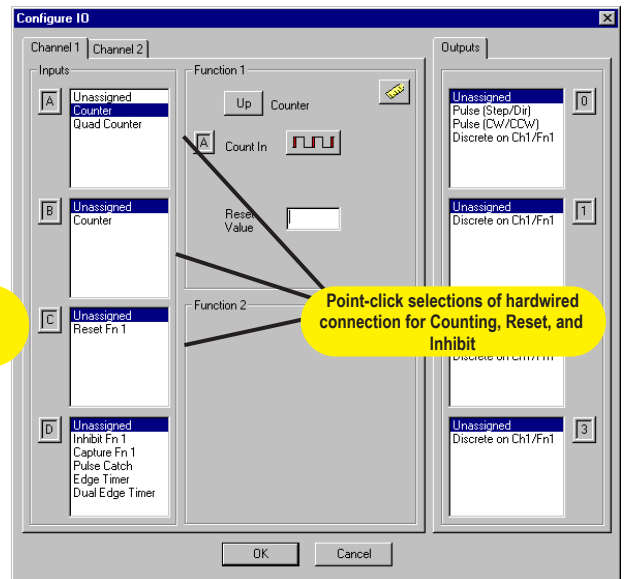
High-speed I/O Counter Module

Pulse output operations

Using Edit Pulse Profile screen to select Trapezoid pulse output profile

Fill-in-the-blank parameters allow precise tuning of the output pulse profile

Rotary indexing liquid fill application
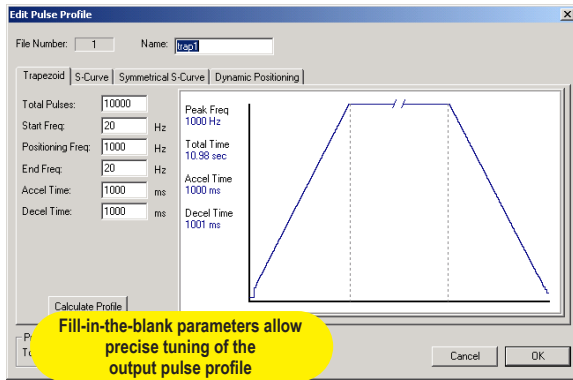
Pulse output for stepper/servo control

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 25 kHz 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 to load the profile and enable the output signal to begin a movement.
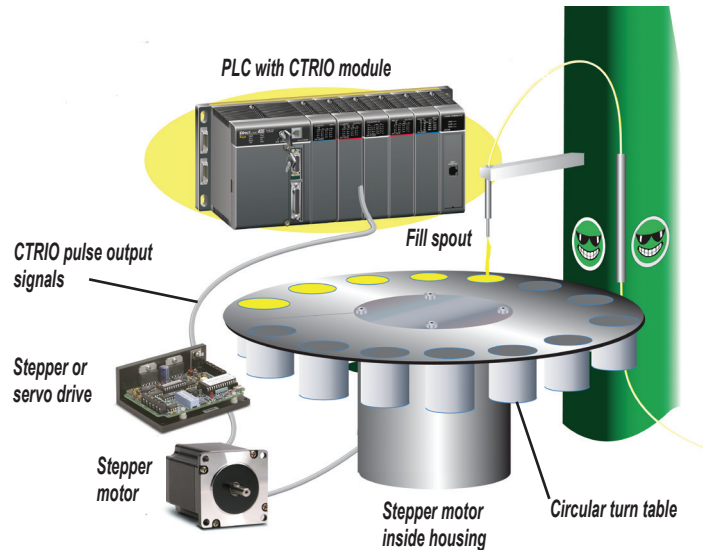
Other common pulse output applications:

- 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

Calculate Profile displays graphical representation of output pulse profile
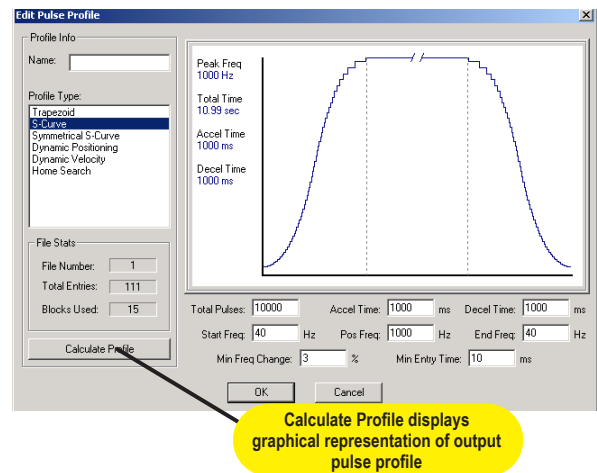
High-speed I/O Counter Module

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

Proximity switch

Proximity switch

Proximity switch

Encoder

PLC with CTRIO module

Stepper motor

Stepper or servo drive
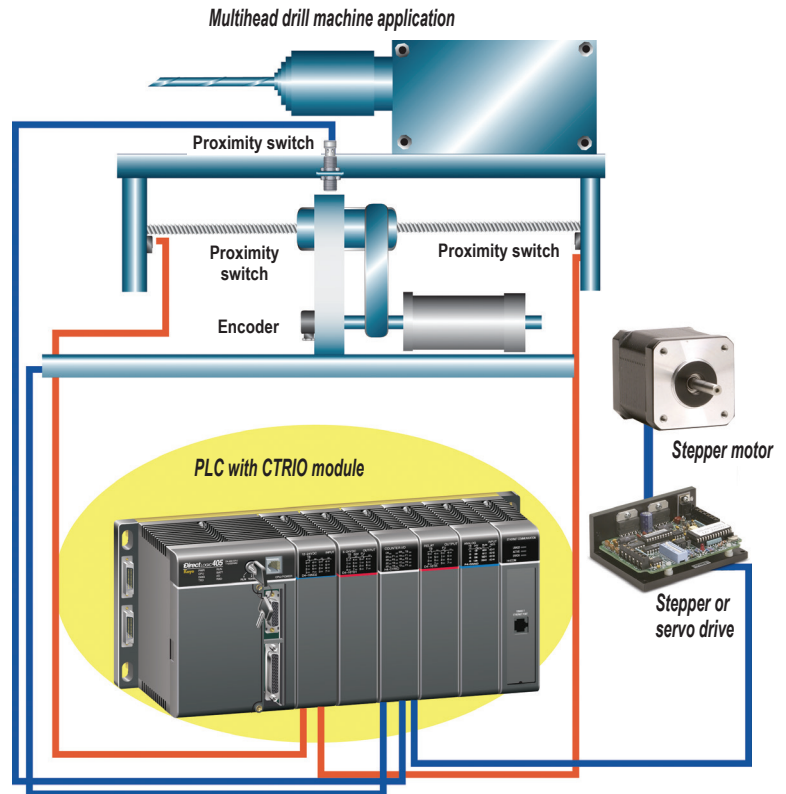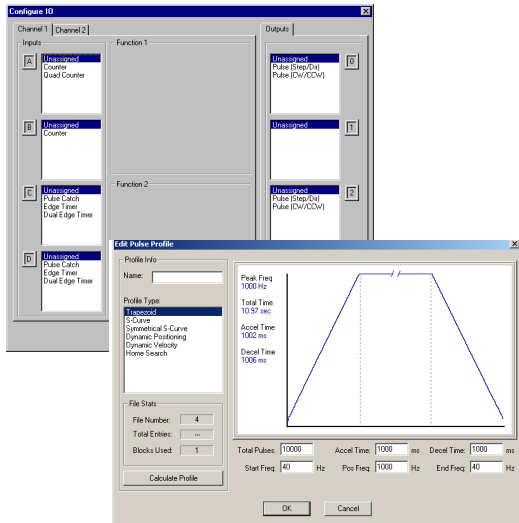
High-Speed inputs and pulse output combinations

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.

PLC CPU program

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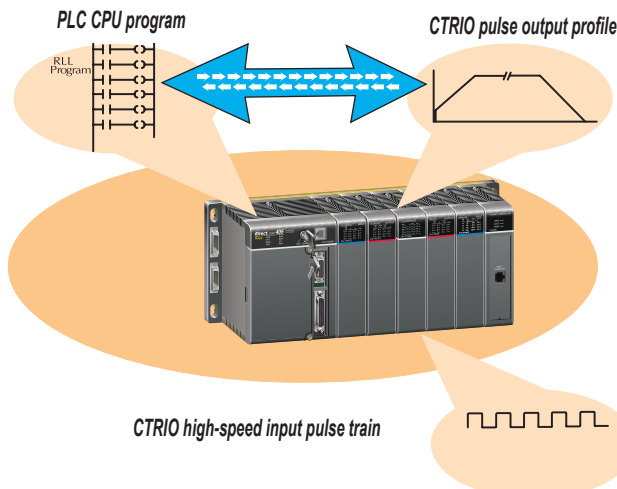
Closed loop control for the CTRIO module requires PLC CPU program interaction to close the loop. This makes the application subject to the PLC CPU scan.

CTRIO high-speed input pulse train

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Wiring Solutions

Wiring Solutions using the *ZIP*Link Wiring System

*ZIP*Links eliminate the normally tedious process of wiring between devices by utilizing prewired cables and DIN rail mount connector modules. It's as simple as plugging in a cable connector at either end or terminating wires at only one end. Prewired cables keep installation clean and efficient, using half the space at a fraction of the cost of standard terminal blocks. There are several wiring solutions available when using the *ZIP*Link System ranging from PLC I/O-to-*ZIP*Link Connector

Modules that are ready for field termination, options for connecting to third party devices, GS, DuraPulse and SureServo Drives, and specialty relay, transorb and communications modules. Pre-printed I/O-specific adhesive label strips for quick marking of *ZIP*Link modules are provided with *ZIP*Link cables. See the following solutions to help determine the best *ZIP*Link system for your application.

Solution 1: DirectLOGIC I/O Modules to ZIPLink Connector Modules
When looking for quick and easy I/O-to-field termination, a *ZIP*Link connector module used in conjunction with a prewired *ZIP*Link cable, consisting of an I/O terminal block at one end and a multi-pin connector at the other end, is the best solution.

Using the PLC I/O Modules to *ZIP*Link Connector Modules selector tables located in this section,

1. Locate your I/O module/PLC.
2. Select a *ZIP*Link Module.
3. Select a corresponding *ZIP*Link Cable.

Solution 2: DirectLOGICI/O Modules to 3rd Party Devices
When wanting to connect I/O to another device within close proximity of the I/O modules, no extra terminal blocks are necessary when using the *ZIP*Link Pigtail Cables. *ZIP*Link Pigtail Cables are prewired to an I/O terminal block with color-coded pigtail with soldered-tip wires on the other end.

Using the I/O Modules to 3rd Party Devices selector tables located in this section,

1. Locate your PLC I/O module.
2. Select a *ZIP*Link Pigtail Cable that is compatible with your 3rd party device.

Using the Drives Communication selector tables located in this section,

1. Locate your Drive and type of communications.
2. Select a *ZIP*Link cable and other associated hardware.

Solution 3: GS Series and DuraPulse Drives Communication Cables
Need to communicate via Modbus RTU to a drive or a network of drives?

*ZIP*Link cables are available in a wide range of configurations for connecting to PLCs and SureServo, SureStep, Stellar Soft Starter and AC drives. Add a *ZIP*Link communications module to quickly and easily set up a multi-device network.

Wiring Solutions

Solution 4: Serial Communications Cables

ZIPLink offers communications cables for use with DirectLOGIC, CLICK, and Productivity3000 CPUs, that can also be used with other communications devices. Connections include a 6-pin RJ12 or 9-pin, 15-pin and 25-pin D-sub connectors which can be used in conjunction with the RJ12 or D-Sub Feedthrough modules.

Using the Serial Communications Cables selector table located in this section,

1. Locate your connector type
2. Select a cable.

Solution 5: Specialty ZIPLink Modules

For additional application solutions, **ZIP**Link modules are available in a variety of configurations including stand-alone relays, 24VDC and 120VAC transorb modules, D-sub, RJ12 and RJ45 feedthrough modules, communication port adapter and distribution modules, and SureServo 50-pin I/O interface connection.

Using the **ZIP**Link Specialty Modules selector table located in this section,

1. Locate the type of application.
2. Select a **ZIP**Link module.

Solution 6: ZIPLink Connector Modules to 3rd Party Devices

If you need a way to connect your device to terminal blocks without all that wiring time, then our pigtail cables with color-coded soldered-tip wires are a good solution. Used in conjunction with any compatible **ZIP**Link Connector Modules, a pigtail cable keeps wiring clean and easy and reduces troubleshooting time.

Using the Universal Connector Modules and Pigtail Cables table located in this section,

1. Select module type.
2. Select the number of pins.
3. Select cable.

PLC I/O Modules to ZIPLink Connector Modules - DL405

DL405 PLC Input Module ZIPLink Selector

PLC	ZIPLink			
Input Module	# of Terms	Component	Module Part No.	Cable Part No.
D4-16ND2	20		See Note 3	
D4-16ND2F				
D4-32ND3-1[2]	40	Feedthrough	ZL-RTB40 (-1)	straight conn: ZL-D24-CBL40 ZL-D24-CBL40-1 ZL-D24-CBL40-2
		Sensor	ZL-LTB32-24-1	
D4-64ND2[1,2]	40	Feedthrough	ZL-RTB40 (-1)	
		Sensor	ZL-LTB32-24-1	45 deg conn: ZL-D24-CBL40-X ZL-D24-CBL40-1X ZL-D24-CBL40-2X
D4-08NA	11		See Note 3	
D4-16NA	20			
D4-16NE3				

DL405 PLC Analog Module ZIPLink Selector

PLC	ZIPLink			
Analog Module	# of Terms	Component	Module	Cable
F4-04AD	20		See Note 3	
F4-04ADS				
F4-08AD				
F4-16AD-1				
F4-16AD-2				
F4-04DA-1				
F4-04DA-2				
F4-08DA-1				
F4-16DA-1				
F4-08DA-2				
F4-16DA-2				
F4-04DAS-1				
F4-08THM	T/C Wire Only			
F4-08THM-n				
F4-08RTD	Matched Only			

Note: ZIPLink Connector Module specifications follow the Compatibility Matrix tables in the ZIPLink section.

