## 7 Steps to Specifying a DL205 System

The following 7 steps will help you specify a DL205 PLC system. They are also covered in more detail on the pages that follow. Your first priority when designing a system should be safety. Please make sure that all of the components in your system will operate within the product's environmental and operating specifications. This catalog is intended to provide abbreviated product descriptions, benefits and prices. It is not intended to be a substitute for the product manuals.

## Review the DL205 family of products

The DL205 family offers a wide variety of products. Please review the complete product offering.

## Select a CPU, programming tool Select a CPU, programming tool and cable <br> (a)

The DL205 family offers a traditional CPUs: the D2-262. Please take the time to understand the features and specifications of the CPU (i.e. builtin communications ports protocols, instructions, etc.).
To program the DL205 CPUs, choose between the Windows-based DirectSOFT programming software and PC cable or handheld programmer. CPU-slot Server base controllers are also introduced in this step.

## (4) <br> Additional communications ports needed?

If your application requires more than the built-in CPU communications ports, then select the H 2 -ECOM100 Ethernet communications module, or the D2-DCM serial communications module. These modules add more ports for networking or connection to an HMI, etc.

Before you begin selecting products for your DL205 PLC system, be sure to evaluate all of your application needs and any future growth potential.


## 7 Steps to Specifying a DL205 System

## (11) Select the discrete, analog and specialty I/O modules

Since there are several different types of I/O and specialty modules available for the DL205 system, it is important to review the module specifications in detail when selecting them for your system. The hardware specifications for the modules are described at the end of the DL205 section, starting with the specialty modules and followed by the discrete and analog I/O modules.


## Choose an I/O configuration method

The DL205 offers several configurations of I/O. Choose among local I/O, local expansion I/O and remote I/O. A DL205 system can be developed using a combination of the configuration arrangements. It is important to understand the octal addressing scheme and I/O module placement restrictions that are described in this step.

It is very important to verify that the selected CPU and I/O modules will operate within the base power budget. Tables list the power supplied and consumed by each DL205 device. This step also describes base dimensions and mounting requirements.

## Place your order!

Place your order either online at www. automationdirect.com, by calling 1-800-633-0405 or by faxing your order to 1-770-889-7876. See the Ordering section in this catalog for details.

Four ways to order:

- Online
- Email
- Phone
- FAX



## Step 1: Review the DL205 Product Family

## CPUs

- D2-262-30.4K words total memory
- 2 communications ports
- 16 built-in PID loops with auto-tuning


## Programming tools

- DirectSOFT Programming Software for Windows
- Handheld Programmer (D2-HPP)


## Bases

- 3-slot base (includes power supply)
- 110/220 VAC (D2-03B-1)
- 12/24 VDC (D2-03BDC1-1)
- 4-slot base (includes power supply)
- 110/220 VAC (D2-04B-1)
- 12/24 VDC (D2-04BDC1-1)
-6-slot base (includes power supply)
- 110/220 VAC (D2-06B-1)
- 12/24 VDC (D2-06BDC1-1)
- 125VDC (D2-06BDC2-1)
-9-slot base (includes power supply)
- 110/220 VAC (D2-09B-1)
- 12/24 VDC (D2-09BDC1-1)
- 125VDC (D2-09BDC2-1)


## Local expansion modules

- D2-262 CPU, using D2-0*B-1 or D2-0*BDC*-1 only
- Base expansion module (D2-EM)
- Expansion base controller module (D2-CM)
- Expansion base cable (D2-EXCBL-1)


## Discrete input modules

## - DC input

- 8-pt. 12-24 VDC sink/source (D2-08ND3)
- 16-pt. 24VDC sink/source (D2-16ND3-2)
- 32-pt. 24VDC sink/source (D2-32ND3)
- 32-pt. 5-12 VDC sink/source (D2-32ND3-2)


## - AC input

- 8-pt. 110VAC (D2-08NA-1)
- 16-pt. 110VAC (D2-16NA)
- 8-pt. 220VAC (D2-08NA-2)

Discrete
output modules

- DC output
- 4-pt. 12-24 VDC $\operatorname{sink}$ (D2-04TD1)
- 8-pt. 12-24 VDC sink (D2-08TD1)
- 8-pt. 12-24 VDC source (D2-08TD2)
- 16-pt. 12-24 VDC sink (D2-16TD1-2)
- 16-pt. 12-24 VDC source (D2-16TD2-2)
- 16-pt. 24VDC sink (Fault protected) (F2-16TD1P)
- 16-pt. 24VDC source (Fault protected) (F2-16TD2P)
- 32-pt. 12-24 VDC sink (D2-32TD1)
- 32-pt. 12-24 VDC source (D2-32TD2)


## - AC output

- 8-pt. 18-220 VAC (D2-08TA)
- 8-pt. 20-125 VAC (F2-08TA)
- 12-pt. 18-110 VAC (D2-12TA)
- Relay output
- 4-pt. 4A/pt (Isolated) (D2-04TRS)
- 8-pt. 1A/pt (D2-08TR)
- 8-pt. 10A/pt. (F2-08TR)
- 8-pt. 7A/pt (Isolated) (F2-08TRS)
- 12-pt. 1.5 A/pt (D2-12TR)


## Combination

 discrete modules- 4-pt. 24VDC in/4pt Relay Out (D2-08CDR)


## Analog modules

## - Analog input

- 4-ch. in, 12 bit, current (F2-04AD-1)
- 4-ch. in, 12 bit, voltage (F2-04AD-2)
- 8-ch. in, 12 bit, current (F2-08AD-1)
- 8-ch. in, 12 bit, voltage (F2-08AD-2)


## - Analog output

- 2-ch. out, 12 bit, current (F2-02DA-1)
- 2-ch. out, 16 bit, current (Isolated) (F2-02DAS-1)
- 2-ch. out, 12 bit, voltage (F2-02DA-2)
- 2 -ch. out, 16 bit, voltage (Isolated) (F2-02DAS-2)
- 8-ch. out, 12 bit, current (F2-08DA-1)
- 8-ch. out, 12 bit, voltage (F2-08DA-2)


## - Combination analog in/out

- 4-ch. in/2-ch. out, 12 bit, current (F2-4AD2DA)
- 8-ch. in/4-ch. out, 16 bit, current (F2-8AD4DA-1)
- 8-ch. in/4-ch. out, 16 bit, voltage
(F2-8AD4DA-2)
- Temperature input
- 4-ch. in, RTD (F2-04RTD)
- 4-ch. in, Thermocouple (F2-04THM)
- Ethernet Communications Module (H2-ECOM100)
- Serial Data Communications Module (D2-DCM)


## Remote I/O modules

## - Ethernet

- Ethernet Remote Client Module (H2-ERM100)
- Ethernet Base Controller (server) (H2-EBC100)


## Specialty modules

- Basic CoProcessor (F2-CP128)
- 8-pt. Input Simulator (F2-08SIM)
- Counter I/O (H2-CTRIO2)
- Counter Interface (D2-CTRINT)*


## CPU-slot <br> Server controllers

- Ethernet Base Controller (H2-EBC100)


## Operator interface

- See the $\mathbf{C}$-more and HMI sections in this catalog for a complete line of compatible text and touch panels and configuration software.


## Connection systems

- See the Terminal Blocks and Wiring Solutions section in this catalog for information on DINnector terminal blocks, ZIPLink connection systems and other connection accessories for use with the DL205 system.
*NOTE: D2-262 CPU does not support the D2-CTRINTmodule.


## (1) 20 (3) (1)

## Step 2: Select the CPU, Programmer and Cable

## DL205 Family CPUs

There are many things to consider when choosing a CPU, most of which depend on your particular application. The facing page provides a comparison between the CPUs. This section provides a quick summary of the key features for each CPU.

## System Capacity

System capacity is the ability of the CPU to accommodate a variety of applications. 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.
If you think you may exceed 256 local I/O points, the D2-262 CPU will support up to four additional bases.

The D2-262 supports Ethernet and serial Remote Client modules used when building a remote I/O network. Port 2 on the D2-262 can also serve as a remote I/O client.

## Performance

For applications that require fast scan times, additional communications or advanced instructions the D2-262 CPU performs even the most basic of math or data instructions, and will provide better overall performance.


## Programming and Diagnostics

Our CPUs offer an incredible array of instructions and diagnostic features that can save you many hours of programming and debug time. From basic Boolean contact logic to PID and floating point math, we have it covered! The table on the next page covers some of the basic instruction categories, but for more details, see our complete list of instructions at the end of this section. If you already have DirectSOFT and/or a Handheld Programmer, you may have to upgrade the software/firmware to accommodate the D2-262 CPU.

## Built-in CPU Communications

Every DL205 CPU provides at least one built-in RS-232 communication port. Either CPU will perform equally well when using an operator interface. The CPU has two built-in communication ports. For the most flexibility, it has built-in DirectNET Server support capability through the top and bottom ports, and DirectNET/ Modbus RTU Client/Server support on the bottom port. The bottom port supports baud rates of 2400 to 38.4 K . The D2262 provides support for ASCII IN/OUT communications as well.

If you require more than two ports, we also offer an Ethernet Communications Module that can be used to quickly add a communication port to a DL205 system with the D2-262 CPU. A D2-DCM module can be added to provide an additional serial communications port.

