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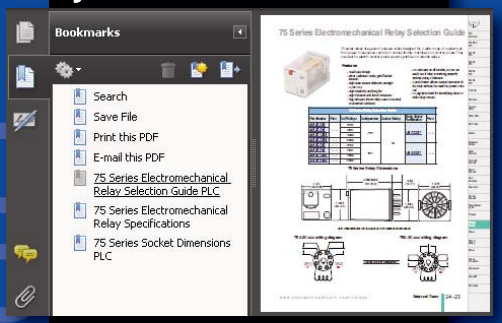


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Programmable Controllers



# The DL405: The BIG Small PLC


**Operator interface** connects to serial port on CPU

**F4-08RTD** 8 channels of RTD inputs

**D4-64ND2** 64-point DC inputs for high density

**H4-CTRIO** High-speed counter module for position control applications

**D4-DCM** RS232C/422 comm port

**H4-ECOM** 10MB Ethernet connection

**D4-16TD2** 16-point DC output

**F4-04DAS-1** Four channels of 16-bit current analog outputs

**D4-32TD2** 32-point DC output

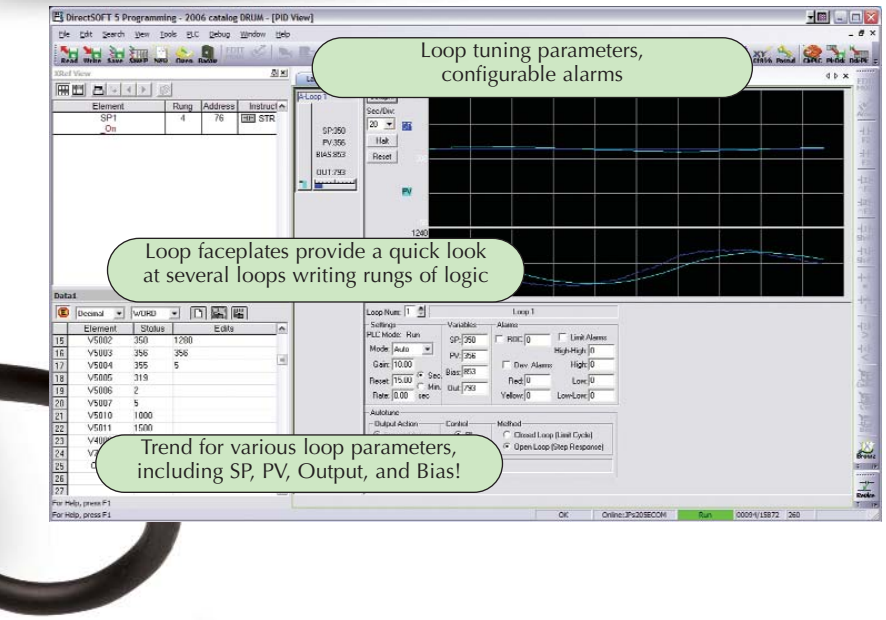
ZIPLINK™ AUTOMATIONDIRECT.com

**Discrete devices** Use our ***ZIP*Link** easy wiring system to save yourself time and money.

**Remote I/O** Up to seven additional bases of I/O connect to the bottom serial port on the D4-450 CPU

Remote I/O

**High-speed counting** The H4-CTRIO module ($325.00) offers both high-speed counting functions (up to 100 kHz max.) and pulse output functions (up to 25 kHz. max.), making it ideal for position speed monitoring and stepper control. It also includes four independently configurable high-speed isolated discrete outputs. An easy-to-use graphical configuration software allows you to configure the module for all of these capabilities.


## What is it?

The DL405 product line packs a lot of power for its size and price. It has the widest variety of I/O modules and configurations of all our PLCs.

## What's it got?

The DL405 has three CPUs from 6.5K memory to 30.8K memory with 16,384 possible I/O.

It also offers three base sizes with built-in power supply, including 12/24 VDC, 110/220 VAC and 125 VDC power.

The DL405 also features flexible I/O and communication modules, such as:

- AC/DC in/out, up to 64 points
- 10A relay out
- 12-bit and 16-bit analog inputs and outputs
- Thermocouple and RTD inputs
- Data communications, including serial and Ethernet modules
- High-speed counter input and pulse output
- Serial remote I/O master and slave modules
- Ethernet remote I/O master and slave base controllers
- Slice I/O master and slave modules

The D4-450, the most advanced CPU, offers an instruction set that includes drum sequencers, ASCII output, floating point math, trig functions, bit of word, timed and hardware-triggered subroutines, For/Next loops, immediate I/O, and more.

### Fill-in-the-blank PID

Many hard-to-use PLCs need a separate ladder program for each PID loop and functions such as ramp/soak, alarms, and loop scheduling. The D4-450 CPU makes it easy with:

- 16 table-configurable PID loops
- Automatic loop scheduling
- Charts for alarms and ramp/soak
- Programming software includes a loop tune screen with trending
- Auto-tuning allows the CPU to automatically determine the near-optimum loop settings

A real-time clock/calendar and historical error logging are also included with the D4-450 CPU.

## What can I do with it?

- Build a control system with local/distributed I/O of up to16,000 points
- Use the built-in PID instruction or specialty modules to perform cost-effective process control

***http://www.automationdirect.com/dl405***

# Flexible I/O Options

## One of the largest I/O selections available

I/O modules are typically the largest part of the cost of a PLC system. But we've got good news - the more I/O you use, the bigger your savings with AUTOMATIONDIRECT. For example, check out our 8-channel F4-08AD analog input module. It offers eight channels of analog inputs and supports 4-20 mA, 0-20 mA, 0-5V, 0-10V, 1-5V, ±5V, and ±10V (seven ranges) for the low price of $495.00. For high-density analog, check out our F4-16AD-1 module with 16 channels of current inputs for only $569.00..

## Isn't that special?

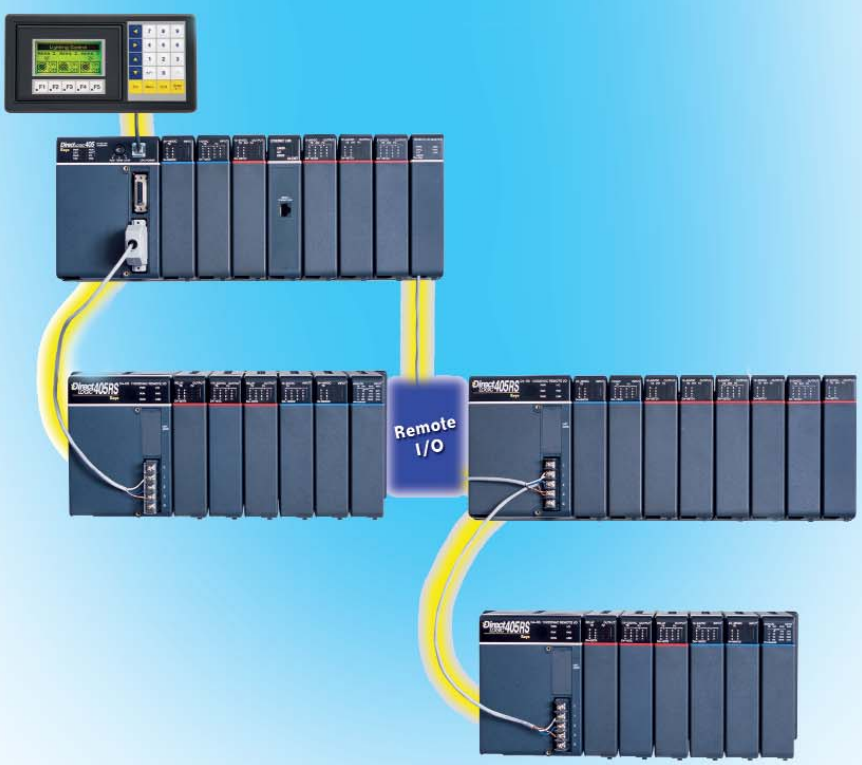
The DL405 family's instruction set covers most industrial applications, but there are times when a specialty module can make the programmer's job a lot easier. Check out our PID or temperature control modules for no-brainer process control, or the magnetic pulse module for flow and volume calculations. The BASIC CoProcessors let you create a custom program or communications interface in an easy-to-use language.


## Put I/O where you need it with flexible serial or Ethernet-based remote capabilities

The DL405 series has the widest range of choices for remote I/O of all the DirectLOGIC PLCs. So what are the possibilities? Here are a few:

For high-speed, easy-to-use remote I/O, use the Ethernet I/O option with the H4-ERM Ethernet Remote master module.

- H4-ERM ($229.00) Ethernet Remote Master module can connect up to four fully expanded DL405 Ethernet Slave bases (H4-EBC for $455.00), 16 DL205 Ethernet Slave bases (H2-EBC for $285.00) or 16 Terminator I/O Slave bases (T1H-EBC for $209.00). These products allow you to use commercially available Ethernet Category 5 cables, hubs and switches at up to 100 meters per segment, for an easy-to-implement Ethernet remote I/O system.
- Use the fiber-optic Ethernet Remote Master and Slave bases for noise immunity in harsh environments.
- Use our Ethernet Drive card (GS-EDRV) with an H4-ERM Ethernet Remote Master module to control and monitor all your drive parameters over Ethernet.




For a low-cost remote I/O solution, use one of our serial remote I/O options. It's even available from the bottom port of the D4-450 at no additional cost.

- D4-RM Remote I/O Master module connects to up to seven remote slave units located in DL405 or DL205 I/O bases, or Terminator I/O stations.
- Communication port on the D4-450 CPU connects to up to seven remote slave units located in DL405 or DL205 I/O bases, or Terminator I/O stations.

# DL405 Connects to Operator Interfaces and Networks

## Flexible communications

Local or remote communications, multi-drop, multi-panel, even multiple Ethernet networks are all available in the DL405 family. The D4-430 and D4-440 CPUs come with two built-in serial ports. The D4-450 CPU gives you four ports to play with, two of which are configurable for RS-422 to accommodate long distance communications or operator panels at baud rates up to 38.4K baud. Most of our serial ports support many protocols, including Modbus RTU (both Master and slave mode), *Direct*NET and K-sequence.

For simple data logging, **DataWorx** *(see Software section)* easily connects the DL205 via Ethernet to standalone PCs or network servers. Collect data without the need for special PC programming or any 3rd party HMI, SCADA, or DAQ software application.


## With Ethernet, talk is cheap!

Think about it. Would you really want to write and debug a 64K or 128K program with thousands of I/O? Just because memory's cheap doesn't mean you have to feel obligated to use it. Our Ethernet networking modules make it easy and inexpensive to create a "virtual PLC", communicating between smaller and more manageable applications running on multiple DL205 and DL405 systems.

## Off-the-shelf specifications

The H4-ECOM is a fully Ethernet-compatible device. It is available in standard 10BaseT or fiber optic connections and supports standard IP and IPX protocols. It's fully compatible with low-cost, off-the-shelf Ethernet PC cards, hubs and other devices that you can buy from your favorite computer store or discount catalog.

AUTOMATIONDIRECT.com

# If it's in your cabinet, it's in our catalog!

# Over 8,500 In-stock Quality Products

Starting with the enclosure, we carry everything you need to build an electrical control system, right down to the wire and tools. And we have the devices that go in the panel, such as logic controllers, HMI, drives, relays, and motor controls. If you're maintaining existing systems, we've got great prices on MRO parts such as circuit breakers, fuses, motors, pneumatics and pilot devices. In addition to our catalog all our products are available to **order 24/7 at www.automationdirect.com**

## Value Pricing

Our everyday prices on industrial control products are well below the list prices of more traditional automation companies because, with our direct business model and focus on high efficiency, AUTOMATIONDIRECT has the **lowest overhead in the industry.** We pass the savings on to you by offering high-quality products at low prices.

## FREE Award Winning Support

Almost 99% of AUTOMATIONDIRECT customers responding to surveys say they would recommend us to someone else, and they do! And we've been **voted tops in service by independent magazine surveys nine years running**.

## FREE & Fast Shipping*

The majority of our products are stocked for same-day shipping, when you place your order by 6 p.m. EST.

** Same day shipping with approved company credit or credit card. Free 2-day (transit) shipping for orders over $300; other expedited services extra. See Web site or catalog Terms and Conditions for all details and exceptions.*

# DL405 Family of Products

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

## CPUs

**D4-450** – 110/220 VAC P/S

**D4-450DC-1** – 24 VDC P/S

**D4-450DC-2** – 125 VDC P/S
30.8K total memory
(7.5K built-in flash program memory or use optional memory cartridge)

16 PID loops with auto-tune

**D4-440** – 110/220 VAC P/S
22.5K total memory
(memory cartridge required)

**D4-440DC-1** – 24 VDC P/S
22.5K total memory
(memory cartridge required)

**D4-440DC-2** – 125 VDC P/S
22.5K total memory
(memory cartridge required)

**D4-430** – 110/220 VAC P/S
6.5K total memory

## Memory cartridges

CMOS RAM - 7.5K (D4-RAM-1)

CMOS RAM - 15.5K (D4-RAM-2)

UVPROM - 7.5K (D4-UV-1)

UVPROM - 15.5K (D4-UV-2)

EEPROM - 15.5K (D4-EE-2)

## Programming

Handheld programmer (D4-HPP-1)

***Direct***SOFT Programming for Windows (PC-DSOFT5)

## 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)

24 VDC P/S (D4-EXDC)

125 VDC P/S (D4-EXDC-2)

## Discrete input modules

**DC input**

8-point 24-48 VDC (D4-08ND3S)

16-point 12-24 VDC (D4-16ND2)

16-point 12-24 VDC (1 ms response) (D4-16ND2F)

32-point 24 VDC (D4-32ND3-1)

32-point 5-12 VDC (D4-32ND3-2)

64-point 20-28 VDC (D4-64ND2)

**AC input modules**

8-point 110/220 VAC (D4-08NA)

16-point 110 VAC (D4-16NA)

**AC/DC input modules**

8-pt 90-150 VAC/DC (isolated) (F4-08NE3S)

16-pt 12-24 VAC/DC (D4-16NE3)

## Discrete output modules

**DC output modules**

8-point 12-24 VDC (D4-08TD1)

8-point 24-150 VDC (F4-08TD1S)

16-point 5-24 VDC (D4-16TD1)

16-point 12-24 VDC (D4-16TD2)

32-point 5-15 VDC D4-32TD1-1)

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)

## 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)

4-channel out, voltage (isolated) (F4-04DAS-2)

## Communications/ networking modules

Ethernet communications [H4-ECOM(-F) and H4-ECOM100]

Data communications (D4-DCM)

Modbus master (F4-MAS-MB)

## Specialty modules

8-point interrupt input (D4-INT)

High-speed counter I/O (H4-CTRIO)

High-speed counter (D4-HSC)

8-point magnetic pulse input (F4-8MPI)

16-loop PID (w/ software) (F4-16PID)

8/16 channel input simulator (D4-16SIM)

4-loop temperature controller (F4-4LTC)

**BASIC CoProcessor module**

128K triple port (F4-CP128-1)

## CPU-Slot slave controllers

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

## Remote I/O modules

**Ethernet**

Ethernet remote Master Module (H4-ERM(-F))

Ethernet base Controller (Slave) (H4-EBC(-F))

**Remote I/O protocol (serial)**

Remote I/O Master Module (D4-RM)

Remote I/O Slave 110/220VAC (D4-RS)

Remote I/O Slave 24VDC (D4-RSDC)

## Operator interface

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

## Connection systems

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

# DL405 CPUs

## System capacity

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

**How much memory do you need?** Consider both ladder memory and data registers (V-memory). For ladder memory, most boolean instructions require one word. Some other instructions, such as timers, counters, etc. require two or more words. Our V-memory locations are 16-bit words and are useful for data storage, etc.

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

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

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

## Performance

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

## Programming and diagnostics

Our CPUs offer a wide array of instructions and diagnostic features that can save you many hours of program and debug time. From basic boolean contact logic to PID and floating point math, we have it covered! For D4-450 CPUs, IBox programming instructions simplify complex tasks with instructions such as Memory, Discrete Helper, Analog Helper, Math, Communications, and CTRIO. The chart on the next page lists the instructions by category and identifies which CPUs support each group. Beginning on page 6-88, you will find a detailed list showing the name and function of each instruction.

## Built-in CPU communications

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

## Specialty I/O modules

In addition to our cost-effective discrete and analog I/O, we also offer specialty modules to solve the really tough applications. Our D4-430 and D4-440 only support specialty modules in the local base (CPU base). Our D4-450 CPU supports specialty modules in the local CPU base, but it can also support selected specialty modules in expansion bases if you use our D4-xxB-1 bases (xx is the number of slots). If you are considering a D4-450 CPU, there may be some restrictions on using speciality modules. See the chart on page 6-88 for complete information.

# DL405 CPU Comparisons

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

# D4-450 Key Features


## D4-450 CPU

The D4-450 provides all the capabilities of the D4-430 and D4-440 CPUs, plus several additional features such as *Direct*SOFT5 IBox instructions.

## Built-in CPU communications ports

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

### 16 PID loops

The D4-450 CPU can process up to 16 PID loops directly in the CPU. You can select from various control modes including automatic control, manual control, and cascade control. There are a wide variety of alarms including Process Variable, Rate of Change, and Deviation. The various loop operation parameters are stored in V-memory, which allows easy access from operator interfaces. Setup is accomplished with our *Direct*SOFT Programming Software. An overview of the various loop specifications and features is on page 6-13.

## Floating-point math

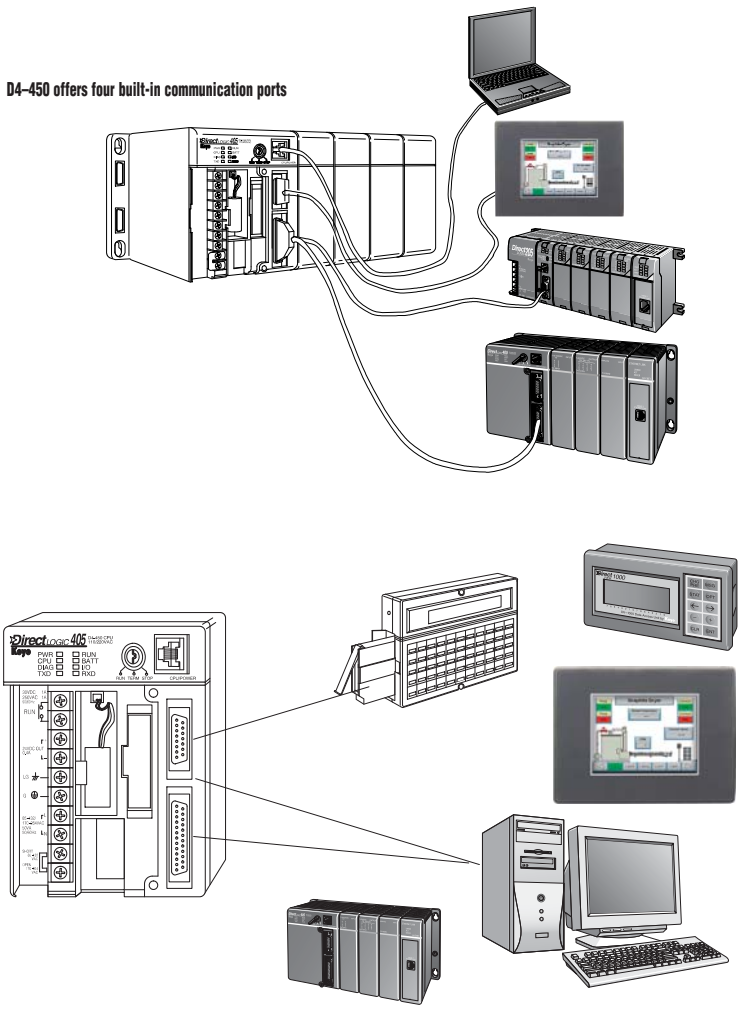
The D4-450 CPU supports IEEE format floating-point math calculations. This feature means the D4-450 includes full trigonometric functions and various forms of integer/floating point number conversions.

## Power supplies

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

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

D4-450 offers four built-in communication ports



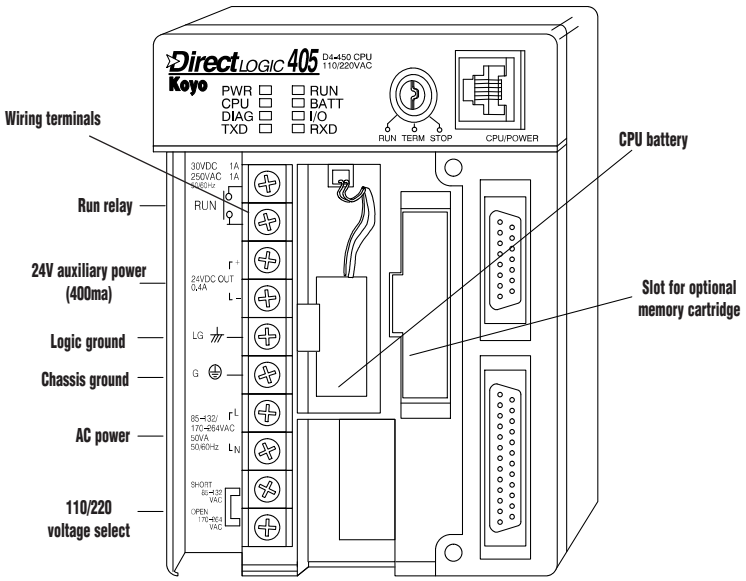
***Note: if you are considering a D4-450 CPU to replace a CPU in an existing system, and the system uses specialty modules with an F4 prefix, then these modules may require an upgrade to operate with the D4-450. Contact our Technical Services group prior to placing your order for more information. (This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

# D4-450 Features

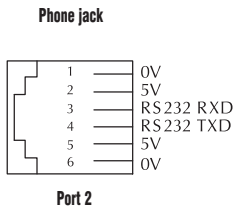
The diagrams on this page show the various hardware features found on the D4-450 CPU.

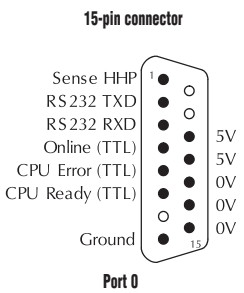
| CPU Keyswitch | | |
|---|---|---|
| ***RUN*** | Forces CPU to RUN mode. Locks Comm port - will not receive incoming data. | |
| ***TERM*** | Allows peripherals (HPP, DCM, *Direct*SOFT, etc.) to select operating mode | |
| ***STOP*** | Forces CPU out of RUN | |
| **CPU Status Indicators** | | |
| ***PWR***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

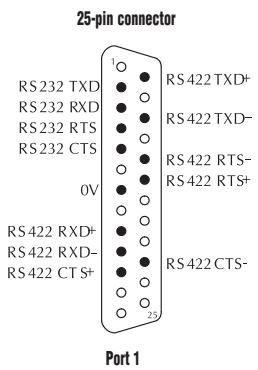
| *Protocol* | *Port 1* | *Port 3* |
|---|---|---|
| K-sequence | ✓ | ✓ |
| DirectNETMaster/Slave | ✓ | ✓ |
| Modbus Master/Slave | ✓ | ✓ |
| Remote I/O | n/a | ✓ |
| ASCII Out | ✓ | ✓ |

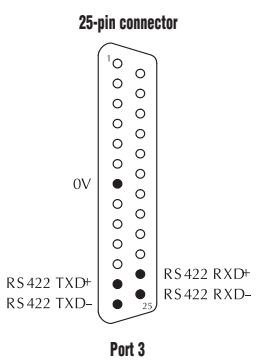



## D4-450 communications ports pin-out



# D4-450 Fixed or Variable Scan

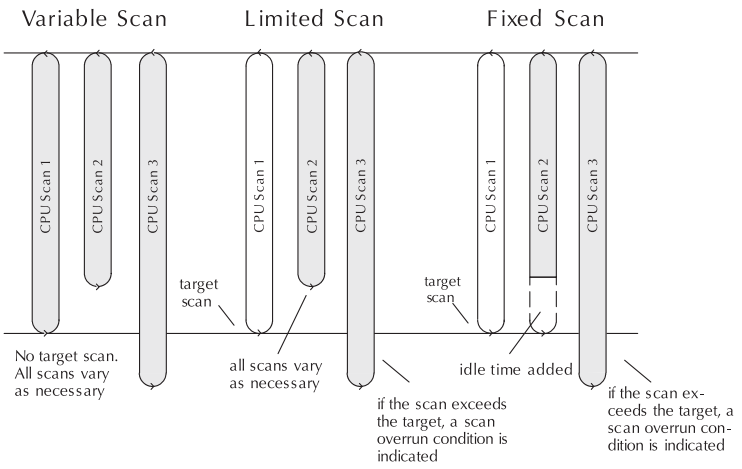
## D4-450 Scan control

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

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

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

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




### Memory

The D4-450 has 7.5K of flash memory on board. Upgrade to 15.5K by choosing an optional memory cartridge listed on page 6-14 . The memory cartridge is recommended since it is removable in the event of problems.

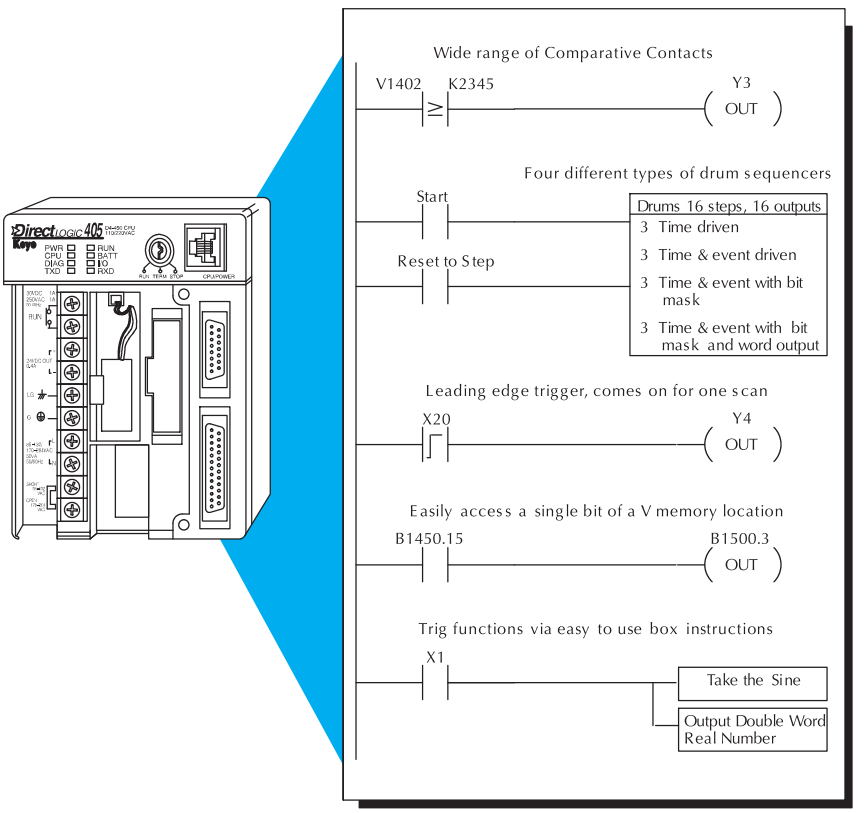
### Full array of instructions

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

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

- Four types of drum sequencers, each with 16 steps and up to 16 outputs
- Leading and trailing edge triggered one-shots
- Bit of word manipulation (bit set, reset, etc.)
- Trigonometric functions
- Floating point conversions
- ***Ibox*** instructions that simplify tasks such as configuring analog modules or performing complex math equations

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

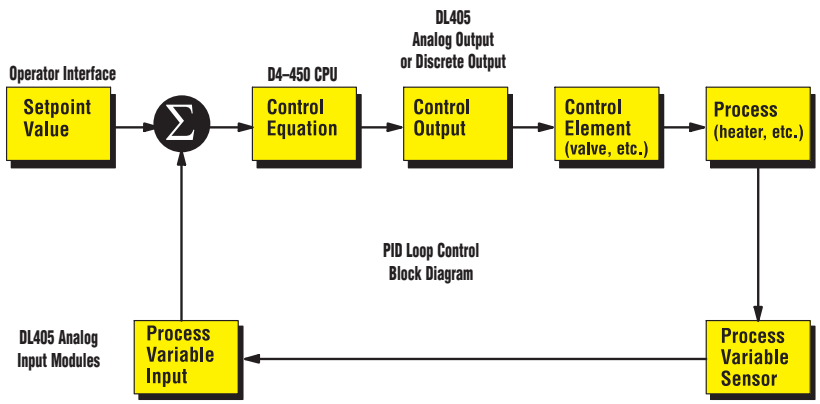



***Note: if you are considering a D4-450 CPU to replace a CPU in an existing system, and the system uses specialty modules with an F4 prefix, then these modules may require an upgrade to operate with the D4-450. Contact our Technical Services group prior to placing your order for more information. (This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

# D4-450 PID loops

| PID Loop Specifications and Key Features | |
|---|---|
| ***Number of Loops*** | Selectable, 16 maximum |
| ***CPU V-memory Required*** | 32 V-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. |

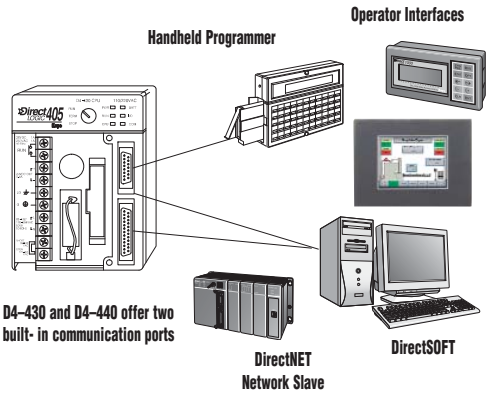
***Need Temperature Control?***
***If you're only interested in controlling temperature, then there may be a better solution than the D4-450 CPU. Check out the F4-4LTC module. This module has the capabilities of our single loop controllers built into one economical module! Detailed specifications can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



# D4-440/430 Key Features

## DL440 CPU

D4-440 <--->
D4-440DC-1 <--->
D4-440DC-2 <--->




## DL430 CPU

D4-430 <--->

## D4-440 CPU

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

### Instruction set

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

### Two built-in communication ports

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

### Range of power supplies

The D4-440 provides a wide range of power supply options:

- 110/220 VAC
- 24 VDC
- 125 VDC

## Memory cartridges

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

## D4-430 CPU

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

### Two built-in communication ports

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

### Built-in EEPROM memory

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

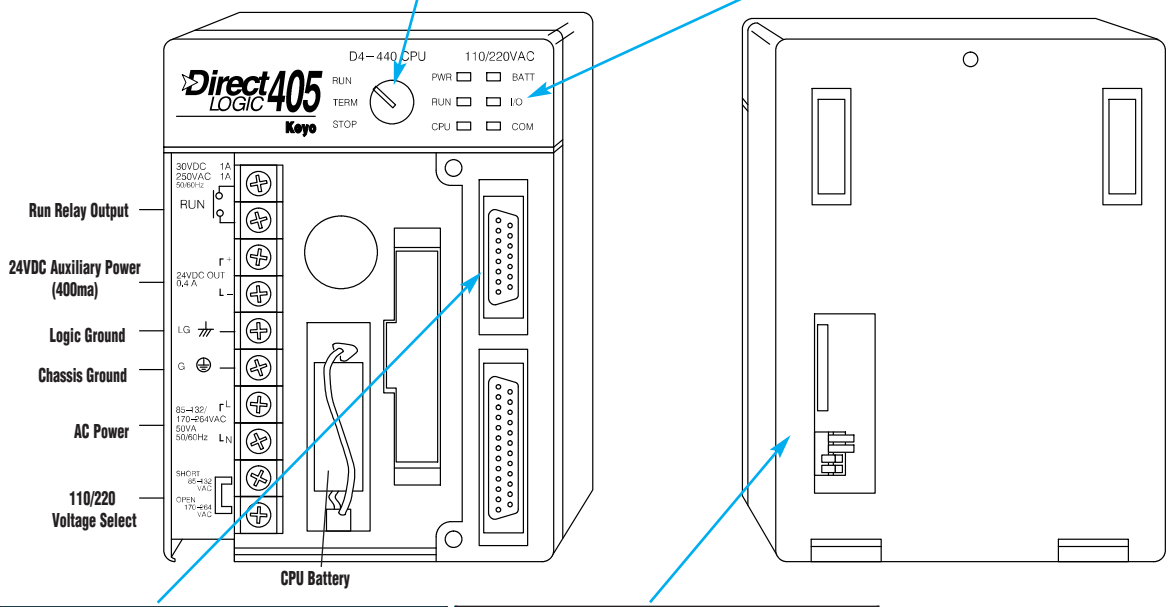
| | D4-RAM-1 <---> | D4-RAM-2 <---> | D4-UV-2 <---> | D4-EE-2 <---> |
|---|---|---|---|---|
| ***Program Storage Capacity*** | 7.5K | 15.5K | 15.5K | 15.5K |
| ***Cartridge Battery Type*** | Lithium | Lithium | None | None |
| ***Writing Cycle Life*** | N/A | N/A | 1,000 | >10,000 |
| ***Write Inhibit***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