DL405 PLC Output Module ZIPLink Selector

PLC	ZIPLink			
Output Module	# of Terms	Component	Module Part No.	Cable Part No.
D4-16TD1	20		See Note 3	
D4-16TD2				
D4-32TD1 [2]	40	Feedthrough	Feedthrough ZL-RTB40 (-1) Fused ZL-RFU40 [4]	straight conn: ZL-D24-CBL40 ZL-D24-CBL40-1 ZL-D24-CBL40-2
		Fuse		
D4-32TD2 [2]		Feedthrough		
		Fuse		
D4-64TD1[1,2]		Feedthrough		45 deg conn: ZL-D24-CBL40-X ZL-D24-CBL40-1X ZL-D24-CBL40-2X
		Fuse		
D4-08TA	11		See Note 3	
D4-16TA	20			
D4-08TR	11			
F4-08TRS-1				
F4-08TRS-2	20			
D4-16TR				

Tables Footnotes:
1. The D4-64ND2 and D4-64TD1 modules have two 32-point connectors and require two ZIPLink cables and two ZIPLink connector modules.
2. To make a custom cable for the 32 or 64-point modules, use: Ribbon-style Connector ZL-D24-CON-R, Solder-style 180° connector ZL-D24-CON or Solder-style 45° connector ZL-D24-CON-X
3. These modules are not supported by the ZIPLink wiring system.
4. Note: Fuses (5 x 20 mm) are not included. See Edison Electronic Fuse section for (5 x 20 mm) fuse. S500 and GMA electronic circuit protection for fast-acting maximum protection. S506 and GMC electronic circuit protection for time-delay performance. Ideal for inductive circuits. To ensure proper operation, do not exceed the voltage and current rating of ZIPLink module. ZL-RFU20 = 2A per circuit; ZL-RFU40 = 400 mA per circuit.

DC Input Modules

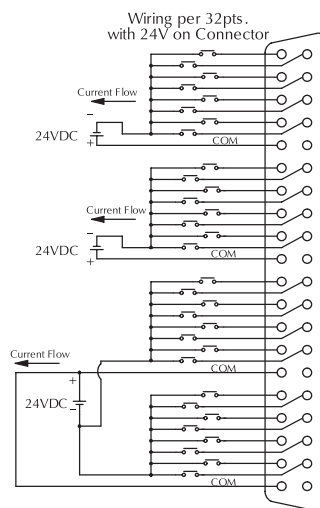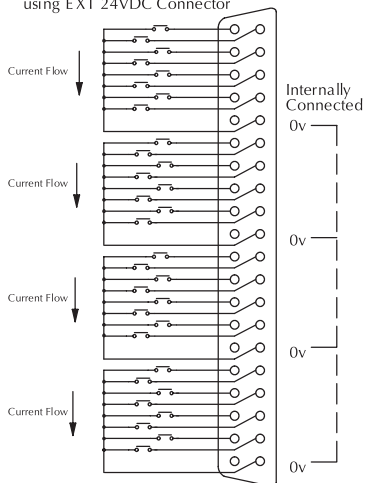| D4-16ND2 DC Input $184.00	
Inputs per Module	16 (current sourcing)
Commons per Module	2 (isolated)
Input Voltage Range	10.2–26.4VDC
Peak Voltage	26.4 VDC
ON Voltage Level	>9.5 V
OFF Voltage Level	<4.0 V
Input Impedance	3.2 kq @ 12VDC 2.9 kq @ 24VDC
Input Current	3.8 mA @ 12VDC 8.3 mA @ 24VDC
Minimum ON Current	3.5 mA
Maximum OFF Current	1.5 mA
Base Power Required 5V	150mA max
OFF to ON Response	1–7 ms (2.3 typical)
ON to OFF Response	2–12 ms (4.6 typical)
Terminal Type (included)	Removable (D4-16ICON)
Status Indicators	Logic side
Weight	8.8 oz. (250g)

See Wiring Solutions for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.
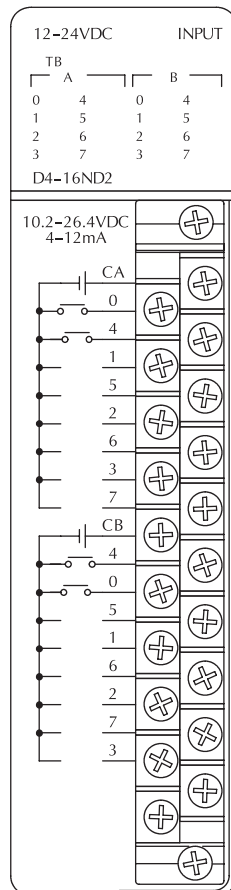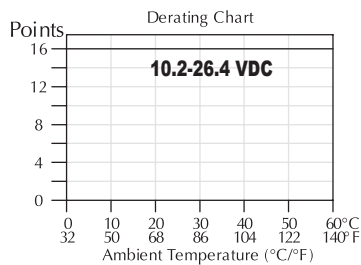
DC Input Modules

D4-16ND2F DC Input $184.00	
Inputs per Module	16 (current sourcing)
Commons per Module	2 (isolated)
Input Voltage Range	10.2–26.4VDC
Peak Voltage	26.4 VDC
ON Voltage Level	>9.5 V
OFF Voltage Level	<4.0 V
Input Impedance	3.2kq @ 12VDC 2.9kq @ 24VDC
Input Current	3.8 mA @ 12VDC 8.3 mA @ 24VDC
Minimum ON Current	3.5 mA
Maximum OFF Current	1.5 mA
Base Power Required 5V	150mA max
OFF to ON Response	1ms
ON to OFF Response	1ms
Terminal Type (included)	Removable D4-16ICON
Status Indicators	Logic side
Weight	8.8oz. (250g)

See Wiring Solutions for part numbers of
*ZIP*Link cables and connection modules
compatible with this I/O module.

D4-32ND3-1 DC Input $286.00	
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	4.8 kq
Input Current	5mA @ 24VDC
Minimum ON Current	3.5 mA
Maximum OFF Current	1.6 mA
Base Power Required 5V	150mA max
OFF to ON Response	2-10 ms
ON to OFF Response	2-10 ms
Terminal type (See ZIPLinks note below)	Connectors sold separately.
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 Wiring Solutions for part numbers of
*ZIP*Link cables and connection modules
compatible with this I/O module.
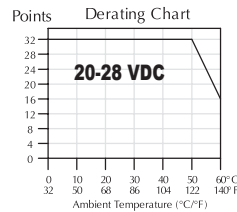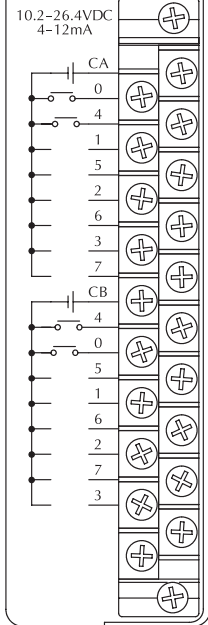
DC Input Modules

D4-64ND2 DC Input $374.00	
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	4.8 kq
Input Current	5.0 mA @ 24VDC
Minimum ON Current	3.6 mA
Maximum OFF Current	2.6 mA
Base Power Required 5V	300mA max

* 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.

External Power Required (optional)	24VDC ± 10%, 320mA max
OFF to ON Response	2.5ms (typical)
ON to OFF Response	5ms (typical)
Terminal Type (See ZIPLinks note below)	Connectors sold separately.
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).

See Wiring Solutions for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.
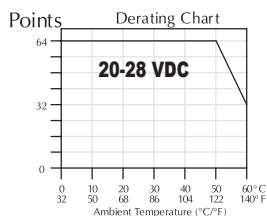
AC Input Modules

D4-08NA AC Input $166.00	
Inputs per Module	8
Commons per Module	2 (isolated)
Input Voltage Range	80–265VAC
Peak Voltage	265VAC
AC Frequency	47–63 Hz
ON Voltage Level	>70V
OFF Voltage Level	<30V
Input Impedance	12kq
Input Current	8.5 mA @ 100VAC 20mA @ 230VAC
Minimum ON Current	5mA
Maximum OFF Current	2mA
Base Power Required 5V	100mA max
OFF to ON Response	5–30 ms
ON to OFF Response	10–50 ms
Terminal Type (included)	Removable
Status Indicators	265VAC Logic side
Weight	8.4 oz. (240g)

| D4-16NA AC Input $233.00	
Inputs per Module	16
Commons per Module	2 (isolated)
Input Voltage Range	80–132 VAC
Peak Voltage	132VAC
AC Frequency	47–63 Hz
ON Voltage Level	>70V
OFF Voltage Level	<20V
Input Impedance	8kq
Input Current	14.5 mA @ 120VAC
Minimum ON Current	7mA
Maximum OFF Current	2mA
Base Power Required 5V	150mA max.
OFF to ON Response	5–30 ms
ON to OFF Response	10–50 ms
Terminal Type (included)	Removable
Status Indicators	Logic side
Weight	9.5 oz. (270g)

See Wiring Solutions for part numbers of
ZIPLink cables and connection modules
compatible with this I/O module.
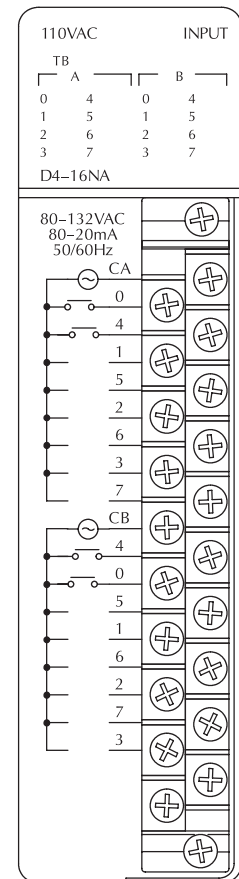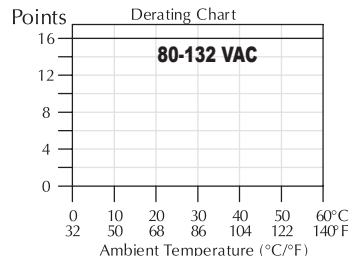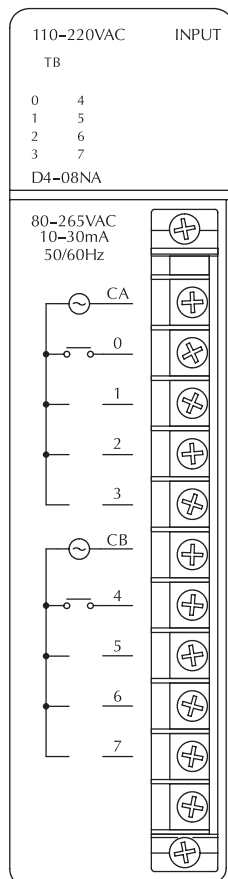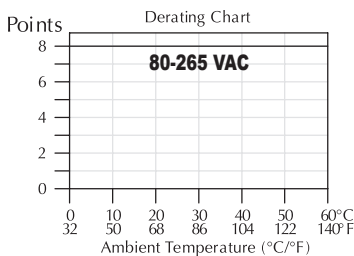
AC/DC Input Module

D4-16NE3 AC/DC Input $185.00	
Inputs per Module	16 (sink/source)
Commons per Module	2 (isolated)
Input Voltage Range	10.2–26.4 VAC/VDC
Peak Voltage	37.5 VAC/VDC
AC Frequency	47–63 Hz
ON Voltage Level	>9.5 V
OFF Voltage Level	<3.0 V
Input Impedance	3.2 kq @ 12V 2.9 kq @ 24V
Input Current	3.8 mA @ 12V 8.3 mA @ 24V
Minimum ON Current	4mA
Maximum OFF Current	1.5 mA
Base Power Required 5V	150mA max
OFF to ON Response	5-40 ms
ON to OFF Response	10-50 ms
Terminal Type (included)	Removable
Status Indicators	Logic side
Weight	8.8 oz. (250g)

See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.