## D2-262 CPU Specifications

| D2-262 CPU Specifications |  |  |
| :---: | :---: | :---: |
| System Capacity |  |  |
| Total memory available (words) | 30.4 |  |
| Ladder memory (words) | 15872 Flash |  |
| V-memory (words) | 14592 |  |
| Battery backup | Yes |  |
| Total CPU memory I/O pts. available (actual I/O pts. depend on I/O configuration method selected) | $\begin{array}{\|l\|} \hline 8192(1024 \text { X + } 1024 \text { Y + } \\ 2048 \text { CR + } 2048 \text { GX + } 2048 \text { GY) } \\ \hline \end{array}$ |  |
| Local I/O (pts.) | 256 |  |
| Local Expansion I/O (pts.) | $1280 \text { (4 exp. bases max.) }$(Including local I/O) |  |
| Serial Remote I/O (pts.) | 8192 max. (Including local \& exp. I/O) |  |
| Remote I/O channels | 8 (7+1 CPU port) |  |
| I/O per remote channel | 2048 |  |
| Ethernet Remote I/O | Yes |  |
| Discrete I/O pts. | $8192$ <br> (Including local and exp.I/O) |  |
| Analog I/O channels | Map into V-memory |  |
| Remote I/O channels | Limited by power budget |  |
| I/O per remote channel | 16,384 (16 fully expanded H4-EBC Servers using V-memory and bit-of-word instructions) |  |
| Performance |  |  |
| Contact execution (Boolean) Typical scan (1K Boolean) | 0.61 Hs | $0.1 \mu \mathrm{~s}$ |
|  | 1.9 ms | 1.0 ms |
| Programming and Diagnostics |  |  |
| RLL Ladder Style | Yes |  |
| RLLPLUS/Flowchart Style (Stages) | Yes/1024 |  |
| Run time editing | Yes |  |
| Supports Overrides | Yes |  |
| Variable/fixed scan | Variable |  |
| Instructions | 231 |  |
| Control relays | 2048 |  |
| Timers | 256 |  |
| Counters | 256 |  |
| Immediate I/O | Yes |  |
| Subroutines | Yes |  |
| For/Next loops | Yes |  |
| Timed Interrupt | Yes |  |
| Integer Math | Yes |  |
| Floating-point Math | Yes |  |
| Trigonometric functions | Yes |  |
| Table Instructions | Yes |  |
| PID | Yes, 16 loops |  |
| Drum Sequencers | Yes |  |
| Bit of Word | Yes |  |
| ASCII Print | Yes |  |
| Real-time clock/calender | Yes |  |
| Internal diagnostics | Yes |  |
| Password security | Multi-level |  |
| System and user error log | Yes |  |
| Communications |  |  |
| Built-in ports | Port 1 RS-232 <br> Port 2 RS-232/422/485 |  |
| K-sequence (proprietary protocol) | Yes |  |
| DirectNET ${ }^{\text {TM }}$ | Yes |  |
| Modbus RTU Client/Server | Yes |  |
| ASCII communications | IN/OUT |  |
| Maximum baud rate | 38.4 K port 2 |  |

D2-262 Key Features


D2-262 \$424.00


## D2-262: Our most powerful DL205 CPU

Our D2-262 CPU provides all the capabilities of the D4-450 and D4-454 CPUs, plus several additional features rarely found in a PLC of this size. With such an incredible array of features, you may be able to replace PLCs costing hundreds (or thousands) more.

DirectSOFT is required to program the D2-262. If using a handheld programmer (H2-HPP), version 2.10 of the handheld programmer firmware is required. Here are a few key features about the D2-262 CPU

D2-262 can serve as network Client Easily connect programming devices or HMI to CPU ports


MODBUS ${ }^{\circledR}$ RTU or DirectNET ${ }^{\text {TM }}$ network protocol


## Powerful built-in CPU communications

Each D2-262 CPU offers two communications ports that provide a vast array of communication possibilities. The top RJ-12
RS-232 port can be used for connection to a C-more operator interface panel or as a single K-sequence or DirectNET Server. The 15-pin bottom port (port 2) supports RS-232 or RS-422/RS485. This port offers several different protocol options such as:

- K-sequence
- DirectNET Client/Server
- Modbus RTU Client/Server
- ASCII In/Out Communications

Port 2 can also serve as a remote I/O Client. The D2-262 supports the Ethernet Communication module and Data Communication Module for additional communications ports.

## D2-262 Key Features

## Local expansion I/O

The D2-262 supports local expansion up to five total bases (one CPU base and four expansion bases). Expansion bases are commonly used when there are not enough slots available in the CPU base, when the base power budget will be exceeded, or when placing an I/O base at a location away from the CPU base (but within the expansion cable limits). All local and expansion I/O points are updated on every CPU scan. Each local expansion base requires the D2-CM module in the CPU slot. The local CPU base requires the D2-EM Expansion Module, as well as each expansion base. For more information on local expansion, refer to the Expansion Modules pages later in this section.

## 16 PID loops <br> with auto-tuning

The D2-262 CPU can process up to 16 PID loops directly in the CPU. You can select from various control modes including automatic, manual, and cascade. There are also a wide variety of alarms including Process Variable, Rate of Change, and Deviation. The loop operation parameters (Process Variable, Setpoint, Setpoint Limits, etc.) are stored in V-memory, which allows easy access from operator interfaces or HMIs. Setup is accomplished with easy-touse setup menus and monitoring views in DirectSOFT programming.
The auto-tuning feature is easy to use and can reduce setup and maintenance time. Basically, the CPU uses the auto-tuning feature to automatically determine near optimum loop settings.

D2-262 local expansion system


Note: All bases in the system must be ( -1 ) bases.


## The D2-262 offers:

- Up to four expansion bases
- Up to 1,024 inputs and 1,024 outputs
- Up to 30 m (98ft) total expansion system cable



# D2-262 Key Features <br> Full array of instructions 

The right instruction can greatly simplify your programming task and can save hours of programming time.
The D2-262 supports over 280 powerful instructions, such as:

- Four types of drum sequencers
- Leading / trailing edge triggered one-shots
- Bit-of-word manipulation
- Floating point conversions
- Trigonometric functions
- Table instructions
- ASCII IN/OUT instructions

For a complete list of instructions supported by all DL205 CPUs, see the end of this section.

## Modbus RTU instructions

The D2-262 CPU supports easy-to-use Modbus Read/Write instructions that expand our existing Modbus network instruction capabilities. The MRX or MWX instructions allow you to enter native Modbus addressing in your ladder program with no need to perform octal-to-decimal conversion. We added Function codes 05,06 and the ability to read Server Exception Codes. These flexible instructions allow the user to select the following parameters within one instruction window:

- 584/984 or 484 Modbus data type
- Server node (0-247)
- Function code
- Modbus starting Client / Server memory address
- Number of bits
- Exception code starting address

Examples of MRX and MWX
instructions in DirectSOFT


## D2-262 Key Features

## ASCII

## communications

 instructionsThe D2-262 CPU supports several easy-to-use instructions that allow ASCII strings to be read into and written from the PLC communications ports.
Raw ASCII: Port 2 can be used for either reading or writing raw ASCII strings, but not for both.

Embedded ASCII characters: The D2-262 can decipher ASCII embedded within a supported protocol (K-Sequence, DirectNet, Modbus, Ethernet) via the CPU ports or D2-DCM.

## Here's how the D2-262 can receive

 ASCII input strings:- ASCII IN (AIN) - This instruction configures port 2 for raw ASCII input strings with parameters such as fixed and variable length ASCII strings, termination characters, byte swapping options, and instruction control bits. Use barcode scanners, weight scales, etc. to write raw ASCII input strings into port 2 based on the (AIN) instruction's parameters.
- Write embedded ASCII strings directly to V-memory from an external HMI or similar Client device via a supported communications protocol using the CPU ports, $\underline{\text { H2-ECOM100 or D2-DCM. The AIN }}$ instruction is not used in this case.
- If a D2-262 PLC is a Client on a network, the Network Read instruction (RX) can be used to read embedded ASCII data from a Server device via a supported communications protocol using port 2, $\mathrm{H} 2-$ ECOM100 or D2-DCM. The RX instruction places the data directly into V-memory.

Here's how the D2-262 can write ASCII output strings:

- Print from V-memory (PRINTV) - Use this instruction to write raw ASCll strings out of port 2 to a display panel or a serial printer, etc. The instruction features the starting V-memory address, string length, byte swapping options, etc. When the instruction's permissive bit is enabled, the string is written to port 2.
- Print to V-memory (VPRINT) - Use this instruction to create pre-coded ASCII strings in the PLC (i.e. alarm messages). When the instruction's permissive bit is enabled, the message is loaded into a pre-defined $V$-memory address location. Then the (PRINTV) instruction may be used to write the pre-coded ASCII string out of port

2. American, European and Asian Time/ Date stamps are supported.

- Print Message (PRINT) - This existing instruction can be used to create precoded ASCII strings in the PLC. When the instruction's permissive bit is enabled, the string is written to port 2. The VPRINT/ PRINTV instruction combination is more powerful and flexible than the PRINT instruction.
- If a D2-262 PLC is a Client on a network, the Network Write instruction (WX) can be used to write embedded ASCII data to an HMI or Server device directly from V-memory via a supported communications protocol using port 2, H2-ECOM100 or D2-DCM.