# D4-440/430 Features

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

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

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

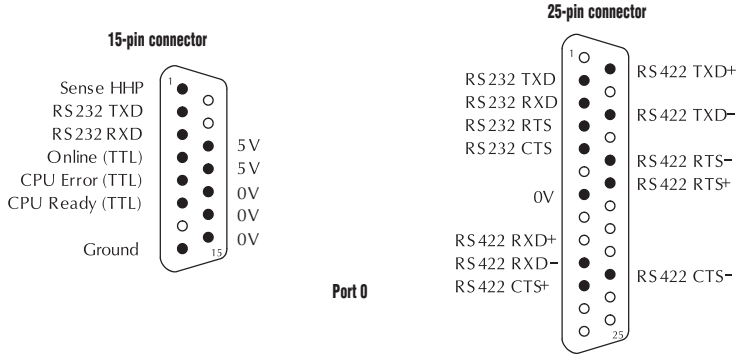



| Communication Ports | |
|---|---|
| ***15 Pin*** | Programming port, RS232C, 9600 Baud, K-sequence protocol, connects to HPP, *Direct*SOFT, DV-1000 and some operator interfaces |
| ***25 Pin*** | Auxiliary port, R232C or RS422, Baud rate selectable via CPU dipswitch, K-sequence protocol, *Direct*NET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

| CPU Dipswitch | | |
|---|---|---|
| ***SW1*** | ON<br>OFF | CPU battery disabled<br>CPU battery enabled |
| ***SW2*** | ON<br>OFF | Station address is 1<br>Station address set by HPP |

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

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



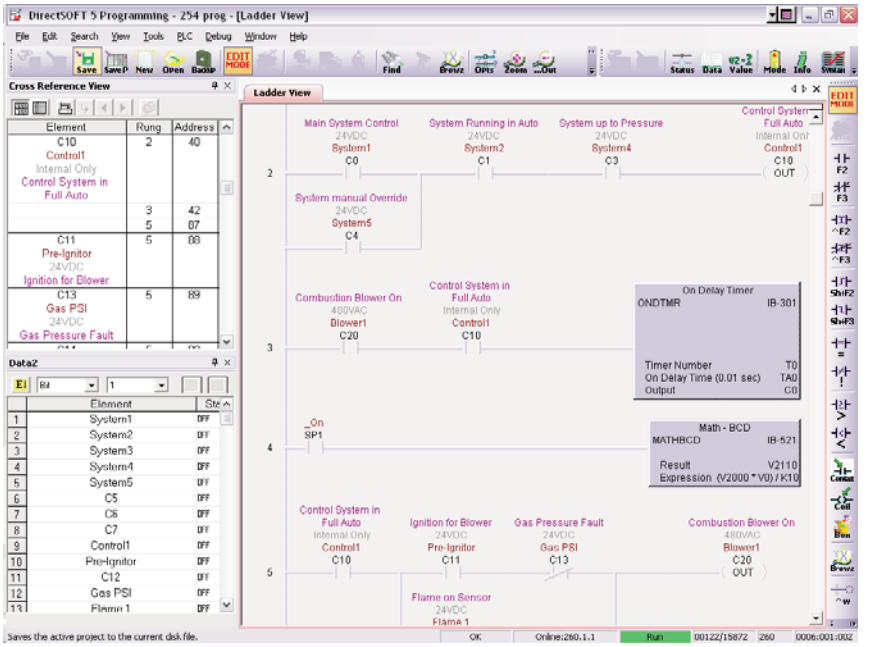
# DL405 Programming Tools and Cables

## Select a programming device

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

### *Direct*SOFT programming software

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

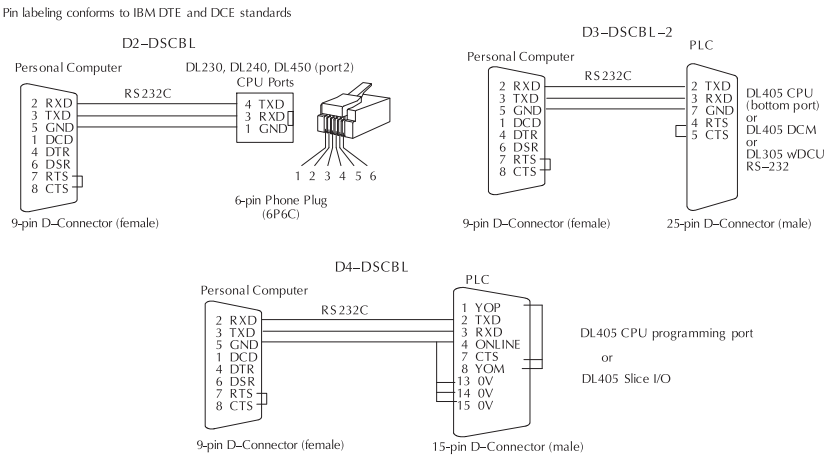



| *Direct*Soft Part Number | Price | Description |
|---|---|---|
| ***PC-DSOFT5*** | <---> | Programs all PLC families DL05/06/105/205/305/405 |

### DL405 programming cables

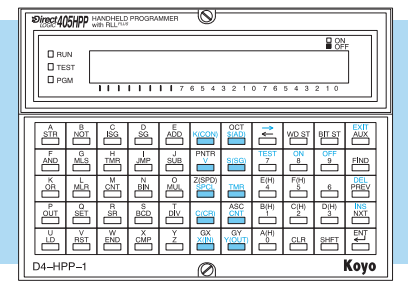
Choose the proper cable to connect the DL405 CPU to your PC running *Direct*SOFT.

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




### Handheld programmer

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




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

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

# Need additional Communications Ports?

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

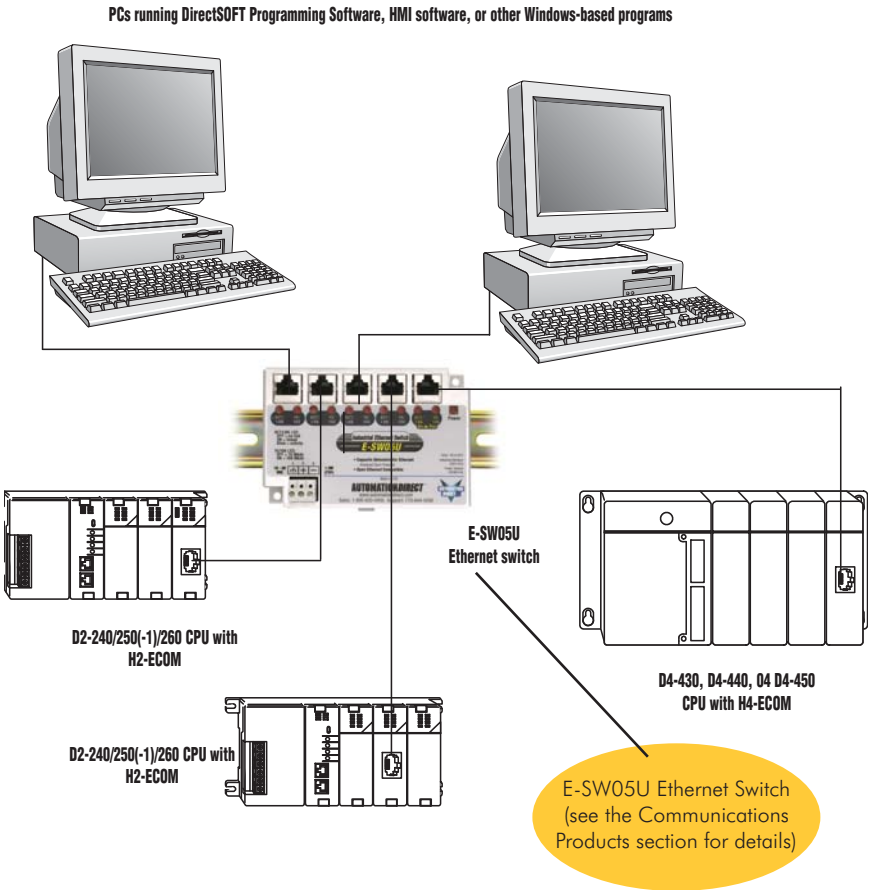
## Ethernet networking with the H4-ECOM

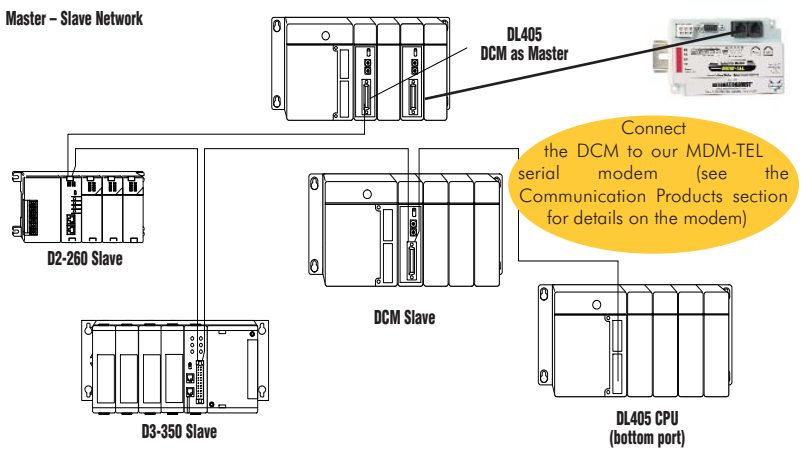
All DL405 CPUs support the H4-ECOM/ECOM100 module, which makes Ethernet networking a snap. The H4-ECOM/ECOM100 module supports industry-standard 10Base-T networking with an RJ45 port. The H4-ECOM-F has ST-style bayonet connectors for 10BaseFL fiber optic connections. The ECOM modules use standard cables, hubs and repeaters, which are available from a large number of suppliers. A virtually unlimited number of PLCs can be connected to an Ethernet network using ECOM modules. This is the fastest data transfer rate we offer for your HMI or other Windows-based software. Use *Direct*SOFT 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 *Direct*Net master/slave, *Direct*Net peer, or a Modbus RTU slave. 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 master, you can use *Direct*SOFT to program any PLC on the network.

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



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

## Review hardware specifications

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

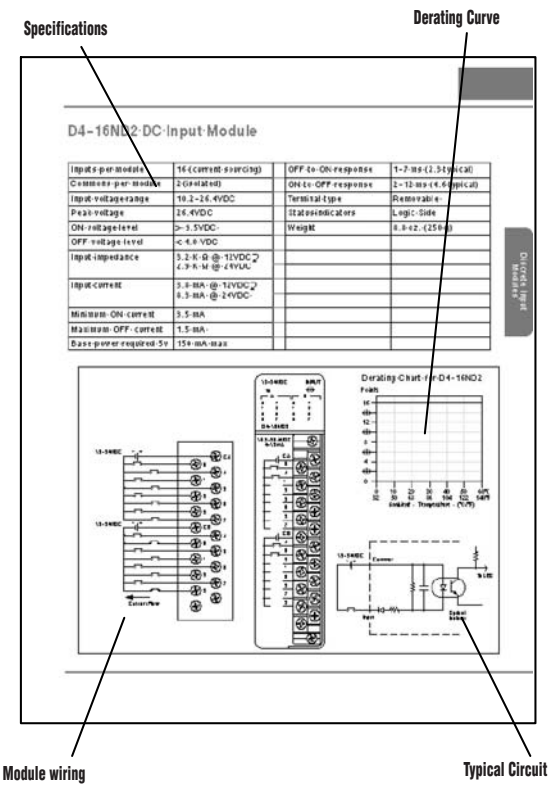
## Understand the factors affecting field termination

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

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

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

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



# I/O Modules

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

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

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

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

## Analog module selection tips

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

## *ZIP*Link connection systems

***ZIP***Links consist of PLC interface cables and connector modules that offer "plug and play" capability by plugging one end of the ***ZIP***Link cable into an I/O module and the other end into the ***ZIP***Link connector module. This eliminates the tedious process of wiring PLC I/O to terminal blocks. For more information, refer to page 6-57 or see the Wiring Solutions section in this catalog.

## DIN*nectors* terminal blocks

**DIN***nectors* are DIN rail mounted connectors or terminal blocks. All **DIN***nectors* are UL, CSA, VDE, SEV, RINA and IEC approved. Refer to the Terminal Blocks & Wiring Systems section of this catalog for details.

## Need spare parts?

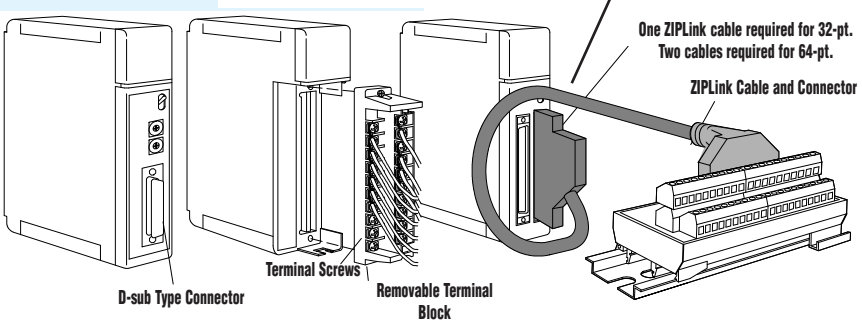
Sometimes it is helpful to have extra I/O module connectors or spare fuses. The DL405 spare parts and accessories are listed below:

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

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

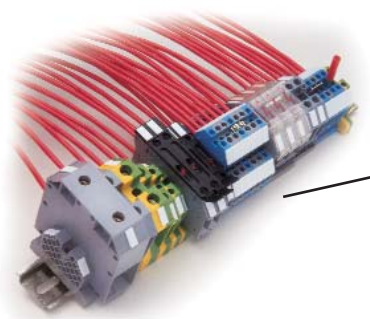
***ZIP***Links eliminate the tedious process of wiring the PLC I/O to terminal blocks. See the Terminal Blocks & Wiring Systems section for details.

### *ZIP*Link connection system




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

### DIN*nectors* terminal blocks



**DIN***nectors* provide a means of connecting and identifying two or more wires within the demands of an industrial environment. See the Terminal Blocks & Wiring Systems 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.

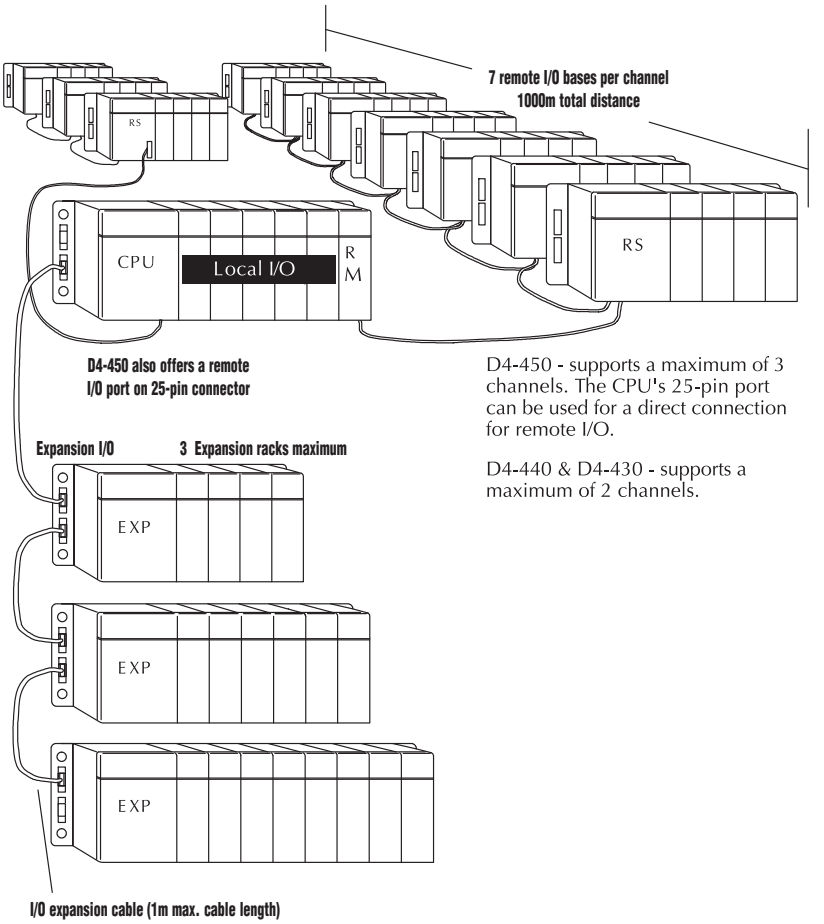
## Local I/O

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 (requires a D4-440 or D4-450).

## Expansion I/O

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

## Example of I/O system configurations




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

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

# I/O Configurations

## Ethernet remote I/O

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

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

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

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

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

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

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

## Serial remote I/O

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

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

The maximum distance between a Remote Master and a Remote Slave is 3,300 feet (1000 m).

# Module Placement and I/O Usage Tables

## I/O module placement restrictions

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

## I/O point usage table for modules

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

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

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

### I/O points required per module

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

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

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

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

# DL405 I/O Addressing

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

## Octal addressing

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

## Automatic addressing

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

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

## Manual addressing

The D4-440 and D4-450 CPUs allow you to manually assign I/O addresses for any or all I/O slots on the local or expansion bases. This feature is useful if you have a standard configuration that you must sometimes change slightly to accommodate special requests. It is also useful if you have to leave empty slots in between I/O modules and you do not want an added module to cause addressing problems. In automatic configuration, the addresses are assigned on 8-point boundaries. Manual configuration assumes that all modules are at least 16 points, so you can only assign addresses that are a multiple of 20 (octal). This does not mean you can only use 16, 32, or 64-point modules with manual configuration. You can use 8-point modules, but 16 addresses will be assigned and 8 are unused.

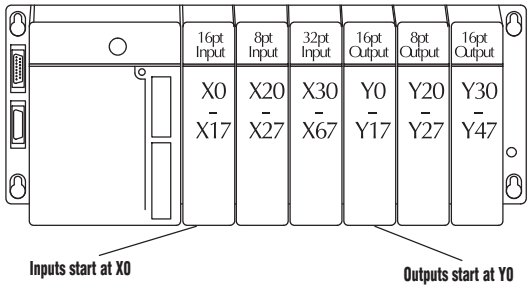
## Remote I/O addressing

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

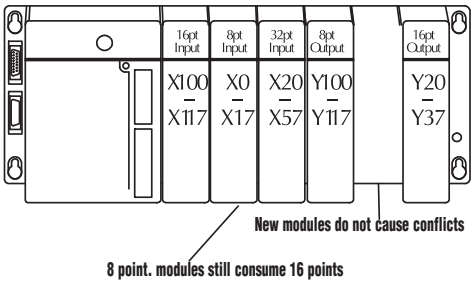
## Manual addressing and choice of data type designators

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

**Automatically Assigned Module Addresses**




**Manually Assigned Module Addresses**



# 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 ***Zip***Link 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 page 6-57 for more information.

This logo is placed next to I/O modules that are supported by the ***ZIP***Link 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.

| | | | | |
|---|---|---|---|---|
| **A** | | | | |
| | ***Base Number 0*** | ***Device Type*** | ***5 VDC (mA)*** | ***External 24 VDC Power (mA)*** |
| **B** | **CURRENT SUPPLIED** | | | |
| | ***CPU/Expansion Unit /Remote Slave*** | D4-440 CPU | 3700 | 400 |
| **C** | **CURRENT REQUIRED** | | | |
| | ***SLOT 0*** | D4-16ND2 | +150 | +0 |
| | ***SLOT 1*** | D4-16ND2 | +150 | +0 |
| | ***SLOT 2*** | F4-04DA | +120 | +100 |
| | ***SLOT 3*** | D4-08ND3S | +100 | +0 |
| | ***SLOT 4*** | D4-08ND3S | +100 | +0 |
| | ***SLOT 5*** | D4-16TD2 | +100 | +0 |
| | ***SLOT 6*** | D4-16TD2 | +100 | +0 |
| | ***SLOT 7*** | D4-16TR | +1000 | +0 |
| **D** | **OTHER** | | | |
| | ***BASE*** | D4-08B | +80 | +0 |
| | ***Handheld Programmer*** | D4-HPP | +320 | +0 |
| **E** | **Maximum Current Required** | | ***2820*** | ***100*** |
| **F** | **Remaining Current Available** | | ***3700-2820=880*** | ***400-100=300*** |

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

## DL405 CPU power supply specifications and power requirements

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

# Power Requirements

## Power Supplied

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

## Power Consumed

| Power-consuming Device | 5V Current Consumed | External 24VD Current Required | Power-consuming Device | 5V Current Consumed | External 24VDC Current Required |
|---|---|---|---|---|---|
| ***I/O Bases*** | | | ***Analog Modules (continued)*** | | |
| D4-04B-1 | 80 | NONE | F4-16AD-1 | 75 | 100 |
| D4-06B-1 | 80 | NONE | F4-16AD-2 | 75 | 100 |
| D4-08B-1 | 80 | NONE | F4-04DA-1 | 70 | 75+20per circuit |
| | | | F4-04DA-2 | 90 | 90 |
| ***DC Input Modules*** | | | F4-04DAS-1 | 60 | 60 per circuit |
| | | | F4-04DAS-2 | 60 | 60 per circuit |
| D4-08ND3S | 100 | NONE | F4-08DA-1 | 90 | 100+20 per circuit |
| D4-16ND2 | 150 | NONE | F4-08DA-2 | 80 | 150 |
| D4-16ND2F | 150 | NONE | F4-16DA-1 | 90 | 100+20 per circuit |
| D4-32ND3-1 | 150 | NONE | F4-16DA-2 | 80 | 25 max. |
| D4-32ND3-2 | 150 | NONE | F4-08RTD | 80 | NONE |
| D4-64ND2 | 300 max. | NONE | F4-08THM-n | 120 | 50 |
| | | | F4-08THM | 110 | 60 |
| ***AC Input Modules*** | | | ***Remote I/O*** | | |
| D4-08NA | 100 | NONE | H4-ERM | 320 | NONE |
| D4-16NA | 150 | NONE | H4-ERM-F | 450 | NONE |
| | | | D4-RM | 300 | NONE |
| ***AC/DC Input Modules*** | | | ***Communications and Networking*** | | |
| D4-16NE3 | 150 | NONE | H4-ECOM100 | 300 | NONE |
| F4-08NE3S | 90 | NONE | H4-ECOM | 530 | NONE |
| ***DC Output Modules*** | | | H4-ECOM-F | 670 | NONE |
| | | | D4-DCM | 500 | NONE |
| D4-08TD1 | 150 | 35 | F4-MAS-MB | 235 | NONE |
| F4-08TD1S | 295 | NONE | FA-UNICON | NONE | 65 |
| D4-16TD1 | 200 | 125 | | | |
| D4-16TD2 | 400 | NONE | ***CoProcessors*** | | |
| D4-32TD1 | 250 | 140 | | | |
| D4-32TD1-1 | 250 | 140 (15V) | F4-CP128-1 | 305 | NONE |
| D4-32TD2 | 350 | 120 (4A max including loads) | | | |
| D4-64TD1 | 800 | NONE | ***Specialty Modules*** | | |
| ***AC Output Modules*** | | | H4-CTRIO | 400 | NONE |
| | | | D4-INT | 100 | NONE |
| D4-08TA | 250 | NONE | D4-HSC | 300 | NONE |
| D4-16TA | 450 | NONE | F4-16PID | 160 | NONE |
| ***Relay Output Modules*** | | | F4-8MPI | 225 | 170 |
| | | | D4-16SIM | 150 | NONE |
| D4-08TR | 550 | NONE | F4-4LTC | 280 | 75 |
| F4-08TRS-1 | 575 | NONE | | | |
| F4-08TRS | 575 | NONE | ***Programming*** | | |
| D4-16TR | 1000 | NONE | D4-HPP-1 (Handheld Prog.) | 320 | NONE |
| ***Analog Modules*** | | | ***Operator Interface*** | | |
| | | | DV-1000 | 150 | NONE |
| F4-04AD | 85 | 100 | ***C-more*** Micro-Graphic | 210 | NONE |
| F4-04ADS | 270 | 120 | | | |
| F4-08AD | 75 | 90 | | | |

# Dimensions and Installation

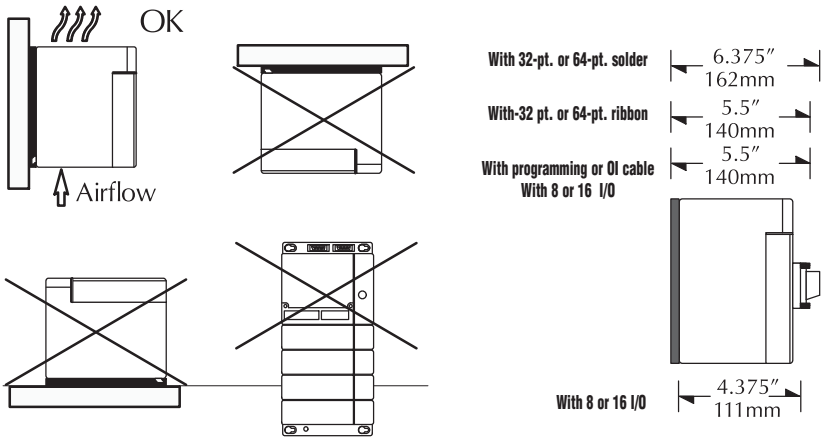
Local base expansion unit, includes 110/220 VAC power supply, requires local I/O expansion cable D4-EXCBL-1 or D4-EXCBL-2It is important to understand the installation requirements for your DL405 system. This will help ensure that the DL405 products operate within their environmental and electrical limits.

## Plan for safety

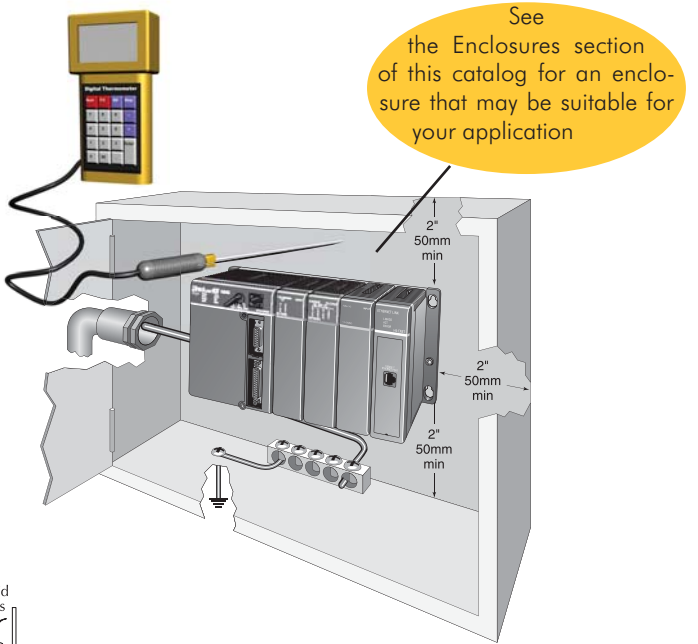
This catalog should never be used as a replacement for the user manual. The user manual, D4-USER-M, contains important safety information that must be followed. The system installation should comply with all appropriate electrical codes and standards.

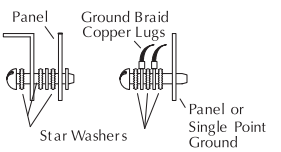
## Base dimensions and mounting orientation

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

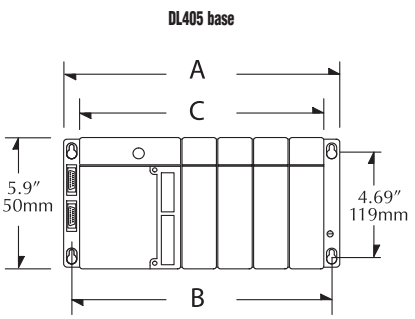



| Specification | Rating |
|---|---|
| ***Storage Temperature*** | -4°F - 158°F (-20°C to 70°C) |
| ***Ambient Operating Temperature*** | 32°F - 140°F (0° to 60°C) |
| ***Ambient Humidity*** | 30% - 95% relative humidity (non-condensing) |
| ***Vibration Resistance*** | MIL STD 810C, Method514.2 |
|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




***Note: there is a minimum of 2" (50mm) clearance required between the panel door or any devices mounted in the panel door and the nearest DL405 component.***




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

# Base Configurations

## Four, six, and eight-slot bases

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

## Expansion units

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

- D4-EX 110/220 VAC power supply
- D4-EXDC 24 VDC power supply
- D4-EXDC-2 125 VDC power supply

and the Remote Slave Units

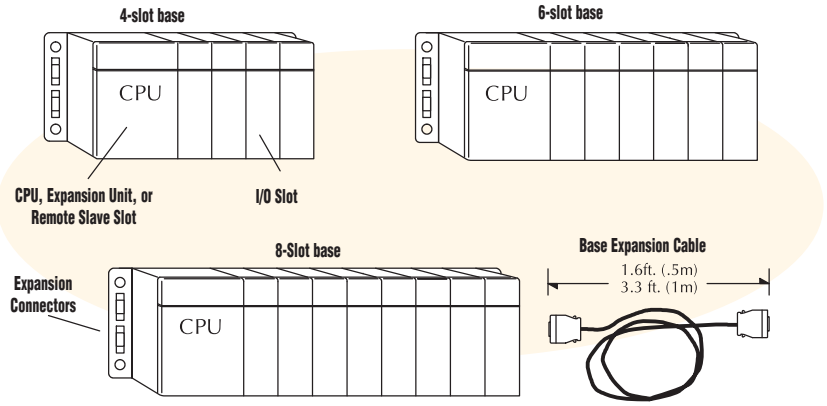
- D4-RS 110/220 VAC power supply

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

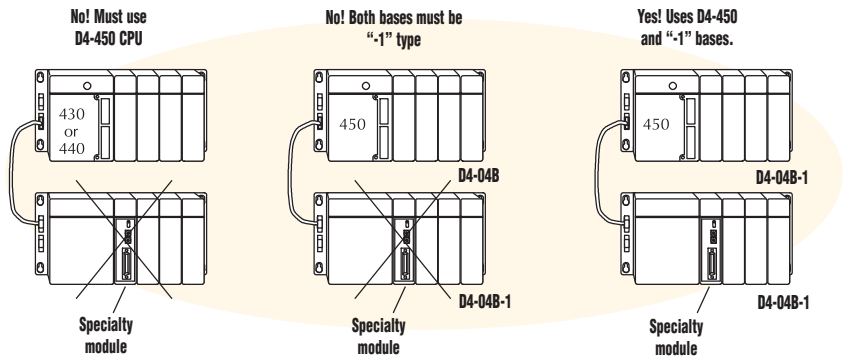
- D4-EXCBL-1 3.08 ft (1m) cable
- D4-EXCBL-2 1.54 ft (0.5m) cable

## D4-450 and –1 bases

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




### Specialty modules in expansion bases



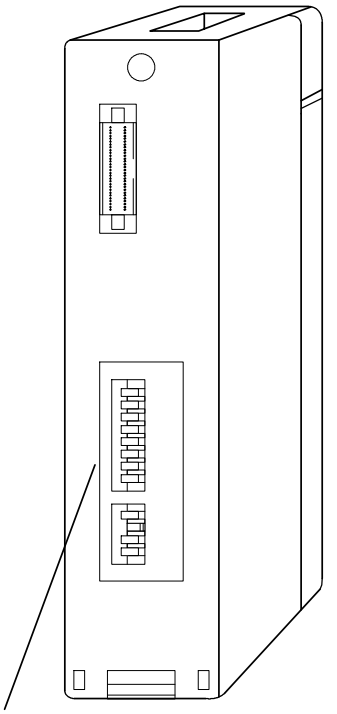

| Part | Description | Price |
|---|---|---|
| ***D4-EX*** | Local base expansion unit, includes 110/220 VAC power supply, requires local I/O expansion cable D4-EXCBL-1 or D4-EXCBL-2 | <---> |
| ***D4-EXDC*** | Local base expansion unit, includes 24 VDC power supply, requires local I/O expansion cable D4-EXCBL-1 or D4-EXCBL-2 | <---> |
| ***D4-EXDC-2*** | Local base expansion unit, includes 125 VDC power supply, requires local I/O expansion cable D4-EXCBL-1 or D4-EXCBL-2 | <---> |
| ***D4-RS*** | Serial remote I/O slave unit (used with D4-RM), includes 110/220 VAC power supply, uses shielded twisted pair (24 AWG minimum) | <---> |
| ***D4-EXCBL-1*** | Base expansion cable, 3.08 ft. (1m) | <---> |
| ***D4-EXCBL-2*** | Base expansion cable, 1.54 ft. (0.5m) | <---> |

# Serial Data Communications Module

**Data Communications Module**
**D4-DCM <--->**

## Extra communications port

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

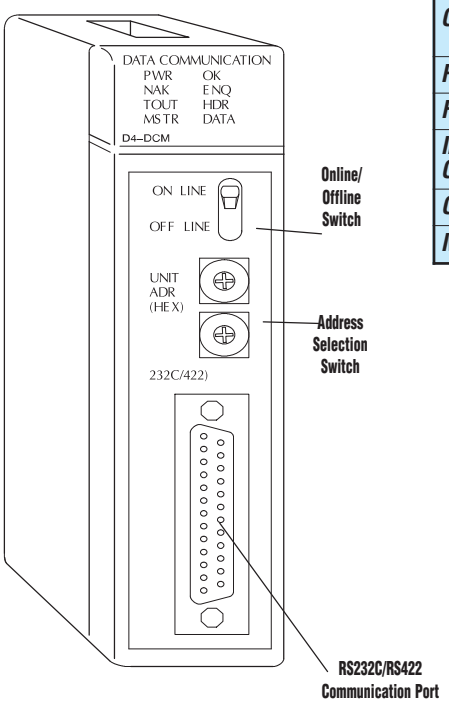


DIP Switches for communications and Protocol Setup

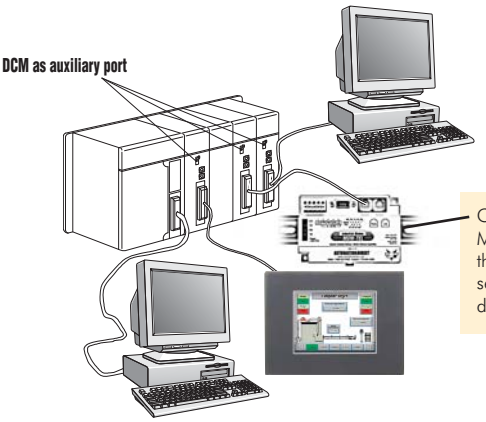
## Overview

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

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




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




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

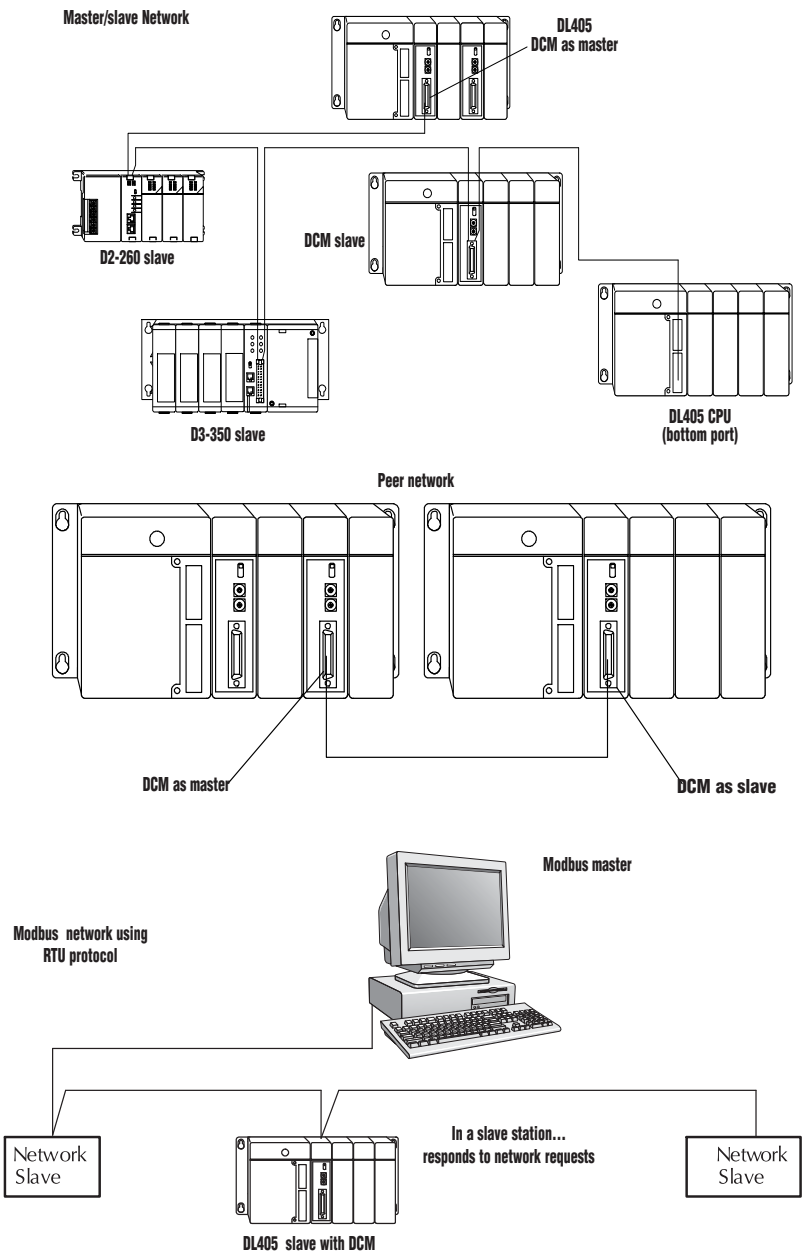
# Serial Data Communications Module

## *Direct*NET network interface

The DCM can be used as a network interface for applications requiring data to be shared between PLCs, or between PLCs and an intelligent device such as a host computer. The DCM connects easily to *Direct*NET. This network allows you to upload or download virtually any type of system data including timer/counter data, I/O information, and V-memory information from any of our PLCs or compatible PLC. The DCM allows the DL405 PLC to function as a master or a slave of *Direct*NET.