Current sourcing configuration shown
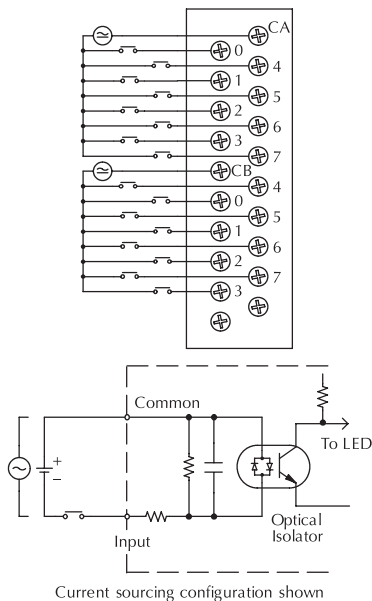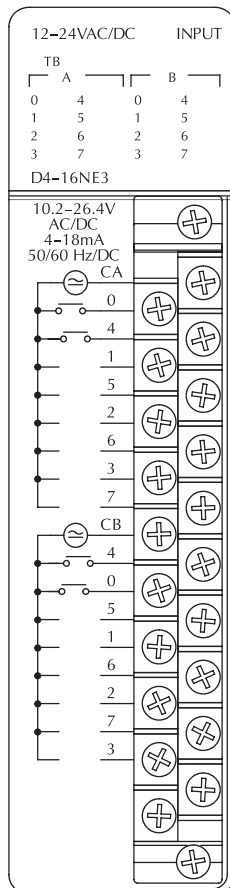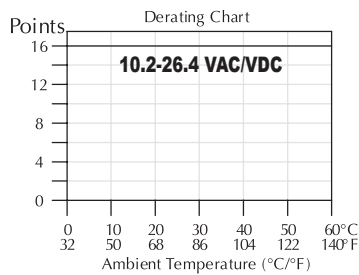
DC Output Modules

D4-16TD1 DC Output $238.00	
Outputs per Module	16 (current sinking)
Commons per Module	2 internally connected
Operating Voltage	4.5–26.4 VDC
Output Type	NPN Open collector
Peak Voltage	40VDC
ON Voltage Drop	0.5 VDC @ 0.5 A 0.2 VDC @ 0.1 A
Max Current (resistive)	0.5 A/point - 3A/common
Max Leakage Current	0.1mA @ 40VDC
Max Inrush Current	2A for 10ms 1A for 100ms
Minimum Load	0.2 mA
Base Power Required 5V	200mA max
External DC Required	24VDC ± 10% @ 125mA
OFF to ON Response	0.5 ms
ON to OFF Response	0.5 ms
Terminal Type (included)	Removable
Status Indicators	Logic side
Weight	9.5 oz. (270g)
Fuses	1 (5A) per common Non-replaceable

See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.

D4-16TD2 DC Output $238.00	
Outputs per Module	16 (current sourcing)
Commons per Module	2 (isolated)
Operating Voltage	10.2–26.4 VDC
Output Type	NPN Emitter Follower
Peak Voltage	40VDC
ON Voltage Drop	1.5 VDC @ 0.5 A
Max Current (resistive)	0.5A/point 3A/common @ 50° C 2.5 A/common @ 60° C
Max Leakage Current	0.1 mA @ 40VDC
Max Inrush Current	2A for 10ms 1A for 100ms
Minimum Load	0.2 mA
Base Power Required 5V	400mA max
External DC Required	None
OFF to ON Response	1ms
ON to OFF Response	1ms
Terminal Type (included)	Removable
Status Indicators	Logic side
Weight	9.8 oz. (280g)
Fuses	1 (5A) per common Non-replaceable

See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.
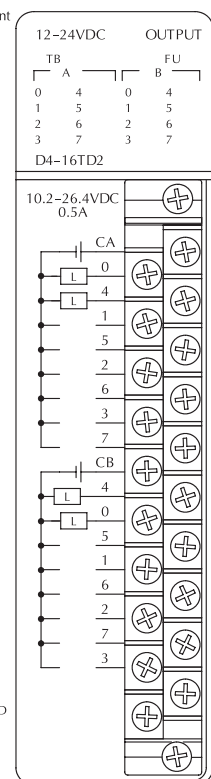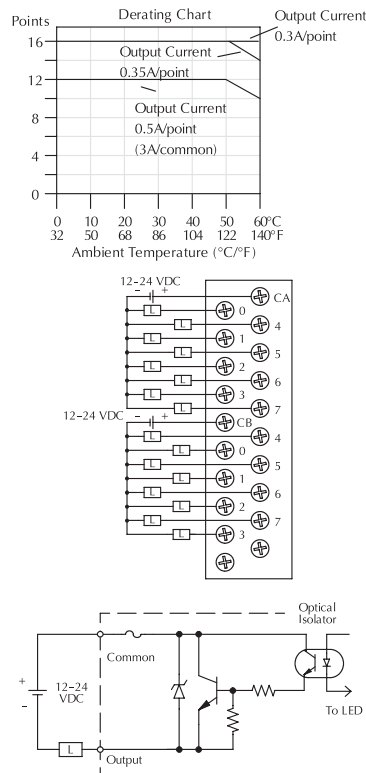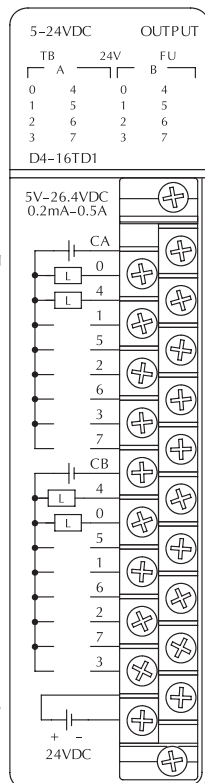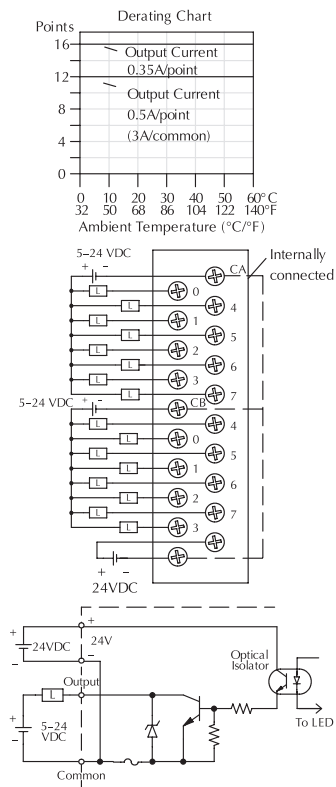
DC Output Modules

D4-32TD1 DC Output $315.00	
Outputs per Module	32 (current sinking)
Commons per Module	4 (isolated)
Operating Voltage	4.75–26.4 VDC
Output Type	NPN Open Collector
Peak Voltage	36VDC
ON Voltage Drop	0.6 VDC @ 0.2 A
Max Current (resistive)	0.2 A/point 1.6 A/common
Max Leakage Current	0.1mA @ 36VDC
Max Inrush Current	1A for 10ms 0.5A for 100ms
Minimum Load	0.1 mA
Base Power Required 5V	250mA max
External DC Required	24VDC± 10%, 140mA max
OFF to ON Response	0.1 ms
ON to OFF Response	0.1 ms
Terminal Type (See ZIPLinks note below)	Connectors sold separately.
Status Indicators	Logic side
Weight	6.7 oz. (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.
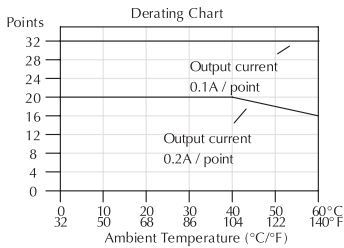
D4-32TD2 DC Output $315.00	
Outputs per Module	32 (current sourcing)
Commons per Module	4 (isolated)
Operating Voltage	10.8–26.4 VDC
Output Type	PNP Open Collector
Peak Voltage	30VDC
ON Voltage Drop	0.6 VDC @ 0.2 A
Max Current (resistive)	0.2 A/point 1.0 A/common 4.0 A/module
Max Leakage Current	0.01 mA @ 26.4VDC
Max Inrush Current	500mA for 10ms
Minimum Load	0.2 mA
Base Power Required 5V	350mA max
External DC Required	10.8–26.4VDC 1A/common including load
OFF to ON Response	0.2 ms
ON to OFF Response	0.2 ms
Terminal Type (See ZIPLinks note below)	Connectors sold separately.
Status Indicators	Logic side
Weight	6.7 oz. (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 Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.

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

See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.
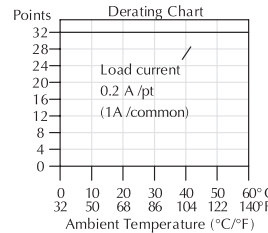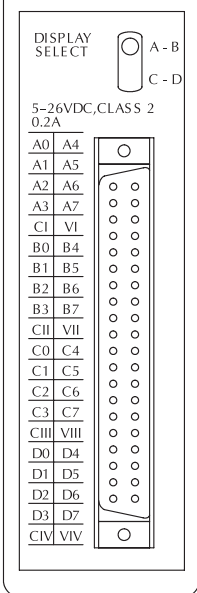
Note: When used with the ZIPLink wiring system, relay outputs are derated not to exceed 2 Amps per point max.
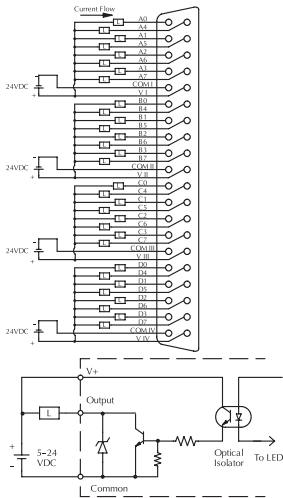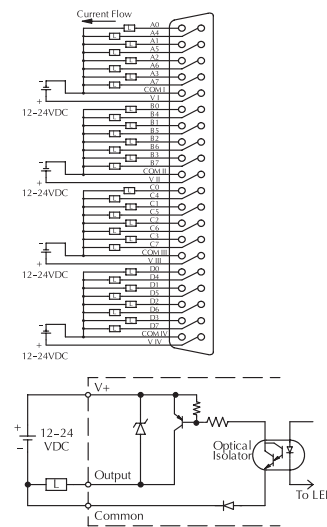
DC Output Modules

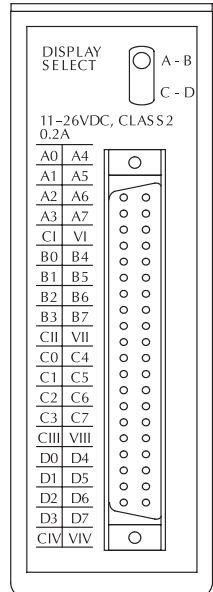## D4-64TD1 DC Output $445.00

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

* 1. If you are using 64-point 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.

Base power Required 5V	800mA max
External DC Required	24VDC ± 10 % (850mA per common) 7.0 A total max
OFF to ON Response	0.1 ms
On to OFF Response	0.2 ms
Terminal type (See ZIPLinks note below)	Connectors sold separately.
Status Indicators	Logic side
ON Voltage Drop	1.5 VAC @ 2A
Weight	7.4 oz. (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).

See Wiring Solutions for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.
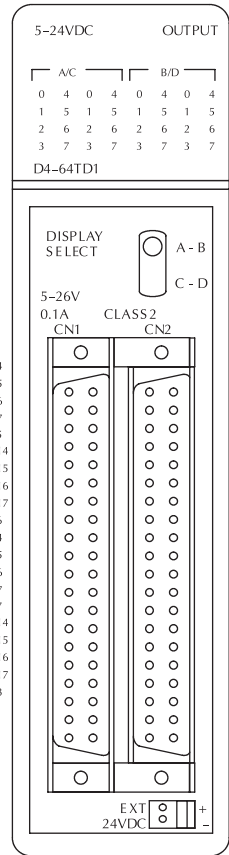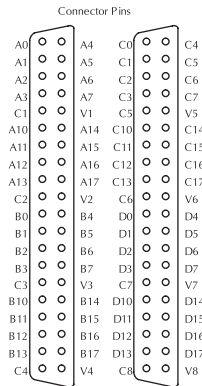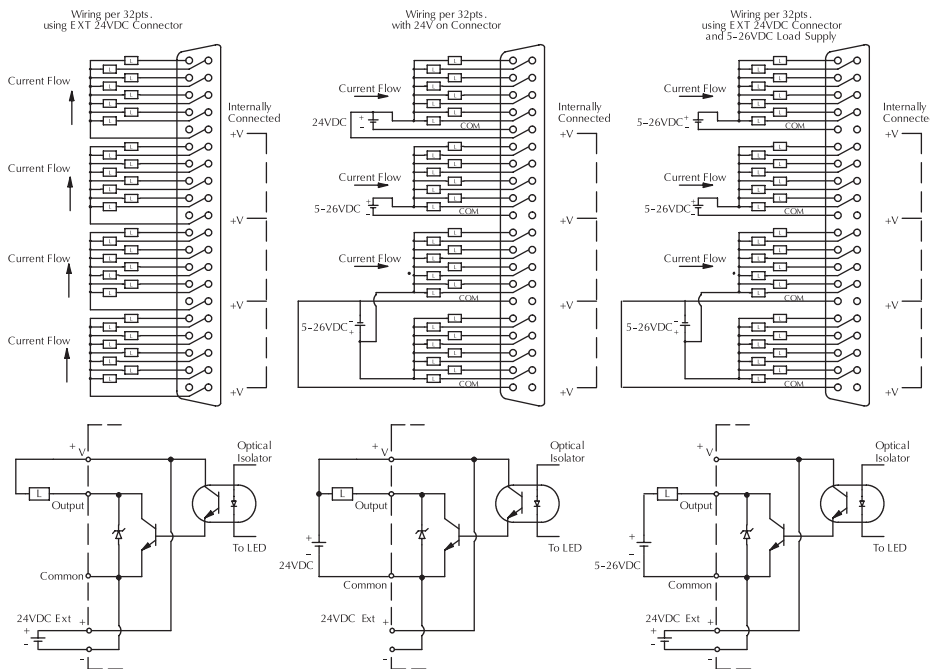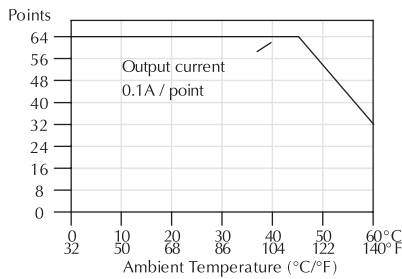
AC Output Modules

D4-08TA AC Output	$286.00
Outputs per Module	8
Commons per Module	2 (isolated)
Operating Voltage	15–265 VAC
Output Type	SSR (triac)
Peak Voltage	265VAC
AC Frequency	47–63 Hz
ON Voltage Drop	1.5 VAC @ 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 (included	Removable
Status Indicators	Logic side
Weight	11.6 oz. (330g)
Fuses	1 (8A) per common, non-replaceable

D4-16TA AC Output	$349.00
Outputs per Module	16
Commons per Module	2 (isolated)
Operating Voltage	15–265 VAC
Output Type	SSR (triac)
Peak Voltage	265VAC
AC Frequency	47–63 Hz
ON Voltage Drop	1.5 VAC @ 0.5A
Max Current	0.5 A/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 (included)	Removable
Status Indicators	Logic Side
Weight	12.2 oz. (350g)
Fuses	1 (5A) per common, non-replaceable

See Wiring Solutions for part numbers of *ZIP*Link cables
and connection modules compatible with this I/O module.