## Example of AIN instruction in DirectSOFT

| V\|x] |  |  |  |
| :---: | :---: | :---: | :---: |
| AIN |  |  |  |
| Length Type |  | Iermination Code Length |  |
| $\bigcirc$ EixedLength |  | C 1 Character |  |
| - Variable Length |  |  |  |
| Port Number: | K2 | $\begin{aligned} & \text { TermCode 1: } 0 \text { A } \\ & \text { hexadecimal } \\ & \text { TermCode 2: } 0 \mathrm{DD} \\ & \text { hexadecimal } \end{aligned}$ |  |
| $\underline{\text { Data }}$ Destination: | V2000 - |  |  |
| * Data Destination = Byte count <br> * Data Destination $+1=$ Start of data |  | Oyerflow Emor: C 177 |  |
|  |  |  |  |
| Maximum VariableLength: |  | Busy : | C4 - |
| Interchar. Timeout: | 2 ms - | Complete: | C5 |
| First Char. Timeout: | 3500 ms - | Interchar. T/O Error: | C6 |
| -Byte Swap: |  | First Char. T/O Error: | C7 |
| $\begin{aligned} & \text { - None } \\ & \stackrel{\text { All }}{ } \end{aligned}$ |  |  |  |
| C All but null |  |  |  |

Additional instructions that help manage the ASCII strings
The following instructions can be very helpful in managing the ASCII strings within the CPU's V-memory:

- ASCII Find (AFIND) - Finds where a specific portion of the ASCII string is located in continuous $V$-memory addresses. Forward and reverse searches are supported.
- ASCII Extract (AEX) - Extracts a specific portion (usually some data value) from the ASCII find location or other known ASCII data location.
- Compare V-memory (CMPV) - This instruction is used to compare two blocks of V -memory addresses and is usually used to detect a change in an ASCII string. Compared data types must be of the same format (i.e. BCD, ASCII, etc.).
- Swap Bytes (SWAPB) - Usually used to swap V-memory bytes on ASCII data that was written directly to V -memory from an external HMI or similar Client device via a communications protocol. The AIN and AEX instructions have a built-in byte swap feature.


## Example of VPRINT instruction in DirectSOFT



## DL205 Programming Tools and Cables

## Handheld programmer

The D2-HPP handheld programmer connects to an RJ12 phone jack port on any of the DL205 CPUs. The handheld unit contains a zero force insertion socket that can be used to store programs on an optional EEPROM. Can be used with DL05, DL06, DL105, and DL205 models.

## Selecting a programming device

There are two tools for programming the DL205 CPUs: DirectSOFT PC-based programming software and the D2-HPP handheld programmer.

## DirectSOFT

## programming software

Our powerful Windows-based programming package makes it easy for you to program and monitor your DL205 PLC system. See the DirectLOGIC Overview Section DL in this catalog for detailed information on DirectSOFT.

| DirectSoft Part Number | Price | Description |
| :---: | :---: | :---: |
| PC-DSOFT6 | \$462.00 | Programs all DirectLOGIC <br> PLC CPUs; offers IBox intelligent instructions |
| PC-DS100 | Free | Free version of DirectSOFT programs all DirectLOGIC PLC CPUs; limited to 100 word program |
| Note: D2-262 CPU requires DirectSOFT version 6.3 or later |  |  |

Pin labeling conforms to IBM DTE and DCE standards
D2-DSCBL


## DL205 programming cables

Choose the proper cable to connect the DL205 CPU to your PC running DirectSoft.

| CPU | Port | Cable | Price |
| :---: | :--- | :--- | :---: |
| D2-262 | Top port | $\underline{\text { D2-DSCBL }}$ | $\$ 35.00$ |
|  | Bottom port | $\underline{\text { D2-DSCBL-1 }}$ | $\$ 67.00$ |



9-pin D-Connector (female)
15-pin HD-connector (male)


D2-HPP
Handheld programmer, cable included
(DV-1000CBL)

## DL205 CPU-Slot Server Controllers

## Overview

There are currently four Server "base controllers" or "Server I/O controllers" available for the DL205 hardware.

## H2-EBC100

Ethernet Base Controller Module


This allows you to use industry proven DL205 I/O for general purpose distributed applications.

The controller modules are plugged into the CPU slot of any size DL205 base. The Server controllers must be connected to a network Client controller module or to a PC running PC-based control, HMI or SCADA software.


## 0000000

## Step 3: Additional Communications Ports Needed?

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 so, then choose between the H 2 -ECOM100 Ethernet communications module or the D2-DCM serial data communications
module. Both modules' specifications and communications details are covered later in this section.

## H2-ECOM100 Ethernet network



The H2-ECOM100 can be used for:

- High-speed peer-to-peer networking of PLCs (any PLC can initiate communications)
- CPU programming with DirectSOFT Programming Software
- High-speed data acquisition via HMI or other HMI software
- Virtually unlimited number of network nodes
- Very easy to setup


## Ethernet networking with the H2-ECOM100

The D2-262 CPU supports the H2ECOM100 Ethernet communications module. Any PLC on an ECOM network can initiate communications with another PLC or use DirectSoft to program any PLC on the network. This is the fastest data transfer rate we offer for HMI or other Windows-based software. When monitoring your PLC, you will notice much
faster updates using the ECOM module. The H2-ECOM 100 module supports the industry standard 10 or 100Base-T with an RJ45 port. 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.

## D2-DCM serial network



The D2-DCM can be used for:

- DirectNet networking of PLCs (only one DCM or PC can serve as Client)
- Peer-to-peer networking of two DCM modules (each can serve as a Client or Server)
- CPU programming with DirectSOFT Programming Software
- Data acquisition via HMI, DSData Server, or other HMI software
- A Server on a Modbus RTU network
- Connection to a serial modem (MDM-TEL)


## Serial networking with the D2-DCM

The D2-262 CPU supports the D2-DCM Data Communications Module, which can serve as a DirectNet Client/Server, DirectNet peer, or a Modbus RTU Server. The D2-DCM supports both RS-232 and RS-422. You can program the CPU through the DCM locally, or if a PC is the RS-422 Client, you can use DirectSoft to program any PLC on the network.

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

1. Environmental specifications: What environmental conditions will the I/O module be subjected to?
2. Hardware specifications: Does this product have the right features, performance and capacity to adequately serve your application?
3. Field termination: How does this module connect to field devices? Do you need a sinking or sourcing DC 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 <br> environmental specifications

The following table lists the environmental specifications that globally apply to the DL205 system (CPUs, bases, and I/O modules). Be sure the modules you choose are operated within these environmental specifications.

## Specifications and ratings <br> Storage temperature* <br> $-4^{\circ} \mathrm{F}-158^{\circ} \mathrm{F}\left(-20^{\circ} \mathrm{C}\right.$ to $\left.70^{\circ} \mathrm{C}\right)$ <br> Ambient operating temperature** <br> $32^{\circ} \mathrm{F}-131^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $55^{\circ} \mathrm{C}$ ) <br> Ambient humidity <br> $30 \%$ - $95 \%$ relative humidity (non-condensing) <br> Vibration resistance <br> MIL STD 810C, Method 514.2 <br> Shock resistance <br> MIL STD 810C, Method 516.2 <br> Noise immunity <br> NEMA (ICS3-304) <br> Atmosphere <br> No corrosive gases <br> *Storage temperature for the Handheld Programmer is $-4^{0}$ to $158^{\circ} \mathrm{F}\left(-20^{\circ}\right.$ to $\left.70^{\circ} \mathrm{C}\right)$ <br> ** Operating temperature for the Handheld Programmer is <br> $32^{\circ}$ to $122^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $50^{\circ} \mathrm{C}$ )

This logo is placed by each I/O module that supports ZIPLink connection svstems. (The I/O modules are listed at the end of this section.) See the Terminal Blocks and Wiring section for details on ZIPLinks.


## Review I/O hardware specifications

The hardware specifications for every DL205 module are described later in this section.

Take time to understand the specification charts, the derating curves and the wiring diagrams. The module specifications should help you determine if this module is right for your application.

## Factors affecting field termination

DL205 modules use three types of field terminations. They include a low density removable terminal block (used on modules with eight or fewer points), a high density removable terminal block (European style terminal block available on modules with 12 to 16 points), and a 40-pin connector (for modules with 32 points). The module diagrams indicate the connector type that is on the module. You can also use our super fast and inexpensive ZIPLink I/O connector systems.

## Module types and suggested AWG range

## 4 point

16*-24 AWG
8 point
$16^{*}-24$ AWG
12 point
16*-24 AWG
16 point
16* -24 AWG
32 point
Ribbon and Solder-style Connectors
*Note: 16 AWG Type TFFN or Type MTW can be used on 8 pt. modules. Other types of 16 AWG may be acceptable, but it really depends on the thickness of the wire insulation. If the insulation is too thick and you use all the $1 / 0$ points, then the plastic terminal cover may not close properly.


## Need spare parts?

Sometimes it is helpful to have extra I/O module connectors or spare fuses. The DL205 spare parts and accessories are listed below:

- D2-FILL - Filler module for empty slots
- D2-8IOCON - 8-pt. I/O terminal blocks
- D2-16IOCON - 16-pt. I/O terminal blocks
- D2-IOCVR - Spare terminal block covers
- D2-FUSE-1 - Fuses for D2-12TA
- D2-FUSE-3 - Fuses for D2-04TD1, D2-04TRS, D2-08TR, D2-08CDR
- D2-FUSE-4 - Fuses for D2-12TR
- D2-ACC-1 - Base power terminal strip screws
- D2-ACC-2 - Spare terminal screws for 4 -pt. and 8 -pt. I/O modules
- ZL-D24-CON-X - Solder-type connector for 32-pt. and 64-pt. modules
- DINnectors and ZIPLinks - Refer to the Terminal Blocks and Wiring section of this catalog for the complete line of products available.