Network Master - The DCM allows the DL405 to serve as a master of a *Direct*NET Network. The DCM takes communication requests issued from the PLC program (the network part of the program can be very simple, as few as seven words) and automatically converts these requests into network commands to read data from or write data to another PLC on the network. This capability also allows a peer to peer configuration of two DL405 systems with DCMs. For other options, consider the H4-ECOM and H4-ECOM100 modules.

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




## Modbus interface

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

# Ethernet Communication Modules

**Ethernet Communications Module**

**H4-ECOM <--->**
**H4-ECOM100 <--->**
**H4-ECOM-F <--->**

## 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.

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

## ECOM starter kit <--->

The H4-ECOM-START gives you everything you need to make your first Ethernet network simple to build. It contains an H4-ECOM module and instruction manual, a network adapter card (PCI) for your PC, a crossover cable, and a Software Product Showcase Demo CD. The CD contains demo versions of our software products that support the ECOM Modules. See the Software Products section in this catalog for information on the available software packages.

## Overview

Ethernet Communications Modules offer features such as:

- High-speed peer-to-peer networking of PLCs
- Fast updates with *Direct*SOFT Programming Software
- High-performance access for Human Machine Interface (HMI), ERP, MES or other Windows-based software
- Industry standard ModbusTCP/IP Client/Server Protocol (H4-ECOM100)
- Free SDK for custom drivers
- Easy setup

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

| Specifications | H4-ECOM | H4-ECOM100 | H4-ECOM-F |
|---|---|---|---|
| ***Communications*** | 10Base-T Ethernet | 10/100Base-T Ethernet | 10Base-FL Ethernet |
| ***Data Transfer Rate*** | 10Mbps max. | 100Mbps max. | 10Mbps max. |
| ***Link Distance*** | 100 meters (328 ft) | 100 meters (328 ft) | 2,000 meters (6,560 ft) |
| ***Ethernet Port*** | RJ45 | RJ45 | ST-style fiber optic |
| ***Ethernet Protocols*** | TCP/IP, IPX | TCP/IP, IPX, MODBUS TCP/IP, DHCP, HTML configuration | TCP/IP, IPX |
| ***Power Consumption*** | 530mA @ 5VDC | 300mA @ 5VDC | 670mA @ 5VDC |
| ***Manufacturer*** | Host Automation Products, L.L.C. | | |

**H4-ECOM100**


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

## H4-ECOM100 *IBox* communications instructions

Over 25 communications *IBox* instructions are available when using the H4-ECOM100 with a DL450 PLC and *Direct*SOFT5 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
- Read/Write PLC memory to networked Hx-ECOM(-F) modules

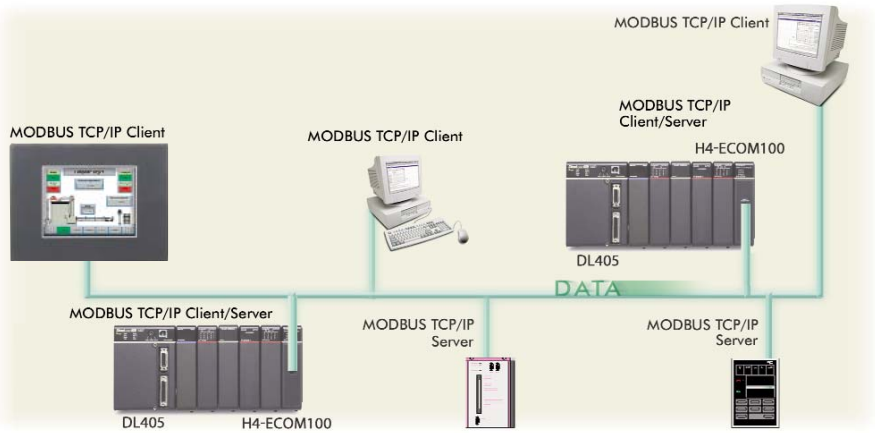
See the following page for example communications *IBox* instructions.

# 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 (master) or as a server (slave) 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 (DL430/440/450, all H4 series ECOMs and all *Direct*SOFT versions). If you're using our *Direct*SOFT5 programming software, a DL450 PLC and an H4-ECOM100, you can use fill-in-the-blank *IBox* instructions to simplify your communications programming. The H4-ECOM100 supports the ECOM100 Configuration *IBox* for use with the ECRX and ECWX *IBox* instructions to read/write to other ECOM(100)s. All 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 (remember DL450/DSOFT5 required). The communications *IBox* instructions execute with built-in interlocking to greatly simplify communications programming.

**ECOM100 Configuration *IBox***

ECOM100 Config

| ECOM100 | IB-710 |
|---|---|
| ECOM100 # | K0 |
| Slot | K1 |
| Status | V400 |
| Workspace | V400 |
| Msg Buffer (65 WORDs) | V400 |

**ECOM100 Read Network *IBox***

ECOM100 RX Network Read

| ECRX | IB-740 |
|---|---|
| ECOM100 # | K0 |
| Workspace | V400 |
| Slave ID | K0 |
| From Slave Element (Src) | C0 |
| Number Of Bytes | K1 |
| To Master Element (Dest) | TA0 |
| Success | C0 |
| Error | C0 |

## NetEdit3 software

NetEdit3 Software ships free with the ECOM User Manual. 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 *Direct*SOFT 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 DL450 CPU and *Direct*SOFT5 are required to use the *IBox* instructions.

**ECOM100 Send EMail *IBox***

ECOM100 Send EMail

| ECEMAIL | IB-711 |
|---|---|
| ECOM100 # | K0 |
| Workspace | V400 |
| Success | C0 |
| Error | C1 |
| Error Code | V400 |
| To | steve@work.com |
| Subject | Machine Offline |
| Body | |

"Machine #" V5010:B "went offline at" _time:24 "on" _date:us

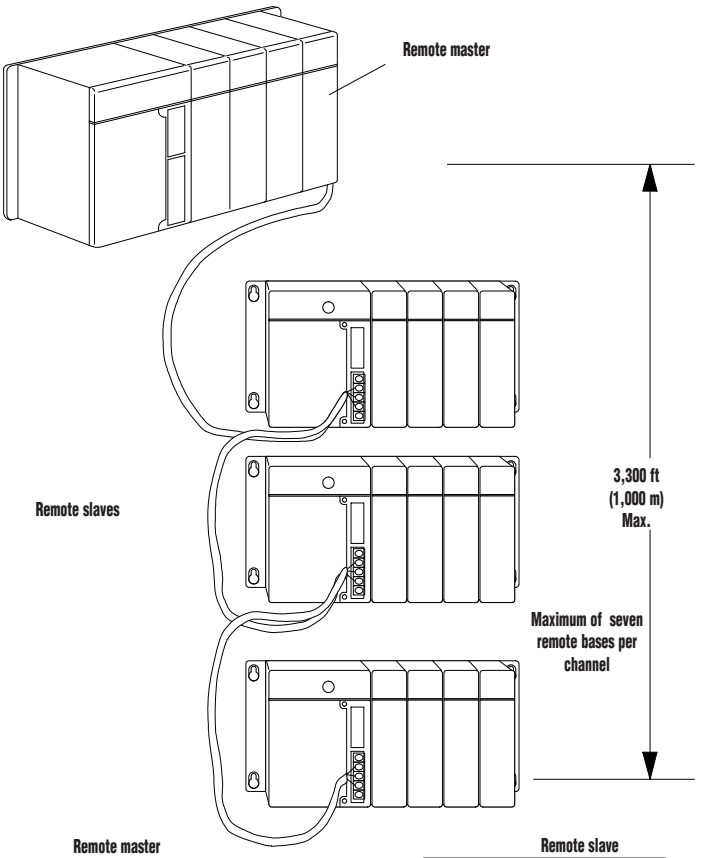
# Serial Remote I/O Master/Slave Modules

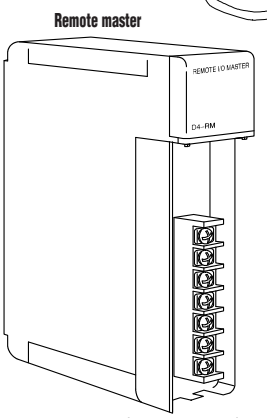
## Remote I/O Master Module

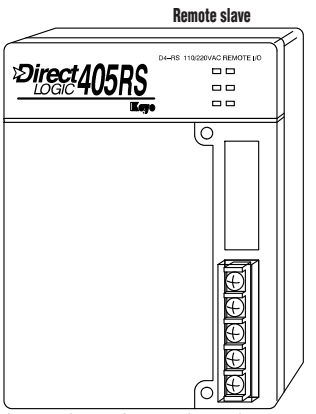
**D4-RM <--->**

## Remote I/O Slave Module

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


## Overview

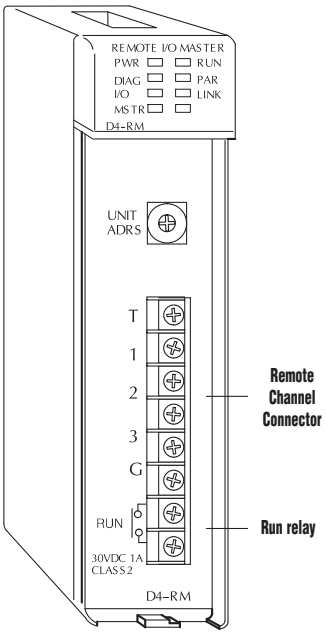
The DL405 offers full-size remote I/O. The goal of remote I/O is to reduce wiring costs by allowing I/O points to be located near the devices they are controlling. The chart at the bottom of this page shows the capacity for each CPU. The D4-450 has the D4-RM functionality built into the 25-pin port directly on the CPU. However, you can also choose to use the D4-RM discussed here. Here's how it works: A special module called the Remote Master is placed in the CPU base. This Master module controls up to seven Remote Slaves. The Remote Slaves are connected to the Master in a daisy-chain manner over a twisted pair communication cable (maximum length of 3,300 feet or 1,000m). Each Remote Slave 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 Master sends the remote I/O information to the CPU. The communication between the Remote Master and the CPU is asynchronous to the CPU scan. For this reason, remote I/O applications should be limited to those that do not require the remote I/O points to be updated with every CPU scan.

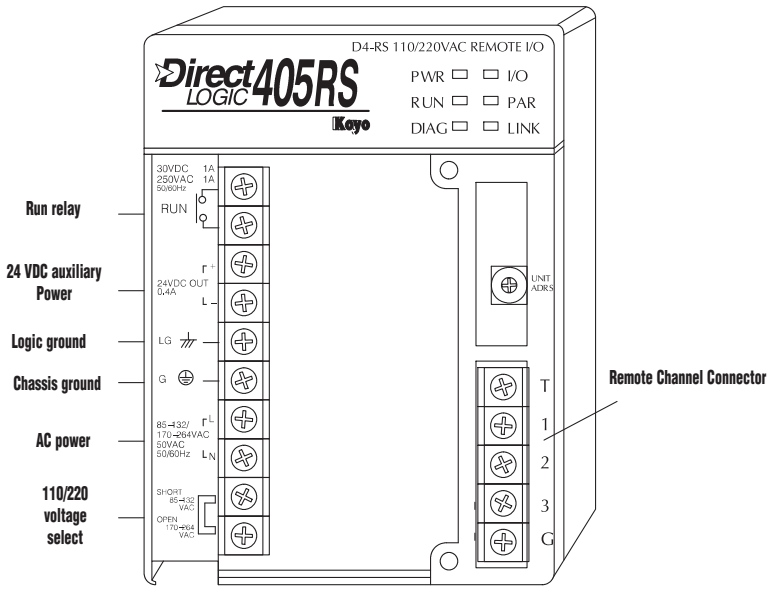
| | D4-450 | D4-440 | D4-430 |
|---|---|---|---|
| ***Maximum number of remote masters supported*** | 3* | 2 | 2 |
| ***Maximum I/O points supported*** | 1536 | 1024 | 512 |
| ***Maximum I/O points supported per channel*** | 512 | 512 | 512 |
| ***Maximum number of remote I/O bases per channel*** | 7 | 7 | 7 |
| ***max. of 2 D4-RM, 1 channel is via 25-pin CPU port*** | | | |

# Serial Remote I/O Master/Slave Modules

**Remote Master**




**Remote Slave**




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

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

# Ethernet Remote I/O Master Modules


## Ethernet remote I/O master

The Ethernet Remote Master H4-ERM (-F) connects DL430, DL440 and DL450 CPU systems to Ethernet Base Controller (EBC) slave 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 (H2-EBC), 16 Terminator I/O EBC systems (T1H-EBC), 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 Edrives. See the Drives section for details.

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

### Simple connections

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

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

### Networking ERMs with other Ethernet devices

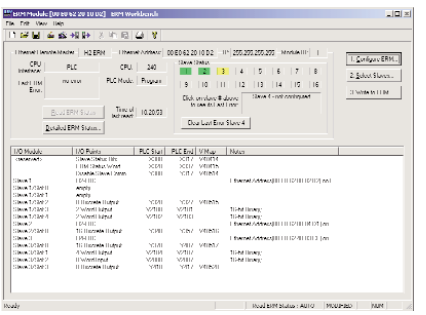
It is required that a dedicated Ethernet remote I/O network be used for the ERM and its slaves. While Ethernet networks can handle a very large number of data transactions, and normally handle them very quickly, heavy Ethernet traffic can adversely affect the reliability of the slave I/O and the speed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

### Software configuration

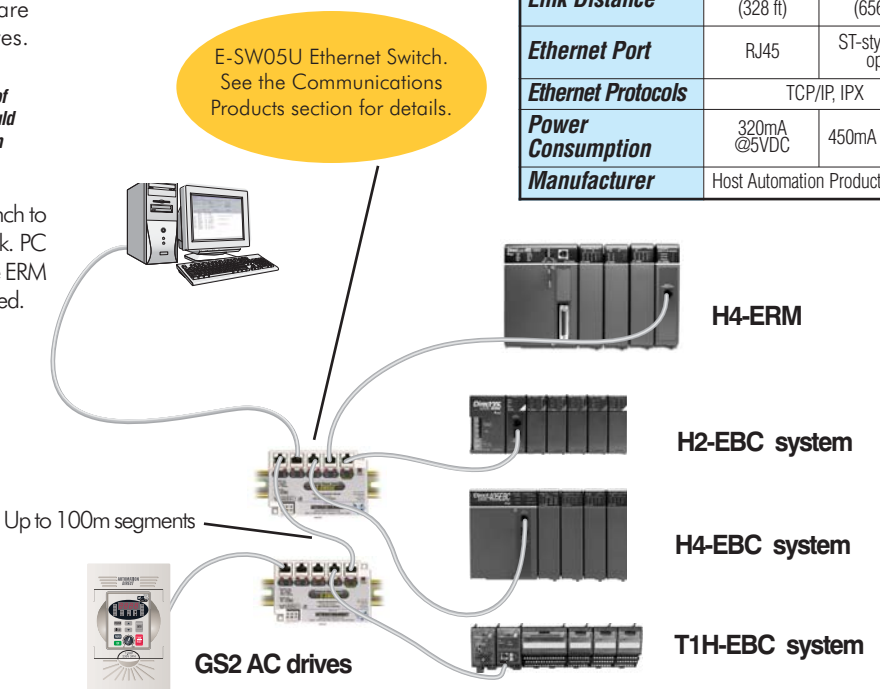
ERM Workbench is a software utility that must be used to configure the ERM and its remote Ethernet slaves. ERM workbench supports two methods of configuring the ERM I/O network:

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

**ERM Workbench Software**



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

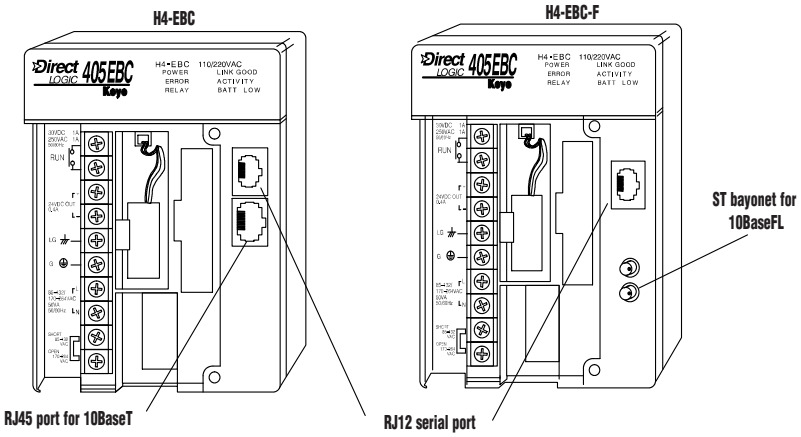


# Ethernet Base Controller Modules

## Ethernet Base Controller Module

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

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



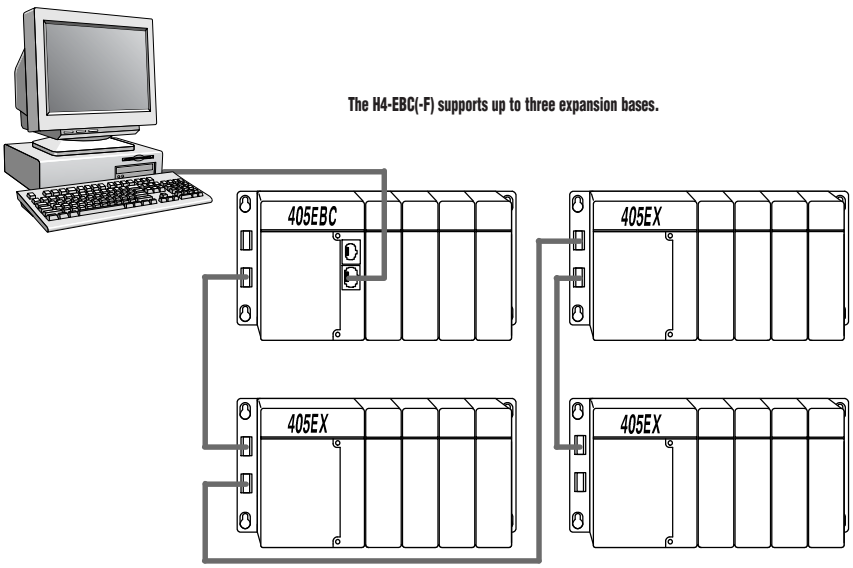

## Use EBCs for PC-based control and for H4-ERM remote I/O slaves

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

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

## Easy to use, reliable and fast

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




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

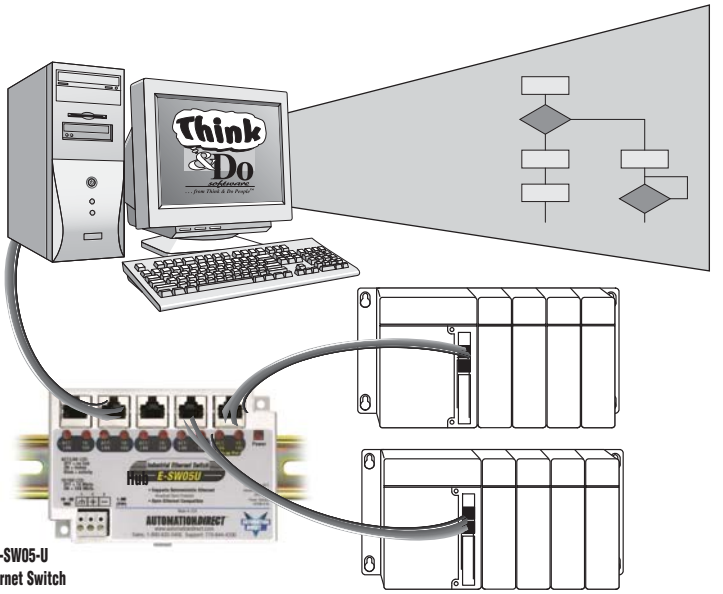
# Ethernet Base Controller Modules

## Off-the-shelf solutions

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

## Software developers

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




**E-SW05-U**
**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.***

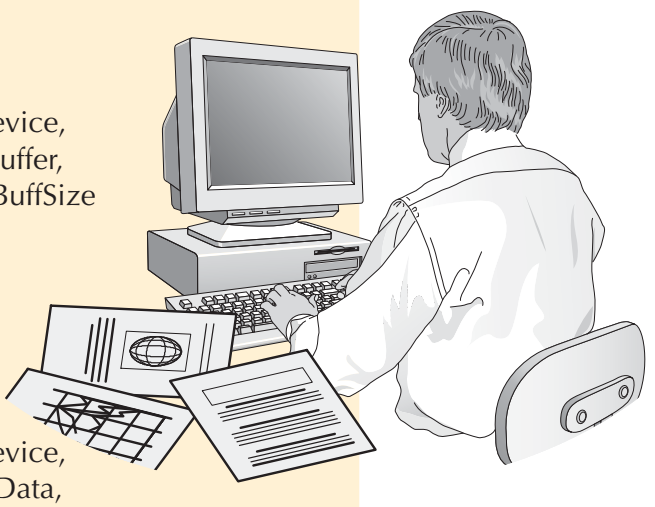
| Vendor | Product | Web Address |
|---|---|---|
| AUTOMATIONDIRECT | KEP*Direct* EBC I/O Server | www.automationdirect.com |
| Phoenix Contact | Think & Do Live! | www.phoenixcon.com/software |
| KEPware | KEPServerEX | www.kepware.com |
| Wonderware | InControl | www.wonderware.com |