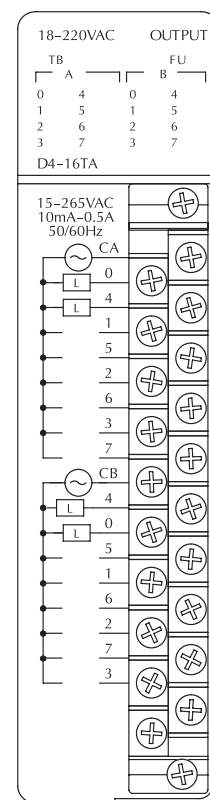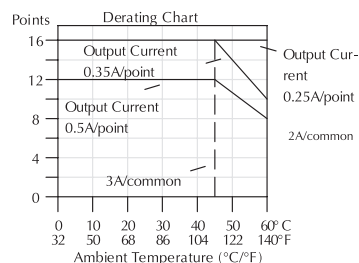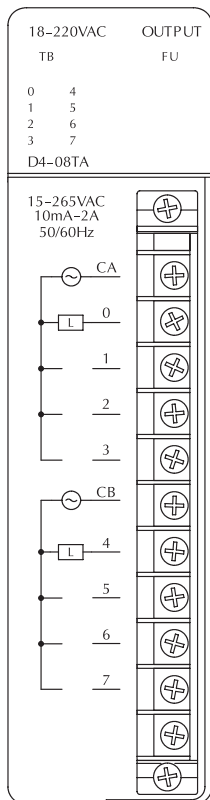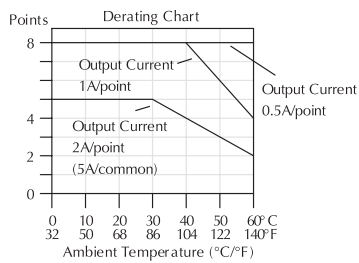*Note: When used with the ZIPLink wiring system, relay outputs are
derated not to exceed 2 Amps per point max.*

Relay Output Modules

D4-08TR Relay Output $200.00

Outputs per Module	8 relays
Commons per Module	2 (isolated)
Operating Voltage	5–30 VDC / 5–250 VAC
Output Type	Form A (SPST-NO)
Peak Voltage	30VDC / 256VAC
AC Frequency	47–63 Hz
ON Voltage Drop	N/A
Max Current	2A/point 5A/common
Max Leakage Current	0.1 mA @ 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 (included)	Removable
Status Indicators	Logic side
Weight	9.1 oz. (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 $294.00

Outputs per Module	8 relays
Commons per Module	8 (isolated)
Operating Voltage	12–30 VDC/ 12–125 VAC *125–250 VAC
Output Type	4, Form C (SPST) 4, Form A (SPST-NO)
Peak Voltage	30VDC/ 250VAC @ 10A
AC Frequency	47–63 Hz
ON Voltage Drop	N/A
Max Current (Resistive)	10A/point 40A/module
Max Leakage Current	N/A
Max Inrush Current	10A
Minimum Load	100mA @ 12VDC
Base Power Required 5V	575mA max
External DC Required	None
OFF to ON Response	7ms
ON to OFF Response	9ms
Terminal Type (included)	Removable
Status Indicators	Logic side
Weight	13.2 oz. (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
0.05A	>50M		

See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.

CAUTION: the ZIPLink wiring system is rated at 2 Amps per I/O point and 4 Amps per common, therefore the F4-08TRS-1 relay outputs are derated to 2 Amps per point and 4 Amps per common when used with the ZIPLink wiring system.

Relay Output Modules

F4-08TRS-2 Relay Output $333.00

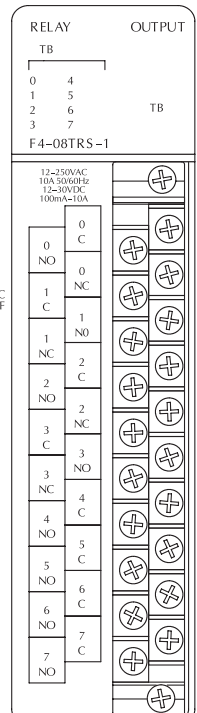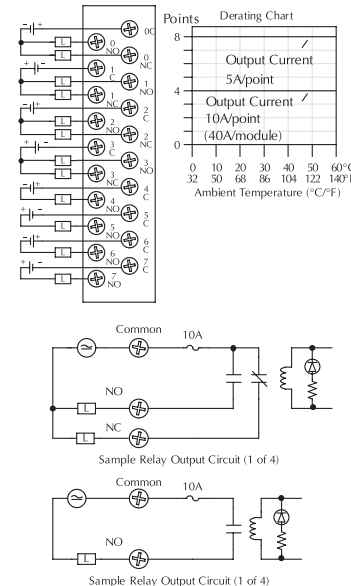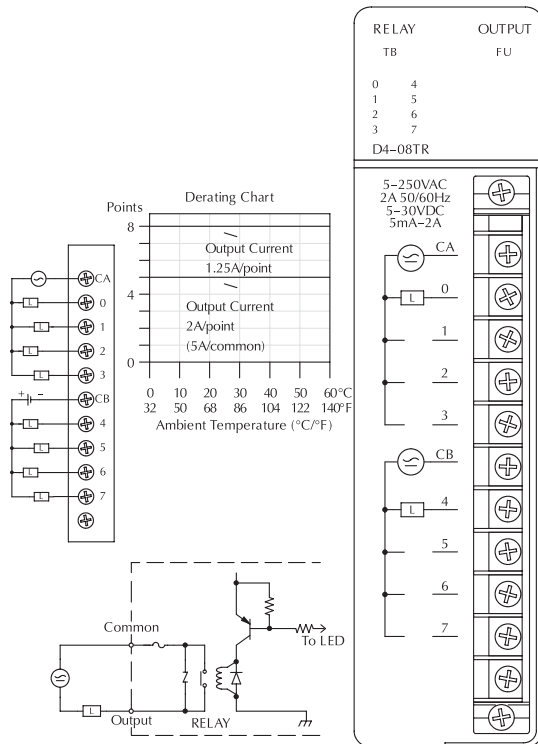|	
Outputs per Module	8 relays
Commons per Module	8 (isolated)
Operating Voltage	12–30 VDC/ 12–250 VAC
Output Type	4, Form C (SPDT) 4, Form A (SPST-NO)
Peak Voltage	30VDC/ 250VAC @ 5A
AC Frequency	47–63 Hz
ON Voltage Drop	N/A
Max Current (Resistive)	5A/point 40A/module
Max Leakage Current	N/A
Max Inrush 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 (included)	Removable
Status Indicators	Logic side
Weight	13.8 oz. (390g)
Fuses 19379-K- Wickman	1 (10A 250V) per common User replaceable
Replacement Fuse	D4-FUSE-2	$23.00

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
5.0 A	200K	100K	
3.0 A	325K	125K	50K
0.05 A	>50M		

See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.

CAUTION: the ZIPLink wiring system is rated at 2 Amps per I/O point and 4 Amps per common, therefore the F4-08TRS-2 relay outputs are derated to 2 Amps per point and 4 Amps per common when used with the ZIPLink wiring system.

D4-16TR Relay Output $300.00

Outputs per Module	16 relays
Commons per Module	2 (isolated)
Operating Voltage	5–30 VDC/ 5–250 VAC
Output Type	Form A (SPST-NO)
Peak Voltage	30VDC/ 250VAC
AC Frequency	47–63 Hz
ON Voltage Drop	N/A
Max Current (Resistive)	1A/point 5A/common
Max Leakage Current	0.1 mA @ 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 (included)	Removable
Status Indicators	Logic side
Weight	10.9 oz. (310g)
Fuses	1 (8A) per common (Non-replaceable)

See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.

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
0.5 A resistive	>2M	800K	500K
0.5 A inductive	>1M	300K	200K

CAUTION: the ZIPLink wiring system is rated at 2 Amps per I/O point and 4 Amps per common, therefore the D4-16TR relay is derated to 4 Amps per common when used with the ZIPLink wiring system.
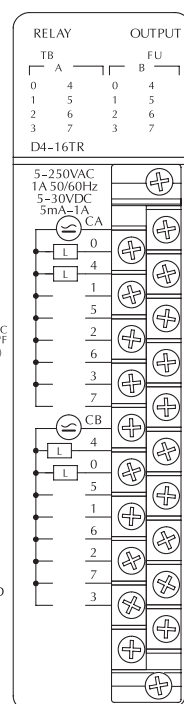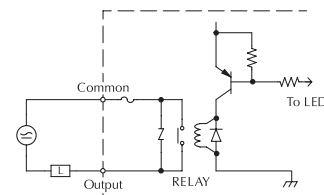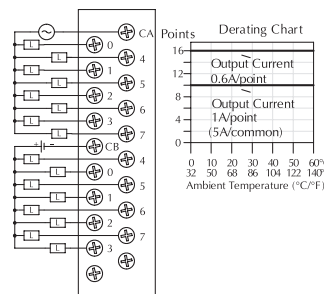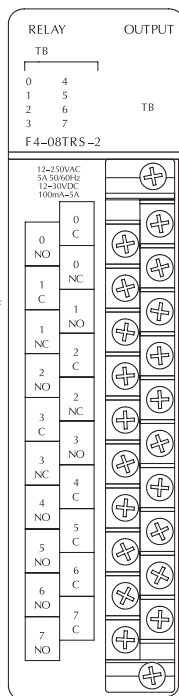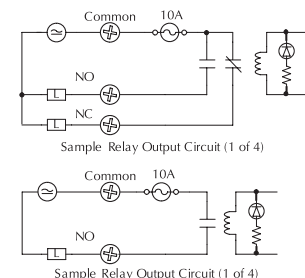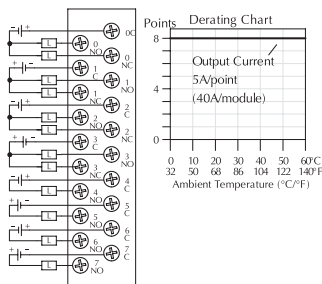
Analog Input Modules

F4-04AD 4-Channel Analog Input $760.00

|	
Number of Channels	4
Input Type	Single-ended or differential Voltage or current
Input Ranges	0–5 V, 0–10 V, 1–5 V, ±5V, ±10V 0–20 mA, 4–20 mA
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
Terminal Type (included)	Removable
Base Power Required 5V	150 mA
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

See Wiring Solutions for part numbers of
*ZIP*Link cables and connection modules
compatible with this I/O module.
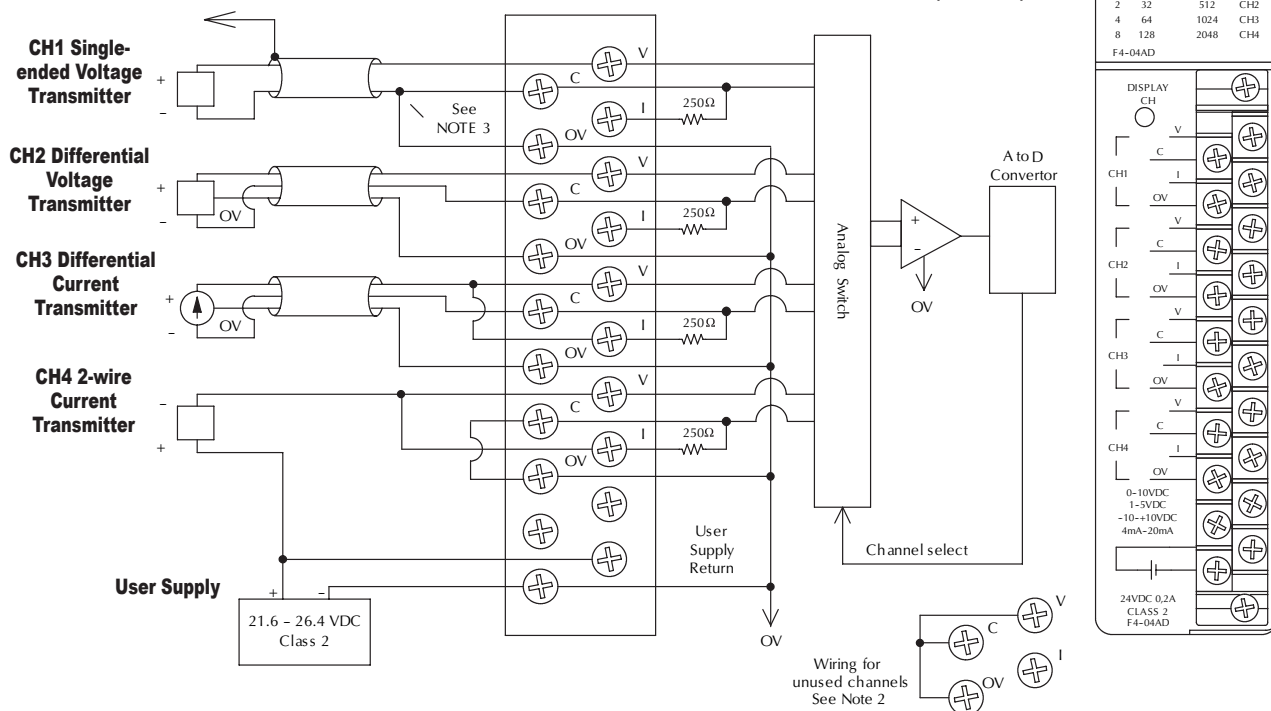
Analog Input Modules

F4-04ADS $1,092.00 4-Channel Isolated Analog Inpu

Number of Channels	4
Input Ranges	0–5 V, 0–10 V, 1–5 V, ±5V, ±10V 0–20 mA, 4–20 mA
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 200kq voltage point
Absolute Maximum Ratings	-45mA to + 45mA, current input ± 100V voltage input
Conversion Time	1ms per selected channel
Linearity Error: unipolar bipolar	± 1 count (0.025% of full scale) max. ± 2 counts (0.025% of full scale) max.
Full Scale Calibraton Error	± 8 counts maximum (Vin = 20mA)
Offset Calibration Error	± 8 counts maximum (Vin = 4mA)

See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.