## DINnectors terminal blocks

DINnectors are DIN-rail mounted connectors or terminal blocks. They provide a means of connecting and identifying two or more wires. All
DINnectors are UL, CSA, VDE, SEV, RINA and IEC approved. For more information, refer to the Terminal Blocks and Wiring section.

## ZIPLink connection systems

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

## I/O Availability

| /0 Avaiabilty Tabe |  |  |
| :---: | :---: | :---: |
| PLC CPU / CPU-Slot Controller | D2-2622 | H2-EBC100 |
| Discrete Modules |  |  |
| DC Sink/Source In | $\checkmark$ | $\checkmark$ |
| DC Output | $\checkmark$ | $\checkmark$ |
| AC Input | $\checkmark$ | $\checkmark$ |
| AC Output | $\checkmark$ | $\checkmark$ |
| Relay Out | $\checkmark$ | $\checkmark$ |
| DC In / Relay Out | $\checkmark$ | $\checkmark$ |
| Analog Modules |  |  |
| Analog Current In | $\checkmark$ | $\checkmark$ |
| Analog Voltage In | $\checkmark$ | $\checkmark$ |
| Analog Current Out | $\checkmark$ | $\checkmark$ |
| Analog Voltage Out | $\checkmark$ | $\checkmark$ |
| Analog Isolated Current Out | $\checkmark$ | $\checkmark$ |
| Analog Isolated Voltage Out | $\checkmark$ | $\checkmark$ |
| Combination Analog | $\checkmark$ | $\checkmark$ |
| Temperature Input | $\checkmark$ | $\checkmark$ |
| Speciality Modules |  |  |
| Local Expansion | $\checkmark$ |  |
| Communications | $\checkmark$ |  |
| Remote I/O | $\checkmark$ |  |
| CoProcessor | $\checkmark$ |  |
| Counter I/O (H2-CTRIO2) | $\checkmark$ | $\checkmark$ |
| Counter Interface (D2-CTRINT)* |  |  |

## Sinking and sourcing for DC field devices

If you are using a DC type of field device, then you should consider 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 sinking/sourcing appendix for a complete explanation on how this affects your system selection.

## Analog module selection tips

If you're going to control the speed of an AC inverter or drive with the DL205 analog module, make sure you select either the current sourcing F2-02DAS-1 or voltage sourcing F2-02DAS-2 isolated analog output module. Complete module specifications are listed later in this section.

If you need to operate within a 12VDC environment, the analog module part numbers that end with (-L) will operate at 12 VDC . Most of the other modules require 24 VDC .

## H2-CTRIO2 vs. D2-CTRINT high-speed counter module

Select the H2-CTRIO2 instead of the D2-CTRINT* if your application requires:

- More than one quadrature encoder
- More than two single up counters
- Compatibility with the WinPLC
- High-speed inputs or outputs $>5 \mathrm{kHz}$
- Output operations on the module based on counts without interacting with the CPU
The H2-CTRIO2 is configured using "CTRIO Workbench", 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
*NOTE: D2-262 CPU does not support the D2-
CTRINT module.


## Step 5: Choose an I/O Configuration

## I/O configurations

The DL205 system offers local I/O, local expansion and remote I/O system configurations. A DL205 system can use a combination of the configuration arrangements. The tables, along with the configuration diagrams, list the number of I/O points, bases, etc. that are available with each configuration.

## I/O bases

I/O bases are used for local I/O, local expansion or remote I/O configurations. The ( -1 ) bases are required for local I/O expansion that is supported by the CPUs. The ( -1 ) bases can be used with all DL205 CPUs (Older, non-(-1) bases can be used if local expansion is not required). There are four DL205 base sizes (3, 4, 6, and 9 -slot), each of which has a built-in power supply.

## Local I/O

The D2-262 CPU supports local I/O and local expansion bases. All local I/O points are updated on every CPU scan. The I/O count limits are determined by the number of available I/O slots, the I/O module point density, and the power budget available for the system.

## Local expansion

The D2-262 supports local expansion up to five total bases (one CPU base and four expansion bases). Expansion bases are commonly used when there are not enough slots available in the CPU base, or when the base power budget will be exceeded. Each local expansion base requires the D2-CM module in the CPU slot. The local CPU base requires the D2-EM Expansion Module, as well as each expansion base. The modules are connected using the D2-EXCBL-1. When using expansion bases, discrete I/O are updated synchronously with each scan, while analog I/O are asynchronous with the scan.

## Ethernet remote I/O

The DL205 Ethernet Remote I/O system allows you to locate I/O bases at a remote distance from the CPU. For many applications, this can reduce wiring costs by allowing I/O points to be located near the devices they are controlling.
The Ethernet Remote Client module (H2-ERM100) is placed in an I/O slot of the local CPU base. Ethernet Base Controller (EBC) modules serve as the remote Server units and are placed in the CPU slot of one or more remote bases. You can use standard DL205 modules in the remote bases. The Remote

Servers are connected to the Client using Category 5 UTP cables for cable runs up to 100 meters. Use repeaters to extend distances and hubs to expand the number of nodes.
Each H2-ERM100 module can support up to: $16 \underline{\mathrm{H} 2-E B C 100 ~ s y s t e m s, ~} 16$ Terminator I/O EBC systems, 16 fully expanded H4-EBC systems, or any combination of these.
The PLC, ERM and EBC Server modules work together to update the remote I/O points. These three scan cycles are occurring at the same time, but asynchronously. It is recommended that critical I/O points that must be monitored every scan be placed in the CPU base.
ERM Workbench is an easy-to-use Windows-based software utility for configuring the ERM and its remote Servers.
It is highly recommended that a dedicated Ethernet remote I/O network be used for the ERM and its Servers. While Ethernet networks can handle a very large number of data transactions, and normally handle them very quickly, heavy Ethernet traffic can adversely affect the reliability of the Server I/O and the speed of the I/O network. Ensure ERM networks, multiple ERM networks and ECOM/office networks are isolated from one another.

## (1) (3)

## Local and Local Expansion I/O

 ConfigurationsLocal I/O configurations

## Four I/O base configurations to select from

| Local I/O Configuration |  |  |  |
| :--- | :---: | :---: | :---: |
| CPU | Total I/O | Max. Inputs | Max. Outputs |
| $\underline{\text { D2-262 }}$ | 256 | 256 | 256 |

6-slot base 160-pts. max.


3-slot base 64-pts. max.


4-slot base 96-pts. max.


9-slot base 256 -pts. max.


## Local expansion I/O configurations using D2-EM and D2-CM modules

## D2-262 local expansion system

The D2-262 support local expansion, up to five total bases (one CPU base and four expansion bases). All bases in an expansion system must be ( -1 ) bases. The CPU base can be located at any point in the expansion system layout. The maximum total expansion system cable length is 30 m ( 98 ft ). For more information, refer to the Expansion Module specification pages later in this section.


| Local Expansion 1/0 Configuration |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| CPU | \# of Exp. Bases | $\begin{gathered} \text { Total } \\ \text { I/O } \end{gathered}$ | Max. <br> Inputs | Max. Outputs |
| D2-262 | 4 | 1280 | 1024 | 1024 |

The D2-EXCBL-1 is a Category 5 straight-through cable that connects the D2-EM modules together. The cable can be user made in custom lengths up to 30 m depending upon the configuration.

## Remote I/O Configurations

Ethernet remote I/O configuration using H2-ERM100 and EBC Servers


Specifications H2-ERM100

| Communications | 10/100Base-T <br> Ethernet |
| :--- | :---: |
| Data Transfer Rate | 100 Mbps |
| Link Distance | 100 meters <br> $(328 \mathrm{ft})$ |
| Ethernet Port | RJ45 |
| Ethernet Protocols | TCP/IP, IPX, Modbus <br> TCP/IP, <br> DHCP, <br> HTML configuration |

## Ethernet Remote I/O Configuration

| CPU | Max. \# of <br> Channels | Max. \# of <br> Servers/ <br> Channel | Discrete <br> I/O pts. | Analog <br> I/O | Remote <br> I/O pts / <br> Channel |
| :--- | :---: | :---: | :---: | :---: | :---: |
| D2-262 | Limited <br> by power <br> budget | 16 Servers <br> $\left(\begin{array}{c}(H 2-\text { EBC100, } \\ \text { (H4-EBC or } \\ \text { T1H-EBC100) }\end{array}\right.$ | 8192 | Map into <br> available <br> memory <br> registers | 16,3841 |

[^0]

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

# I/O Addressing Schemes 

## DL205 I/O addressing scheme

You may have used other PLC systems prior to trying DirectLOGIC products. One of the key differences between various PLC systems is the I/O module addressing. This section will show you how we address the individual I/O points in a DL205 system.