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
        );
```



# Ethernet Remote I/O Kits


## Overview

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

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

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

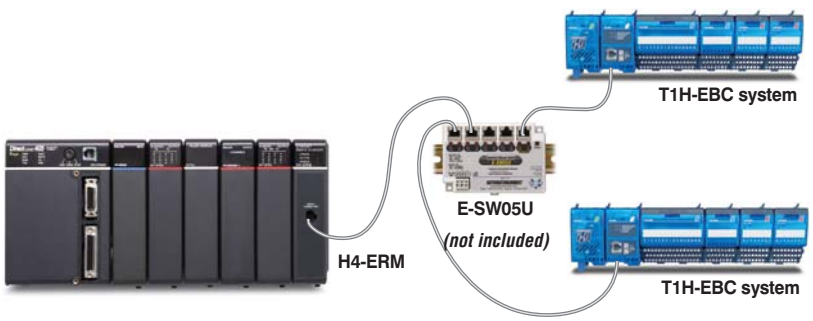
## T14-ERKIT-x Ethernet Remote I/O Kits

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

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

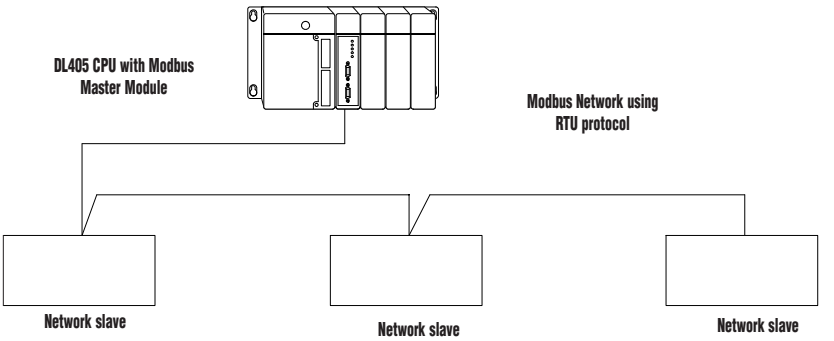

| T14-ERKIT-x Ethernet Remote I/O Kits | | |
|---|---|---|
| ***Kit Number*** | ***Kit Contents*** | ***Price*** |
| T14-ERKIT-1 | 1 H4-ERM + 1 T1H-EBC | <---> |
| T14-ERKIT-2 | 1 H4-ERM + 2 T1H-EBCs | <---> |
| T14-ERKIT-3 | 1 H4-ERM + 3 T1H-EBCs | <---> |
| T14-ERKIT-4 | 1 H4-ERM + 4 T1H-EBCs | <--->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

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



# Modbus Network Master


| 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)<br>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) |
| ***Manufacturer*** | FACTS Engineering |




Typical network slaves might include PLCs, drives, PC, etc

## Overview

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

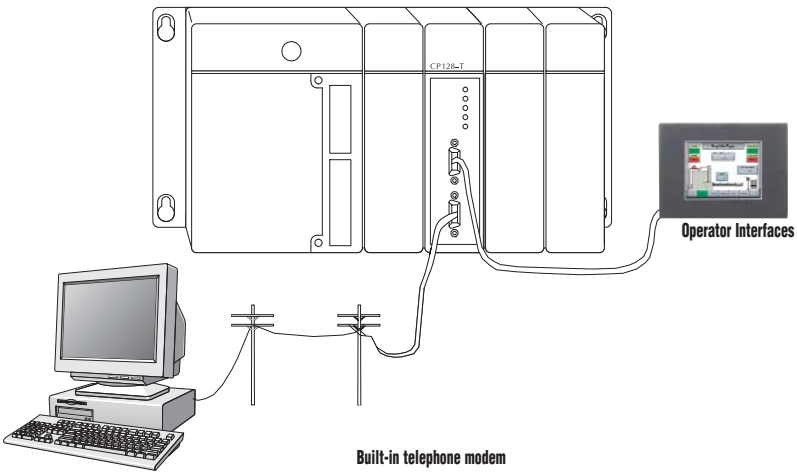
## Easy setup and operation

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

# CoProcessor Modules

## Basic CoProcessor Modules

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




## Overview

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

## Features

- FACTS Extended BASIC and ABM Commander for Window software makes program development fast and simple. Allows ONLINE, full-screen BASIC program editing and the ability to save programs on disk (software on CD included with each module)
- Non-volatile memory of up to 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 master/slave BASIC examples and other application examples on CD

## CoProcessor applications

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

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

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

# CoProcessor Modules

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

# 16 Loop PID CoProcessor


## Overview

The F4-16PID is a Proportional Integral Derivative (PID) CoProcessor designed to execute up to 16 PID loops independent of the DL405 CPU. Using the high-speed Intelligent Bus Interface, the F4-16PID reads the process variable and writes the PID output directly into V-memory of the DL405 CPU. Configure the module PID loop using *Direct*SOFT Data View or ladder logic.

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

## Operation

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

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

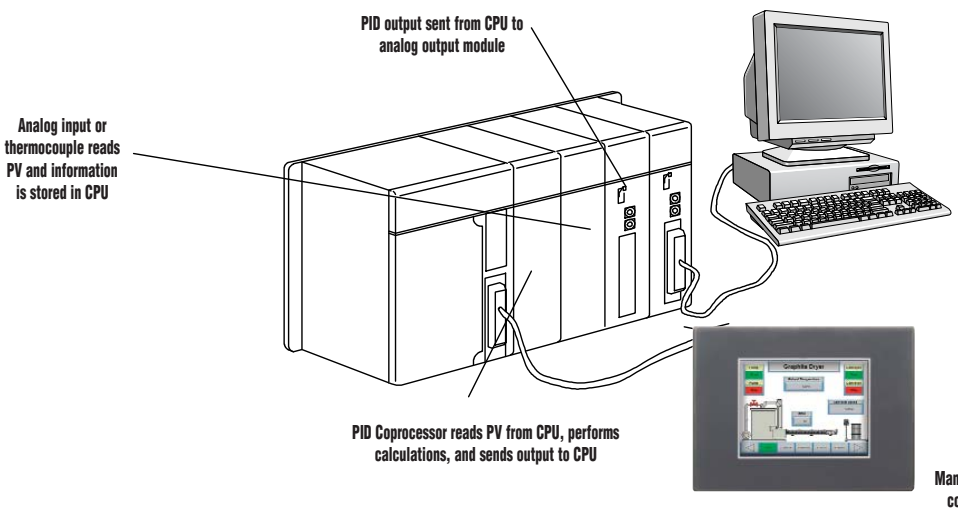
All loop information is read from and written to a user specified block of V-memory. Each loop that is enabled requires 32 V-memory locations. Since all loop parameters are stored in V-memory, any device capable of reading and writing DL405 V-memory can be used to configure, tune, and monitor loops.

The information included in each loop's block of V-memory includes:

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

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

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



# 16 Loop PID CoProcessor

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

# Four Loop Temperature Controller


## Overview

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

## Operation

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

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

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

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

### Read continually

- Mode word
- Temperature setpoint

### Written after loop update

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

### Read setup/write after auto tune

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

### Read for setup

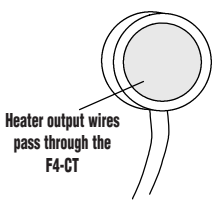
- Temperature Low Alarm
- Temperature High Alarm
- Temperature Deviation Alarm
- Alarm Deadband
- Setpoint Low Limit
- Setpoint High Limit
- Input Type (for Thermocouple)
- PID Control Period
- On/Off Hysteresis

### RTD or thermocouple inputs

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

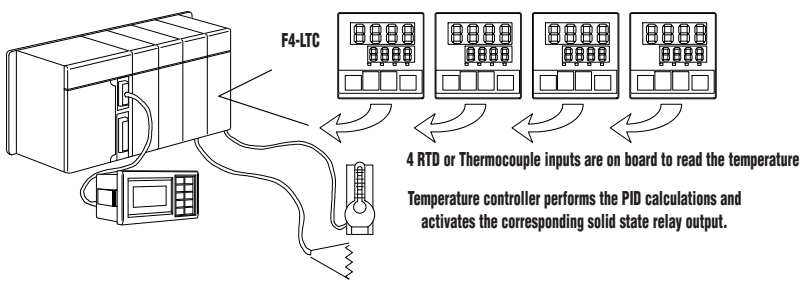
### Current transformer

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




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

***Combines four single loop controllers into one module.***



# Four Loop Temperature Controller

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

| Thermocouple Specifications | |
|---|---|
| ***Temperature Ranges*** | J, -190/760 °C (-310/1400 °F)<br>E, -210/1000 °C (-346/1832 °F)<br>K, -150/1372 °C (-238/2502 °F)<br>R, 65/1768 °C (149/3214 °F)<br>S, 65/1768 °C (149/3214 °F)<br>T, -230/400 °C (-382/752 °F)<br>B, 529/1820 °C (984/3308 °F)<br>N, -70/1300 °C (-94/2372 °F)<br>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)<br>PT1000 -200/595°C (-328/1103 °F)<br>jPT100 -35/450°C (-36/842 °F)<br>10Ω -200/260°C (328/500 °F)<br>25Ω -200/260°C (328/500 °F) |
| ***Input Fault Protection*** | 50VDC maximum |
| ***RTD Excitation Current*** | 200µA |
| ***Resolution*** | ±0.1°C |
| ***Maximum Inaccuracy*** | ±1°C |

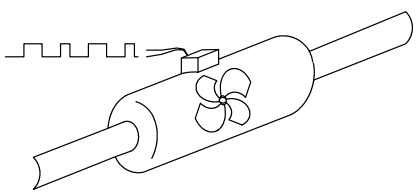
| Loop Specifications | |
|---|---|
| ***Loop Operating Modes*** | PID control - computes and controls the outputs based on the PID parameters stored in V memory. If auto tuning is enabled, the module uses PID parameters calculated during the auto tuning process. ON/OFF Control - the outputs turn on,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

# Magnetic Pulse Input Module


## Overview

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

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



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

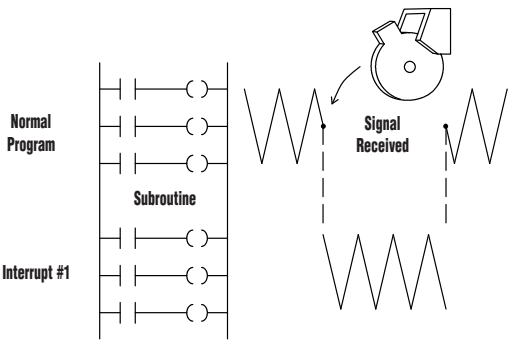
| Modes | |
|---|---|
| ***Indicated and Gross Volume*** | |
| ***Configuration*** | The module calculates Indicated Volume of flow given a K Factor. The K Factor is the nominal pulses per unit for the flow meter. This is the factory calibration number normally stamped on the flow meter housing. Indicated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

# Interrupt Input Module


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

## Overview

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




## Hardware features

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

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

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

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

# High-speed Counter I/O Module


## 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 100 kHz, 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

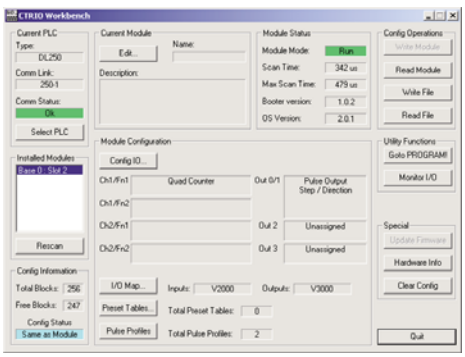
Outputs supported:

- 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

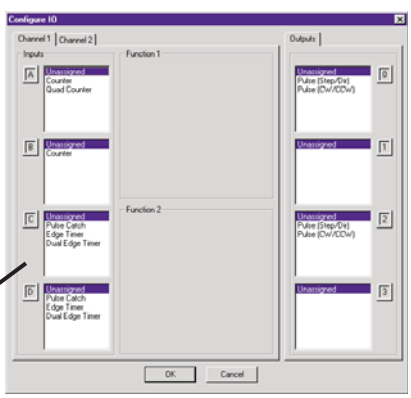
## Software Configuration

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 than10 $\mu$ sec pulse-catch capability for high-speed product detection
- Functions for level or flow

## Supported systems

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

### *Direct*LOGIC DL405 PLC

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

### PC-based Ethernet I/O control systems

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

### ERM to EBC systems

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

# High-speed 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% |
| ***Manufacturer*** | Host Automation Products, L.L.C. |
| ***Isolation*** | 2500V I/O to Logic, 1000V among Input Channels and All Outputs |

| H4-CTRIO Input Specifications | |
|---|---|
| ***Inputs*** | 8 pts sink/source |
| ***Minimum Pulse Width*** | 5 µsec |
| ***Input Voltage Range*** | 9-30VDC |
| ***Maximum Voltage*** | 30VDC |
| ***Input Voltage Protection*** | Zener Clamped at 33VDC |
| ***Rated Input Current*** | 8mA typical 12mA maximum |
| ***Minimum ON Voltage*** | 9.0VDC |
| ***Maximum OFF Voltage*** | 2.0VDC |
| ***Minimum ON Current*** | 5.0mA (9VDC required to guarantee ON state) |
| ***Maximum OFF Current*** | 2.0mA |
| ***OFF to ON Response*** | Less than 3 µsec |
| ***ON to OFF Response*** | Less than 3 µsec |

| H4-CTRIO Output Specifications | |
|---|---|
| ***Outputs*** | 4 pts, independently isolated, current sourcing or sinking<br>FET Outputs: open drain and source with floating gate drive |
| ***Voltage Range*** | 5VDC - 36VDC |
| ***Maximum Voltage*** | 36VDC |
| ***Output clamp Voltage*** | 60VDC |
| ***Maximum load Current*** | 1.0A |
| ***Maximum load Voltage*** | 36VDC |
| ***Maximum Leakage Current*** | 100µA |
| ***Inrush Current*** | 5A for 20ms |
| ***OFF to ON Response*** | less than 3µsec |
| ***ON to OFF Response*** | less than 3µsec |
| ***ON State V Drop*** | m 0.3V |
| ***External Power Supply*** | for loop power only, not required for internal module function* |
| ***Overcurrent Protection*** | 15A max |
| ***Thermal Shutdown*** | Tjunction = 150°C |
| ***Overtemperature Reset*** | Tjunction = 130°C |
| ***Duty Cycle Range*** | 1% to 99% in 1% increments (default = 50%) |
| ***Configurable Presets a) Single b) Multiple*** | a) each output can be assigned one preset, or<br>b) each output can be assigned one table of presets, one table can contain max. 128 presets, max. predefined tables = 255 |

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

| H4-CTRIO Input Resources | |
|---|---|
| ***Counter/Timer*** | 4, (2 per 4 input channel group) up to 100KHz |
| ***Resource Options*** | 1X, 2X, or 4X Quadrature, Up or Down Counter, Edge Timer, Dual Edge Timer, Input Pulse Catch, Reset, Inhibit, Capture |
| ***Timer Range / Resolution*** | 4.2 billion (32 bits); 1 µsec |
| ***Counter Range*** | + / - 2.1 billion (32 bits or 31 bits + sign bit) |

| H4-CTRIO Output Resources | |
|---|---|
| ***Pulse Output / Discrete Outputs*** | Pulse outputs: 2 channels (2 outputs each channel) (20Hz-20KHz);<br>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<br>Discrete outputs: 4 configurable for set, reset, pulse on, pulse off, toggle, reset count functions (assigned to respond to Timer/Counter input functions).<br>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 |

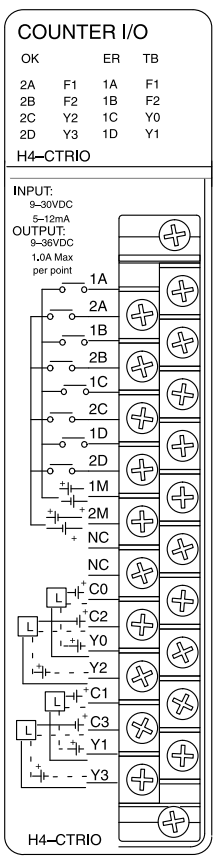
## Installation and wiring

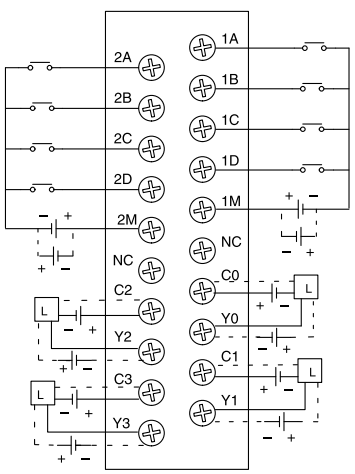
The H4-CTRIO module has two independent input channels, each consisting of 4 optically isolated input points (pts. 1A-1D on common 1M and pts. 2A-2D on common 2M). The inputs can be wired to either sink or source current.

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:*

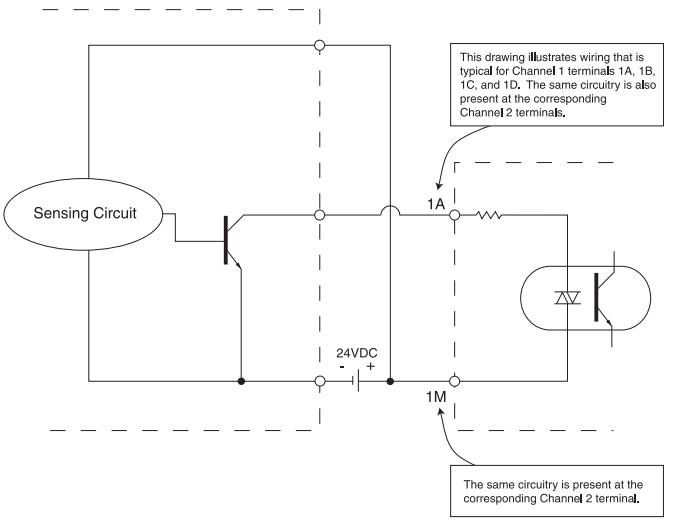
1. ***Inputs (1A, 1B, 1C, 1D and 2A, 2B, 2C, 2D) require user-provided 9-30 VDC power sources. Terminals 1M and 2M are the commons for Channel 1 and Channel 2 inputs. Maximum current consumption is 12mA per input point.***
2. ***Polarity of the input power sources (shown right) can be reversed. Consideration 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

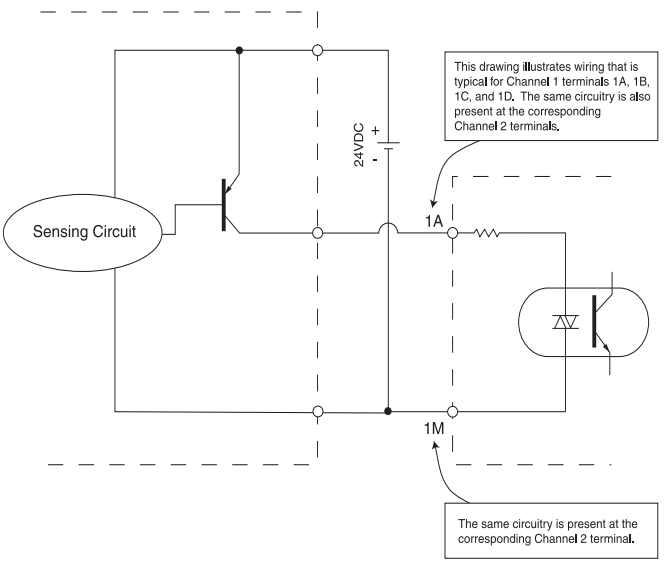
## Solid state input wiring device

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.

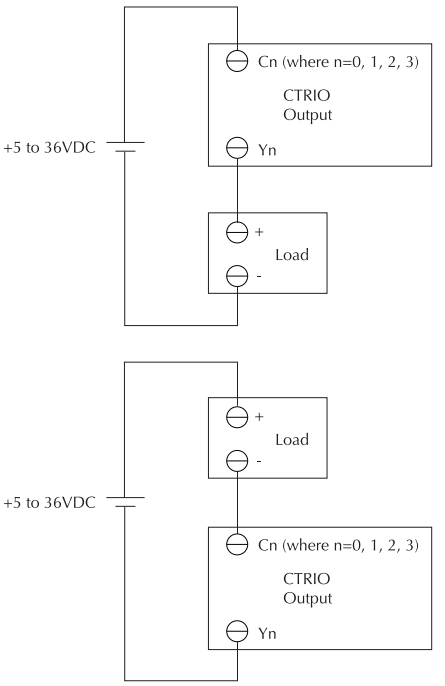
### NPN Field Device (sink)



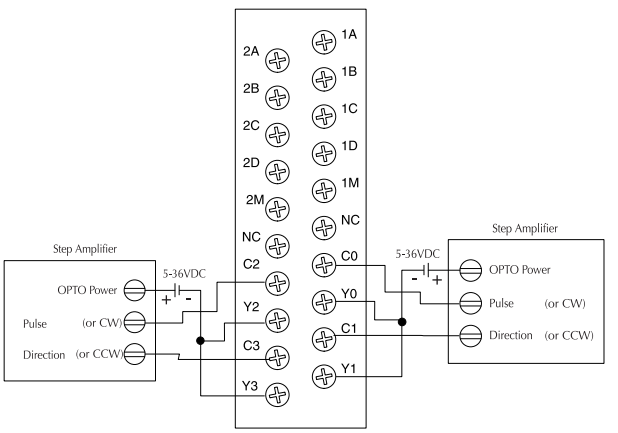

### PNP Field Device (source)




## Pulse output schematic




## Stepper/Servo drive wiring example

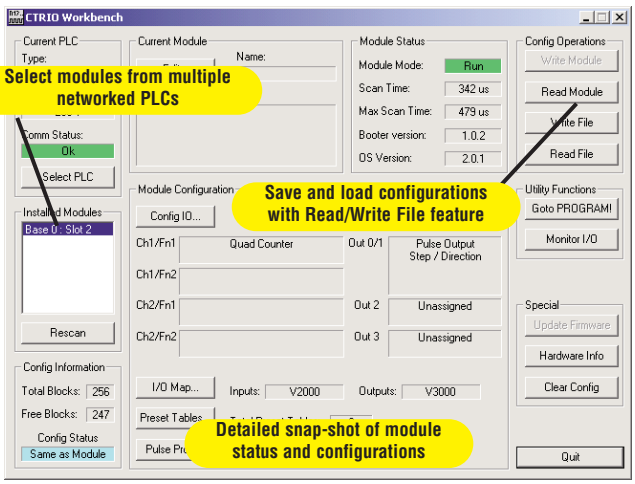


# High-speed I/O Counter Module

## 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 CTRIO Workbench utility ships with the CTRIO User Manual. You can also download the latest version free at the Host Engineering's Web site: www.hosteng.com.

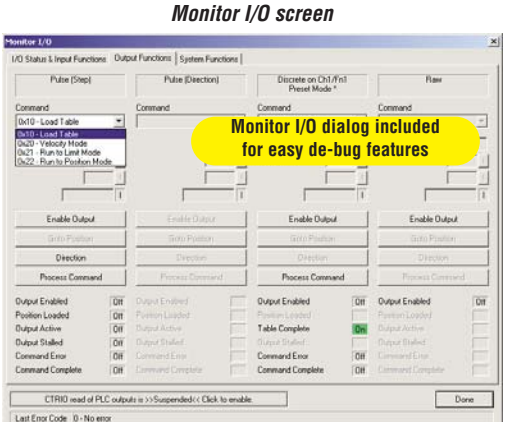
***CTRIO Workbench main configuration screen***




## CTRIO Workbench diagnostics and monitoring

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

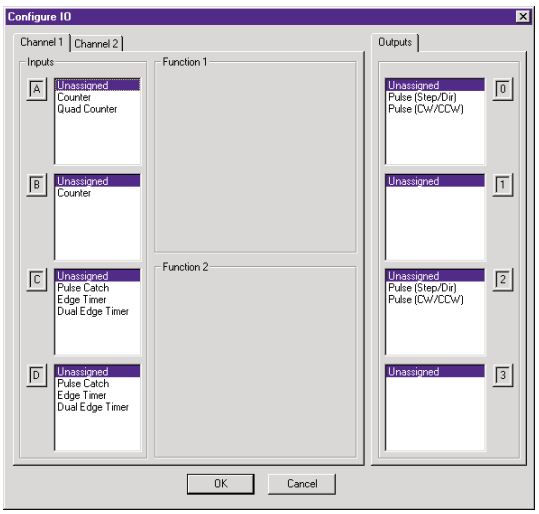
***Monitor I/O screen***




## CTRIO Workbench configure I/O setup

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

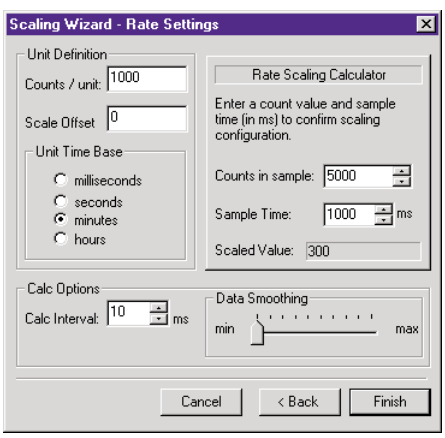
***Configure I/O Screen***




## 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

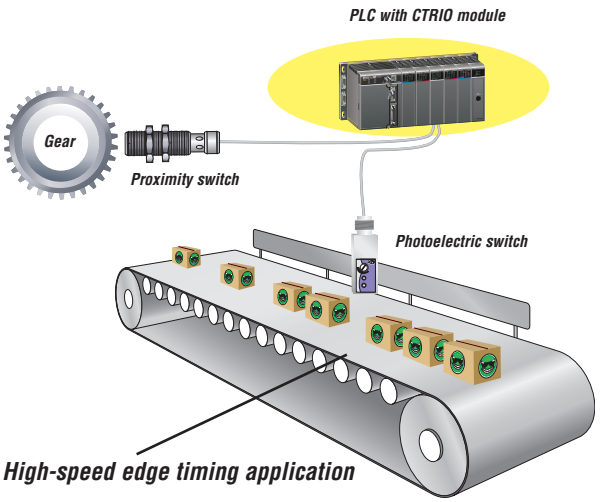
## High-speed input operations

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

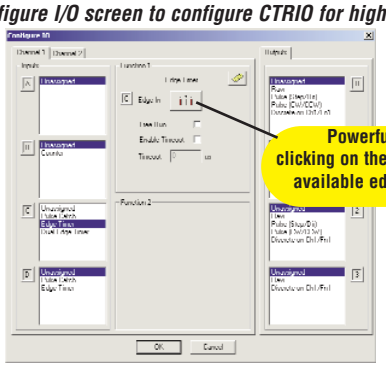
The CTRIO can be configured for timing functions based on both count or rate. Using a common configuration of a proximity switch sensing the teeth on a gear, the module is able to calculate the velocity of the gear based on the rate it receives its counts. This value can be scaled within the module to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

***High-speed timing application***




***High-speed edge timing application***

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

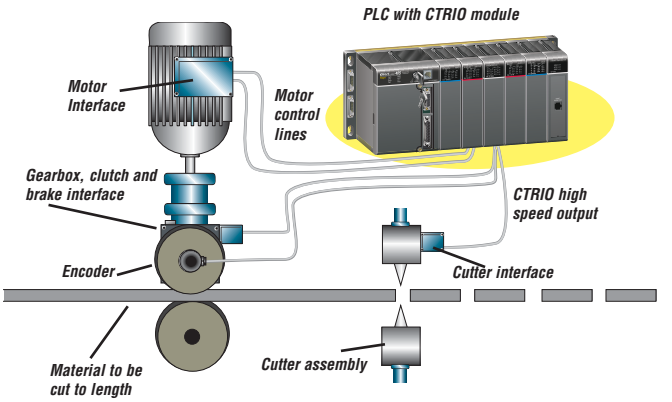


**Powerful edge timing functions - clicking on the edge button cycles through the available edge timing functions available**

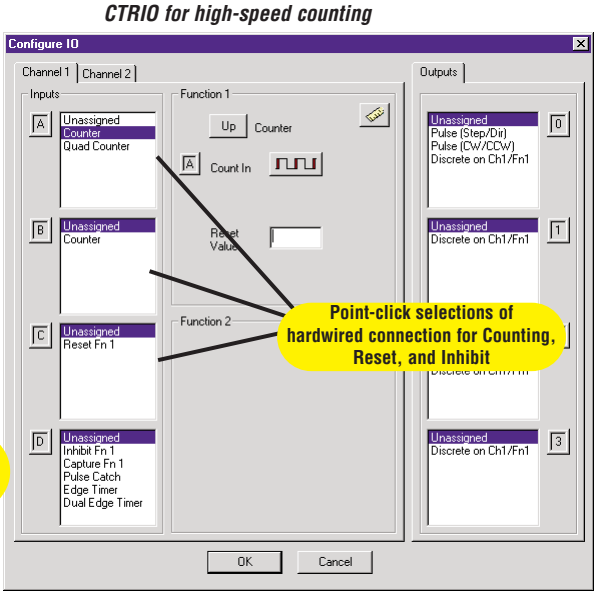
### High-speed counting

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

***High-speed cut-to-length application***




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

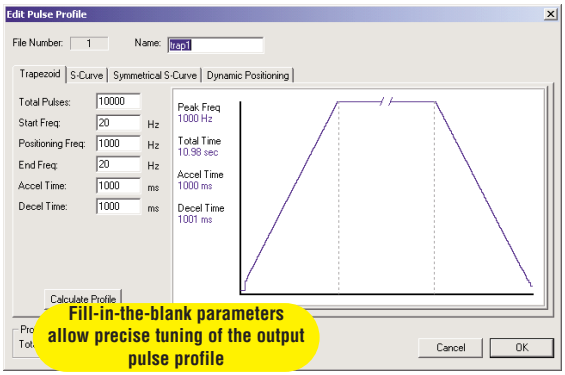



**Point-click selections of hardwired connection for Counting, Reset, and Inhibit**

# High-speed I/O Counter Module

## Pulse output operations

***Using Edit Pulse Profile screen to select Trapezoid pulse output profile***

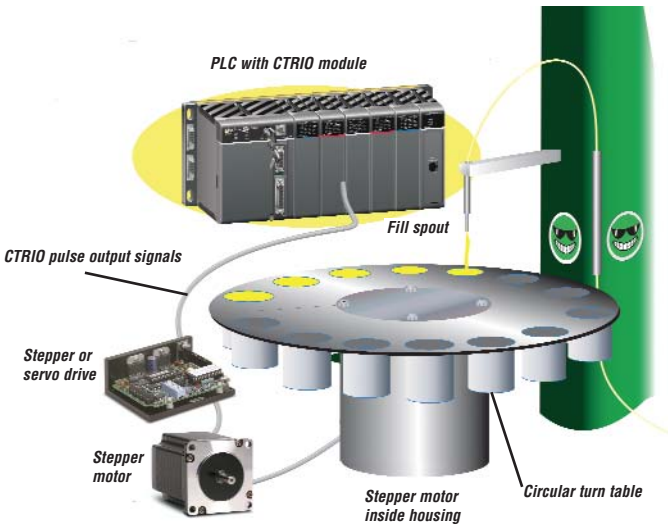



### Pulse output for stepper/servo control

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.

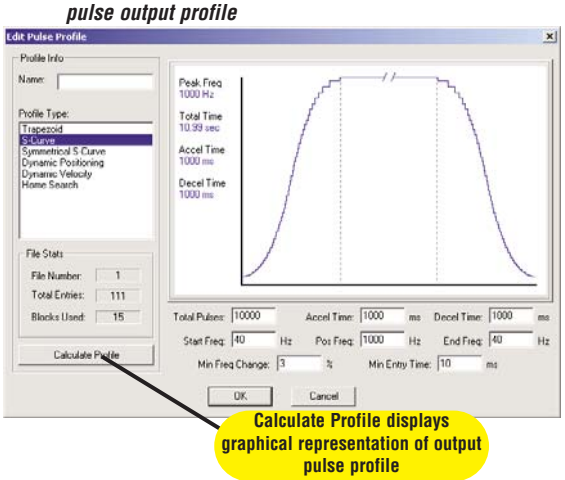



***Rotary indexing liquid fill application***

### Other common pulse output applications:

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

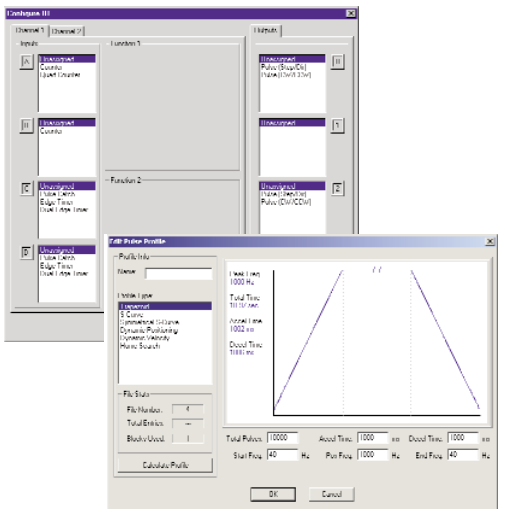
***Example of S-Curve acceleration and deceleration pulse output profile***



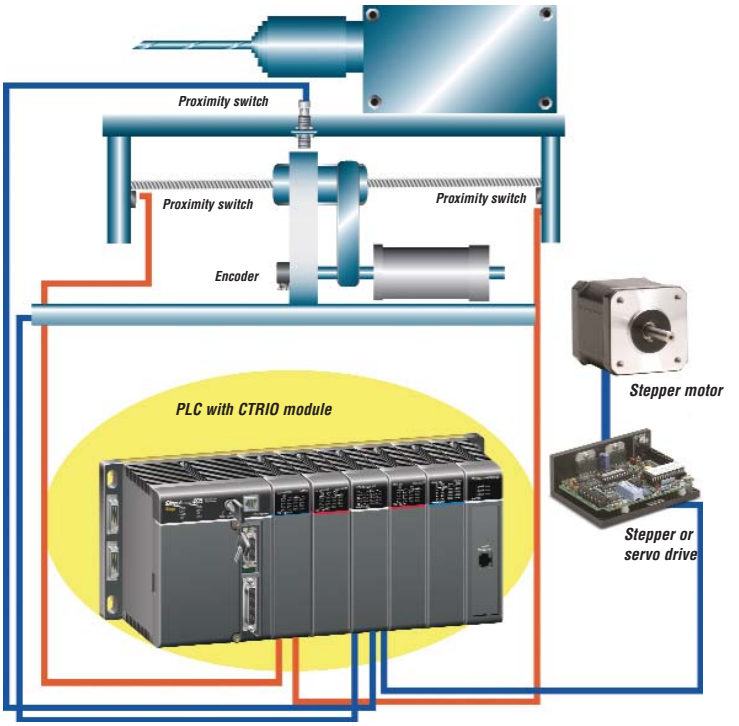
# High-speed I/O Counter Module

## 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***

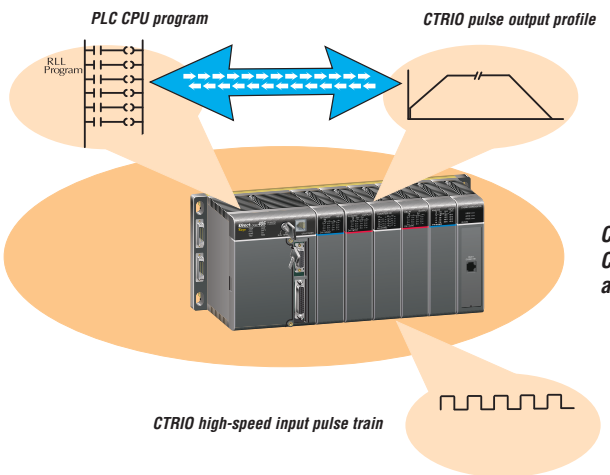



### High-Speed inputs and pulse output combinations

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

### Example application

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




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

# High-speed Counter Module

## High-speed Counter Module

**D4-HSC <--->**

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

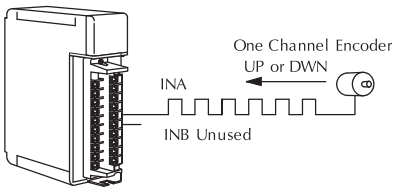
## Overview

The DL405 high-speed counter provides high-speed up or down counting capability. It provides the user with count data and output signals such as Clockwise, Counter-clockwise, Decelerate, and Equal. The module functions asynchronously with the DL405 CPU, allowing fast response and control.

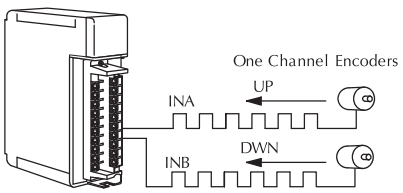
The D4-HSC module supports the following key features:

- Quadrature or up/down encoder input
- Maximum input pulse rate of 100 kHz (50% duty cycle)
- Seven user control inputs
- Four external outputs for controlling motor modes
- Counting range from –8,388,608 to +8,388,607 with overflow
- Counter input multiplication of X1, X2, or X4
- User selectable count direction
- A or B mode selection
  A mode to reset counter at preset
  B mode to continue counting after preset
- Find **Home** mode to search for home position
- Sampling count to determine pulse rate

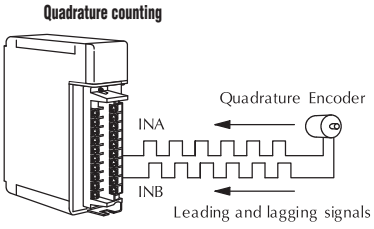