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/°C maximum full scale (including maximum offset)
Terminal Type (included)	Removable
Base Power Required 5V	370mA
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	±100ppm /°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
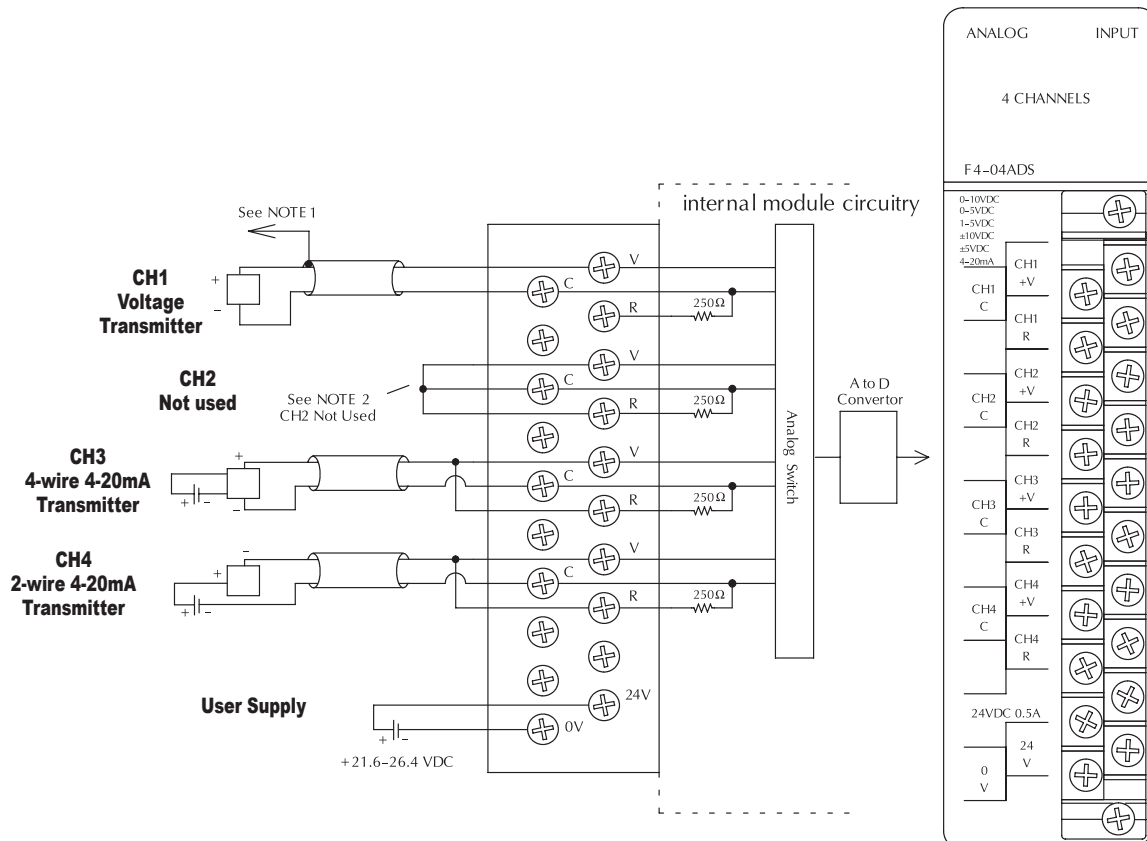
Analog Input Modules

F4-08AD 8-Channel Analog Input $956.00

Number of Channels	8, single ended (one common)
Input Ranges	0–5 V, 0–10 V, 1–5 V, ±5V, ±10V 0–20 mA, 4–20 mA
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 1MΩ 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
Terminal Type (included)	Removable
External Power Supply	18–30 VDC, 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.

See Wiring Solutions for part numbers of
*ZIP*Link cables and connection modules
compatible with this I/O module.

Analog Input Modules

F4-16AD-1 $1,054.00 16-Channel Analog Current Input	
Number of Channels	16, single ended (one common)
Input Ranges	0–20 mA, 4–20 mA
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
Terminal Type (included)	Removable
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	± 50ppm /°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).
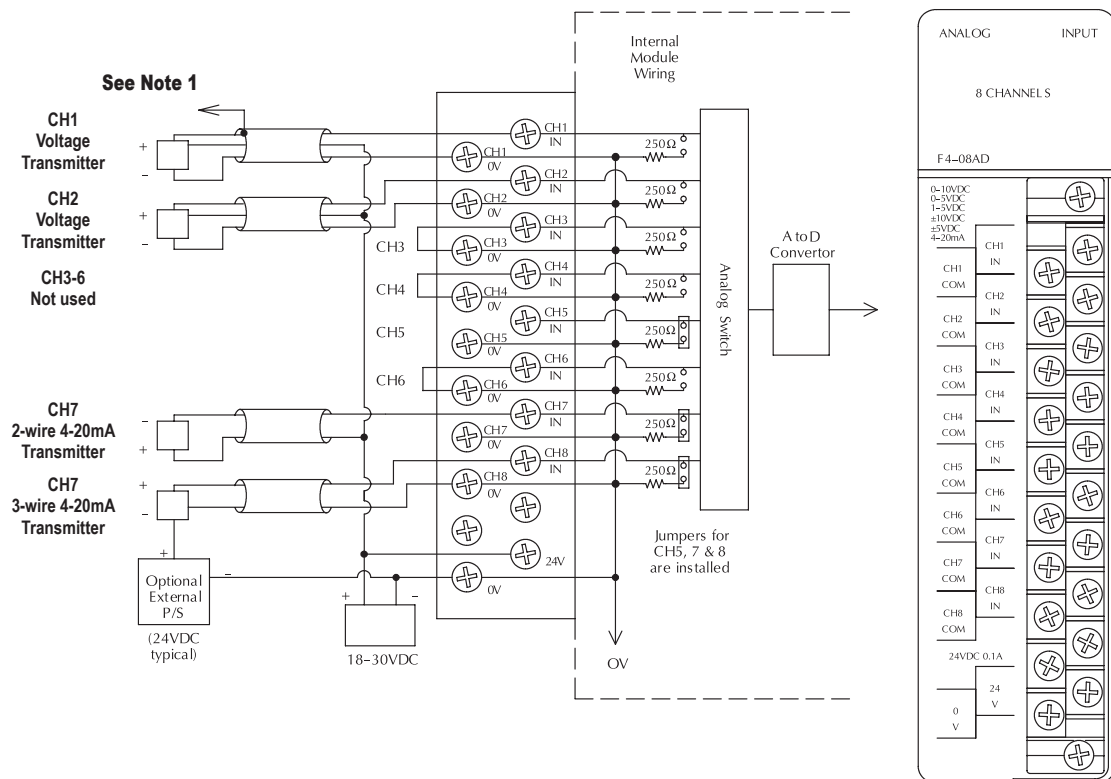NOTE 1: Shields should be grounded at the signal source.
   A Series 217, 0.032A, fast-acting fuse is recommended for 4-20 mA current loops.
   If the power supply common of an external power supply is not connected to 0VDC on the module, then the output of the external transmitter must be isolated.
   To avoid "ground loop" errors, recommended 4-20 mA transmitter types are:
      2 or 3 wire: Isolation between input signal and power supply.
      4 wire: Isolation between input signal, power supply and 4-20 mA output.

See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.

Analog Input Modules

F4-16AD-2 $1,102.00 16-Channel Analog Voltage Input	
Number of Channels	16, single ended (one common)
Input Ranges	0–5 V, 0–10 V,
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	1Mq minimum
Absolute Maximum Ratings	130VAC/100VDC,
Conversion Time	0.4 ms per channel (module conversion) 2ms 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
Terminal Type (included)	Removable
External Power Supply	21.6–26.4 VDC, 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

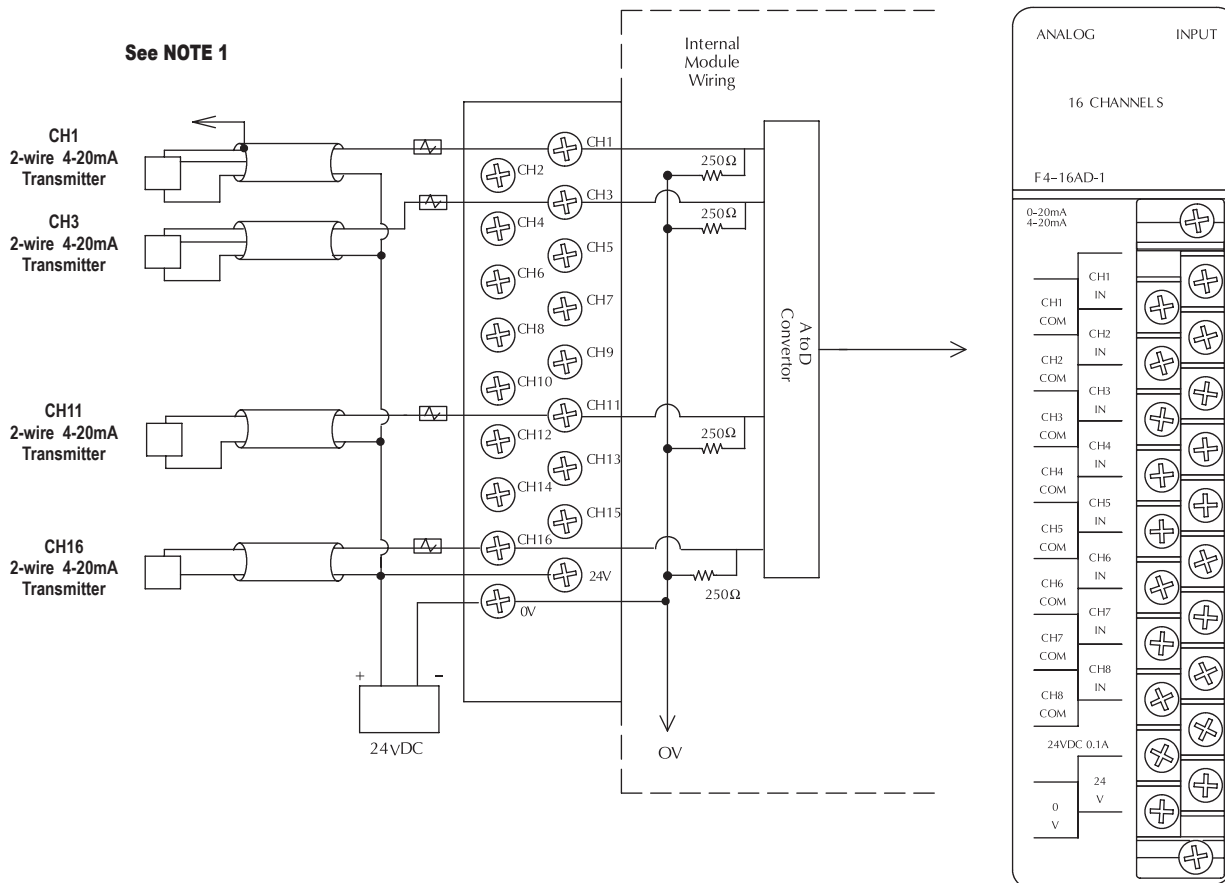**One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).**
NOTE 1: Shields should be grounded at the signal source.
   More than one external power supply can be used (see channel 8)
   If the power supply common of an external power supply is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