## Octal addressing

The DL205 uses octal addressing. That is, the I/O point addresses do not include any " 8 s " or " 9 s ". The I/O points start at 0 and continue in increments of 8 or 16 points, depending on the modules being used. We have designated "X" for inputs and " $Y$ " for outputs.
Note: Four-point modules consume eight points, but only the first four points are actually used by the module. Twelve-point modules consume 16 points, but only 12 points are used. The first six points are used, then two points are skipped, then the next six points are used, and the last two are skipped.

## Automatic addressing

The DL205 CPUs automatically examine local I/O modules to establish the correct I/O addressing on power-up. The D2-262 CPU automatically examines I/O modules in expansion bases as well. The modules don't have to be grouped by type and can typically be mixed in any order. However, there are restrictions placed on some specialty modules or combinations of modules (see the next page). The diagram to the right shows sample addresses for a simple system that contains a few discrete I/O modules.

## Manual addressing

The D2-262 CPU allows you to manually assign I/O addresses for any or all I/O slots on the local or expansion bases. This feature is useful if you have a standard configuration that you need to change slightly to accommodate a special request (i.e. adding or removing I/O modules from a system). Manual addresses are based on 16-point boundaries.

## Remote I/O addressing

Remote I/O allows you to assign addresses manually. You can choose the data type for the remote points. Ethernet remote I/O (H2-ERM100) allows you to map the analog I/O channels directly into V-memory ( 16 -bit words) while mapping the discrete I/O points into input/output bit memory ( $\mathrm{Xs} \& \mathrm{Ys}$ ). Serial remote I/O allows you to assign one starting address for all of the input modules and one starting address for the output modules.

## Leaving empty slots

You may be tempted to leave empty slots for future expansion. This is perfectly acceptable, but it is very important that you understand the implications of placing a module in the empty slot at a later time.

Since the CPU automatically assigns the I/O addresses, it is possible to cause problems by adding a module to the system. Examine the example system shown below. If you added an input module to the empty slot, the new input addresses would start after the existing input addresses, so no problems would occur. However, if you added an output to the empty slot, your remaining output addresses would change. Therefore, you would have to edit your RLL program to reflect the address changes. The manual addressing feature is especially useful when adding an I/O module between existing I/O modules or removing a module.
You should always add extra modules to the right of existing modules of the same type to avoid any re-addressing of your I/O points.


I/O base with a slot left empty. The examples below show the addressing changes if an input or an output module is added to the system.


Add Input module. Addresses follow existing, so no program modification is required.


Add output module. Addresses are re-numbered and program modification is required.

## Verify planned I/O module locations

There are very few I/O module placement restrictions in the DL205 family. In general, any mix of analog and discrete module types can be used in any local, expansion or remote base. However, there are a few situations with the analog and specialty modules that warrant some special considerations. Reference the Module Placement Restrictions table to the right for the DL205.

## Analog I/O with expansion bases

When using an analog module in an expansion base, the analog update time to the CPU will be asynchronous to the scan time.

## I/O point usage

The table to the right indicates the number of I/O points consumed by each module. Use this information to ensure you stay within the maximum I/O count of the I/O system you have chosen.

| Module Placement Restrictions |  |  |  |
| :---: | :---: | :---: | :---: |
| Module/Unit | Local CPU Base | Local Expansion | Remote Base |
| CPUs <br> DC Input <br> AC Input <br> DC Output <br> AC Output <br> Relay Output <br> Analog Input \& Output | CPU slot only $\checkmark$ $\checkmark$ $\checkmark$ $\checkmark$ $\checkmark$ $d$ | $\begin{aligned} & v \\ & v \\ & v \\ & v \\ & v \\ & v \\ & v \end{aligned}$ | $\begin{aligned} & v \\ & v \\ & v \\ & v \\ & v \\ & v \\ & v \end{aligned}$ |
| $\begin{array}{\|l\|l} \hline \text { Local Expansion1 } \\ \hline \text { (D2-262) } & \\ & \text { Base Expansion Unit (D2-EM) } \\ & \text { Base Controller Unit (D2-CM) } \end{array}$ | $\checkmark$ | CPU slot only |  |
| $\|$Remote I/O <br> Remote Client <br> Remote Server Unit <br> Ethernet <br> Remote Client | $\begin{aligned} & \checkmark \\ & \checkmark \end{aligned}$ |  | CPU slot only |
| CPU Device <br> Ethernet Base Controller <br> DeviceNET <br> SDS | CPU slot only CPU slot only CPU slot only |  |  |
| Specialty modules <br> Counter Interface (D2-CTRINT) ${ }^{3}$ <br> Counter I/O (H2-CTRIO2) ${ }^{2}$ <br> Simulator <br> Data Communications <br> Ethernet Communications <br> Basic CoProcessor | Slot 0 only <br> Any slot except Slot 0 <br> $\checkmark$ <br> Any slot except Slot 0 Any slot except Slot 0 <br> Any slot except Slot 0 | $\checkmark$ | $\checkmark$ |
| 1 When used in expansion bases, the analog update is asynchronous to the PLC. <br> 2 H2-CTRIO2 will not work in slot 0 when used with the D2-262. The H2-CTRIO2 is not supported in expansion bases at this time. <br> 3 D2-262 does not support the D2-CTRINT module. |  |  |  |


| //0 Module Point Usage |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| DC INPUT |  | RELAY OUTPUT |  | SPECIALTY MODULES |  |
| $\frac{\mathrm{D} 2-08 \mathrm{ND} 3}{}$ <br> $\mathrm{D2} 2-16 \mathrm{ND} 3-2$ <br> $\mathrm{D} 2-32 \mathrm{ND} 3$ <br> $\mathrm{D} 2-32 \mathrm{ND3} 3$ <br> AC INPUT | $\begin{aligned} & 8 \mathrm{in} \\ & 16 \text { in } \\ & 32 \mathrm{in} \\ & 32 \mathrm{in} \end{aligned}$ | D2-04TRS <br> D2-08TR <br> F2-08TR <br> F2-08TRS <br> D2-12TR | $8^{*}$ out <br> 8 out <br> 8 out <br> 8 out <br> 16** out | D2-CM <br> F2-08SIM <br> D2-CTRIT <br> H2-CTRIO2 <br> D2-DCM <br> H2-EBC100 <br> H2-ECOM100 <br> F2-CP128 | None 8 in 8 in 8 out None None None None None |
| D2-08NA-1 | 8 in | COMBINATION |  |  |  |
| $\frac{\mathrm{D} 2-08 \mathrm{NA}-2}{\mathrm{D} 2-16 \mathrm{~A}}$ | $\begin{aligned} & 8 \text { in } \\ & 16 \text { in } \end{aligned}$ | D2-08CDR | 8 in** $^{*}$ out* |  |  |
| DC OUTPUT |  | ANALOG |  |  |  |
| $\frac{D 2-04 T D 1}{}$ <br> D2-08TD1 <br> D2-08TD2 <br> D2-16TD1-2 <br> D2-16TD2-2 | 8* out <br> 8 out <br> 8 out <br> 16 out <br> 16 out |  | 16 in <br> 16 in <br> 16 in <br> 16 out 16 out <br> 16 in/16 out <br> $32 \mathrm{in} / 32$ out $32 \mathrm{in} / 32$ out <br> 32 out <br> 32 out 16 out <br> 16 out <br> 32 in 32 in | REMOTE I/O |  |
| $\frac{\text { F2-16TD1P }}{\text { F2-16TD2P }}$ <br> D2-32TD1 <br> D2-32TD2 | $\begin{aligned} & 16 \mathrm{in} / 16 \text { out } \\ & 16 \mathrm{in} / 16 \text { out } \\ & 32 \text { out } \\ & 32 \text { out } \end{aligned}$ |  |  | H2-ERM100 | None |
| AC OUTPUT |  |  |  |  |  |
| $\frac{\text { D2-08TA }}{\frac{\text { F2-08TA }}{\text { D2-12TA }}}$ | 8 out 8 out 16** out |  |  |  |  |
| * 4-pt. modules consume eight points. Only the first four points are used. <br> ** 12-pt. modules consume 16 points. The first six points are assigned, two are skipped, and then the next six points are assigned. For example, a D2-12TA installed in slot 0 would use $\mathrm{Y} 0-\mathrm{Y}$, and $\mathrm{Y} 10-\mathrm{Y} 15$. $\mathrm{Y} 6-\mathrm{Y} 7$, and Y16-Y17 would be unused. |  |  |  |  |  |

## Step 6: Check the Power Budget

## Managing your power resource

When determining the types and quantity of I/O modules you will be using, it is important to remember there is a defined amount of power available from the base power supply.

The chart on the next page indicates the power supplied and used by each DL205 device. The adjacent chart shows an example of how to calculate the power used by your particular system. These charts should make it easy for you to determine if the devices you have chosen will operate 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 may be able to resolve the problem by using local expansion or remote I/O bases.

## DL205 power supply specifications

The table below lists base power supply specifications, including maximum inrush current and maximum power consumed from your power source.