**Standard counting using one input**

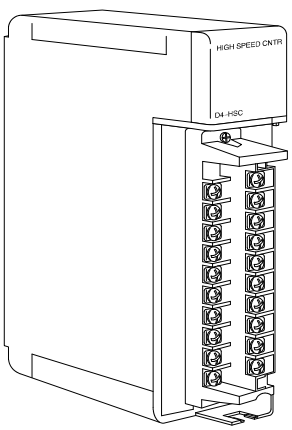



**Standard counting using two inputs**



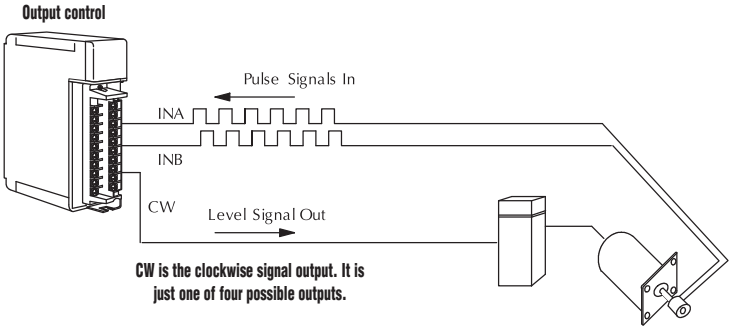

**Quadrature counting**




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

**Output control**




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

# High-speed Counter Module

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

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

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

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

# Wiring System for DL405 PLCs

## Cut PLC wiring time to minutes instead of hours

The *ZIP*Link wiring system eliminates the normally tedious process of wiring PLC I/O to terminal blocks. Simply plug one end of a *ZIP*Link pre-wired terminal block cable into your I/O module and the other end into a *ZIP*Link connector module. It's that easy. *ZIP*Links use half the space, at a fraction of the total cost of terminal blocks.

*ZIP*Links are available in a variety of styles to suit your needs, including fused, relay and sensor/LED connector modules. *ZIP*Links are available for all DL405 Series PLC discrete and analog input and output modules.

For complete information see *ZIP*Links in the Terminal Blocks and Wiring Solutions section.

## Specify your *ZIP*Link system

Use the Compatibility Matrix table below:

| | |
|---|---|
| ***Step 1*** | Locate the I/O module part number. |
| ***Step 2*** | Locate Connector Module Type. (Feedthrough Module, Fuse Module, etc...) |
| ***Step 3*** | Select the cable length by replacing the # symbol with: Blank = 0.5m, -1 = 1.0m, -2 = 2.0m[1] |

[1] ***Note: Cable part number denotes compatibility between Connector Module and I/O Modules.***

**ZipLink Wiring System Compatibility Matrix for DL405 PLCs**

| | ***Step 2: Connector Module Type*** | | ***Feedthrough Modules*** | | ***Fuse Modules*** | | ***Relay Modules*** | ***Sensor Input Modules*** | | ***Pigtail Cable*** |
|---|---|---|---|---|---|---|---|---|---|---|
| | ***Step 1: I/O Module*** | ***Number of Terminals*** | **Step 3: Cables** | | | | | | | |
| | **Inputs** | | | | | | | | | |
| ***I/O Module*** | ***D4-08ND3S*** | 20 | ZL-D4-CBL20# | | | | | | | |
| | ***D4-16ND2*** | 20 | ZL-D4-CBL20# | | | | | ZL-D4-CBL20# | | |
| | ***D4-16ND2F*** | 20 | ZL-D4-CBL20# | | | | | ZL-D4-CBL20# | | |
| | ***D4-32ND3-1*** | 40 | | ZL-D24-CBL40# | | | | | ZL-D24-CBL40# | ZL-D24-CBL40#P |
| | ***D4-32ND3-2*** | 40 | | ZL-D24-CBL40# | | | | | ZL-D24-CBL40# | ZL-D24-CBL40#P |
| | ***D4-64ND2**** | 40 | | ZL-D24-CBL40# | | | | | ZL-D24-CBL40# | ZL-D24-CBL40#P |
| | ***D4-08NA***** | 11 | | | | | | | | |
| | ***D4-16NA*** | 20 | ZL-D4-CBL20# | | | | | | | |
| | ***D4-16NA-1*** | 20 | ZL-D4-CBL20# | | | | | | | |
| | ***D4-16NE3*** | 20 | ZL-D4-CBL20# | | | | | ZL-D4-CBL20# | | |
| | ***F4-08NE3S*** | 20 | ZL-D4-CBL20# | | | | | | | |
| | **Outputs** | | | | | | | | | |
| | ***D4-08TD1***** | 11 | | | | | | | | |
| | ***F4-08TD1S***** | 20 | | | | | | | | |
| | ***D4-16TD1*** | 20 | ZL-D4-CBL20# | | ZL-D4-CBL20# | | | | | |
| | ***D4-16TD2*** | 20 | ZL-D4-CBL20# | | ZL-D4-CBL20# | | | | | |
| | ***D4-32TD1*** | 40 | | ZL-D24-CBL40# | | ZL-D24-CBL40# | | | | ZL-D24-CBL40#P |
| | ***D4-32TD1-1*** | 40 | | ZL-D24-CBL40# | | ZL-D24-CBL40# | | | | ZL-D24-CBL40#P |
| | ***D4-32TD2*** | 40 | | ZL-D24-CBL40# | | ZL-D24-CBL40# | | | | ZL-D24-CBL40#P |
| | ***D4-64TD1**** | 40 | | ZL-D24-CBL40# | | ZL-D24-CBL40# | | | | ZL-D24-CBL40#P |
| | ***D4-08TA***** | 11 | | | | | | | | |
| | ***D4-16TA*** | 20 | ZL-D4-CBL20# | | ZL-D4-CBL20# | | | | | |
| | ***D4-08TR***** | 11 | | | | | | | | |
| | ***F4-08TRS-1******** | 20 | ZL-D4-CBL20# | | | | | | | |
| | ***F4-08TRS-2******** | 20 | ZL-D4-CBL20# | | | | | | | |
| | ***D4-16TR***** | 20 | ZL-D4-CBL20# | | ZL-D4-CBL20# | | | | | |

**** The D4-64ND2 and D4-64TD1 modules have two 32-point connectors and require 2 ZIPLink cables and 2 ZIPLink connector modules.***

***** These modules are not supported by the ZIPLink wiring system.***

****** Caution: The D4-16TR relay outputs are derated not to exceed 2 Amps per point and 4 Amps per common when used with the ZIPLink wiring system.***

******* The F4-08TRS-1 and F4-08TRS-2 are derated not to exceed 2 Amps per point and 2 Amps per common when used with the ZIPLink wiring system.***

***ZIPLinks Connector Modules specifications begin on page 26-56***

***ZIPLinks Cables specifications begin on page 26-74***

# Wiring System for DL405 PLCs

| | |
|---|---|
| ***Step 1*** | Locate the I/O module part number. |
| ***Step 2*** | Locate Connector Module Type. (Feedthrough Module, Fuse Module, etc...) |
| ***Step 3*** | Select the cable length by replacing the # symbol with: Blank = 0.5m, -1 = 1.0m, -2 = 2.0m[1] |
| [1] ***Note: Cable part number denotes compatibility between Connector Module and I/O Modules.*** | |

**ZipLink Wiring System Compatibility Matrix for DL405 PLCs Continued**

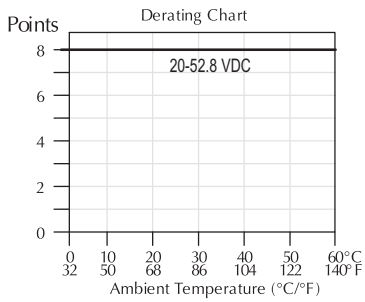
| I/O Module | Step 2: Connector Module Type | | Feedthrough Modules | | Fuse Modules | | Relay Modules | | Pigtail Cable | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Step 1: I/O Module | Number of Terminals | ZL-RTB20 | ZL-RTB40 | ZL-RFU20 | ZL-RFU40 | ZL-RRL16-24 | ZL-RRL16-120 | ZL-LTB16-24 | ZL-LTB32-24 |
| | | | Step 3: Cables | | | | | | | |
| | **Analog** | | | | | | | | | |
| | F4-04AD | 20 | ZL-D4-CBL20# | | | | | | | |
| | F4-04ADS | 20 | ZL-D4-CBL20# | | | | | | | |
| | F4-08AD | 20 | ZL-D4-CBL20# | | | | | | | |
| | F4-16AD-1 | 20 | ZL-D4-CBL20# | | | | | | | |
| | F4-16AD-2 | 20 | ZL-D4-CBL20# | | | | | | | |
| | F4-04DA-1 | 20 | ZL-D4-CBL20# | | | | | | | |
| | F4-04DA-2 | 20 | ZL-D4-CBL20# | | | | | | | |
| | F4-08DA-1 | 20 | ZL-D4-CBL20# | | | | | | | |
| | F4-16DA-1 | 20 | ZL-D4-CBL20# | | | | | | | |
| | F4-08DA-2 | 20 | ZL-D4-CBL20# | | | | | | | |
| | F4-16DA-2 | 20 | ZL-D4-CBL20# | | | | | | | |
| | F4-04DAS-1 | 20 | ZL-D4-CBL20# | | | | | | | |
| | F4-04DAS-2 | 20 | ZL-D4-CBL20# | | | | | | | |
| | F4-08THM* | 21 | | | | | | | | |
| | F4-08THM-n* | 21 | | | | | | | | |
| | F4-08RTD* | 20 | | | | | | | | |

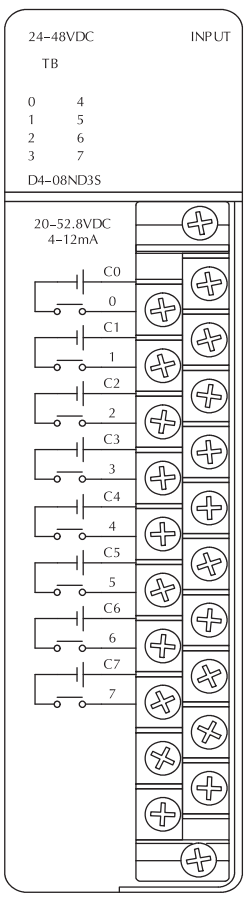
**** The F4-08THM, F4-08THM-n and F4-08RTD modules are not supported by the ZIPLink wiring system. These modules require wire specific to the signal type.***

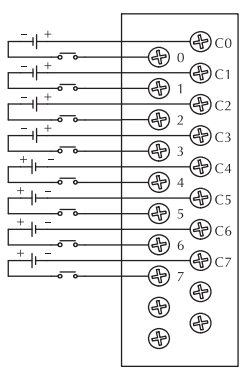
# DC Input Modules

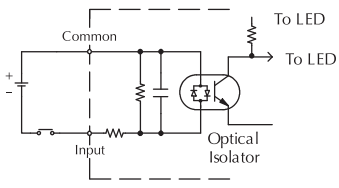
| D4-08ND3S DC Input <---> | |
|---|---|
| ***Inputs per Module*** | 8 (sink/source) |
| ***Commons per Module*** | 8 (isolated) |
| ***Input Voltage Range*** | 20- 52.8VDC |
| ***Peak Voltage*** | 52.8VDC |
| ***ON Voltage Level*** | >18V |
| ***OFF Voltage Level*** | <7V |
| ***Input Impedance*** | 4.8KΩ |
| ***Input Current*** | 5mA @ 24VDC<br>10 mA @ 48VDC |
| ***Minimum ON Current*** | 3.5mA |
| ***Maximum OFF Current*** | 1.5mA |
| ***Base Power Required 5V*** | 100mA max |
| ***OFF to ON Response*** | 3-10ms |
| ***ON to OFF Response*** | 3-12ms |
| ***Terminal Type (included)*** | Removable (D4-16ICON) |
| ***Status Indicators*** | Logic Side |
| ***Weight*** | 8.8oz. (250g) |

See page 6-57 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.



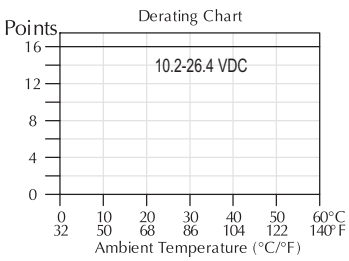



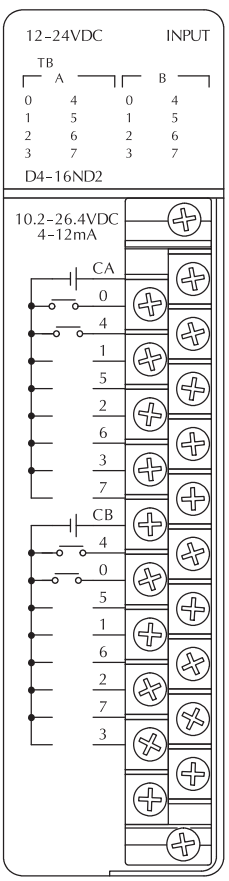



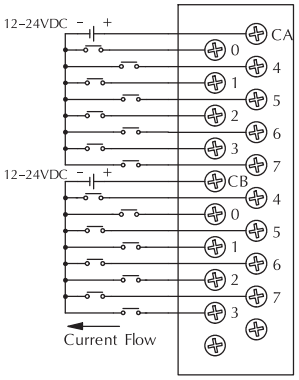

Current sourcing configuration shown

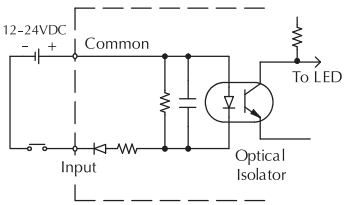
| D4-16ND2 DC Input <---> | |
|---|---|
| ***Inputs per Module*** | 16 (current sourcing) |
| ***Commons per Module*** | 2 (isolated) |
| ***Input Voltage Range*** | 10.2- 26.4VDC |
| ***Peak Voltage*** | 26.4VDC |
| ***ON Voltage Level*** | >9.5V |
| ***OFF Voltage Level*** | <4.0V |
| ***Input Impedance***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

See page 6-57 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.



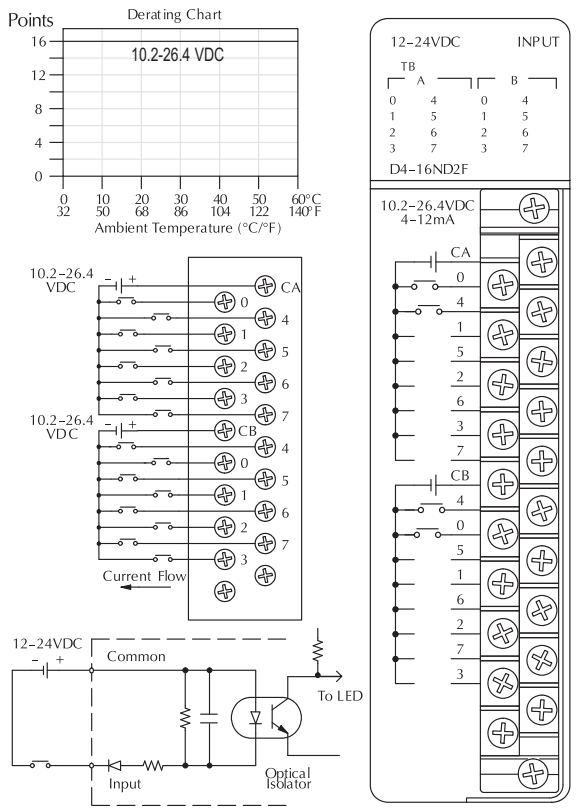



# DC Input Modules

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

See page 6-57 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.

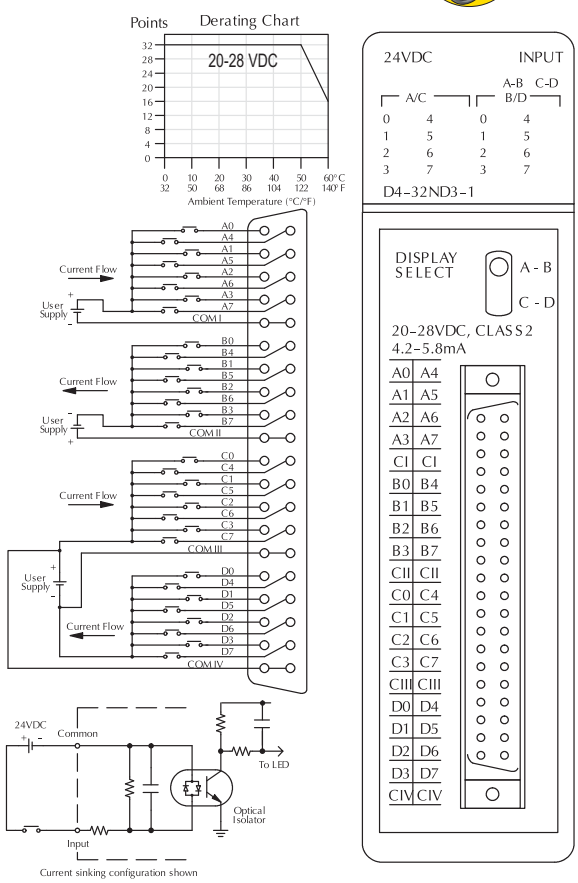


# DC Input Modules

| D4-32ND3-1 DC Input <---> | |
|---|---|
| ***Inputs per Module*** | 32 (sink/source) |
| ***Commons per Module*** | 4 (isolated) |
| ***Input Voltage Range*** | 20- 28 VDC |
| ***Peak Voltage*** | 30VDC |
| ***ON Voltage Level*** | >19V |
| ***OFF Voltage Level*** | <10V |
| ***Input Impedance*** | 4.8KΩ |
| ***Input Current*** | 5mA @ 24VDC |
| ***Minimum ON Current*** | 3.5mA |
| ***Maximum OFF Current*** | 1.6mA |
| ***Base Power Required 5V*** | 150mA max |
| ***OFF to ON Response*** | 2-10ms |
| ***ON to OFF Response*** | 2-10ms |
| ***Terminal type*** (See *ZIP*Links note below) | Connectors sold separately. See page 6-19. |
| ***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 page 6-57 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.



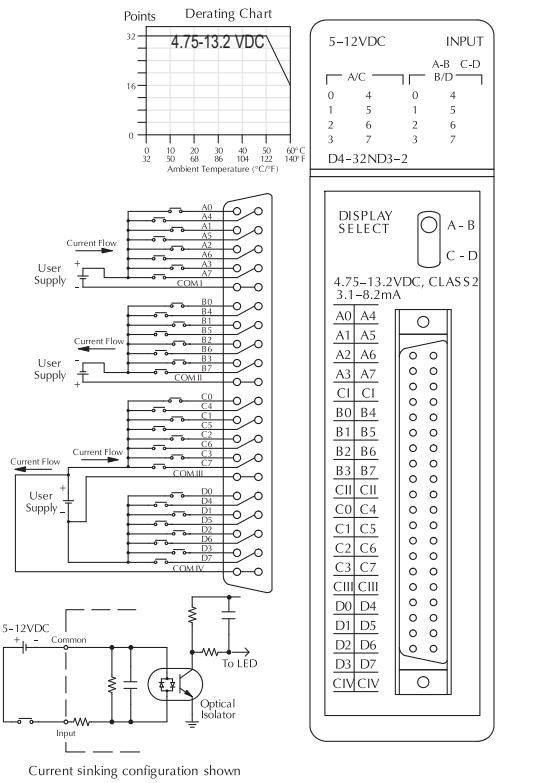

Current sinking configuration shown

| D4-32ND3-2 DC Input <---> | |
|---|---|
| ***Inputs per Module*** | 32 (sink/source) |
| ***Commons per Module*** | 4 (isolated) |
| ***Input Voltage Range*** | 4.75-13.2VDC |
| ***Peak Voltage*** | 15VDC |
| ***ON Voltage Level*** | >4V |
| ***OFF Voltage Level*** | <2V |
| ***Input Impedance*** | 2KΩ @ 5V<br>1.6MΩ @ 12VDC |
| ***Input Current*** | 2.5mA @ 5V<br>7.5mA @ 12V |
| ***Minimum ON Current*** | 1.8mA |
| ***Maximum OFF Current*** | 0.8mA |
| ***Base Power Required 5V*** | 150mA max |
| ***OFF to ON Response*** | 1-4ms |
| ***ON to OFF Response*** | 1-4ms |
| ***Terminal type*** (See *ZIP*Links note below) | Connectors sold separately. See page 6-19. |
| ***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 page 6-57 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.***




Current sinking configuration shown

# DC Input Modules

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

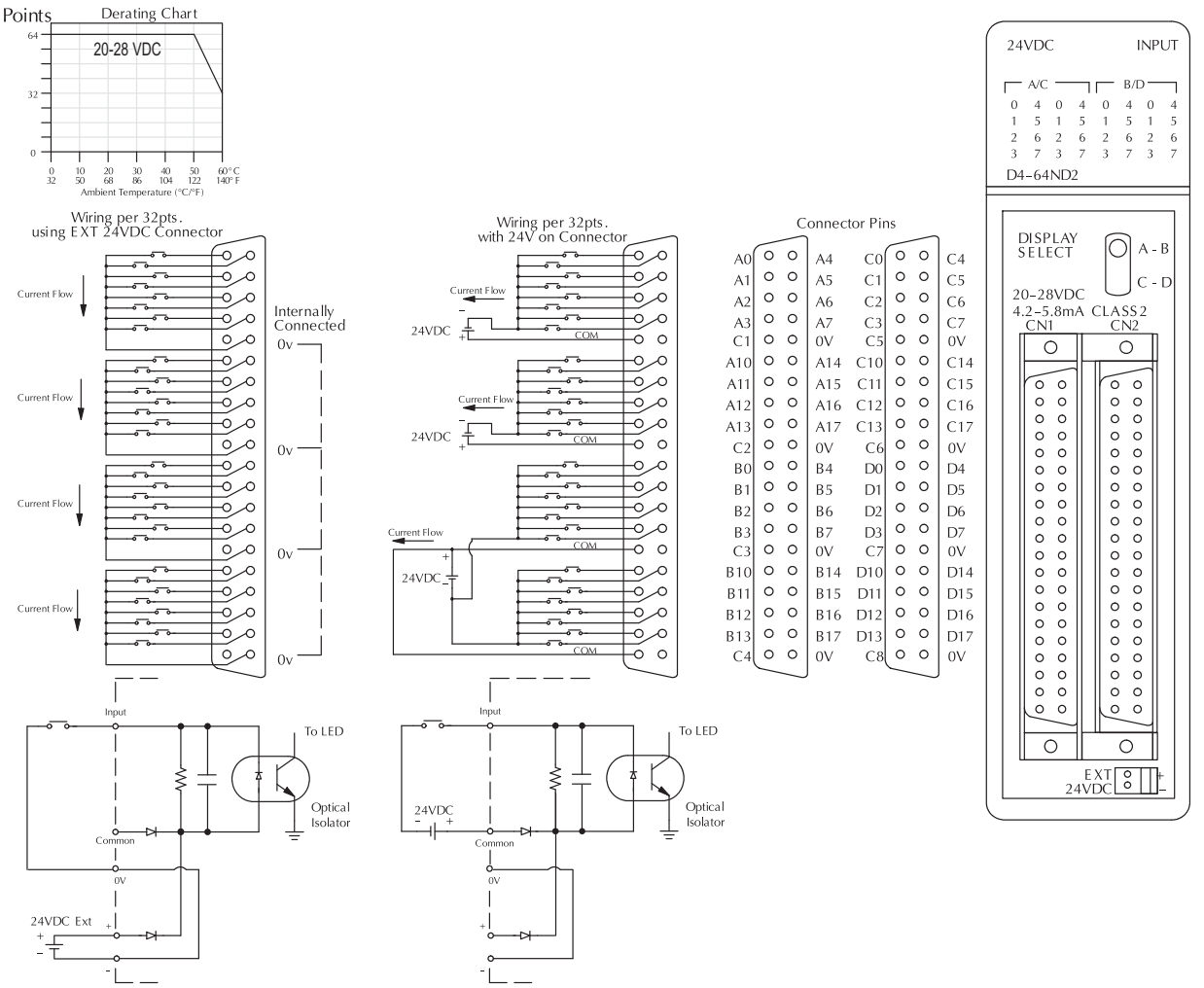
| | |
|---|---|
| ***External Power Required (optional)*** | 24VDC ± 10%, 320mA max |
| ***OFF to ON Response*** | 2.5ms (typical) |
| ***ON to OFF Response*** | 5ms (typical) |
| ***Terminal Type*** (See ***ZIP***Links note below) | Connectors sold separately. See page 6-19. |
| ***Status Indicators*** | 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 page 6-57 for part numbers of ***ZIP***Link cables and connection modules compatible with this I/O module.

**** 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.***

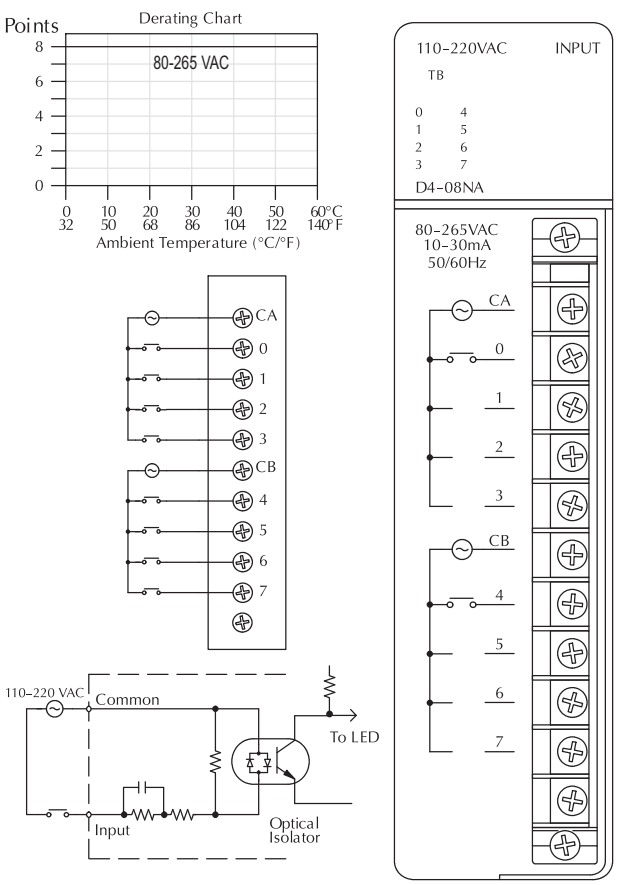


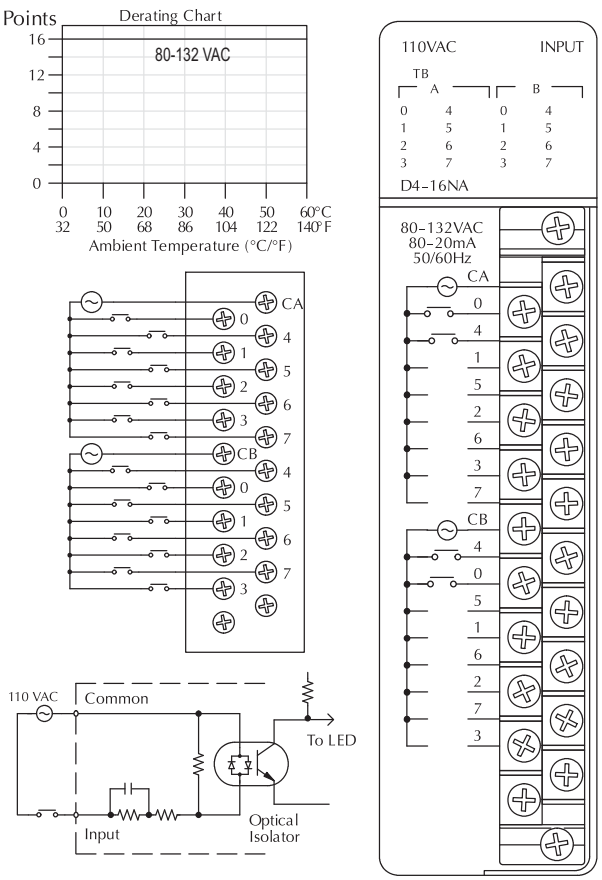
# AC Input Modules

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

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

See page 6-57 for part numbers of ***ZIP***Link cables and connection modules compatible with this I/O module.

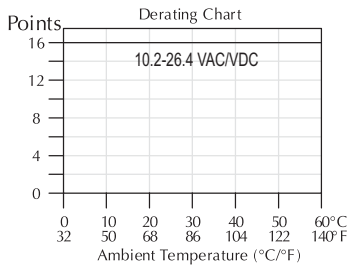


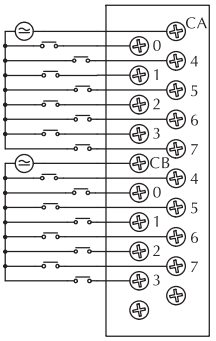



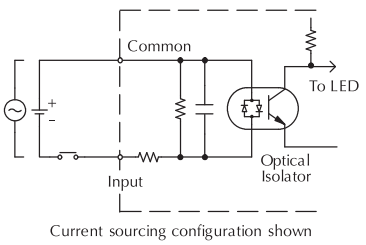
# AC and AC/DC Input Modules

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

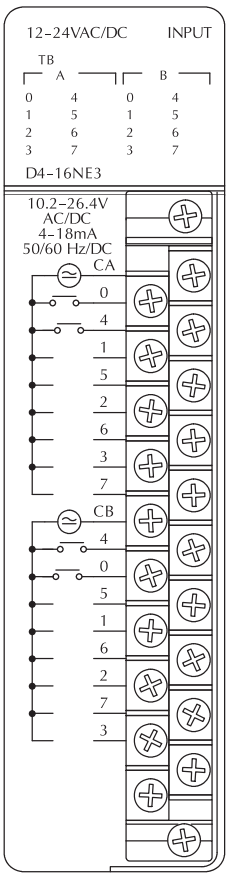
See page 6-57 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.




Current sourcing configuration shown

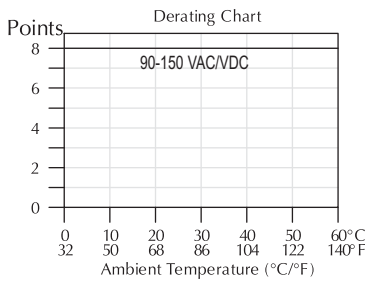


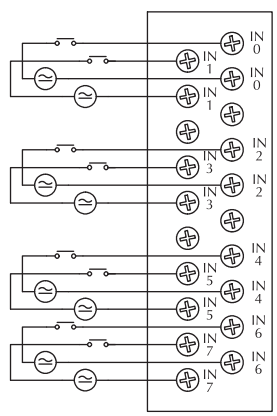
# AC/DC Input and Simulator Modules

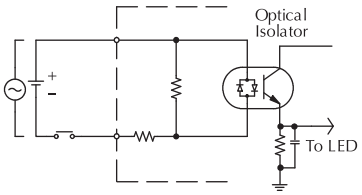
| F4-08NE3S AC/DC Input <---> | |
|---|---|
| ***Inputs per Module*** | 8 (sink/source) |
| ***Commons per Module*** | 8 (isolated) |
| ***Input Voltage Range*** | 90-150VAC/VDC |
| ***Peak Voltage*** | 350 peak < 1ms |
| ***AC Frequency*** | 47-63Hz |
| ***ON Voltage Level*** | >90VDC/75VAC |
| ***OFF Voltage Level*** | <60VDC/45VAC |
| ***Input Impedance*** | 22KΩ |
| ***Input Current*** | 5.5mA @ 120V |
| ***Minimum ON Current*** | 4mA |
| ***Maximum OFF Current*** | 2mA |
| ***Base Power Required 5V*** | 90mA max |
| ***OFF to ON Response*** | 8ms |
| ***ON to OFF Response*** | 15ms |
| ***Terminal Type (included)*** | Removable (D4-16IOCON) |
| ***Status Indicators*** | Logic side |
| ***Weight*** | 9oz. (256g) |

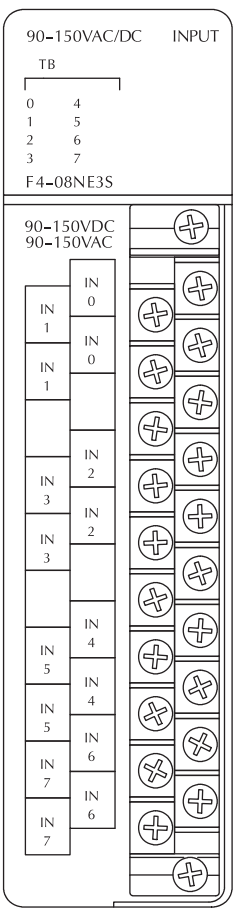
| D4-16SIM Input Simulator <---> | |
|---|---|
| ***Inputs per Module*** | 8 or 16 selectable by internal switch |
| ***Base Power Required 5V*** | 150mA max |
| ***Terminal Type*** | None |
| ***Status Indicators*** | Logic side |
| ***Weight*** | 8.8oz. (250g) |
| **8 or 16 point selection switch is located on the back of the module<br>8 or 16 point selection is indicated by the LEDs above the input switch status** | |

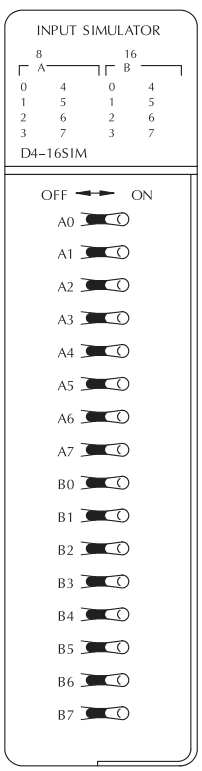
See page 6-57 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.



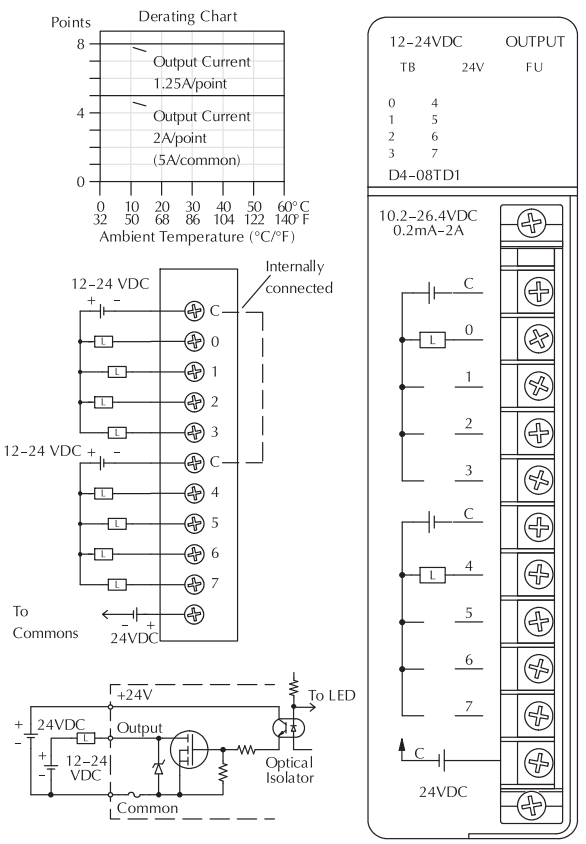



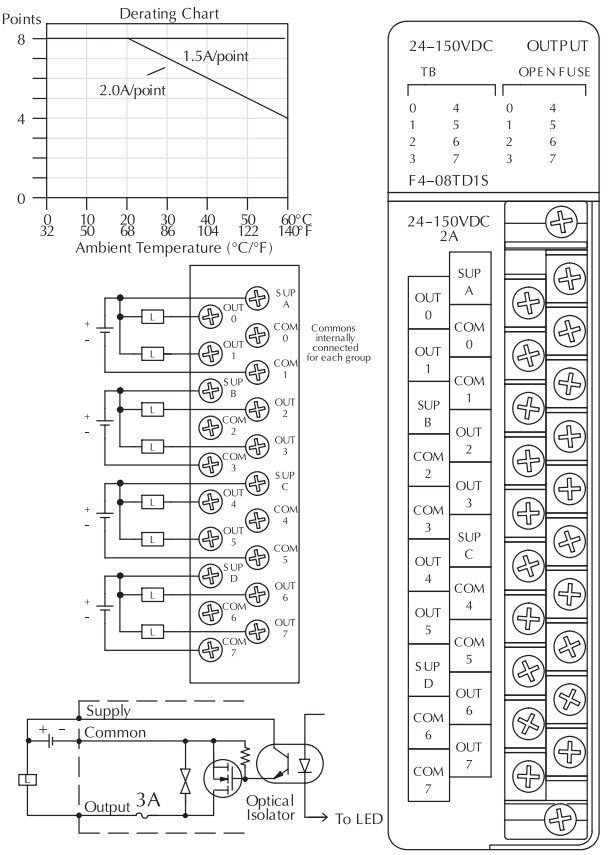



# DC Output Modules

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

| F4-08TD1S DC Output <---> | |
|---|---|
| ***Outputs per Module*** | 8 (current sinking) |
| ***Commons per Module*** | 4 (isolated, 8 terminals) |
| ***Operating Voltage*** | 24-150VDC |
| ***Output Type*** | MOS FET |
| ***Peak Voltage*** | 200VDC < 1ms |
| ***ON Voltage Drop*** | 0.5VDC @ 2A |
| ***Max Current (resistive)*** | 2A/point<br>4A/common |
| ***Max Leakage Current*** | 5µA |
| ***Max Inrush Current*** | 30A for 1ms<br>19A for 10ms |
| ***Minimum Load*** | N/A |
| ***Base Power Required 5V*** | 295mA max |
| ***External DC Required*** | None |
| ***OFF to ON Response*** | 25µs |
| ***ON to OFF Response*** | 25µs |
| ***Terminal Type (included)*** | Removable (D4-16IOCON) |
| ***Status Indicators*** | Logic side |
| ***Weight*** | 10oz. (282g) |
| ***Fuses*** | 1 (3A) per output (see diagram)<br>Non-replaceable |

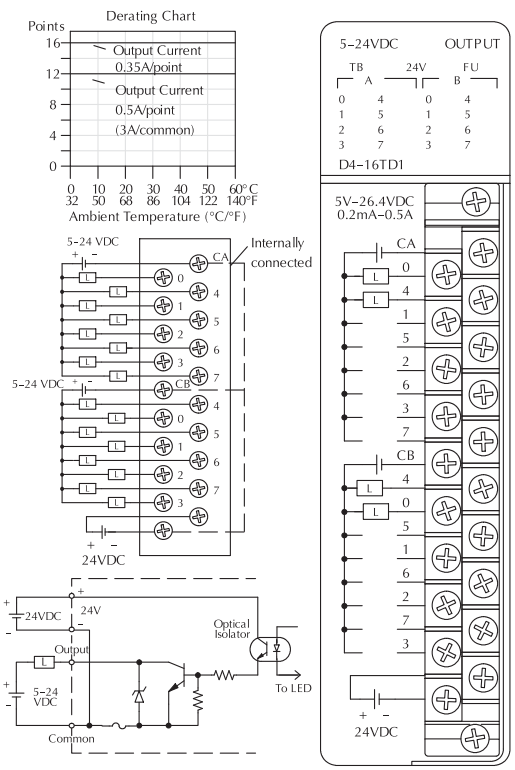


# DC Output Modules

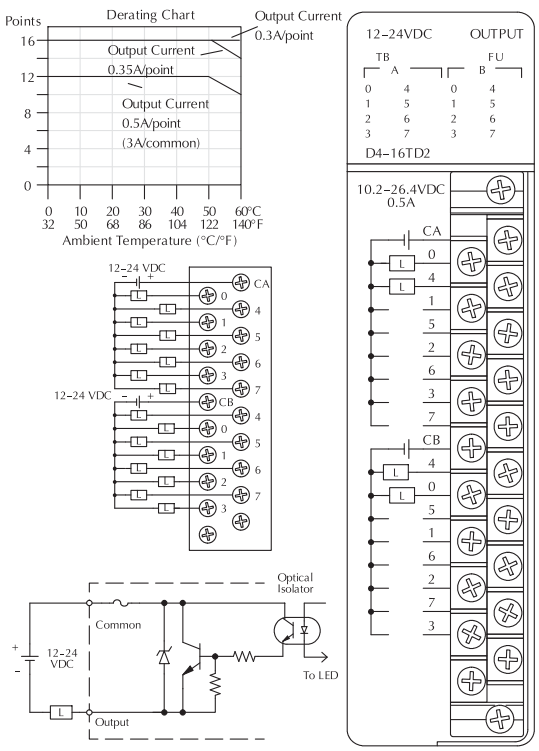
| D4-16TD1 DC Output <---> | |
|---|---|
| ***Outputs per Module*** | 16 (current sinking) |
| ***Commons per Module*** | 2 internally connected |
| ***Operating Voltage*** | 4.5-26.4VDC |
| ***Output Type*** | NPN Open collector |
| ***Peak Voltage*** | 40VDC |
| ***ON Voltage Drop*** | 0.5VDC @ 0.5A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

See page 6-57 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.




See page 6-57 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.

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

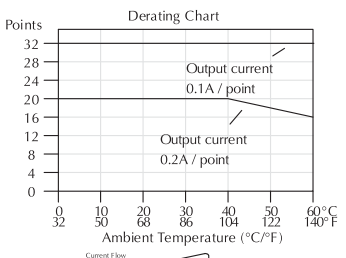


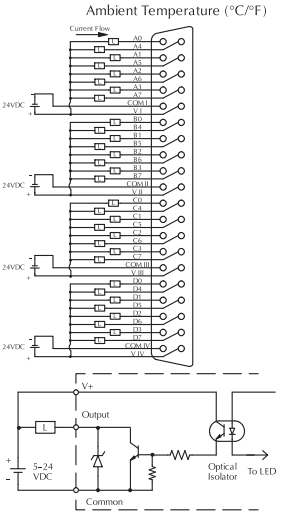
# DC Output Modules

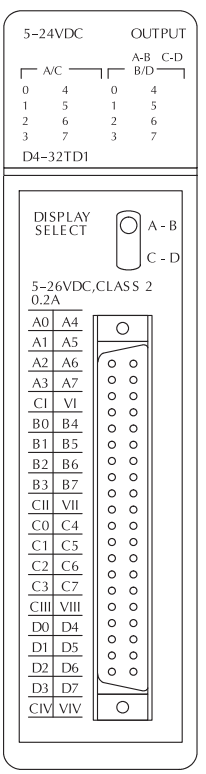
| D4-32TD1 DC Output <---> | |
|---|---|
| ***Outputs per Module*** | 32 (current sinking) |
| ***Commons per Module*** | 4 (isolated) |
| ***Operating Voltage*** | 4.75–26.4VDC |
| ***Output Type*** | NPN Open Collector |
| ***Peak Voltage*** | 36VDC |
| ***ON Voltage Drop*** | 0.6VDC @ 0.2A |
| ***Max Current (resistive)*** | 0.2A/point<br>1.6A/common |
| ***Max Leakage Current*** | 0.1mA @ 36VDC |
| ***Max Inrush Current*** | 1A for 10ms<br>0.5A for 100ms |
| ***Minimum Load*** | 0.1mA |
| ***Base Power Required 5V*** | 250mA max |
| ***External DC Required*** | 24VDC± 10%, 140mA max |
| ***OFF to ON Response*** | 0.1ms |
| ***ON to OFF Response*** | 0.1ms |
| ***Terminal Type***<br>(See *ZIP*Links note below) | Connectors sold separately.<br>See page 6-19. |
| ***Status Indicators*** | Logic side |
| ***Weight*** | 6.7oz. (190g) |
| ***Fuses*** | None |

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

See page 6-57 for part numbers of *ZIP*Link 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.**

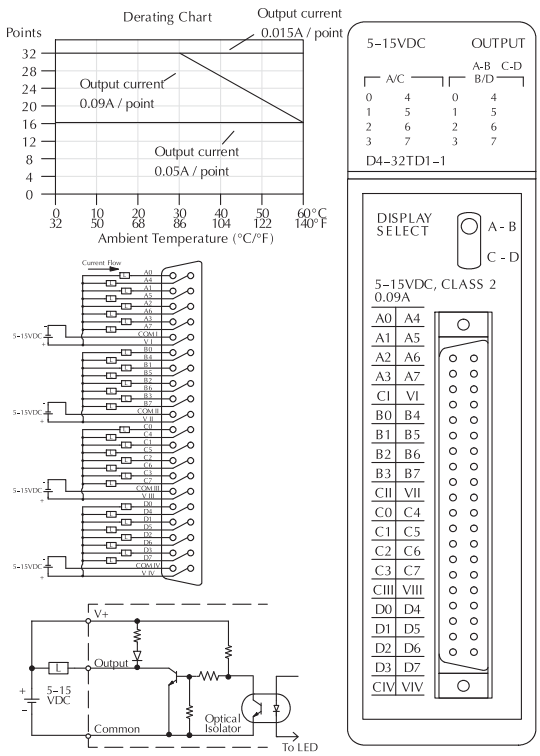
# DC Output Modules

| D4-32TD1-1 DC Output <---> | |
|---|---|
| ***Outputs per Module*** | 32 (current sinking) |
| ***Commons per Module*** | 4 (isolated) |
| ***Operating Voltage*** | 5-15VDC |
| ***Output Type*** | NPN Open Collector (with pull-up) |