See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.
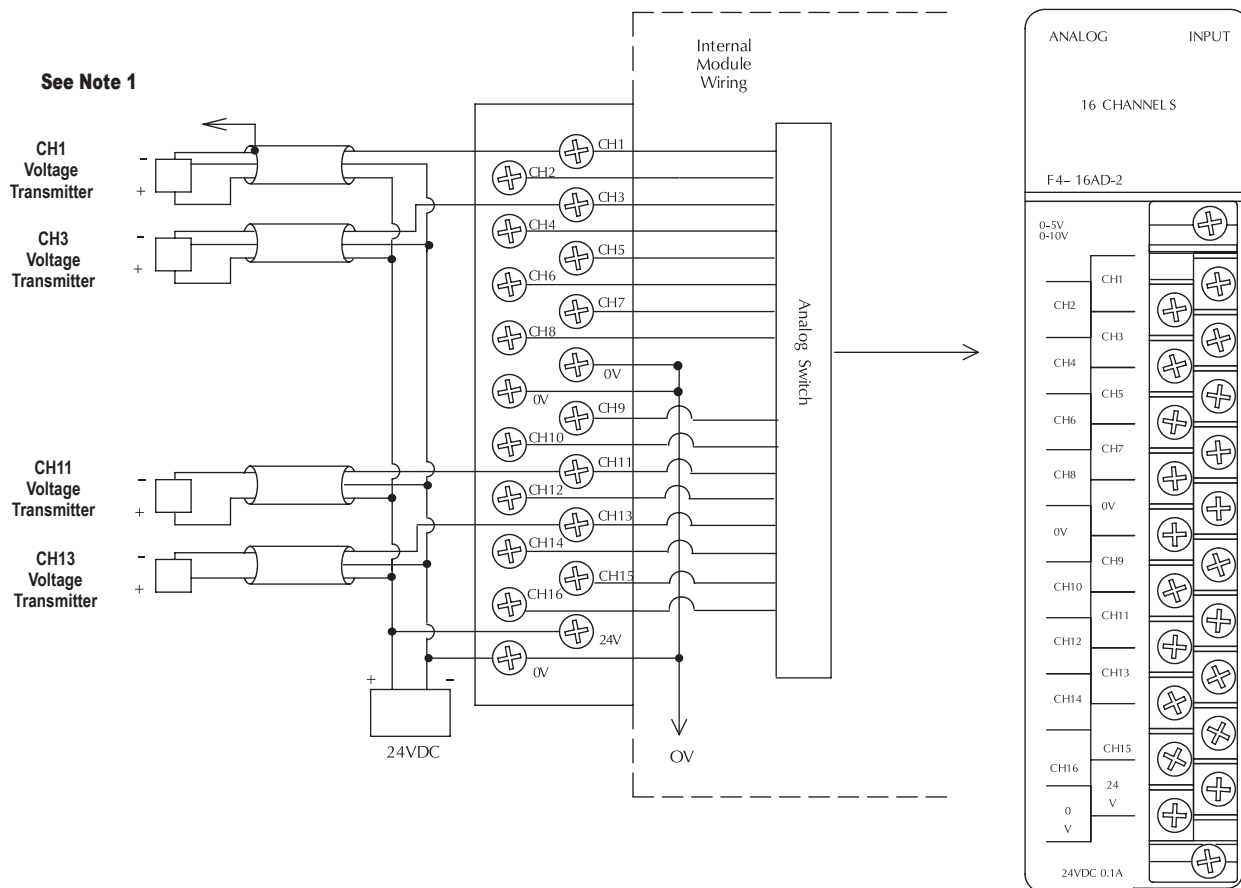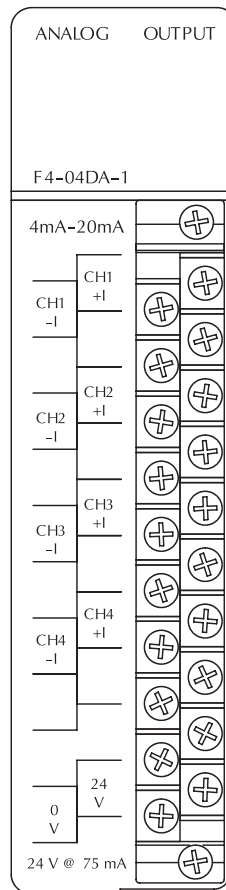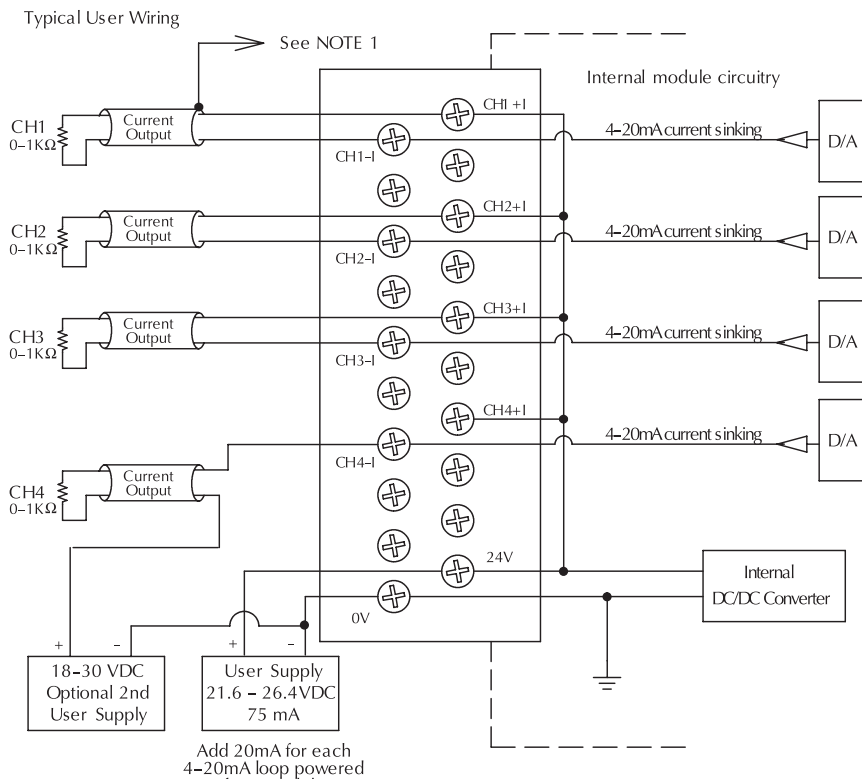
Analog Output Modules

F4-04DA-1 $644.00 4-Channel Analog Current Output	
Number of Channels	4, single-ended (one common)
Output Range	4–20 mA current
Resolution	12 bit (1 to 4095)
Output Type	Outputs sink 4–20 mA from external supply
External Load Resistance	0q minimum
Maximum Loop Supply	30VDC
Peak Output Voltage	40VDC (clamped, transient suppressor)
Maximum Load/Power Supply	620q/18V, 910q/24V, 1200q/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 2.0 ms 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	21.6–26.4 VDC, 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)

See Wiring Solutions for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.

Analog Output Modules

F4-04DA-2 4-Channel Analog Voltage Output $705.00	
Number of Channels	4, single ended (one common)
Output Ranges	0–5 V, 0–10 V, ±5V, ±10V
Channels Individually Configurable	Yes
Resolution	12-bit (1 to 4,095)
Load Impedance	2kq minimum
Load Capacitance	0.01 μF maximum
Voltage Output Current	5.0 mA sink or source
Short-circuit Current	15mA typical
Linearity Error (End to End) and Relative Accuracy	± 1 count (±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 2.0 ms 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	90mA
Terminal Type (included)	Removable
External Power Supply	21.6–26.4 VDC, 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)

See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.
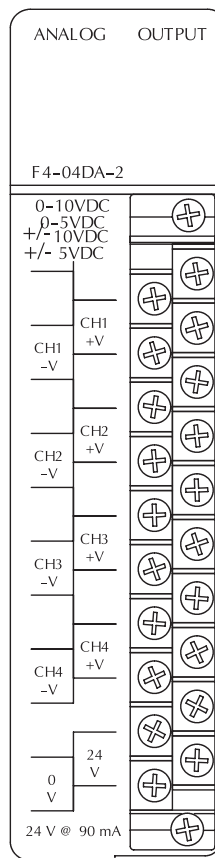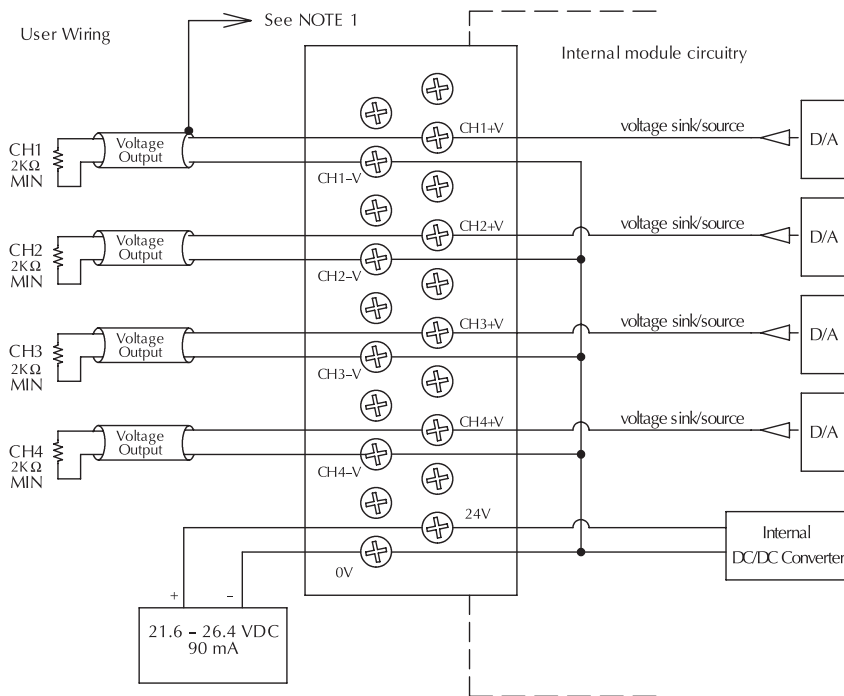
Analog Output Modules

F4-08DA-1 $1,048.00
8-Channel Analog Current Output
F4-16DA-1 $1,265.00
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	4–20 mA current
Resolution	12 bit (1 to 4095)
Output Type	Outputs sink 4–20 mA from external supply
Peak Output Voltage	40VDC (no transient voltage suppression)
External Load Resistance	0–480q @ 18V, 220–740 q @ 24V, 1550–1760 q @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. (20.0 mA at 25°C)
Offset Calibration Error	± 3 counts max. (4.0 mA 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	F4-08DA-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
Terminal Type (included)	Removable
External Power Supply	21.6–26.4 VDC, 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)

See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.
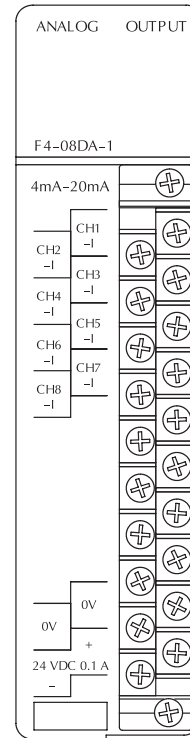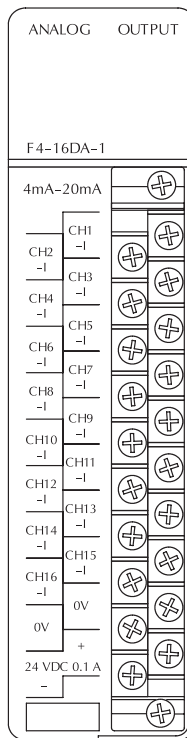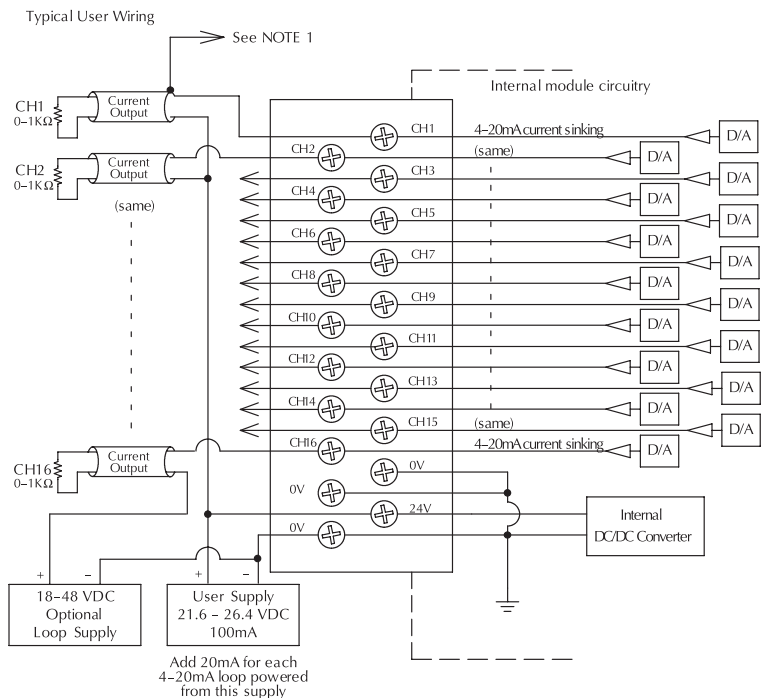
Analog Output Modules

F4-08DA-2 8-Channel Analog Voltage Output $1,067.00 F4-16DA-2 16-Channel Analog Voltage Output $1,286.00	
Number of Channels **F4-08DA-2** **F4-16DA-2**	8, single ended (one common) 16, single ended (one common)
Output Range	0–5 VDC, 0-10 VDC
Resolution	12 bit (1 to 4095)
Output Type	Voltage Sourcing 10mA max.
External Load Resistance	1kq max./10kq min. (example: 10volts@ 1kq = 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)
Terminal Type (included)	Removable
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.

See Wiring Solutions for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.