## Power budget example

The example on the right shows how to calculate the power budget for the DL205 system. The examples are constructed around a single 9 -slot base using the devices shown. It is recommended you construct a similar table for your DL205 system. Follow the steps to the right to determine your power budget.
1.Using a chart similar to the one below, fill in column 2.
2.Using the tables on the next page, enter the current supplied and used by each device (columns 3 and 4). Devices which fall into the "Other" category (Row D) are devices such as the operator interface and the handheld programmer, which also have power requirements, but do not directly plug into the base.
3.Add the current used by the system devices (columns 3 and 4) starting with the CPU slot 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 power supply does not need to supply all the external power. If you need more than the 300 mA supplied, you can add an external 24 V power supply. This will help keep you within your power budget for external power.

| A | Column 1 | Column 2 | Column 3 | Column 4 |
| :---: | :---: | :---: | :---: | :---: |
|  |  | Device Type | 5VDC (mA) | External Power 24 VDC (mA) |
| B | CURRENT SUPPLIED |  |  |  |
|  | Base | 9 slot | 2,600 | 300 |
| C | CURRENT REQUIRED |  |  |  |
|  | CPU SLOT <br> SLOT 0 <br> SLOT 1 <br> SLOT 2 <br> SLOT 3 <br> SLOT 4 <br> SLOT 5 <br> SLOT 6 <br> SLOT 7 | D2-262 (CPU) <br> D2-16ND3-2 <br> D2-16ND3-2 <br> D2-16NA <br> D2-08NA-1 <br> D2-16TD1-2 <br> D2-07A <br> D2-08TA | 336 100 100 100 50 200 250 250 | $\begin{aligned} & \hline 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 80 \\ & 0 \\ & 0 \end{aligned}$ |
| D | OTHER |  |  |  |
|  | Operator interface Handheld programmer | $\begin{aligned} & \text { EA9- } \\ & \text { D2-HPP } \end{aligned}$ | $\begin{aligned} & 150 \\ & 200 \end{aligned}$ | $0$ |
| E | Maximum Current Required |  | 1736 | 80 |
| $F$ | Remaining Current Available |  | 2600-1730=870 30 | $300-80=220$ |


| Power Supply Specifications |  |  |  |
| :---: | :---: | :---: | :---: |
| Specification | AC Powered Bases | 24 VDC Powered Bases | 125 VDC Powered Bases |
| Part Numbers | D2-03B-1, D2-04B-1, D2-06B-1, D2-09B-1 | $\begin{aligned} & \text { D2-03BDC1-1, } \\ & \text { D2-06BDC1-1 } \\ & \hline \text { D2-04BDC1-1, } \\ & \hline 2-09 B D C 1-1 \end{aligned}$ | $\begin{aligned} & \text { D2-06BDC2-1 } \\ & \hline \text { D2-09BDC2-1 } \\ & \hline \end{aligned}$ |
| Voltage Withstand (dielectric) | 1 minute @ 1,500 VAC between primary, secondary, field ground, and run relay |  |  |
| Insulation Resistance | $>10 \mathrm{Mq}$ at 500VDC |  |  |
| Input Voltage Range | 85-132 VAC (110 range) 170-264 VAC (220 range) $47-63 \mathrm{~Hz}$ | 10.2-28.8 VDC (24VDC), with less than $10 \%$ ripple | 100-264 VDC (125VDC), with less than $10 \%$ ripple |
| Auxiliary 24 VDC Output | 300mA max. | None | 300 mA max. |
| Maximum Inrush Current | 30A | 10A | 20A |
| Maximum Power | 80VA | 25W | 30W |

## (2)0 (1)

## Power Requirements

## These charts help determine your power requirements

This section shows the amount of power supplied by each of the base power supplies and the amount of power consumed by each DL205 device. The Power Consumed charts list how much INTERNAL power from each power source is required for the DL205 devices. Use this information when calculating the power budget for your system.
In addition to the internal power sources, the DL205 bases offer a 24 VDC auxiliary power supply with external power connections. This auxiliary power supply can power external devices.

## Use ZIPLinks to reduce power requirements

If your application requires a lot of relay outputs, consider using the ZIPLink AC or DC relay output modules. These modules can switch high current (10A) loads without putting a load on your base power budget. Refer to the Terminal Blocks and Wiring Solutions section in this catalog for more information.
This logo is placed next to the I/O modules that are supported by the ZIPLink connection systems. See the I/O module specifications at the end of this section.


| Power Consumed |  |  |
| :--- | :--- | :--- |
| Device | 5V(mA) | 24V Auxiliary |
| Operator Interface |  |  |
| C-more Micro- <br> Graphic | 210 | 0 |


| Power Supplied |  |  |  |
| :--- | :--- | :--- | :--- |
| Device | Price | 5V(mA) | 24V Auxiliary |
| Bases |  |  |  |
| D2-03B-1 | $\$ 200.00$ | 2600 | 300 |
| D2-03BDC1-1 | $\$ 249.00$ | 2600 | None |
| D2-04B-1 | $\$ 217.00$ | 2600 | 300 |
| D2-04BDC1-1 | $\$ 274.00$ | 2600 | None |
| D2-06B-1 | $\$ 268.00$ | 2600 | 300 |


| Power Consumed |  |  |
| :--- | :--- | :--- |
| Device | 5V(mA) | 24V Auxiliary |
| CPUs |  |  |
| D2-262 | 336 | 0 |
| DC Input Modules |  |  |
| D2-08ND3 | 50 | 0 |
| D2-16ND3-2 | 100 | 0 |
| D2-32ND3 | 25 | 0 |
| D2-32ND3-2 | 25 | 0 |
| AC Input Modules |  |  |
| D2-08NA-1 | 50 | 0 |
| D2-08NA-2 | 100 | 0 |
| D2-16NA | 100 | 0 |
| Input Simulator Module |  |  |
| F2-08SIM | 50 | 0 |
| DC Output Modules |  |  |
| D2-04TD1 | 60 | 20 |
| D2-08TD1 | 100 | 0 |
| D2-08TD2 | 100 | 0 |
| D2-16TD1-2 | 200 | 80 |
| D2-16TD2-2 | 200 | 0 |
| F2-16TD1P | 70 | 50 |
| F2-16TD2P | 70 | 50 |
| D2-32TD1 | 350 | 0 |
| D2-32TD2 | 350 | 0 |
| AC Output Modules |  |  |
| D2-08TA | 250 | 0 |
| F2-08TA | 250 | 0 |
| D2-12TA | 350 | 0 |
| Relay Output Modules |  |  |
| D2-04TRS | 250 | 0 |
| D2-08TR | 250 | 0 |
| F2-08TR(S) | 670 | 0 |
| D2-12TR | 450 | 0 |
| Combination In/Out Module |  |  |
| D2-08CDR | 200 | 0 |


| Power Supplied |  |  |  |
| :--- | :--- | :--- | :--- |
| Device | Price | 5V(mA) | 24V Auxiliary |
| Bases |  |  |  |
| D2-06BDC1-1 | $\$ 304.00$ | 2600 | None |
| D2-06BDC2-1 | $\$ 279.00$ | 2600 | 300 |
| D2-09B-1 | $\$ 333.00$ | 2600 | 300 |
| D2-09BDC1-1 | $\$ 360.00$ | 2600 | None |
| D2-09BDC2-1 | $\$ 359.00$ | 2600 | 300 |


| Power Consumed |  |  |
| :---: | :---: | :---: |
| Device | 5V(mA) | 24V Auxiliary |
| Analog Modules |  |  |
| F2-04AD-1 | 100 | 5 |
| F2-04AD-2 | 110 | 5 |
| F2-08AD-1 | 100 | 5 |
| F2-08AD-2 | 100 | 5 |
| F2-02DA-1 | 40 | 60 (note 1) |
| F2-02DA-2 | 40 | 60 |
| $\begin{aligned} & \text { F2-02DAS-1 } \\ & \hline \text { F2-02DAS-2 } \\ & \hline \end{aligned}$ | $\begin{aligned} & 100 \\ & 100 \end{aligned}$ | 50 / channel 60 / channel |
| F2-08DA-1 | 30 | 50 (note 1) |
| F2-08DA-2 | 60 | 140 |
| F2-4AD2DA | 60 | 80 (note 1) |
| F2-8AD4DA-1 | 35 | 100 (note 1) |
| F2-8AD4DA-2 | 35 | 80 (note 1) |
| F2-04RTD | 90 | 0 |
| F2-04THM | 110 | 60 |
| Specialty Modules |  |  |
| D2-CTRINT | 50* | 0 |
| D2-CM / D2-EM | 100/130 | 0 |
| H2-CTRIO2 | 275 | 0 |
| D2-DCM | 300 | 0 |
| H2-EBC100 | 300 | 0 |
| H2-ECOM100 | 300 | 0 |
| F2-CP128 | 235 | 0 |
| Remote I/0 |  |  |
| H2-ERM100, (-F) | 300, (-F: | 0 |
| Programming Devices |  |  |
| D2-HPP | 200 | 0 |
| * Requires external 5VDC for outputs <br> Note 1: Add an additional 20 mA per output loop. |  |  |

## (1) (2) 0 (3) <br> Dimensions and Installation

Understanding the installation requirements for your DL205 system will help ensure that the DL205 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, D2-USER-M (downloadable online), contains important safety information that must be followed. The system installation should comply with all appropriate electrical codes and standards.

## Environmental specifications

The Environmental Specifications table at the right lists specifications that apply globally to the DL205 system (CPUs, bases, and I/O modules). Be sure that the DL205 system is operated within these environmental specifications.