| ***Peak Voltage*** | 16.5VDC |
| ***ON Voltage Drop*** | 0.4VDC @ 0.1A |
| ***Max Current (resistive)*** | 0.09A/point<br>0.72A/common<br>2.88A/module |
| ***Max Leakage Current*** | 0.01mA @ 16.5VDC |
| ***Max Inrush Current*** | 0.5A for 10ms<br>0.2A for 100ms |
| ***Minimum Load*** | 0.15mA |
| ***Base Power Required 5V*** | 250mA max |
| ***External DC Required*** | 5-15VDC ± 10%, 150mA max |
| ***OFF to ON Response*** | 0.1ms |
| ***ON to OFF Response*** | 0.1ms |
| ***Terminal Type***<br>(See *ZIP*Links note below) | Connectors sold separately.<br>See page 6-19. |
| ***Status Indicators*** | Logic side |
| ***Weight*** | 6.7oz. (190g) |
| ***Fuses*** | None |

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

**This module operates on reverse logic -**
**(voltage present when output is OFF, no voltage when output is ON).**

See page 6-57 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.

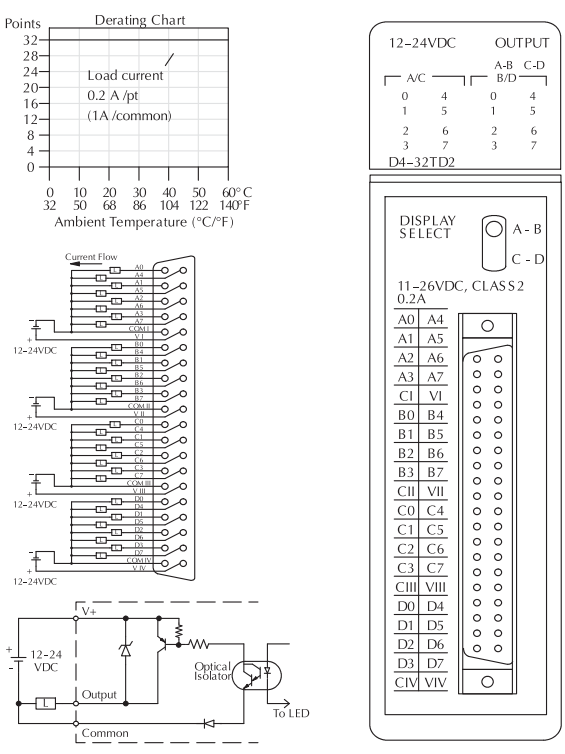



See page 6-57 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.

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

| D4-32TD2 DC Output <---> | |
|---|---|
| ***Outputs per Module*** | 32 (current sourcing) |
| ***Commons per Module*** | 4 (isolated) |
| ***Operating Voltage*** | 10.8-26.4VDC |
| ***Output Type*** | PNP Open Collector |
| ***Peak Voltage*** | 30VDC |
| ***ON Voltage Drop*** | 0.6VDC @ 0.2A |
| ***Max Current (resistive)*** | 0.2A/point<br>1.0A/common<br>4.0A/module |
| ***Max Leakage Current*** | 0.01mA @ 26.4VDC |
| ***Max Inrush Current*** | 500mA for 10ms |
| ***Minimum Load*** | 0.2mA |
| ***Base Power Required 5V*** | 350mA max |
| ***External DC Required*** | 10.8-26.4VDC<br>1A/common including load |
| ***OFF to ON Response*** | 0.2ms |
| ***ON to OFF Response*** | 0.2ms |
| ***Terminal Type***<br>(See *ZIP*Links note below) | Connectors sold separately.<br>See page 6-19. |
| ***Status Indicators*** | Logic side |
| ***Weight*** | 6.7oz. (190g) |
| ***Fuses*** | None |

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



# DC Output Modules

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

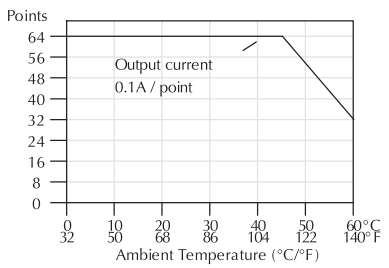
**** 1. If you are using 64-pt. modules, you cannot install any speciality modules in slots 5, 6, or 7 of the local CPU base.***

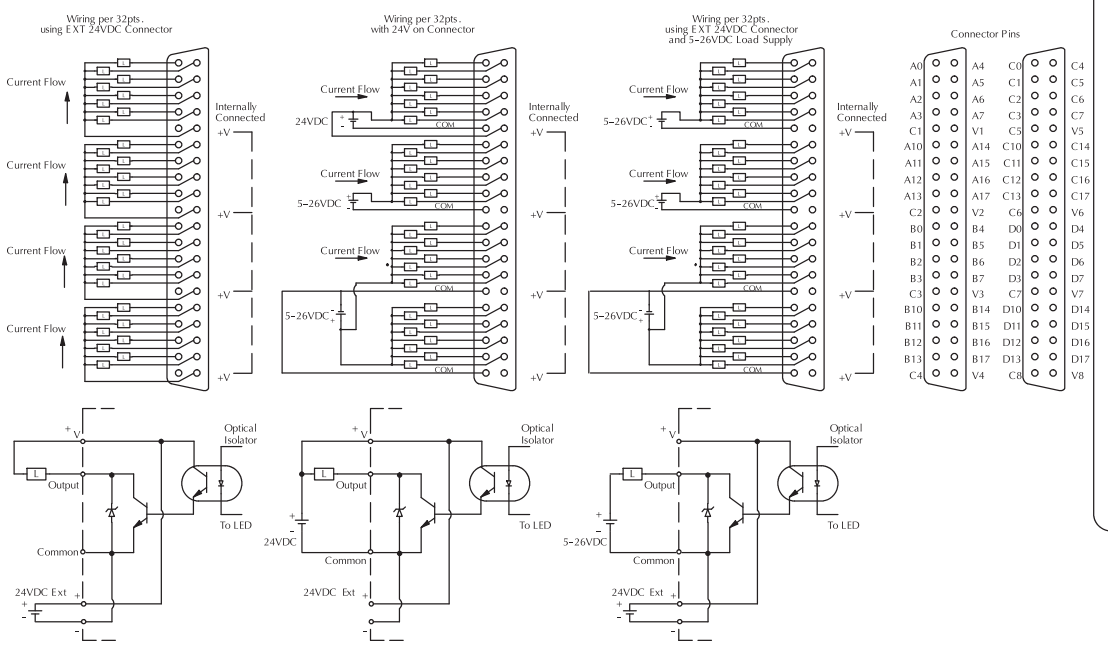
***2. Modules are not allowed in expansion bases.***

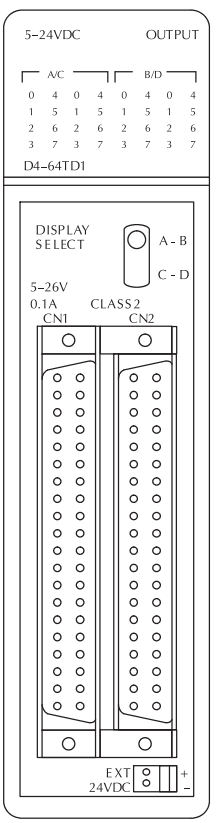
| | |
|---|---|
| ***Base power Required 5V*** | 800mA max |
| ***External DC Required*** | 24VDC ± 10 % (850mA per common) 7.0A total max |
| ***OFF to ON Response*** | 0.1ms |
| ***On to OFF Response*** | 0.2ms |
| ***Terminal type*** (See ***ZIP***Links note below) | Connectors sold separately. See page 6-19. |
| ***Status Indicators*** | Logic side |
| ***ON Voltage Drop*** | 1.5VAC @ 2A |
| ***Weight*** | 7.4oz. (210g) |
| ***Fuses*** | None |

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

See page 6-57 for part numbers of ***ZIP***Link cables and connection modules compatible with this I/O module.



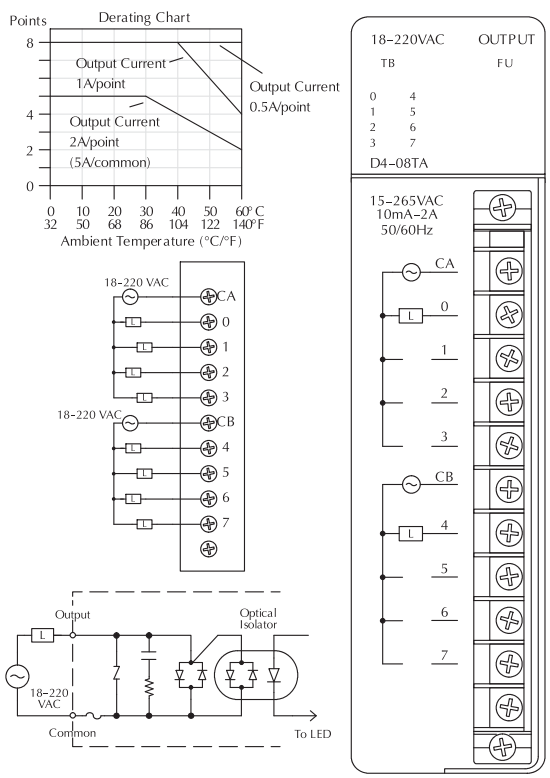
# AC Output Modules

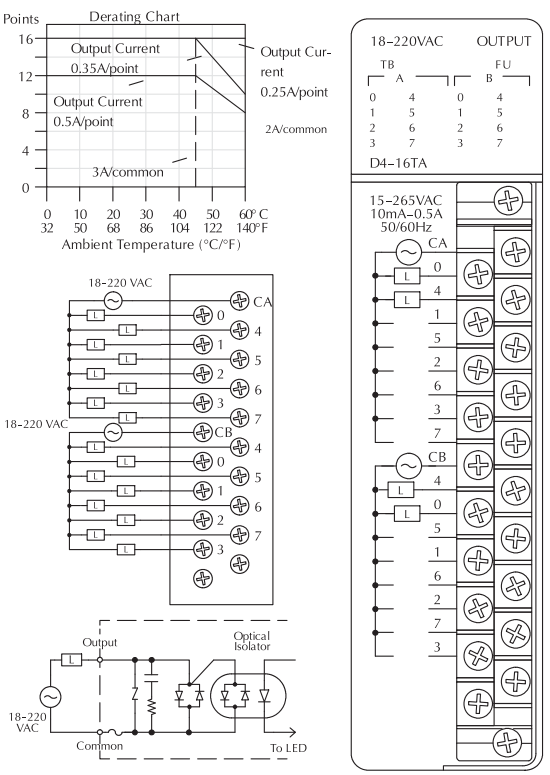
| D4-08TA AC Output <---> | |
|---|---|
| ***Outputs per Module*** | 8 |
| ***Commons per Module*** | 2 (isolated) |
| ***Operating Voltage*** | 15-265VAC |
| ***Output Type*** | SSR (triac) |
| ***Peak Voltage*** | 265VAC |
| ***AC Frequency*** | 47-63Hz |
| ***ON Voltage Drop*** | 1.5VAC @ 2A |
| ***Max Current*** | 2A/point<br>5A/common @ 30° C<br>2A/common @ 60° C |
| ***Max Leakage Current*** | 5mA @ 265VAC |
| ***Max Inrush Current*** | 30A for 10ms<br>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 (D4-8IOCON) |
| ***Status Indicators*** | Logic side |
| ***Weight*** | 11.6oz. (330g) |
| ***Fuses*** | 1 (8A) per common, non-replaceable |

| D4-16TA AC Output <---> | |
|---|---|
| ***Outputs per Module*** | 16 |
| ***Commons per Module*** | 2 (isolated) |
| ***Operating Voltage*** | 15-265VAC |
| ***Output Type*** | SSR (triac) |
| ***Peak Voltage*** | 265VAC |
| ***AC Frequency*** | 47-63Hz |
| ***ON Voltage Drop*** | 1.5VAC @ 0.5A |
| ***Max Current*** | 0.5A/point<br>3A/common @ 45° C<br>2A/common @ 60° C |
| ***Max Leakage Current*** | 4mA @ 265VAC |
| ***Max Inrush Current*** | 15A for 10ms<br>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 (D4-16IOCON) |
| ***Status Indicators*** | Logic Side |
| ***Weight*** | 12.2oz. (350g) |
| ***Fuses*** | 1 (5A) per common, non-replaceable |

See page 6-57 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 <---> | |
|---|---|
| Outputs per Module | 8 relays |
| Commons per Module | 2 (isolated) |
| Operating Voltage | 5-30VDC/5-250VAC |
| Output Type | Form A (SPST-NO) |
| Peak Voltage | 30VDC/256VAC |
| AC Frequency | 47-63Hz |
| ON Voltage Drop | N/A |
| Max Current | 2A/point<br>5A/common |
| Max Leakage Current | 0.1mA @ 265VAC |
| Max Inrush Current | 2A |
| Minimum Load | 5mA |
| Base Power Required 5V | 550mA max |
| External DC Required | None |
| OFF to ON Response | 12ms |
| ON to OFF Response | 12ms |
| Terminal Type (included) | Removable (D4-8IOCON) |
| Status Indicators | Logic side |
| Weight | 9.1oz. (260g) |
| Fuses | 1 (8A) per common<br>Non-replaceable |

| F4-08TRS-1 Relay Output <---> | |
|---|---|
| Outputs per Module | 8 relays |
| Commons per Module | 8 (isolated) |
| Operating Voltage | 12-30VDC/12-125VAC *125VAC-250VAC |
| Output Type | 4, Form C (SPST) 4, Form A (SPST-NO) |
| Peak Voltage | 30VDC/250VAC @ 10A |
| AC Frequency | 47-63Hz |
| ON Voltage Drop | N/A |
| Max Current (Resistive) | 10A/point 40A/module |
| Max Leakage Current | N/A |
| Max Inrush Current | 10A |
| Minimum Load | 100mA @ 12 VDC |
| Base Power Required 5V | 575mA max |
| External DC Required | None |
| OFF to ON Response | 7ms |
| ON to OFF Response | 9ms |
| Terminal Type (included) | Removable (D4-16IOCON) |
| Status Indicators | Logic side |
| Weight | 13.2oz. (374g) |
| Fuses | 1 (10A) per common Non-replaceable |

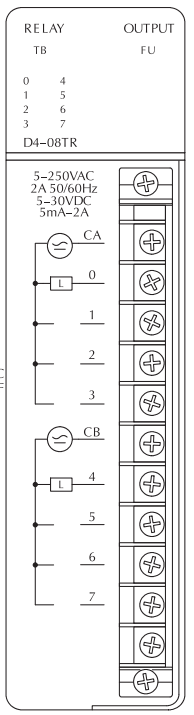
Maximum DC voltage rating is 120 VDC @ 0.5A @ 30,000 cycles typical. Motor starters up to and including NEMA size 4 can be used with this module.

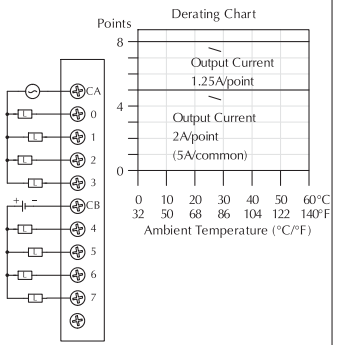
See page 6-57 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.

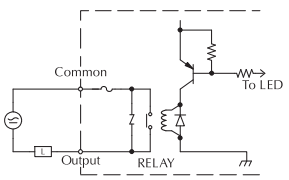
| Typical Relay Life (Operations) | | | |
|---|---|---|---|
| Maximum Resistive or Inductive Inrush Load Current | Operating Voltage | | |
| | 30 VDC | 120 VAC | 250 VAC |
| 2A resistive | 100K | 300K | 200K |
| 2A inductive | 100K | 80K | 60K |
| 0.5A resistive | 800K | 1M | 800K |
| 0.5A inductive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

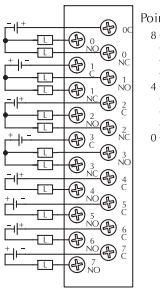
| Typical Relay Life (Operations) | | | |
|---|---|---|---|
| Maximum Resistive or Inductive Inrush Load Current | Operating Voltage | | |
| | 28 VDC | 120 VAC | 250 VAC |
| 1/4HP | | 25K | |
| 10.0A | 50K | 50K | |
| 5.0A | 200K | 100K | |
| 3.0A | 325K | 125K | 50K |
| 0.05A | >50M | | |

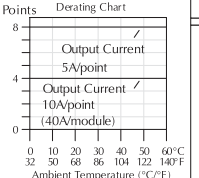
***Caution: the ZIPLink wiring system is rated at 2 Amps per I/O point and 4 Amps per common, therefore the F4-08TRS-1 relay outputs are derated to 2 Amps per point and 4 Amps per common when used with the ZIPLink wiring system.***

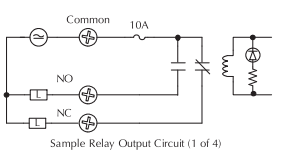


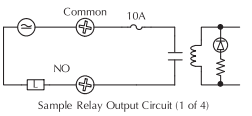



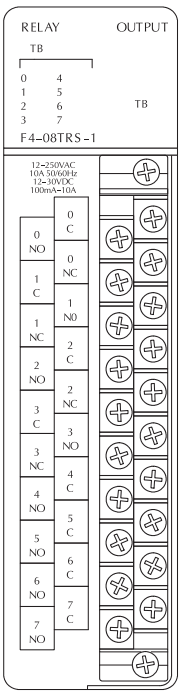





# Relay Output Modules

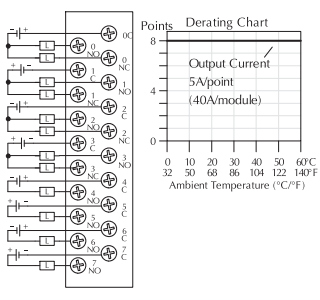
| F4-08TRS-2 Relay Output <---> | | |
|---|---|---|
| Outputs per Module | 8 relays | |
| Commons per Module | 8 (isolated) | |
| Operating Voltage | 12-30VDC-12-250VAC | |
| Output Type | 4, Form C (SPDT)<br>4, Form A (SPST-NO) | |
| Peak Voltage | 30VDC/250VAC @ 5A | |
| AC Frequency | 47-63Hz | |
| ON Voltage Drop | N/A | |
| Max Current (Resistive) | 5A/point<br>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 (D4-16IOCON) | |
| Status Indicators | Logic side | |
| Weight | 13.8oz. (390g) | |
| Fuses 19379-K- Wickman | 1 (10A 250V) per common User replaceable | |
| Replacement Fuse | D4-FUSE-2 | <---> |

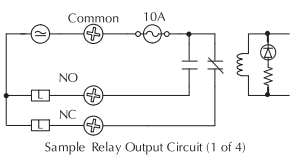
Maximum DC voltage rating is 120 VDC @ 0.5A @ 30,000 cycles typical. Motor starters up to and including NEMA size 3 can be used with this module.

| Typical Relay Life (Operations) | | | |
|---|---|---|---|
| Maximum Resistive or Inductive Inrush Load Current | Operating Voltage | | |
| | 28 VDC | 120 VAC | 240 VAC |
| 5.0A | 200K | 100K | |
| 3.0A | 325K | 125K | 50K |
| 0.05A | >50M | | |

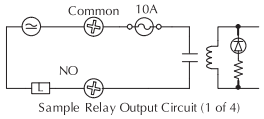
See page 6-57 for part numbers of ZIPLink cables and connection modules compatible with this I/O module.

*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.*

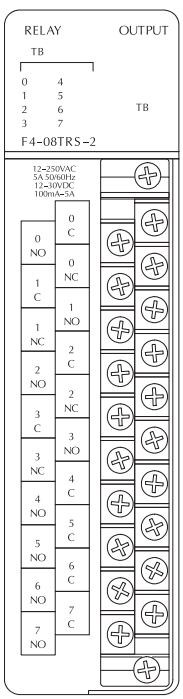



Sample Relay Output Circuit (1 of 4)




Sample Relay Output Circuit (1 of 4)

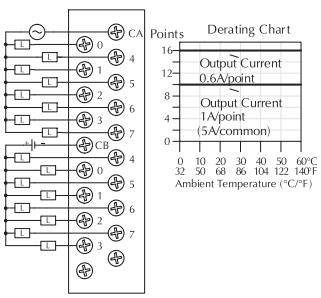


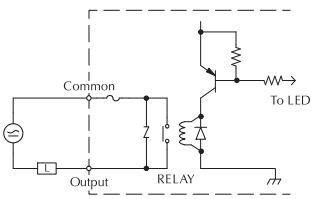

| D4-16TR Relay Output <---> | |
|---|---|
| Outputs per Module | 16 relays |
| Commons per Module | 2 (isolated) |
| Operating Voltage | 5-30VDC-5-250VAC |
| Output Type | Form A (SPST-NO) |
| Peak Voltage | 30VDC/250VAC |
| AC Frequency | 47-63Hz |
| ON Voltage Drop | N/A |
| Max Current (Resistive)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

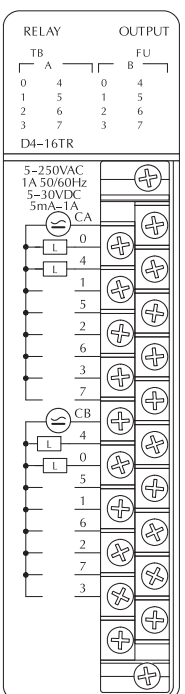
See page 6-57 for part numbers of ZIPLink cables and connection modules compatible with this I/O module.

| 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 |
| 0.5A resistive | >2M | 800K | 500K |
| 0.5A 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.*



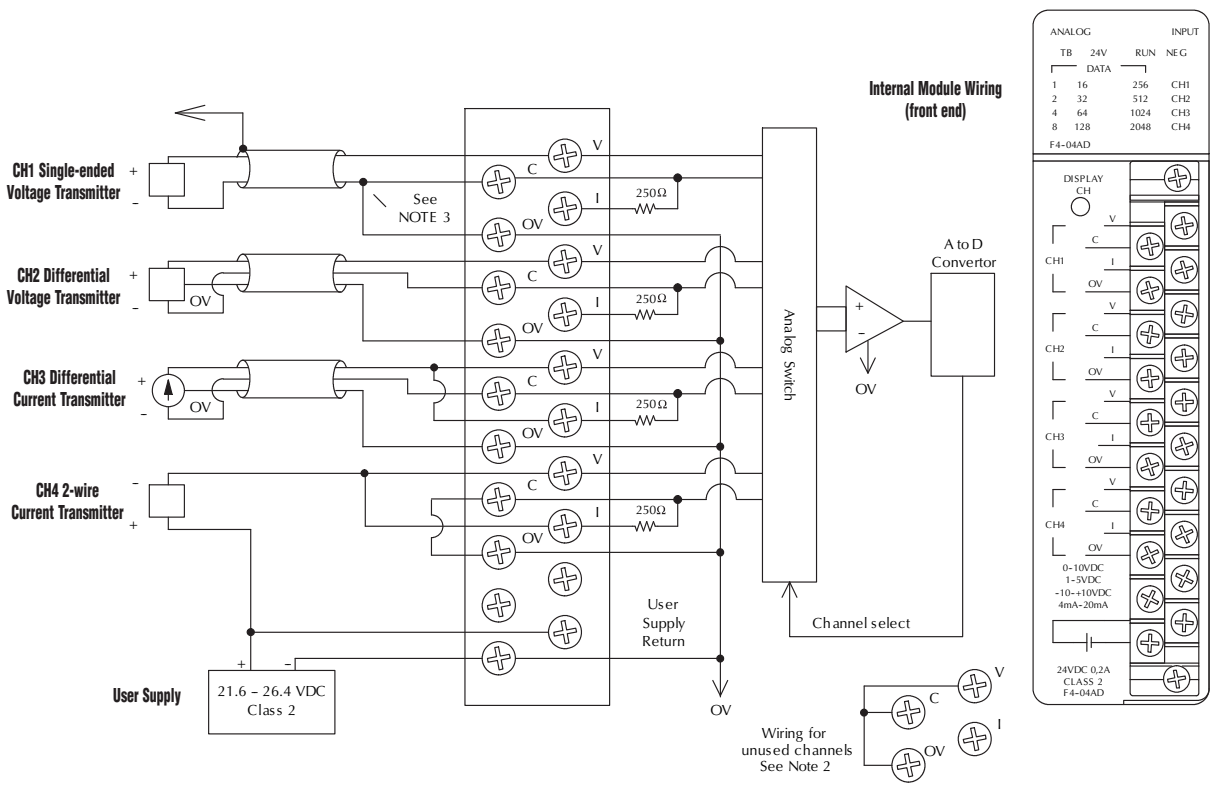
# Analog Input Modules

| F4-04AD 4-Channel Analog Input <---> | |
|---|---|
| ***Number of Channels*** | 4 |
| ***Input Type*** | Single-ended or differential Voltage or current |
| ***Input Ranges*** | 0-5V, 1-5V, 0-10V, ±5V, ±10V<br>0-20mA, 4-20mA |
| ***Channels Individually Configurable*** | Range is selected for all channels. Each channel can be wired for voltage or current |
| ***Resolution*** | 12 bit (0 to 4095), unipolar<br>13 bit (-4095 to +4095), bipolar |
| ***Input Impedance*** | 20MΩ- minimum, voltage input<br>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<br>± 16 counts max., at 20.0mA current input |
| ***Offset Calibration Error*** | ± 1 count max., voltage input<br>± 2 counts max., at 4.0mA current input |
| ***Maximum Inaccuracy*** | 0.4% max. @ 77°F (25°C)<br>0.55% max. @ 32 to 140°F (0 to 60°C) |

| | |
|---|---|
| ***Conversion Time*** | <6mS per selected channel |
| ***Noise Rejection Ratio*** | Normal mode: -3dB @ 50Hz,<br>-6 dB/octave<br>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 (D4-16IOCON) |
| ***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 page 6-58 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.



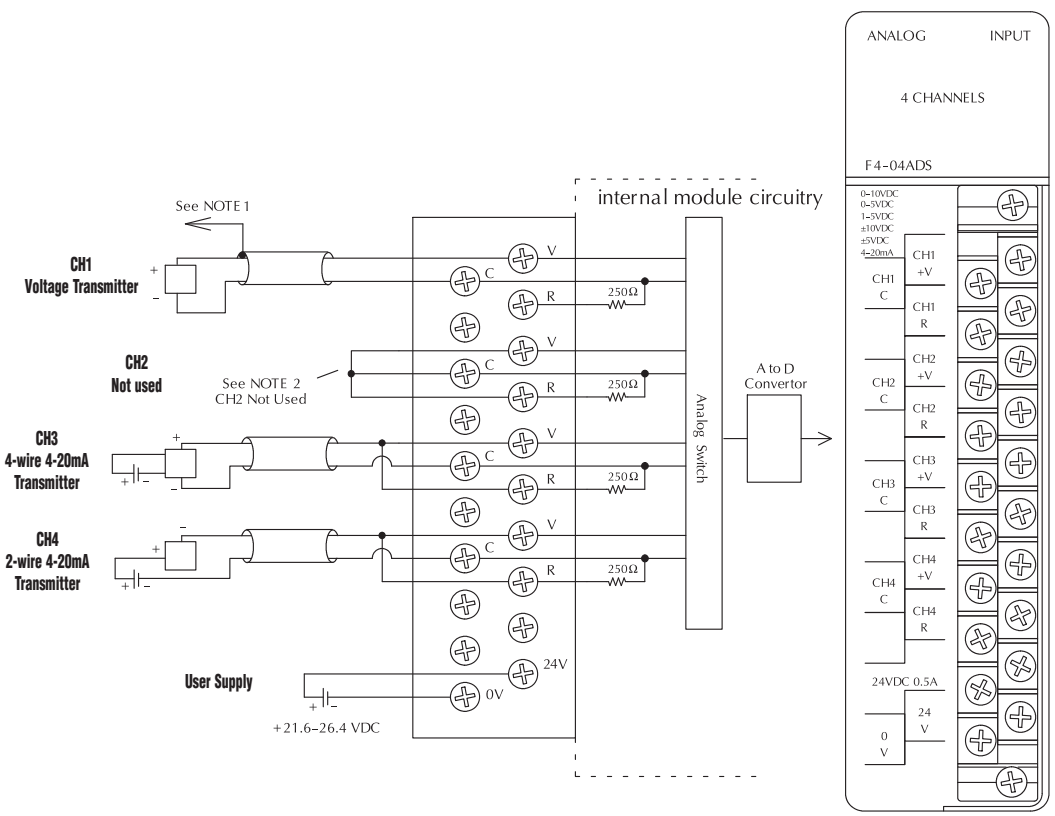
# Analog Input Modules

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

| | |
|---|---|
| ***PLC Update Rate*** | 1 channel per scan |
| ***Digital Input Points Required*** | 16 (X) input points (12 binary data bits, 4 active channel indicator bits) |
| ***Accuracy vs Temperature*** | ± 100 ppm/ÞC maximum full scale (including maximum offset) |
| ***Terminal Type (included)*** | Removable (D4-16IOCON) |
| ***Base Power Required 5V*** | 270mA |
| ***External Power Supply*** | 24VDC, ± 10%, 120mA, class 2 |
| ***Recommended Fuse*** | 0.032 A, Series 217 fast-acting, current inputs |
| ***Operating Temperature*** | 32° to 140°F (0 to 60°C) |
| ***Accuracy vs. Temperature*** | ±100 ppm /°C maximum full scale (including maximum offset) |
| ***Storage Temperature*** | -4 to 158°F (-20 to 70°C) |
| ***Relative Humidity*** | 5 to 95% (non-condensing) |
| ***Environmental Air*** | No corrosive gases permitted |
| ***Vibration*** | MIL STD 810C 514.2 |
| ***Shock*** | MIL STD 810C 516.2 |
| ***Noise Immunity*** | NEMA ICS3-304 |

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

See page 6-58 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.



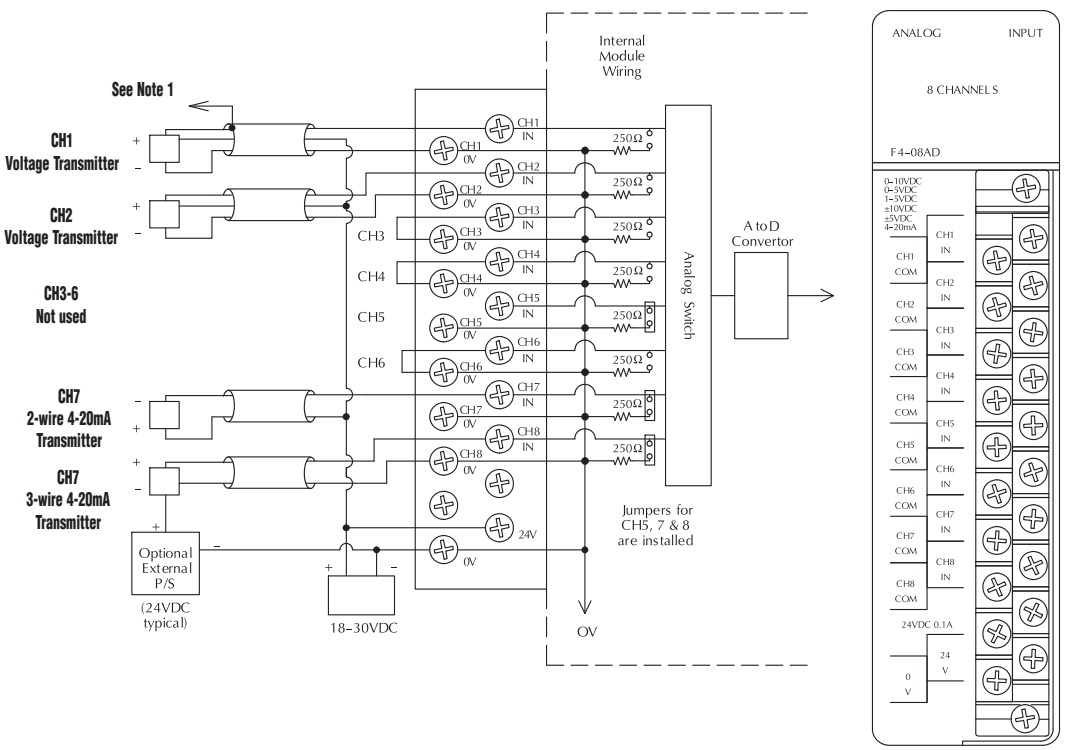
# Analog Input Modules

| F4-08AD 8-Channel Analog Input <---> | |
|---|---|
| ***Number of Channels*** | 8, single ended (one common) |
| ***Input Ranges*** | 0-5V, 0-10V, 1-5V, ±5V, ±10V<br>0-20mA, 4-20mA |
| ***Channels Individually Configurable*** | No. Each channel can be configured for current or voltage but must be same range. |
| ***Resolution*** | 12 bit (1 to 4,096) |
| ***Active Low-pass Filtering*** | -3dB at 20Hz, -12 dB per octave |
| ***Input Impedance*** | 250Ω ± 0.1%, 1/2W current input<br>>20MΩ voltage input<br>1 MΩ minimum |
| ***Absolute Maximum Ratings*** | -45mA to + 45mA, current input<br>-75V to +75V, voltage input |
| ***Conversion Time*** | 0.4ms per channel (module conversion)<br>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<br>± 12 counts max. @ 20mA current input |
| ***Offset Calibration Error*** | ± 2 counts max., unipolar voltage input<br>± 4 counts max., bipolar voltage input,<br>± 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 (D4-16IOCON) |
| ***External Power Supply*** | 18-30VDC, 120mA, class 2 |
| ***Recommended Fuse*** | 0.032 A, Series 217 fast-acting, current inputs |
| ***Operating Temperature*** | 32° to 140°F (0 to 60°C) |
| ***Accuracy vs. Temperature*** | ± 50 ppm/°C maximum full scale (including maximum offset change of 2 counts) |
| ***Storage Temperature*** | -4 to 158°F (-20 to 70°C) |
| ***Relative Humidity*** | 5 to 95% (non-condensing) |
| ***Environmental Air*** | No corrosive gases permitted |
| ***Vibration*** | MIL STD 810C 514.2 |
| ***Shock*** | MIL STD 810C 516.2 |
| ***Noise Immunity*** | NEMA ICS3-304 |

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

See page 6-58 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.



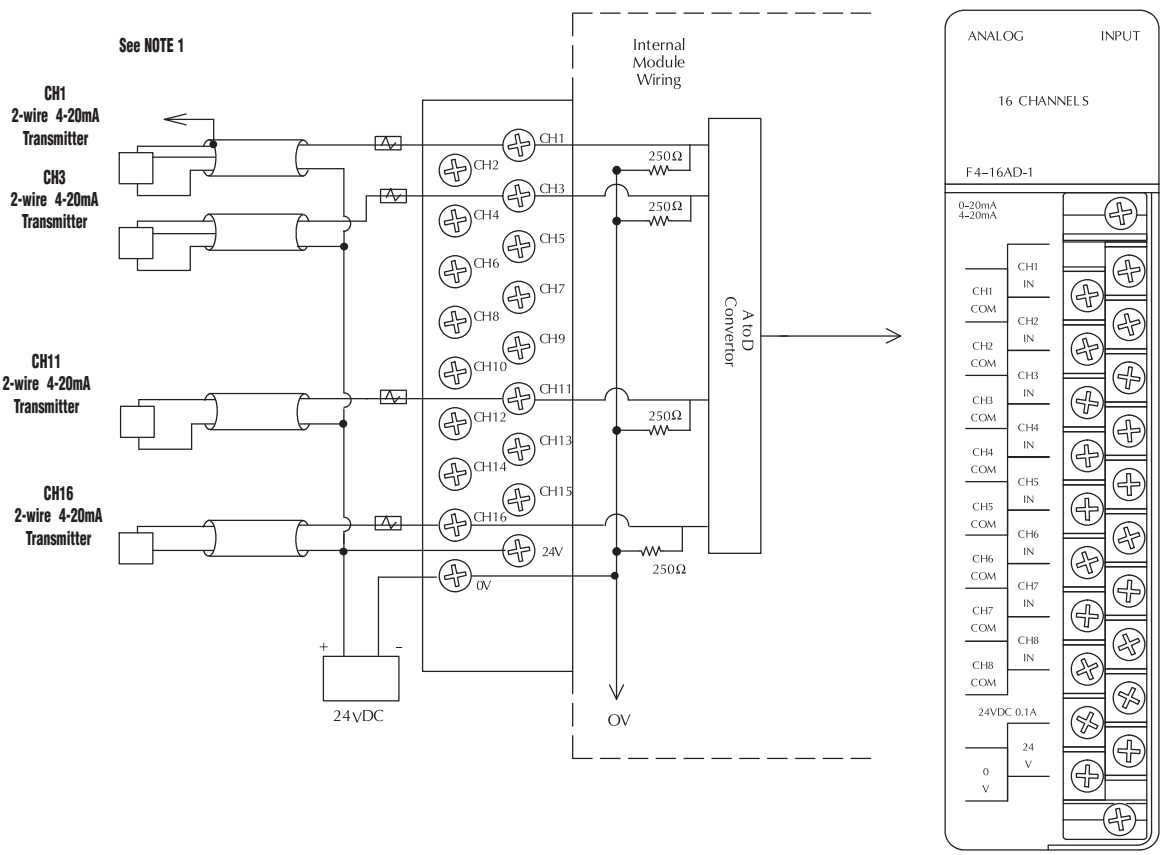
# Analog Input Modules

| F4-16AD-1 16-Channel Analog Current Input <---> | |
|---|---|
| ***Number of Channels*** | 16, single ended (one common) |
| ***Input Ranges*** | 0-20mA, 4-20mA |
| ***Channels Individually Configurable*** | No. Each channel can be configured for current or voltage but must be same range. |
| ***Resolution*** | 12 bit (1 to 4,096) |
| ***Active Low-pass Filtering*** | -3dB at 20Hz, -12 dB per octave |
| ***Input Impedance*** | 250Ω ± 0.1%, 1/2W current input<br>>20MΩ voltage input<br>1 MΩ minimum |
| ***Absolute Maximum Ratings*** | -45mA to + 45mA, current input<br>-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 (D4-16IOCON) |
| ***External Power Supply*** | 21.6-26.4VDC, 100mA, class2 |
| ***Recommended Fuse*** | 0.032 A, Series 217 fast-acting, current inputs |
| ***Operating Temperature*** | 32° to 140°F (0 to 60°C) |
| ***Accuracy vs. Temperature*** | ± 50 ppm/°C maximum full scale (including maximum offset change of 2 counts) |
| ***Storage Temperature*** | -4 to 158°F (-20 to 70° C) |
| ***Relative Humidity*** | 5 to 95% (non-condensing) |
| ***Environmental Air*** | No corrosive gases permitted |
| ***Vibration*** | MIL STD 810C 514.2 |
| ***Shock*** | MIL STD 810C 516.2 |
| ***Noise Immunity*** | NEMA ICS3-304 |

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

See page 6-58 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.



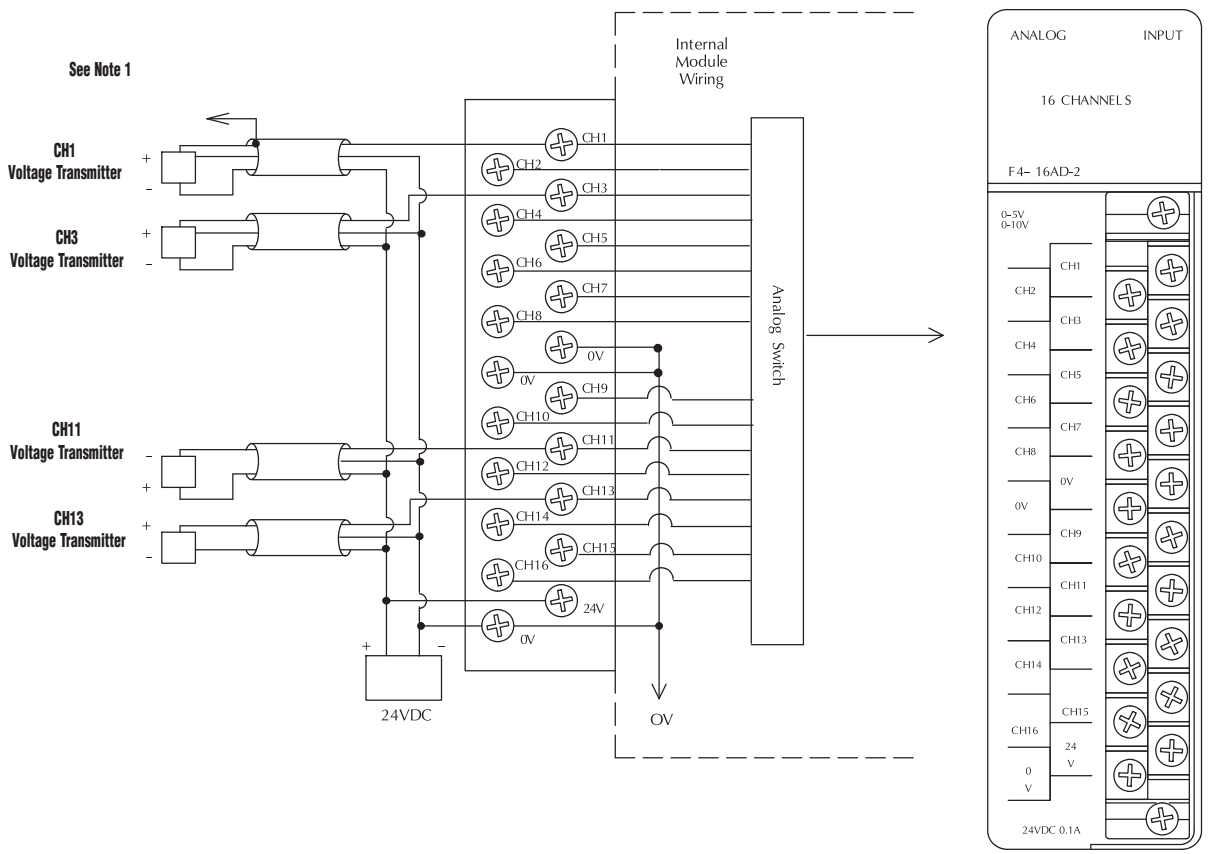
# Analog Input Modules

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

| | |
|---|---|
| ***PLC Update Rate*** | 1 channel per scan min., 16 per scan, max. |
| ***Digital Input Points Required*** | 16 (X) input points (12 binary data bits, 4 active channel bits,) |
| ***Base Power Required 5V*** | 75mA |
| ***Terminal Type (included)*** | Removable (D4-16IOCON) |
| ***External Power Supply*** | 21.6-26.4VDC, 100mA, class2 |
| ***Operating Temperature*** | 32° to 140°F (0 to 60°C) |