Typical User Wiring
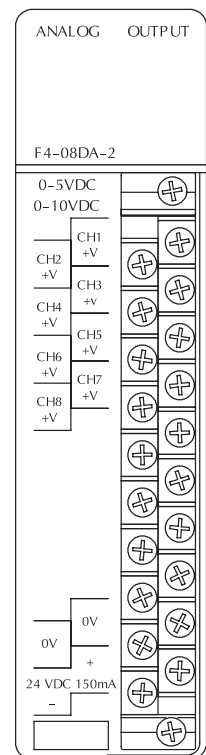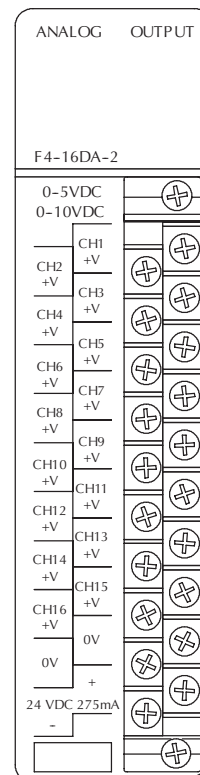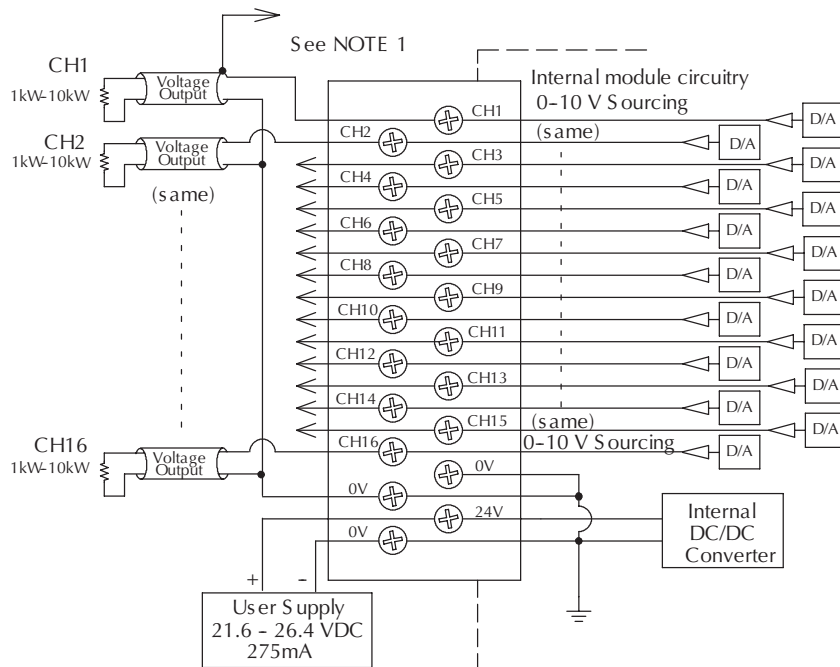
Analog Output Modules

F4-04DAS-1 4-Ch. 4-20mA Isolated Analog Out $986.00	
Number of Channels	4, isolated current sourcing
Output Range	4–20 mA current
Resolution	16 bit (1 to 65536)
Output Type	Outputs source 4–20 mA from external supply
Isolation Voltage	±750V continuous, channel to channel, channel to logic
Loop Supply	12–32 VDC
Output Loop Compliance	Vin - 2.5 V
Load Impedance	0–1375 q (@ 32V)
Maximum Load/Power Supply	375q/12V, 975q/24V, 1375q/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

Terminal Type (included)	Removable
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

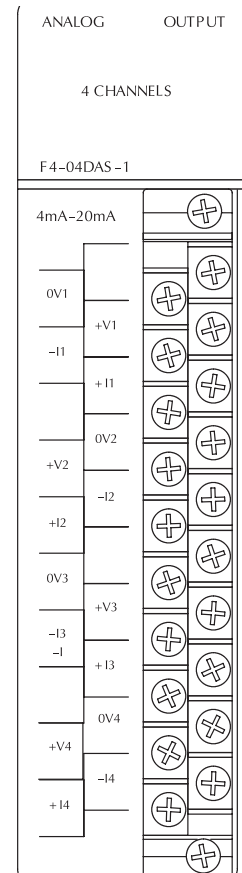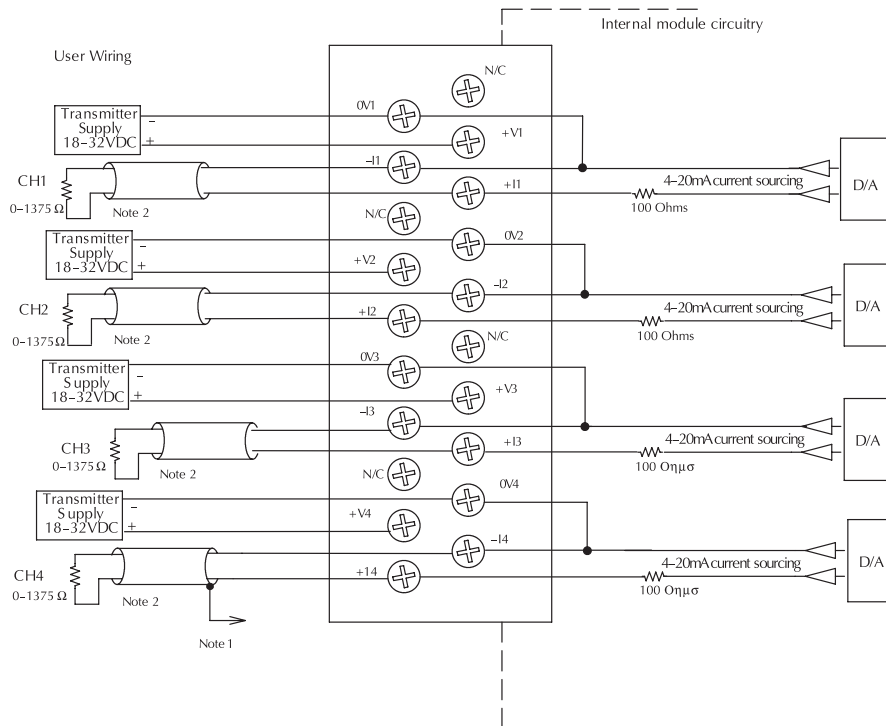One count in the specification table is equal to one least significant bit of the analog data value (1 in 65536).
NOTE 1: Shields should be connected to the 0V.
NOTE 2: Load must be within compliance voltage.
NOTE 3: For non-isolated outputs, connect all 0V's together (0V1…0V4) and connect all +V's together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

See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.

Temperature Input Modules

F4-08THM 8-Channel Thermocouple Input $1,096.00		
General Specifications		**Thermocouple Specifications**
Number of Channels	8, differential	**Input Ranges***	Type J -190 to 760°C -310 to 1400°F Type E -210 to 1000°C -346 to 1832°F 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 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
Common Mode Range	± 5VDC		
Common Mode Rejection	90dB min. @ DC, 150dB min. @ 50/60Hz.		
Input Impedance	1MΩ		
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	**Warm-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
Terminal Type (included)	Removable		
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**	0–5 V, ± 5V, 0–156.25 mV, ± 156.25 mVDC
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 NOTE 3: This module is not compatible with the *ZIP*Link wiring system.	

Thermocouple Input Wiring Diagram
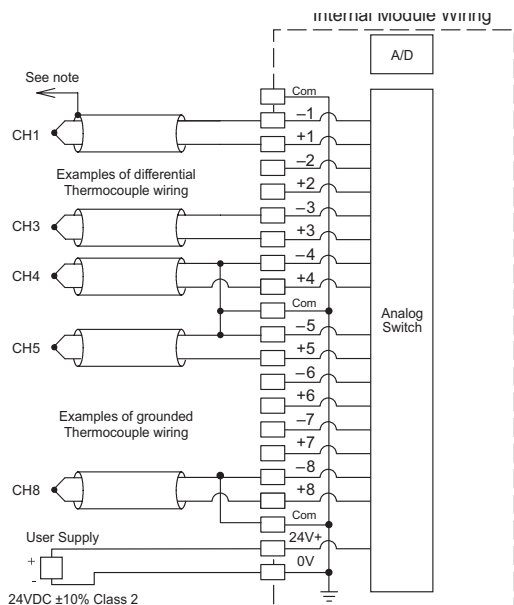
Voltage Input Wiring Diagram
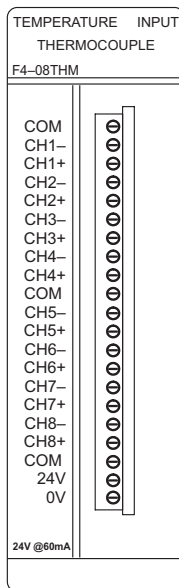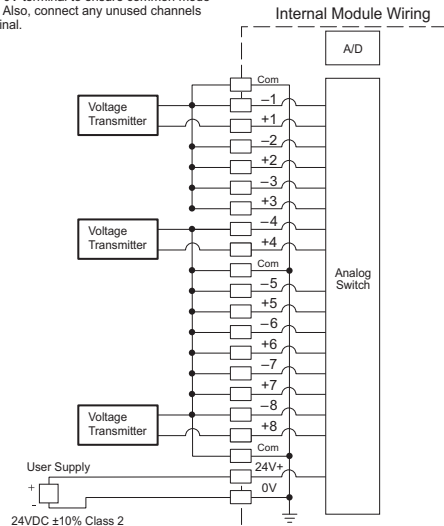
Temperature Input Modules

F4-08THM-J-n 8-Channel Thermocouple Input $1,144.00

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.**

Number of channels	8, differential inputs
Input Ranges	Type J -210/760°C, -350/1390°F
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 J
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
Terminal Type (included)	Non-removable
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)
Note 3: This module is not compatible with the *ZIP*Link wiring system.

Internal Module Wiring
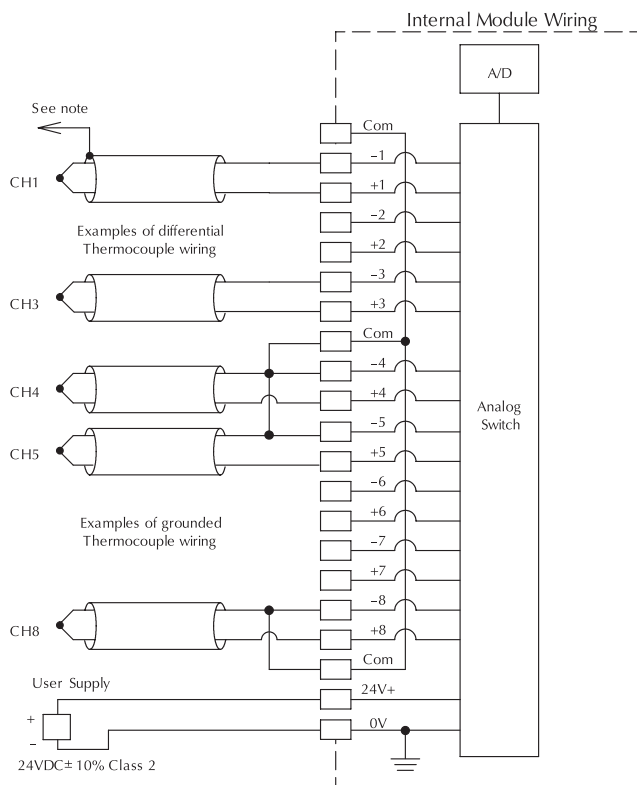
*Max. Inaccuracy is not guaranteed for temperatures lower than: -200°C for type J
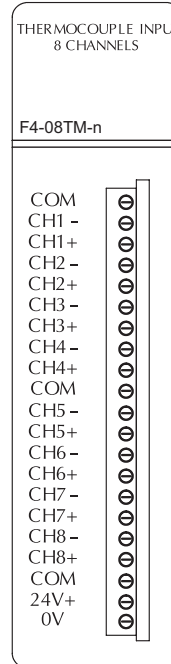
Temperature Input Modules

F4-08RTD 8-Channel RTD Input $867.00	
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	27kΩ
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	100 msec (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
Terminal Type (included)	Removable
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.
3. This module is not compatible with the ZIPLink wiring system.
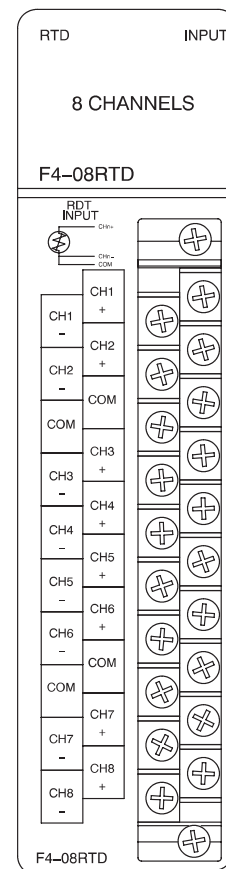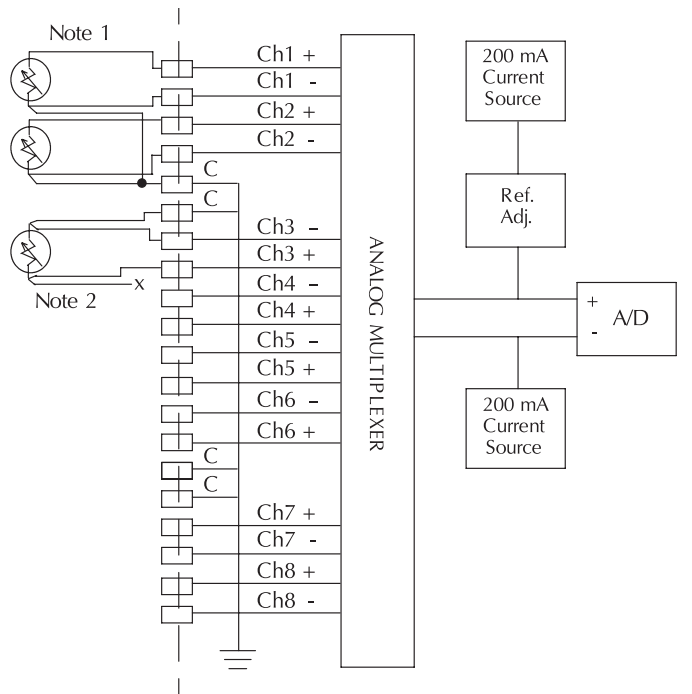
Instruction Set

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)
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)
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)
Logically ORs a normally open bit of word contact in parallel with another contact in a rung.