## Base dimensions and mounting

Use the diagrams below to make sure the DL205 system can be installed in your application. To ensure proper airflow for cooling purposes, DL205 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 approximately $3^{\prime \prime}$ of space is left in front PLC surface for ease of access and cable clearances. Also, check the installation guidelines for recommended cabinet clearances.


| Base | A |  | $B$ |  | C |  | D |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| D2-03B-1, D2-03BDC1-1 | 6.77 " | 172 mm | 6.41" | 163mm | 5.8" | 148 mm | 7.24" | 184 mm |
| D2-04B-1, D2-04BDC1-1 | 7.99" | 203mm | 7.63" | 194mm | 7.04" | 179mm | 8.46" | 215 mm |
| D2-06B-1, D2-06BDC1-1, D2-06BDC2-1 | 10.43" | 265 mm | 10.07" | 256 mm | 9.48 " | 241 mm | 10.90" | 277 mm |
| D2-09B-1, D2-09BDC1-1, D2-09BDC2-1 | 14.09" | 358 mm | 13.74" | 349 mm | 13.14" | 334 mm | 14.56" | 370 mm |


| Environmental Specification | Rating |
| :--- | :--- |
| Storage Temperature | $-4^{\circ} \mathrm{F}$ to $158^{\circ} \mathrm{F}\left(-20^{\circ} \mathrm{C}\right.$ to $\left.70^{\circ} \mathrm{C}\right)$ |
| Ambient Operating Temperature | $32^{\circ} \mathrm{F}$ to $131^{\circ} \mathrm{F}\left(0^{\circ} \mathrm{C}\right.$ to $\left.55^{\circ} \mathrm{C}\right)$ |
| Ambient Humidity | $30 \%$ to $95 \%$ relative humidity (non-condensing) |
| Vibration Resistance | MIL STD 810 C, Method 514.2 |
| Shock Resistance | MIL STD 810 C, Method 516.2 |
| Noise Immunity | NEMA (ICS3-304) |
| Atmosphere | No corrosive gases |



## Local Expansion Modulles

BASE EXPANSION Module

D2-EM \$102.00


Expansion Base CONTROLLER Module

## D2-CM \$84.00



## Local expansion modules

The D2-262 supports local expansion up to five total bases (one CPU base + four expansion bases). Expansion bases are commonly used when there are not enough slots available in the CPU base, when the base power budget will be exceeded, or when placing an I/O base at a location away from the CPU base but within the expansion cable limits. Expansion base I/O addressing is based on the numerical order of the D2-CM rotary switch selection. The CPU recognizes the expansion bases on power-up.

| D2-EM Expansion Module Specifications |  |
| :--- | :--- |
| Module Type | Base expansion unit |
| I/O Slots Consumed | None; attaches to right side of (-1) bases |
| I/O Points Consumed | None |
| Expansion Connectors | Two 8-pin RJ45 |
| Cable | Category 5 with RJ45 connectors (straight-through) |
| Maximum Cable Length | $30 \mathrm{~m} \mathrm{(98f)}$ ) total expansion system |
| Power Consumption | 130 mA @ 5 VDC (supplied by base) |
| Operating Environment | $0^{\circ} \mathrm{C}$ to $60^{\circ} \mathrm{C}\left(32^{\circ} \mathrm{F}\right.$ to $\left.140^{\circ} \mathrm{F}\right)$, <br> $5 \% ~ t o ~$ <br> $95 \%$ |


| D2-CM Controller Module Specifications |  |
| :--- | :--- |
| Module Type | Expansion base controller module |
| Modules per Base | One, CPU slot of (-1) base only |
| IO Points Consumed | None |
| Expansion Base Number Select Switch | Rotary switch select $1-4$ in any order |
| Power Consumption | 100 mA @ 5 VDC (supplied by base) |
| Operating Environment | $0^{\circ} \mathrm{C}$ to $60^{\circ} \mathrm{C}\left(32^{\circ} \mathrm{F}\right.$ to $\left.140^{\circ} \mathrm{F}\right)$, <br> $5 \%$ to $95 \%$ humidity (non-condensing) |


| CPU Supported / /O Points |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: |
| CPU | \# of Exp. <br> Bases | Total <br> $\boldsymbol{I} / \mathbf{O}^{7}$ | Max. <br> Inputs | Max. <br> Outputs |
| D2-262 | 4 | 1280 | 1024 | 1024 |

${ }^{1}$ Includes CPU base and local expansion bases

## I/O Considerations

When using expansion bases in a PLC system, the CPU updates all discrete I/O points on every scan. However, if using analog modules in an expansion base, they are updated asynchronous to the CPU scan. Therefore, it is recommended that analog modules be placed in the CPU base.

## Local expansion requires (-1) bases

Part number D2-xxB(xxx)-1 I/O bases must be used in local expansion systems. Each expansion base requires that the D2-CM module is placed in the CPU slot. The CPU base and each expansion base require the D2-EM unit that attaches to the right side of the $(-1)$ bases.

## D2-EXCBL-1 local expansion base cable

The category 5 straight-through cable D2-EXCBL-1 ( 1 m ) is used to connect the expansion modules together. If longer cable lengths are required, we recommend that you purchase commercially manufactured cables with RJ45 connectors already installed. The maximum total expansion system cable length is 30 m (98ft).

## Local Expansion Modulles

## D2-CM Expansion Base Controller Module

The D2-CM module is placed in the CPU slot of each expansion base. The rotary switch is used to select the expansion base number. The expansion base I/O addressing (Xs \& $Y_{S}$ ) is based on the numerical order of the rotary switch selection and is recognized by the CPU on power-up. Duplicate expansion base numbers will not be recognized by the CPU. An example of base I/O addressing order is shown to the right.


D2-262 expansion system

D2-CM \#3


## D2-EM Base

 Expansion ModuleThe D2-EM expansion unit is attached to the right side of each base in the expansion system. The D2-EMs on each end of the expansion system should have the TERM switch placed in the ON position. The expansion units between the end-most units should have the TERM switch placed in the OFF position. The CPU base can be located at any base position in the expansion system. It does not have to be located at one end or the other.

## D2-262 expansion system

The D2-262 supports local expansion up to five total bases (one CPU base + four expansion bases) and up to a maximum of 1280 total I/O points. All local and expansion I/O points are updated on every CPU scan. No specialty modules can be located in the expansion bases. Refer to the Module Placement Table earlier in this section for restrictions. The maximum total expansion system cable length is 30 m ( 98 ft ). The red text and arrows in the example to the right indicate the I/O addressing order.

The D2-262 CPU base can be located at any



Note: Only discrete and analog //0 modules are supported on the expansion bases. No specialty or communications modules can be used on the expansion bases at this time.

## Ethernet Remote I/O Client Modules



The Ethernet Remote Client H2-ERM100 connects D2-262 CPU systems to Server I/O over a high-speed Ethernet link.

## Need a lot of I/O?

Each ERM module can support up to 16 additional H2-EBC100 systems, 16 Terminator I/O EBC systems (T1HEBC100), or 16 fully expanded $\mathrm{H} 4-\mathrm{EBC}$ systems. 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-EBC100 analog I/O or H4-EBC 16-channel analog I/O, could exceed the buffer capacity of a single H2-ERM100 module. In these cases, an additional H2-ERM100 may be required.

## Simple connections

The ERM connects to your control

| Specifications | H2-ERM100 |
| :--- | :---: |
| Communications | $10 / 100 \mathrm{BaseT}$ Ethernet |
| Data Transfer | 100 Mbps |
| Rate | 100 m (328ft) |
| Link Distance | RJ45 |
| Ethernet Port | TCPIP, IPX, Modbus TCP/IP, <br> DHCP, HTML configuration |
| Ethernet <br> Protocols | 300mA @ 5VDC |
| Power <br> Consumption | Host Automation Products, <br> L.L.C. |
| Manufacturer |  |

network using Category 5 UTP cables for cable runs up to 100 meters. Distances can be greatly extended with Ethernet/ Fiber media converters like the SE-MC2UST.
The PLC, ERM and EBC Server modules work together to update the remote I/O points. These three scan cycles are occurring at the same time, but asynchronously. Critical I/O points that must be monitored every scan are best placed in the CPU base.

## Networking ERMs with other Ethernet devices

It is highly recommended that a dedicated Ethernet remote I/O network be used for the ERM and its Servers. While Ethernet networks can handle a large number of data transactions, and normally handle them very quickly, heavy Ethernet traffic can adversely affect the reliability of the Server I/O and the speed of the I/O network. Ensure ERM networks, multiple ERM networks and ECOM/office networks are isolated from one another.
and its remote Ethernet Servers. ERM Workbench supports two methods of configuring the ERM I/O network:

- ERM Workbench PLC Wizard greatly simplifies the configuration procedure when a PLC is used as the CPU interface.
- ERM Workbench configures the I/O network and allows access to all ERM(100) I/O network parameters.