| ***Accuracy vs Temperature*** | ± 50 ppm/°C maximum full scale (including maximum offset change of 2 counts) |
| ***Storage Temperature*** | -4 to 158°F (-20 to 70° C) |
| ***Relative Humidity*** | 5 to 95% (non-condensing) |
| ***Environmental Air*** | No corrosive gases permitted |
| ***Vibration*** | MIL STD 810C 514.2 |
| ***Shock*** | MIL STD 810C 516.2 |
| ***Noise Immunity*** | NEMA ICS3-304 |

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

See page 6-58 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.



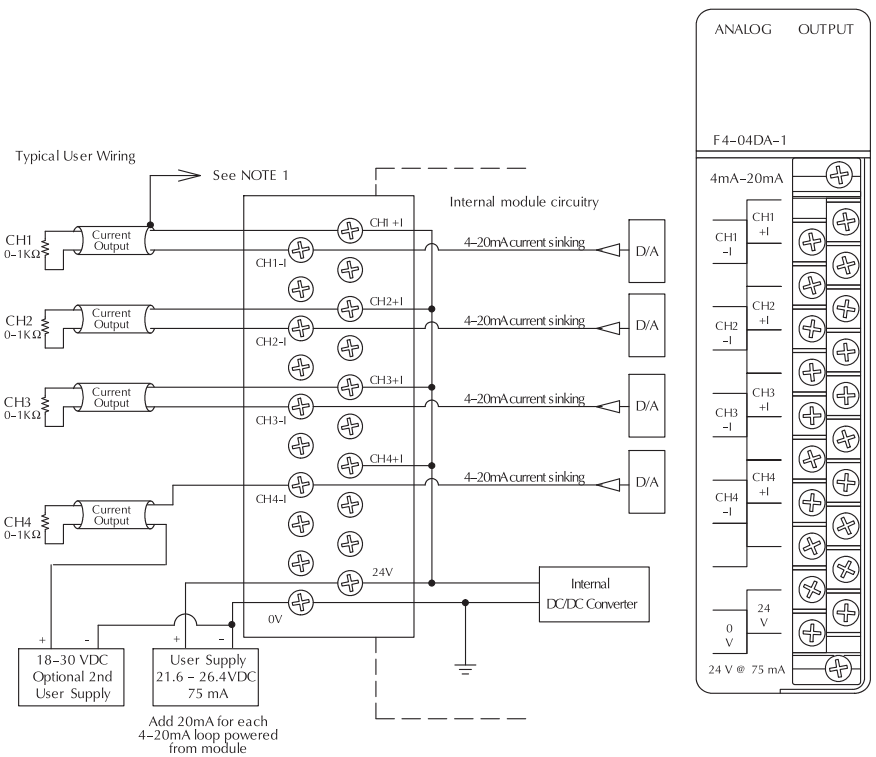
# Analog Output Modules

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

| | |
|---|---|
| ***Digital Output Points Required*** | 16 (Y) output points (12 bits binary data, 4 active channel bits) |
| ***Base Power Required 5V*** | 70mA |
| ***External Power Supply*** | 21.6-26.4VDC, 75mA, class 2 (add 20mA for each current loop used) |
| ***Accuracy vs. Temperature*** | ± 57 ppm/°C full scale calibration range (including maximum offset change, 2 counts) |
| ***Operating Temperature*** | 32° to 140°F (0 to 60°C) |
| ***Storage Temperature*** | -4 to 158°F (-20 to 70°C) |
| ***Relative Humidity*** | 5 to 95% (non-condensing) |
| ***Environmental Air*** | No corrosive gases permitted |
| ***Vibration*** | MIL STD 810C 514.2 |
| ***Shock*** | MIL STD 810C 516.2 |
| ***Noise Immunity*** | NEMA ICS3-304 |

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

See page 6-58 for part numbers of ***ZIP***Link cables and connection modules compatible with this I/O module.



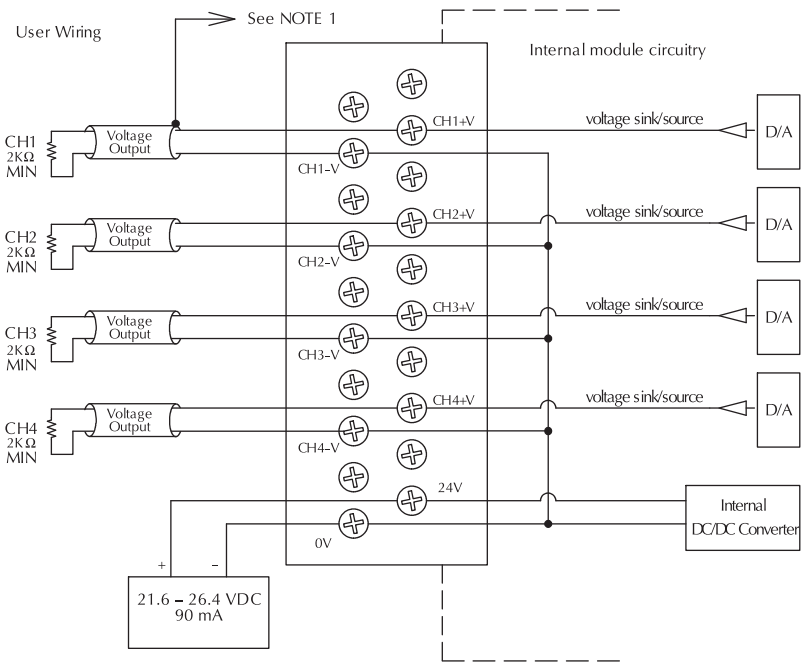
# Analog Output Modules

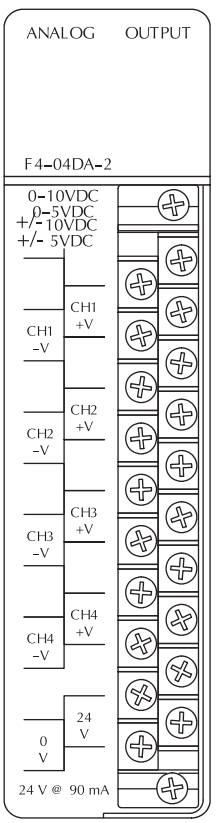
| F4-04DA-2 4-Channel Analog Voltage Output <---> | |
|---|---|
| ***Number of Channels*** | 4, single ended (one common) |
| ***Output Ranges*** | 0-5V, 0-10V, ±5V, ±10V |
| ***Channels Individually Configurable*** | Yes |
| ***Resolution*** | 12 bit (1 to 4,095) |
| ***Load Impedance*** | 2KΩ minimum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

| | |
|---|---|
| ***Conversion Time*** | 5µs maximum, settling time<br>2.0ms maximum, digital out to analog out |
| ***Digital Output Points Required*** | 16 (Y) output points (12 bits binary data, 4 active channel bits or 2 active channel bits and 1 sign bit for bipolar) |
| ***Base Power Required 5V*** | 90 mA |
| ***Terminal Type (included)*** | Removable (D4-16IOCON) |
| ***External Power Supply*** | 21.6-26.4VDC, 90mA, class 2 (outputs fully loaded) |
| ***Accuracy vs. Temperature*** | ± 57 ppm/°C full scale calibration change (including maximum offset change, 2 counts) |
| ***Operating Temperature*** | 32° to 140°F (0 to 60°C) |
| ***Storage Temperature*** | -4 to 158°F (-20 to 70°C) |
| ***Relative Humidity*** | 5 to 95% (non-condensing) |
| ***Environmental Air*** | No corrosive gases permitted |
| ***Vibration*** | MIL STD 810C 514.2 |
| ***Shock*** | MIL STD 810C 516.2 |
| ***Noise Immunity*** | NEMA ICS3-304 |

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

See page 6-58 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.



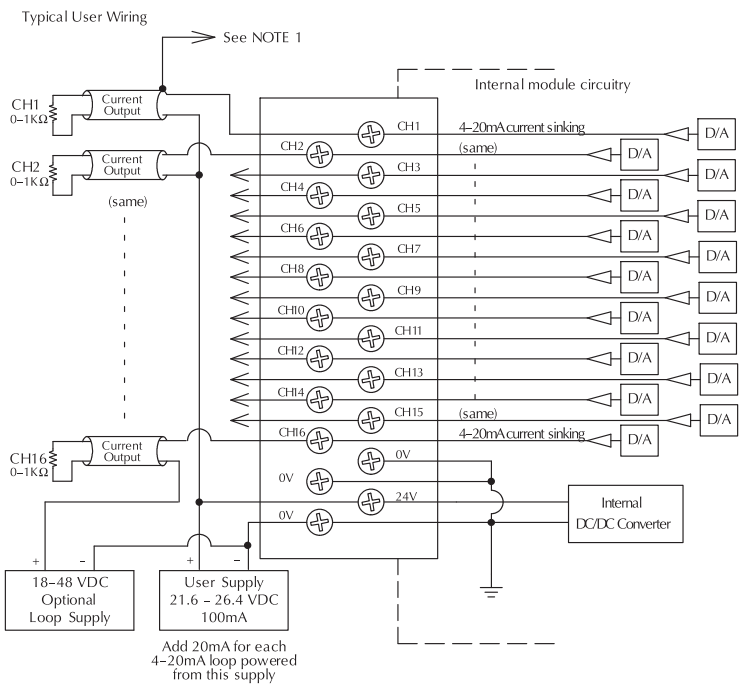
# Analog Output Modules

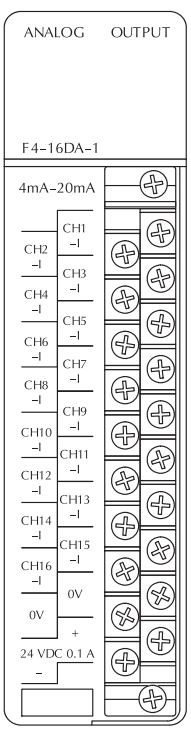
| F4-08DA-1 8-Channel Analog Current Output <---><br>F4-16DA-1 16-Channel Analog Current Output <---> | |
|---|---|
| ***Number of Channels***<br>***F4-08DA-1***<br>***F4-16DA-1*** | 8, single ended (one common)<br>16, single ended (one common) |
| ***Output Ranges*** | 4-20mA current |
| ***Resolution***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

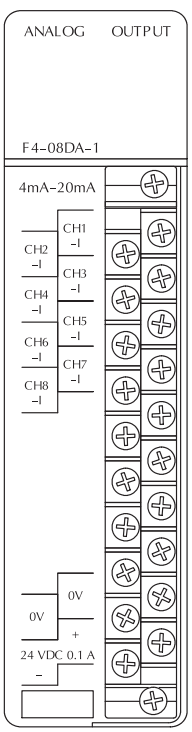
See page 6-58 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.

| | |
|---|---|
| ***Conversion Time*** | 400µs maximum, for full scale change<br>2.25 to 4.5 ms for digital out to analog out |
| ***Digital Output Points Required*** | **F4-08DA-1**<br>16 (Y) output points (12 bits binary data, 3 bits channel select , 1bit output enable)<br>**F4-16DA-1**<br>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 (D4-16IOCON) |
| ***External Power Supply*** | 21.6-26.4VDC, 100mA, class 2 (add 20mA for each current loop used) |
| ***Accuracy vs. Temperature*** | ± 57 ppm/°C full scale calibration range (including maximum offset change, 2 counts) |
| ***Operating Temperature*** | 32° to 140°F (0 to 60°C) |
| ***Storage Temperature*** | -4 to 158°F (-20 to 70° C) |
| ***Relative Humidity*** | 5 to 95% (non-condensing) |
| ***Environmental Air*** | No corrosive gases permitted |
| ***Vibration*** | MIL STD 810C 514.2 |
| ***Shock*** | MIL STD 810C 516.2 |
| ***Noise Immunity*** | NEMA ICS3-304 |

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



# Analog Output Modules

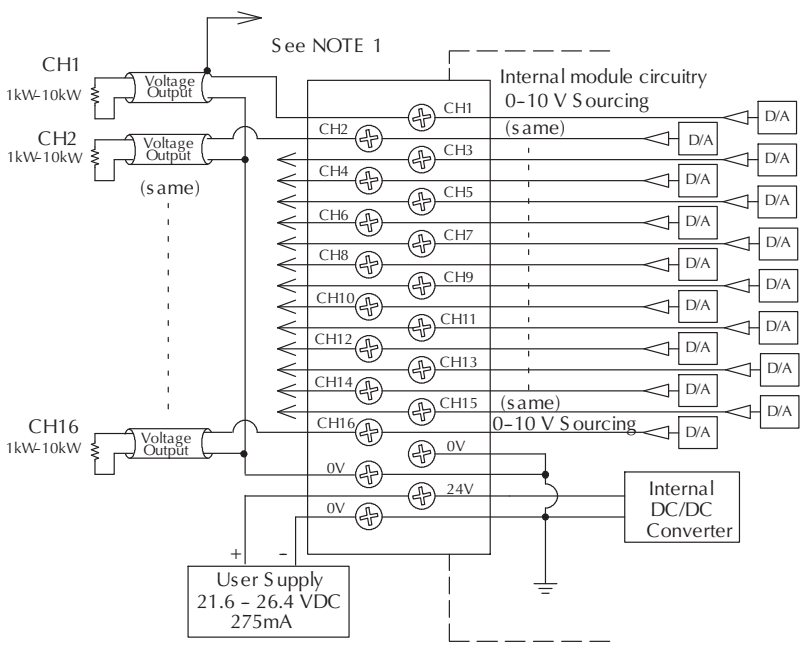
| F4-08DA-2 8-Channel Analog Voltage Output <---><br>F4-16DA-2 16-Channel Analog Voltage Output <---> | |
|---|---|
| ***Number of Channels***<br>***F4-08DA-2***<br>***F4-16DA-2*** | <br>8, single ended (one common)<br>16, single ended (one common) |
| ***Output Range*** | 0-5VDC, 0-10VDC |
| ***Resolution***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

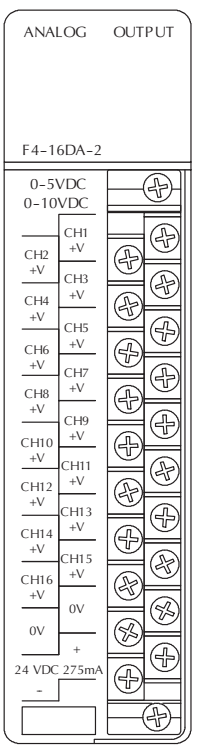
See page 6-58 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.

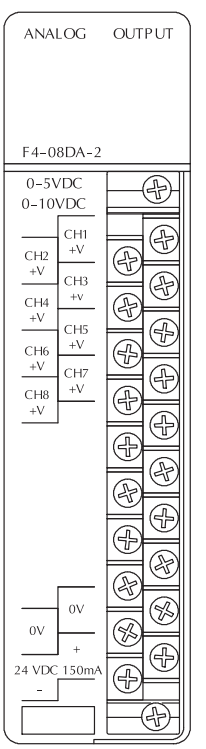
| | |
|---|---|
| ***Conversion Time*** | 400µs maximum, for full scale change<br>4.5 to 9ms for digital out to analog out |
| ***Digital Output Points Required*** | **F4-08DA-2**<br>16 (Y) output points 12 bits binary data, 3 bits channel select ,1 bit output enable)<br>**F4-16DA-2**<br>32 (Y) output 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 (D4-16IOCON) |
| ***External Power Supply*** | 21.6-26.4VDC, 150mA, class 2 |
| ***Accuracy vs. Temperature*** | ± 57 ppm/°C full scale calibration range (including maximum offset change, 2 counts) |
| ***Operating Temperature*** | 32° to 140°F (0 to 60°C) |
| ***Storage Temperature*** | -4 to 158°F (-20 to 70°C) |
| ***Relative Humidity*** | 5 to 95% (non-condensing) |
| ***Environmental Air*** | No corrosive gases permitted |
| ***Vibration*** | MIL STD 810C 514.2 |
| ***Shock*** | MIL STD 810C 516.2 |
| ***Noise Immunity*** | NEMA ICS3-304 |

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

Typical User Wiring



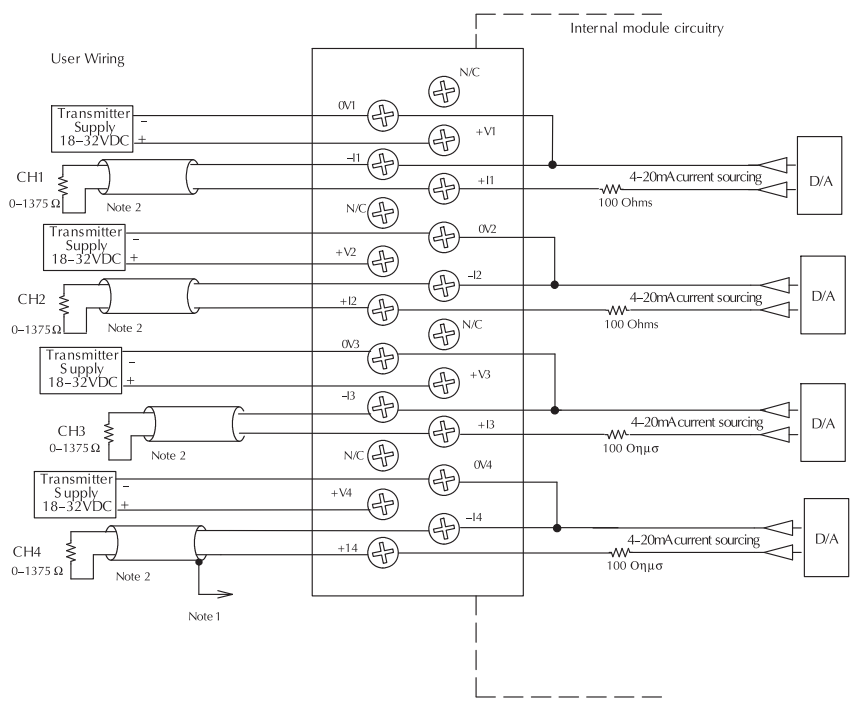
# Analog Output Modules

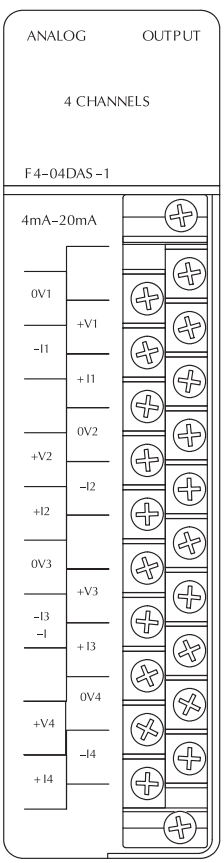
| F4-04DAS-1 4-Ch. 4-20mA Isolated Analog Out <---> | |
|---|---|
| ***Number of Channels*** | 4, isolated current sourcing |
| ***Output Range*** | 4-20mA current |
| ***Resolution*** | 16 bit (1 to 65536) |
| ***Output Type*** | Outputs source 4-20mA from external supply |
| ***Isolation Voltage***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

| | |
|---|---|
| ***Terminal Type (included)*** | Removable (D4-16IOCON) |
| ***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)<br>±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 page 6-58 for part numbers of ***ZIP***Link cables and connection modules compatible with this I/O module.



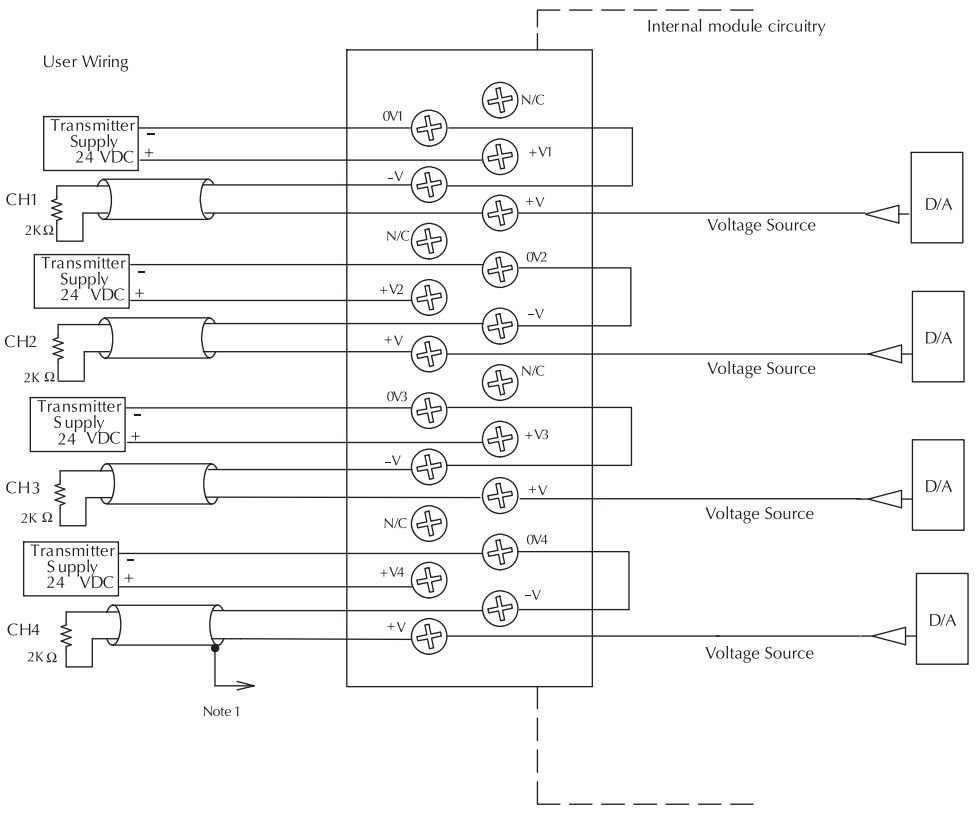
# Analog Output Modules

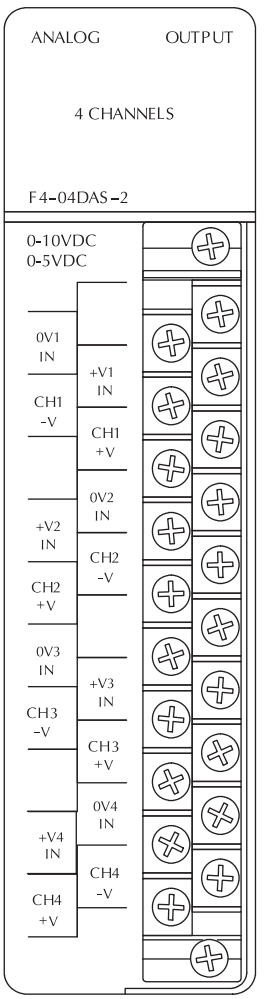
| F4-04DAS-2 4-Channel 0-5V/10V Isolated Analog Output <---> | |
|---|---|
| ***Number of Channels*** | 4, isolated |
| ***Output Range*** | 0-5VDC, 0-10VDC |
| ***Resolution*** | 16 bit (1 to 65536) |
| ***Isolation Voltage*** | ±750V continuous, channel to channel, channel to logic |
| ***Load Impedance*** | 2kΩ min |
| ***PLC Update Rate*** | 1 channel per scan min., 4 per scan max. |
| ***Digital Output Points Required*** | 16 data bits, 2 channel ID, 1 output enable 32 (Y) output points |
| ***Power Budget Requirement*** | 60mA @ 5VDC (supplied by base) |
| ***Terminal Type (included)*** | Removable (D4-16IOCON) |
| ***External Power Supply*** | 60mA per channel, 21.6VDC-26.4VDC |

| | |
|---|---|
| ***Linearity Error (End-to-End)*** | ± 10 count maximum (0.015% of full scale) |
| ***Conversion Settling Time*** | 3ms to 0.1% of full scale |
| ***Gain Calibration Error*** | ± 32 counts (± 0.05%) |
| ***Offset Calibration Error*** | ± 13 counts (± 0.02%) |
| ***Maximum Inaccuracy*** | ±0.07% @ 77° F (25° C)<br>±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 terminal.
NOTE 2: For non-isolated outputs, connect all 0V's together (0V1...0V4) and connect all +V's together (+V1...+V4).

See page 6-58 for part numbers of *ZIP*Link cables and connection modules compatible with this I/O module.

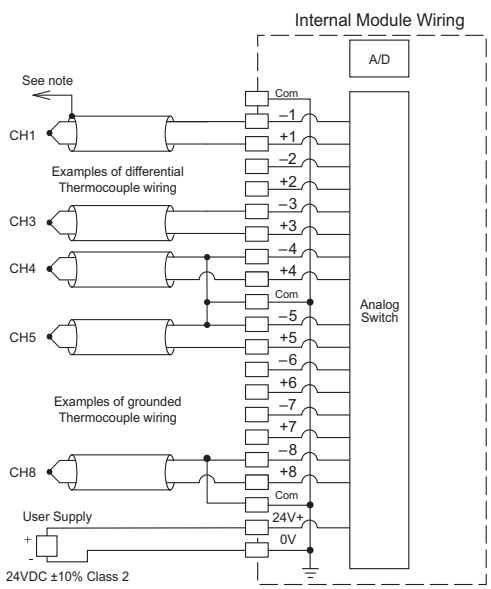


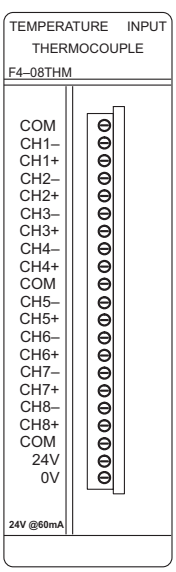



# Temperature Input Modules

| F4-08THM 8-Channel Thermocouple Input <---> | | | |
|---|---|---|---|
| **General Specifications** | | **Thermocouple Specifications** | |
| **Number of Channels** | 8, differential | **Input Ranges*** | Type J -190 to 760°C -310 to 1400°F<br>Type E -210 to 1000°C -346 to 1832°F<br>Type K -150 to 1372°C -238 to 2502°F<br>Type R 65 to 1768°C 149 to 3214°F<br>Type S 65 to 1768°C 149 to 3214°F<br>Type T -230 to 400°C -382 to 752°F<br>Type B 529 to 1820°C 984 to 3308°F<br>Type N -70 to 1300°C -94 to 2372°F<br>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** | 1M Ω | | |
| **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 (D4-16IOCON) | | |
| **External Power Supply** | 60mA maximum, 18 to 26.4VDC | **Maximum Inaccuracy** | ± 3°C (excluding thermocouple error) |
| **Power Budget Requirements** | 110mA max., 5VDC (supplied to base) | **Voltage Input Specifications** | |
| **Operating Temperature** | 0° to 60°C (32° to 140°F) | **Voltage Ranges** | 0-5V, ± 5V, 0-156.25mV, ± 156.25mVDC |
| **Storage Temperature** | -20° to 70°C (-4° to 158°F) | **Resolution** | 16 bit (1 in 65535) |
| **Relative Humidity** | 5 to 95% (non-condensing) | **Full Scale Calibration Error (Offset error Included)** | ± 13 counts typical, ± 33 maximum |
| **Environmental Air** | No corrosive gases permitted | **Offset Calibration Error** | ± 1 count maximum, @ 0V input |
| **Vibration** | MIL STD 810C 514.2 | **Linearity Error (End to End)** | ± 1 count maximum |
| **Shock** | MIL STD 810C 516.2 | **Maximum Inaccuracy** | ± 02% @ 25°C (77°F) |
| **Noise Immunity** | NEMA ICS3-304 | NOTE 1: Terminate shields at the respective signal source<br>NOTE 2: Leave unused channels open (no connection)<br>*Thermocouple type is selected by setting internal jumpers<br>NOTE 3: This module is not compatible with the ZIPLink wiring system. | |

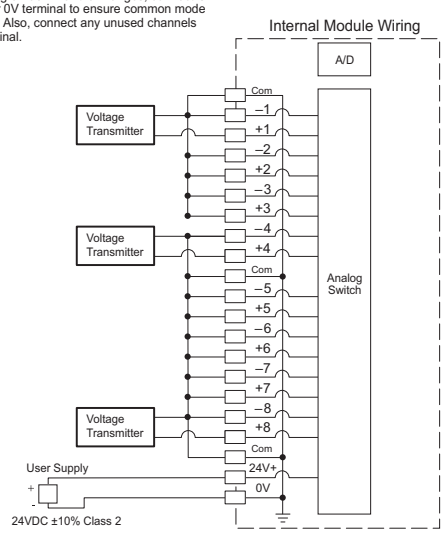
### Thermocouple Input Wiring Diagram




### Voltage Input Wiring Diagram

Note 3: When using 0-156mV and 5V ranges, connect CH- terminal to Com or 0V terminal to ensure common mode range acceptance. Also, connect any unused channels to Com or 0V terminal.



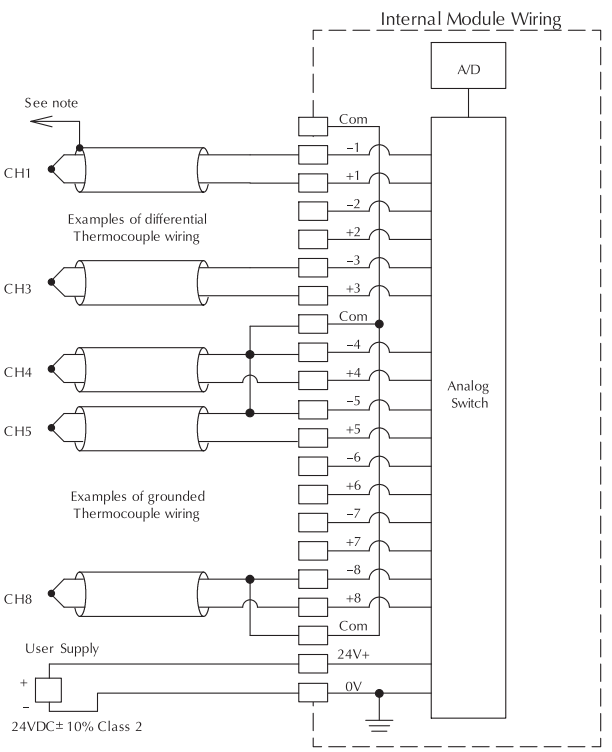
# Temperature Input Modules

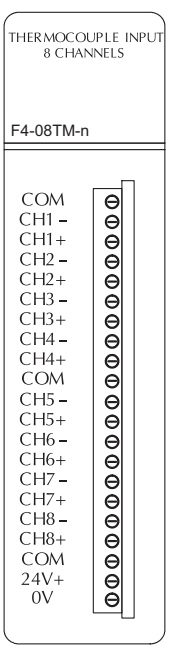
| F4-08THM-n 8-Channel Thermocouple Input <---> | |
|---|---|
| When you order the module, replace the "n" with the type of Thermocouple needed. For example, to order a Type J thermocouple module, order part number F4-08THM-J or part number F4-08THM-K for a Type K module. | |
| ***Number of channels***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

| | |
|---|---|
| ***Linearity Error*** | ± 1 count (0.03% of full scale) maximum |
| ***Full Scale Calibration Error*** | ± 0.35% of full scale |
| ***Maximum Inaccuracy**** | ± 1°C for type E, J, K, and T<br>± 3°C for type B, C, R, and S |
| ***PLC Update Rate*** | 1 ch. per scan min., 8 per scan max. |
| ***Digital Input Points Required*** | 16 (X) input points (12 binary data bits, 3 channel ID bits, 1 sign bit) |
| ***Base Power Required 5V*** | 120mA |
| ***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 ZIPLink wiring system.

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



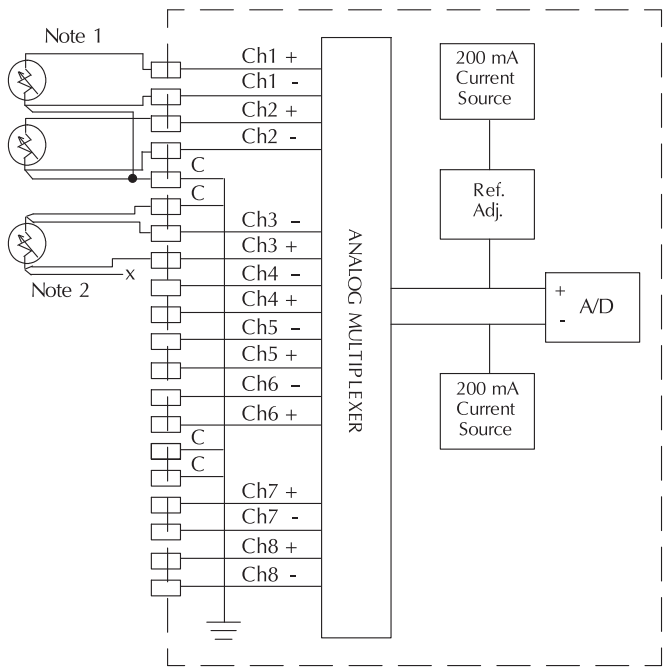



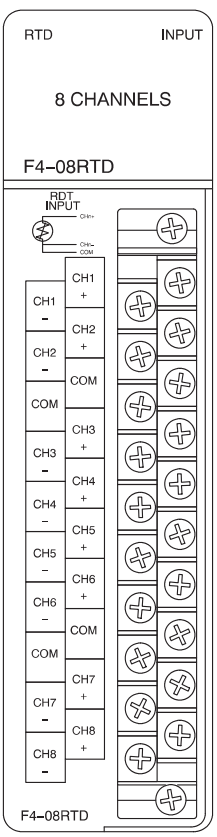
# Temperature Input Modules

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

| | |
|---|---|
| ***Absolute Maximum Ratings*** | Fault protected inputs to ±50 VDC |
| ***Converter Type*** | Charge Balancing |
| ***Linearity Error*** | ± 1°C maximum, ±.01°C typical |
| ***Full Scale Calibration Error*** | ± 1°C |
| ***PLC Update Rate*** | 1 ch. per scan min., 8 per scan max. |
| ***Digital Input Points Required*** | 32 (X) input points (15 binary data bits, 3 channel ID bits, 1 sign bit, 8 fault bits) |
| ***Base Power Required 5V*** | 80mA @ 5VDC |
| ***Terminal Type (included)*** | Removable (D4-16IOCON) |
| ***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 ***ZIP***Link 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)**
DL450 Only Begins a new rung or an additional branch in a rung with a normally open contact that examines a single bit of a V-memory location.

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

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

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

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

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

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

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

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

## Differential Instructions

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

**Store Positive Differential (STRD)**
DL450 Only Leading edge triggered one-shot contact. When the corresponding memory location transitions from low to high, the contact comes on for one CPU scan.

**Store Negative Differential (STRND)**
DL450 Only Trailing edge triggered one-shot contact. When the corresponding memory location transitions from high to low, the contact comes on for one CPU scan.

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

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

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

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

## Immediate Instructions

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

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

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

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

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

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

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

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

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

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

**Load Immediate (LDI)**
DL450 Only Loads the accumulator with the contents of a specified 16-bit V-memory location. The status for each bit of the specified V-memory location is loaded into the accumulator. Typically used for input module V-memory addresses. Allows you to specify the V location instead of the X location and the number of points as with the LDIF.

**Load immediate Formatted (LDIF)**
DL440&DL450 Only Loads the accumulator with a specified number of consecutive inputs. The field device status for the specified inputs points is loaded into the accumulator when the instruction is executed.

**Out Immediate (OUTI)**
DL450 Only Outputs the contents of the accumulator to a specified V-memory location. The status for each bit of the specified V-memory location will reflect the status of the lower 16 bits of the accumulator. Typically used for output module V-memory addresses. Allows you to specify the V location instead of the Y location and the number of points as with the OUTIF.

**Out immediate Formatted (OUTIF)**
DL440&DL450 Only Outputs the contents of the accumulator to a specified number of consecutive outputs. The output field devices are updated when the instruction is processed by the program scan.

## Timer, Counter, and Shift Register Instructions

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