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

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

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

Out Bit of Word (OUTB)
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)
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)
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)
Leading edge triggered one-shot contact. When the corresponding memory location transitions from low to high, the contact comes on for one CPU scan.

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

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

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

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

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

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)
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)
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)
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)
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 & Output Load (LD)

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)
Loads a real number contained in two consecutive V-memory locations or an 8-digit constant into the accumulator.

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

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

Load Accumulator indexed (LDX)
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)
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)
Outputs a specified number of bits (1-32) from the accumulator to the specified discrete memory locations.

Out Least (OUTL)
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)
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)
Only Logically ANDs the value in the accumulator and a specified range of discrete memory bits (1-32).

And with Stack (ANDs)
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)
Only Logically ORs the value in the accumulator with a range of discrete bits (1-32).

Or with Stack (ORs)
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)
Performs an exclusive or of the value in the accumulator and a range of discrete bits (1-32).

Exclusive Or with Stack (XORs)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
Multiplies the 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)
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)
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)
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)
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)
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)
Only Converts a ta ble of ASCII values to a table of hexadecimal values.

HEX to ASCII (HTA)
OOnly 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)
Converts a 16 bit GRAY code value in the accumulator to a corresponding BCD value. The result resides in the accumulator.

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

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

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

Radian Real Conversion (RADR)
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)
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)
Takes the square root of the real number stored in the accumulator. The result resides in the accumulator.

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

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

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

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

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

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

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)
Sets a single bit (to a 1) in a V-memory location.

Reset Bit (RSTBIT)
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)
Finds a value in a V-memory table and returns the table position, containing the value, to the accumulator.

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

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

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

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

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

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

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

Move Block (MOVBLK)
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)
Copies data between V-memory and program ladder memory.

Program Control Instructions

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

For/Next (FOR/NEXT)
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)
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.

Client Line Set/Client 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)
Displays a V-memory value or a Data label constant to the handheld programmer or personal computer using DirectSOFT.

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

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

Clock/Calendar Instructions

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

Time (TIME)
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)
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 Client device to a Server 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)
Converge stages are a group of stages that when all stages are active the associated converge jump(s) (CVJMP) will activate another stage(s). One scan after the CVJMP is executed, the converge stages will be deactivated.

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

Block Call/Block/Block End (BCALL w/BLK and BEND)
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)
Time driven drum with up to 16 steps and 16 discrete output points. Output status is written to the appropriate output during each step. Specify a time base per count (in milliseconds). Each step can have a different number of counts to trigger the transition to the next step. Also define preset step as destination when reset occurs.

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

Time & Event Drum with Discrete Outputs and Output Mask (MDRMD)
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)
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.

Here are some of the IBox Instructions Available

***The IBox instructions are available when using a
D4-454 CPU and DirectSOFT6.1 or later.***

Analog Scale 12 Bit BCD to BCD (ANSCL)
Scales a 12 bit BCD analog value (0-4095 BCD) into BCD engineering units.
Only works with unipolar unsigned raw values.

Analog Scale 12 Bit Binary to Binary (ANSCLB)
Scales a 12 bit binary analog value (0-4095 decimal) into Binary
engineering units. Only works with unipolar unsigned raw values.

Filter Over Time - BCD (FILTER)
Performs a first-order filter on the Raw Data on a defined time interval (BCD).

Filter Over Time - Binary (FILTERB)
Perform a first-order filter on the Raw Data on a defined time interval (binary).

Hi/Low Alarm - BCD (HILOAL)
Monitors a BCD value V memory location and sets four possible alarm states,
High-High, High, Low, and Low-Low.

Hi/Low Alarm - Binary (HILOALB)
Monitors a binary (decimal) value V memory location and sets four possible
alarm states, High-High, High, Low, and Low-Low.

IBox Instructions - Discrete Helper

Off Delay Timer - (OFFDTMR)
Delays the "turning off" of the Output parameter by the specified Off Delay
Time (in hundredths of a second).

On Delay Timer - (ONDTMR)
Delays the "turning on" of the Output parameter by the specified amount of
time (in hundredths of a second).

One Shot - (ONESHOT)
Turns on the given bit output parameter for one scan on an OFF to ON
transition.

Push On / Push Off Circuit (PONOFF)
Toggles an output state whenever its input power flow transitions from off to
on. Also known as a "flip-flop" circuit.

IBox Instructions - Memory

Move Single Word (MOVEW)
Moves (copies) a word to a memory location directly or indirectly via a pointer,
either as a HEX constant, from a memory location, or indirectly through a
pointer.

Move Double Word (MOVED)
Moves (copies) a double word to two consecutive memory locations directly
or indirectly via a pointer, either as a double HEX constant, from a double
memory location, or indirectly through a pointer to a double memory location.

IBox Instructions - Math

BCD to Real with Implied Decimal Point (BCDTOR)
Converts the given 4 digit WORD BCD value to a Real number, with the
implied number of decimal points (K0-K4).

**Double BCD to Real with Implied Decimal Point
(BCDTORD)**
Converts the given 8 digit DWORD BCD value to a Real number, given an
implied number of decimal points (K0-K8).

Math - BCD (MATHBCD)
Allows entry of complex mathematical expressions like in Visual Basic, Excel,
or C++ to do complex calculations, nesting parentheses up to 4 levels deep.
Every V-memory reference MUST be to a single word BCD formatted value.

Math - Binary (MATHBIN)
Allows entry of complex mathematical expressions like in Visual Basic, Excel,
or C++ to do complex calculations, nesting parentheses up to 4 levels deep.
Every V-memory reference MUST be to a single word binary formatted value.

Math - Real (MATHR)
Allows entry of complex mathematical expressions like in Visual Basic, Excel,
or C++ to do complex calculations, nesting parentheses up to 4 levels deep.
Every V-memory reference MUST be able to fit into a double word Real
formatted value.

**Real to BCD with Implied Decimal Point and Rounding
(RTOBCD)**
Converts the absolute value of the given Real number to a 4 digit BCD
number, compensating for an implied number of decimal points (K0-K4) and
performs rounding.

**Real to Double BCD with Implied Decimal Point and
Rounding (RTOBCDD)**
Converts the absolute value of the given Real number to an 8 digit
DWORDBCD number, compensating for an implied number of decimal points
(K0-K8) and performs rounding.

Square BCD (SQUARE)
Squares the given 4-digit WORD BCD number and writes it as an
8-digit DWORD BCD result.

Square Binary (SQUAREB)
Squares the given 16-bit WORD binary number and writes it as a
32-bit DWORD binary result.

Square Real (SQUARER)
Squares the given REAL DWORD number and writes it to a REAL DWORD
result.

Sum BCD Numbers (SUMBCD)
Sums a list of consecutive 4-digit WORD BCD numbers into an 8-digit DWORD
BCD result.

Sum Binary Numbers (SUMBIN)
Sums a list of consecutive 16-bit WORD binary numbers into an 32-bit DWORD
binary result.

Sum Real Numbers (SUMR)
Sums a list of consecutive Real DWORD numbers into a Real DWORD result.

IBox Instructions - Communications

ECOM100 Configuration (ECOM100)
Defines the common information for a specific ECOM100 module which is
used by the other ECOM100 IBoxes and resides at the top of the ladder/
stage program. If using more than one ECOM100 in a PLC system, a different
ECOM100 Configuration IBox must be used for each ECOM100 module that
utilizes ECOM IBox instructions.

ECOM100 Disable DHCP (ECDHCPD)
Commands the ECOM100 to use its internal TCP/IP settings.

ECOM100 Enable DHCP (ECDHCPE)
Commands the ECOM100 to obtain its TCP/IP settings from a DHCP server.

ECOM100 Query DHCP Setting (ECDHCPQ)
Determines if DHCP is enabled in the ECOM100.

ECOM100 Send E-mail (ECEMAIL)
Allows the ECOM100 to behave as an EMail client to send an SMTP request
to the SMTP Server for sending the EMail messages to EMail addresses in the
To: field and Cc: list hard coded in the ECOM100. Messages are limited to 100
characters for the entire instruction.

ECOM100 Restore Default E-mail Setup (ECEMRDS)
Restores the original EMail Setup data stored in the ECOM100 back to the
working copy based on the specified ECOM100#.

ECOM100 E-mail Setup (ECEMSUP)
Modifies the working copy of the EMail setup currently in the ECOM100 based
on the specified ECOM100#. You may pick and choose any or all fields to be
modified using this instruction.

ECOM100 IP Setup (ECIPSUP)
Configures the three TCP/IP parameters in the ECOM100: IP Address, Subnet
Mask and Gateway Address.

ECOM100 Read Description (ECRDDES)
Reads the ECOM100's Description field up to the number of specified
characters.

ECOM100 Read Gateway Address (ECRDGWA)
Reads the ECOM100's Gateway address and stores it in 4 consecutive V
memory locations in decimal format.

ECOM100 Read IP Address (ECRDIP)
Reads the ECOM100's IP address and stores it 4 consecutive V memory
locations in decimal format.

ECOM100 Read Module ID (ECRDMID)
Reads the ECOM100's binary (decimal) WORD sized Module ID and stores it
in V memory.

ECOM100 Read Module Name (ECRDNAM)
Reads the ECOM100's Module Name up to the number of specified characters
and stores it in V memory.

ECOM100 Read Subnet Mask (ECRDSNM)
Reads the ECOM100's Subnet Mask address and stores it 4 consecutive V
memory locations in decimal format.

ECOM100 Write Description (ECWRDES)
Writes the specified Description to the ECOM100 module.

ECOM100 Write Gateway Address (ECWRGWA)
Writes the specified Gateway IP Address to the ECOM100 module.

ECOM100 Write IP Address (ECWRIP)
Writes the specified IP Address to the ECOM100 module.

ECOM100 Write Module ID (ECWRMID)
Writes the specified Module ID to the ECOM100 module.

ECOM100 Write Name (ECWRNAM)
Writes the specified Name to the ECOM100 module.

ECOM100 Write Subnet Mask (ECWRSNM)
Writes the specified Subnet Mask to the ECOM100 module.

ECOM100 RX Network Read (ECRX)
Performs the RX instruction with built-in interlocking with all other ECOM100
RX (ECRX) and ECOM100 WX (ECWX) IBoxes in your program to simplify
communications networking.

ECOM100 WX Network Write (ECWX)
Performs the WX instruction with built-in interlocking with all other ECOM100
RX (ECRX) and ECOM100 WX (ECWX) IBoxes in your program to simplify
communications networking.

NETCFG Network Configuration (NETCFG)
Defines all the common information necessary for performing RX/WX
Networking using the NETRX and NETWX IBox instructions via a local CPU
serial port, DCM or ECOM module.

Network RX Read (NETRX)
Performs the RX instruction with built-in interlocking with all other Network
RX (NETRX) and Network WX (NETWX) IBoxes in your program to simplify
communications networking.

Network WX Read (NETWX)
Performs the WX instruction with built-in interlocking with all other Network
RX (NETRX) and Network WX (NETWX) IBoxes in your program to simplify
communications networking.

IBox Instructions - Counter I/O

CTRIO Configuration (CTRIO)
Defines the common information for a specific CTRIO module which is used
by the other CTRIO IBox instructions and resides at the top of the ladder/stage
program. If using more than one CTRIO module in a PLC system, a different
CTRIO Configuration IBox must be used for each CTRIO module that utilizes
CTRIO IBox instructions.

CTRIO Add Entry to End of Preset Table (CTRADPT)
Appends an entry to the end of a memory based Preset Table on a
specific CTRIO Output resource. Will take more than 1 PLC scan
to execute.

CTRIO Clear Preset Table (CTRCLRT)
Clears the RAM based Preset Table on a leading edge transition to this IBox.
Will take more than 1 PLC scan to execute.

CTRIO Edit Preset Table Entry (CTREDPT)
Edits a single entry in a Preset Table on a specific CTRIO Output resource. Will
take more than 1 PLC scan to execute.

CTRIO Edit Preset Table Entry and Reload (CTREDRL)
Performs this dual operation to a CTRIO Output resource in one CTRIO
command. Will take more than 1 PLC scan to execute.

CTRIO Initialize Preset Table (CTRINPT)
Creates a single entry Preset Table in memory not as a file, on a specific CTRIO
Output resource. Will take more than 1 PLC scan to execute.

CTRIO Initialize Preset Table on Reset (CTRINTR)
Configures the initial Preset Table to be automatically loaded whenever the
Reset event occurs on a specific Output resource. Will take more than 1 PLC
scan to execute.

CTRIO Load Profile (CTRLDPR)
Loads a CTRIO Profile File to a CTRIO Output resource on a leading edge
transition to this IBox. Will take more than 1 PLC scan to execute.

CTRIO Read Error (CTRRDER)
Gets the decimal error code value from the CTRIO module and places it into
the specified Error Code register. Since the Error Code in the CTRIO is only
maintained until another CTRIO command is given, this instruction must be
used immediately after the CTRIO IBox that reports an error via its Error bit
parameter.

CTRIO Run to Limit Mode (CTRRTLM)
Loads the Run to Limit command and given parameters on a specific Output
resource. The CTRIO's Input(s) must be configured as Limit(s) for this function
to operate. Will take more than 1 PLC scan to execute.

CTRIO Run to Position Mode (CTRRTPM)
Loads the Run to Position command and given parameters on a specific
Output resource. Will take more than 1 PLC scan to execute.

CTRIO Velocity Mode (CTRVELO)
Loads the Velocity command and given parameters on a specific Output
resource. Will take more than 1 PLC scan to execute.

CTRIO Write File to ROM (CTRWFTR)
Writes the runtime changes made to a loaded CTRIO Preset Table back to
Flash ROM. Will take more than 1 PLC scan to execute.