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

**Accumulating Timer (TMRA)**
Two input incrementing timer with 0.1 second resolution (0-9999999.9 sec.). Time and enable/reset inputs control the timer.

**Accumulating Fast Timer (TMRAF)**
Two input incrementing timer with 0.01 second resolution (o-999999.99 sec.).Time input and enable/reset input control timer.

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

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

**Up Down Counter (UDC)**
Three input counter (0-99999999). Up, down, and reset inputs control the counter.

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

## Accumulator/Data Stack Load and Output

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

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

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

**Load Formatted (LDF)**
DL440 & DL 450 Only Loads the accumulator with a specified number of consecutive discrete memory bits.

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

**Load Accumulator indexed (LDX)**
Loads the accumulator with a V memory address to be offset by the value in the accumulator stack.

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

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

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

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

**Out Least (OUTL)**
DL450 Only Copies the value in the lower 8 bits of the accumulator to the lower 8 bits of a specified V memory location.

**Out Most (OUTM)**
DL450 Only Copies the value in the upper 8 bits of the lower accumulator word (1st 16 bits) to the upper 8 bits of a specified V memory location.

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

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

# Instruction Set

## Accumulator Logic Instructions

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

**And Double (ANDD)**
Logically ands the value in the accumulator with two consecutive V memory locations.

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

**And with Stack (ANDS)**
DL440 & DL450 Only Logically ands the value in the accumulator with the first value in the accumulator stack.

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

**Or Double (ORD)**
Logically ors the value in the accumulator with two consecutive V memory locations.

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

**Or with Stack (ORS)**
(DL440 & DL450 Only ) Logically ors the value in the accumulator with the first value in the accumulator stack.

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

**Exclusive Or Double (XORD)**
Performs an exclusive or of the value in the accumulator and two consecutive V memory locations.

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

**Exclusive Or with Stack (XORS)**
DL440 & DL450 Only Performs an exclusive or of the value in the accumulator and the first accumulator stack location.

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

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

**Compare Formatted (CMPF)**
DL440 & DL450 Only Compares the value in the accumulator with a specified number of discrete bits (1-32).

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

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

## Math Instructions

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

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

**Add Real Number (ADDR)**
DL450 Only Adds a real number in the accumulator with a real number constant or a real number contained in two consecutive V-memory locations. The result resides in the accumulator.

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

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

**Subtract Real Number (SUBR)**
DL450 Only Subtract a real number, which is either two consecutive V memory locations or an 8-digit constant, from the real number in the accumulator. The result resides in the accumulator.

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

**Multiply Double (MULD)**
DL450 Only Multiplies a BCD value contained in two consecutive V memory locations by the value in the accumulator. The result resides in the accumulator.

**Multiply Real Number (MULR)**
DL450 Only Multiplies a real number, which is either two consecutive V memory locations or a real number constant, by the real number in the accumulator. The result resides in the accumulator.

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

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

**Divide Real Number (DIVR)**
DL450 Only Divides a real number in the accumulator by a real number which is either two consecutive V memory locations or a real number constant. The result resides in the accumulator.

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

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

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

**Add Binary Double (ADDBD)**
DL 440 & DL450 Only Adds the binary value in the accumulator to a value which is either two consecutive V memory locations or a 32 bit constant. The result resides in the accumulator.

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

**Subtract Binary Double (SUBBD)**
DL440 & DL450 Only Only Subtracts a 32 bit binary value, which is either two consecutive V memory locations or a 32 bit constant, from the value in the accumulator. The result resides in the accumulator.

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

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

**Add Formatted (ADDF)**
DL440 & DL450 Only Adds the BCD value in the accumulator to a value which is a range of discrete bits (1-32). The result resides in the accumulator.

**Subtract Formatted (SUBF)**
DL440 & DL450 Only Subtracts a BCD value which is a range of discrete bits (1-32) from the BCD value in the accumulator. The result resides in the accumulator.

**Multiply Formatted (MULF)**
DL440 & DL450 Only Multiplies a BCD value in the lower 16 bits in the accumulator by a BCD value which is a range of discrete bits (1-16). The result resides in the accumulator.

**Divide Formatted (DIVF)**
DL440 & DL450 Only Divides the BCD value in the lower 16 bits in the accumulator by the BCD value which is a range of discrete bits (1-16). The result resides in the accumulator.

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

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

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

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

**Add Binary Top of Stack (ADDBS)**
DL440 & DL450 Only Adds the binary value in the accumulator with the binary value in the first accumulator stack location. The result resides in the accumulator.

**Subtract Binary Top of Stack (SUBBS)**
DL440 & DL450 Only Subtracts the binary value in the first level of the accumulator stack from the binary value in the accumulator. The result resides in the accumulator.

**Multiply Binary Top of Stack (MULBS)**
DL440 & DL450 Only Multiplies the 16 bit binary value in the first level of the accumulator stack by the 16 bit binary value in the accumulator. The result resides in the accumulator.

**Divide Binary Top of Stack (DIVBS)**
DL440 & DL450 Only Divide a value in the accumulator by the binary value in the top location of the stack. The accumulator contains the result.

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

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

## Number Conversion Instructions

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

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

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

**Ten's Complement (BCDCPL)**
Takes the ten's complement of the BCD value in the accumulator. The result resides in the accumulator.

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

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

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

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

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

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

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

**Radian Real Conversion (RADR)**
DL450 Only Converts the real degree value in the accumulator to the equivalent real number in radians. The result resides in the accumulator.

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

## Trigonometric Instructions

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

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

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

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

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

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

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

# Instruction Set

## Bit Operation Instructions

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

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

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

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

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

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

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

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

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

## Table Instructions

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

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

**Find Greater Than (FDGT)**
DL440 & DL450 Only Finds a value in a V memory table which is greater than the specified search value. The table position containing the value is returned to the accumulator.

**Find Block (FINDB)**
DL450 Only Finds a block of data values in a V memory table and returns the starting address of the table containing the values to the accumulator.

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

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

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

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

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

**Add To Top of Table (ATT)**
DL440 & DL450 Only Pushes a value from a specified V memory location onto the top of a V memory table. All other values in the V memory table are shifted down each time a value is pushed onto the table.

**Table Shift Left (TSHFL)**
DL450 Only Shifts a specified number of bits to the left in a V-memory table.

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

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

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

## Program Control Instructions

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

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

**Goto Subroutine/Subroutine Return**

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

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

## Interrupt Instructions

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

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

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

## Message Instructions

**Fault/Data Label (FAULT/DLBL)**
DL440 & DL450 Only Displays a V memory value or a Data label constant to the handheld programmer or personal computer using DirectSOFT.

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

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

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

## Clock/Calendar Instructions

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

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

## CPU Control Instructions

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

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

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

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

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

## Intelligent I/O Instructions

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

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

## Network Instructions

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

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

## RLL PLUS Programming Instructions

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

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

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

**Not Jump (NJMP)**
Normally closed coil that deactivates the active stage and activates a specified stage when there is no power flow to the coil.

**Converge Stages (CV)**
DL440 & DL450 Only Converge stages are a group of stages that when all stages are active the associated converge jump(s) (CVJMP) will activate another stage(s). One scan after the CVJMP is executed, the converge stages will be deactivated.

**Converge Jump (CVJMP)**
DL440 & DL450 Only Normally open coil that deactivates the active CV stages and activates a specified stage when there is power flow to the coil.

**Block Call/Block/Block End (BCALL w/BLK and BEND)**
DL440 & DL450 Only BCALL is a normally open coil that activates a block of stages when there is power flow to the coil. BLK is the label which marks the beginning of a block of stages. BEND is a label used to mark the end of a block of stages.

## Drum Instructions

**Timed Drum with Discrete Outputs (DRUM)**
DL450 Only Time driven drum with up to 16 steps and 16 discrete output points. Output status is written to the appropriate output during each step. Specify a time base per count (in milliseconds). Each step can have a different number of counts to trigger the transition to the next step. Also define preset step as destination when reset occurs.

**Time & Event Drum with Discrete Outputs (EDRUM)**
DL450 Only Time and/or event driven drum with up to 16 steps and 16 discrete output points. Output status is written to the appropriate output during each step. Specify a time base per count (in milliseconds). Each step can have a different number of counts and an event to trigger the counting. Once the time has expired, a transition to the next step occurs. Also define preset step as destination when reset occurs.

**Time & Event Drum with Discrete Outputs and Output Mask (MDRMD)**
DL450 Only Time and/or event driven drum with up to 16 steps and 16 discrete output points. Actual output status is the result of a bit-by-bit AND between the output mask and the bit mask in the step. Specify a time base per count (in milliseconds). Each step can have a different number of counts and an event to trigger the counting. Once the time has expired, a transition to the next step occurs. Also define preset step as destination when reset occurs.

**Time & Event Drum with Word Output & Output Mask (MDRMW)**
DL450 Only time and/or event driven drum with up to 16 steps and a single V-memory output location. Actual output word is the result of a bit-by-bit AND between the word mask and the bit mask in the step. Specify a time base per count (in milliseconds). Each step can have a different number of counts and an event to trigger the counting. Once the time has expired, a transition to the next step occurs. Also define preset step as destination when reset occurs.

# Instruction Set - IBox Instructions

***The IBox instructions are available when using a D4-450 CPU with firmware version 3.30 or later and DirectSOFT5.***

## IBox Instructions - Analog Helper

**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.

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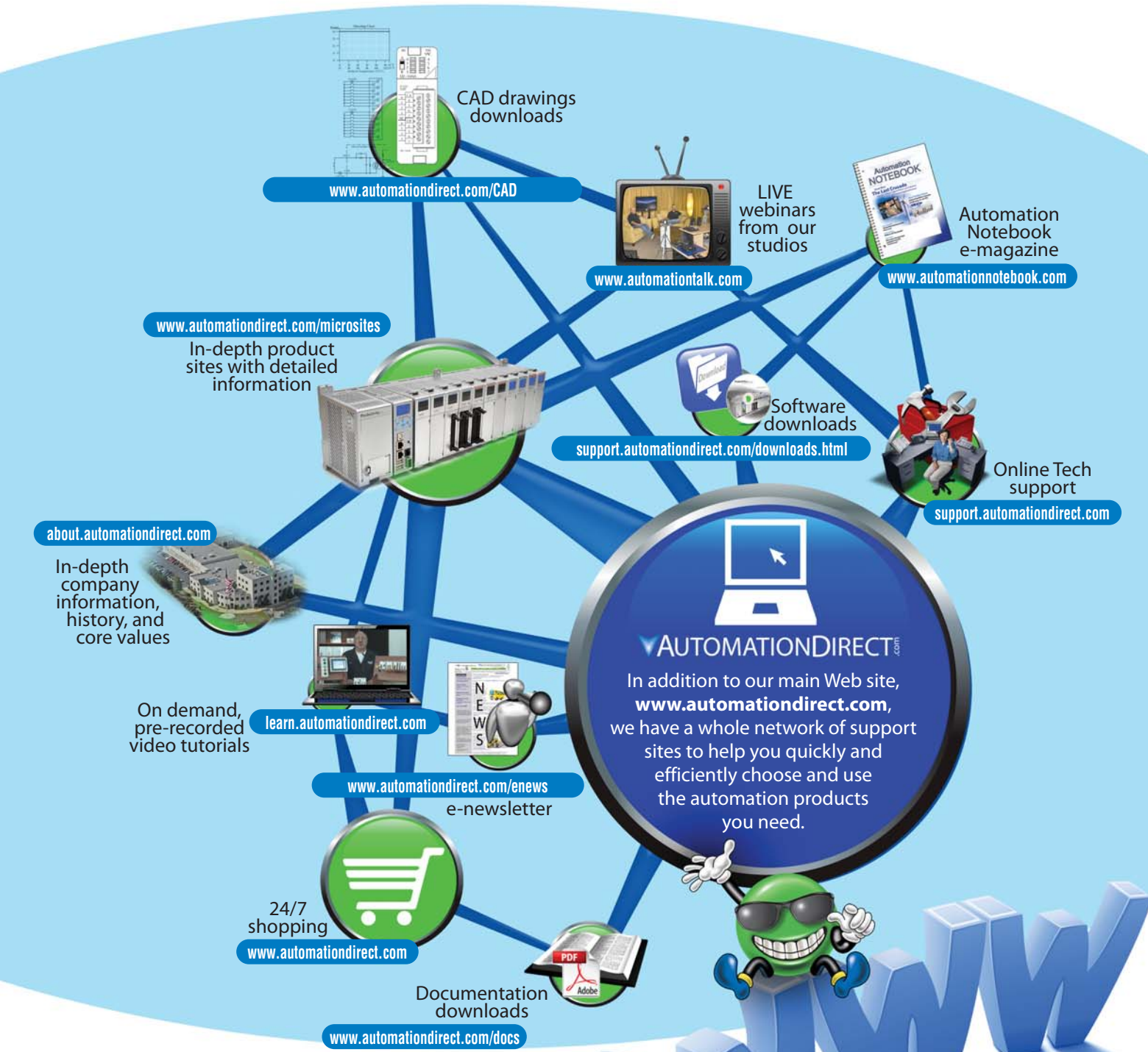


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*IEN magazine March 2009*