## Software configuration

ERM Workbench is a software utility that must be used to configure the ERM


## Ethernet Base Controller Modules

## ETHERNET BASE <br> CONTROLLER MODULES (EBC)

 H2-EBC100 \$465.00

## Use EBCs for PC-based control and for H*-ERM100 remote I/O Servers

The H2-EBC100 Ethernet Base Controller module provide a low-cost, highperformance Ethernet link between DL205 I/O and your PC-based control system or DL205/DL405 CPUs using the $\mathrm{H}^{*}$-ERM100 module for remote I/O. The H2-EBC100 can also be used to connect your DL205 I/O to a Modbus TCP/IP client (Client). The H2-EBC100 supports industry standard 10/100BaseT Ethernet communications.
EBC modules offer:

- Lower cost on your DirectLOGIC I/O system compared to competitive I/O
- Virtually unlimited number of I/O points
- Deterministic I/O updates on dedicated networks
- Fast I/O updates (<1ms per base)
- On board serial port for possible operator panel, ASCII In/Out, etc. (serial port not supported when used with ERM module)

| Specifications | (2-EBC100 |
| :--- | :--- |
| Communications | $10 / 100 \mathrm{Base-T}$ Ethernet |
| Data Transfer Rate | Up to 100Mbps |
| Link Distance | 100 meters (328 ft) |
| Ethernet Port | RJ45 |
| Ethernet Protocols | Do-more Ethernet remote I/O, Modbus <br> TCP/IP, TCP/IP, UDP/IP, IPX |
| Serial Port | RJ12, K-sequence, ASCII IN/OUT, <br> Modbus RTU, provides 5V 220mA |
| Max. Discrete I/O | 256 |
| Max. Analog I/O | 64 |
| Power Consumption | 300 mA |



## Software developers

For programmers developing custom drivers for our I/O, we offer a free Ethernet Software Development Kit (SDK). The SDK, developed and offered by Host Automation Products, L.L.C., provides a simplified API for interfacing with the $\mathrm{H} 2-$ EBC100. The software interface libraries are provided for WIN32, WIN16, and DOS operating systems. The source code is available to developers under a nondisclosure agreement. Visit the technical support link at our Web site, or go to www.hosteng.com for more information.

## Off-the-shelf solutions

You can purchase PCbased control software that is ready to use with the H2-EBC100 module. PCbased control packages are equipped with compatible I/O device drivers, program development tools, and run-time environments. For READ I/O
int HEIReadIO int HEIReadIO



## Easy to use, reliable and fast

The $\mathrm{H} 2-\mathrm{EBC100}$ module plugs into the CPU slot of any DL205 I/O base and supports all DL205 discrete and analog I/O modules, the H2-SERIO(-4) and H2-CTRIO2 specialty modules. All EBC modules can be configured using NetEdit3, a free Windows software utility. The H2-EBC100 also supports HTML configuration.

The chart below identifies vendors that have PC-based Control products ready to control DirectLOGIC I/O, or have products to be released in the immediate future. PC-based control solution that ships with everything you need to make your PC into an industrial controller, see the PC-based Control section of this catalog. Most of the software packages listed below allow you to connect serial devices, such as barcode readers, to the H2-EBC100's serial port.

| Vendor | Product | Web Address |
| :---: | :---: | :---: |
| KEPware | KEPSeverex | mumkeppure.com |
| Wondemare | InContol | wwwwondeware.com |
| MDSI | OpencNo | mmwndsi2 com |

The D2-INST-M installation and I/O Manual covers information about DL205 I/O modules, power budgeting, and installation and wiring. This catalog does not cover CPU-slot controllers.

## Serial Data Communications Module



The D2-DCM Data Communications Module is used primarily for three reasons:

- Extra communications port to connect a PC, operator interface, etc.
- Network interface to DirectNET
- Network interface to a Modbus ${ }^{\circledR}$ network using the RTU protocol


## Extra

## communications port

If additional communication ports are needed, they can easily be added by installing DCM modules. This allows additional connections of devices, such as operator interfaces, PCs, etc. Since the DCM does not require any programming, you can set the DCM communication parameters, connect the cables, and start transferring data. Make sure the device has a DL205 compatible driver.

## DirectNET network interface

The DCM can be used as a network interface for applications requiring data to be shared between PLCs, or between PLCs and an intelligent device such as a host PC. The DCM connects easily to DirectNET. This network allows you to upload or download virtually any type of system data including Timer/Counter data, I/O information, and V-memory information from any DirectLOGIC or compatible PLC. The DCM allows the DL205 to function as a network Client or network Server.

| Specifications |  |
| :---: | :---: |
| Module Type | Intelligent |
| Modules per CPU | 7 maximum, any slot except slot 0, CPU base only |
|  | D2-262 |
| Communications | RS-232/422 signal levels, DirectNET Client/Server, K-sequence or Modbus RTU Server protocol, Baud rate selectable from 300 baud to 38.4 Kbaud, Odd or No parity, DirectNET HEX or ASCII mode |
| Recommended Cable | Belden 9729 or equivalent (for RS-422) |
| Field Wiring Connector | 25-pin D-shell connector |
| Internal Power Consumption | 300 mA maximum at 5VDC, (supplied by base power supply) |
| Operating Environment | $0^{\circ} \mathrm{C}$ to $60^{\circ} \mathrm{C}\left(32^{\circ} \mathrm{F}\right.$ to $140^{\circ} \mathrm{F}$ ), $5 \%$ to $95 \%$ humidity (non-condensing) |
| Manufacturer | Koyo Electronics |

## Modbus RTU interface

The DCM can be used as a Server station interface to connect your DL205 system to a Modbus ${ }^{\circledR}$ network using the Modbus RTU protocol. The host system must be capable of issuing the Modbus commands to read or write the appropriate data. Remember that the bottom port on the D2-262 CPU can act as a Modbus Client.


Client/Server Network
Connect the DCM to our MDM-TEL serial modem (see the Communication Products section for details on the modem) ner

## Serial Module for EBC Systems



H2-SERIO


H2-SERIO-4

| H2-SER10 / H2-SER10-4 Specifications |  |  |
| :---: | :---: | :---: |
|  | H2-SERIO | H2-SERIO-4 |
| Module Type | Intelligent module for use with H2-DM1, H2-DM1E or H2-EBC100 with PC application |  |
| Approvals | cUL Listed, file number E185989 |  |
| Number of Serial Ports per Module | 3 ports: all RS-232 (RJ12 jack) | 3 ports: 2 RS-232 ports (RJ12 jack) and 1 RS-422/485 (5 position terminal strip) |
| Signals | RS-232: CTS, RXD, TXD RTS, GND RTS transmision delay times: 5,50, 250 and 500 ms | RS-232: CTS, RXD, TXD RTS, GND RTS transmision delay times: 5,50, 250 and 500 ms <br> RS-422 (4 wire) : TX+, TX-, RX-, RX+, GND RS-485 (2 wire): Data+, Data-, GND |
| Number of Modules Supported | 8 per H2-DM1, H2-DM1E or H2-EBC100 |  |
| Recommended Cables | Belden 9729 or equivalent | RS-232 ports: Belden 9729 or equivalent RS-422/RS-485 terminal: 16-28 AWG solid or stranded conductor ( $1.5 \mathrm{~mm}^{2}$ ) <br> Wire strip length: 0.24-0.27 inches ( $6-7 \mathrm{~mm}$ ); <br> Screw torque: $1.7 \mathrm{in} \cdot \mathrm{lbs}(0.2 \mathrm{~N} \cdot \mathrm{~m})$ |
| Protocols Supported | Serial ASCII (full-duplex) and Modbus RTU Server |  |
| Power Consumption | 80 mA @ 5VDC |  |
| Baud Rates | 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 |  |
| Parity | None, odd, even |  |
| Start and Stop Bits | 1, 2 |  |
| Operating Environment | 0 to $60^{\circ} \mathrm{C}\left(32^{\circ} \mathrm{F}\right.$ to $140^{\circ} \mathrm{F}$ ), $5 \%$ to $95 \% \mathrm{RH}$ (non-condensing); No corrosive gases, Pollution level 2; Vibration: MIL STD 810C 514.2; Shock: MIL STD 810C 516.2 |  |
| Storage Temperature | -20 to $70^{\circ} \mathrm{C}\left(-4^{\circ} \mathrm{F}\right.$ to $\left.158^{\circ} \mathrm{F}\right)$ |  |
| Firmware Note | The H2-EBC100 requires firmware version v2.1383 or later to support the H2-SERIO or H2-SERIO-4. |  |

## Serial I/O modules for PC-based control

Add serial ports to your EBC-based rack system by simply plugging the H2-SERIO or H2-SERIO-4 modules into the DL205 I/O base.
The H2-SERIO module has three RS-232C ports, while the H2-SERIO-4 module has two RS-232C ports and one RS422/485port.

## Processing large amounts of serial data

While the H 2 -SERIO(-4) module will support virtually any serial device, processing large amounts of serial data will increase the system response time. This is important to consider when using multiple H2-SERIO(-4) modules.

## Serial Modules for EBC Systems

## Separate

communications parameters for each port
Use the Do-More software package to set baud rate, parity, data bits, and stop bits for each serial port. Choose from 300 baud to 57.6 K baud communication speeds. Do-More allows each port to be designated as a Modbus Server or a generic serial device. Each port on the $\mathrm{H} 2-\mathrm{SERIO}(-4)$ module is capable of full hardware handshaking.

## Easy

## serial communications

Do-More software includes advanced string and array functions that make transmitting, receiving and manipulating serial data a snap.

## Using H2-SERIO(-4) in an EBC system

Do-More versions 2.3 and later support the use of up to eight H2-SERIO(-4) modules per EBC node in a PC-based control system. The Client must be a CPU running Do-More v2.3 or later.

## H2-SERIO(-4) Wiring: RS-232

| RS-232 <br> 6 pin RJ12 Phone Type Jack - both por | H2-SERIO(-4) RS-232 Pin Descriptions |  |  |
| :---: | :---: | :---: | :---: |
|  | 1 | OV | Power (-) connection (GND) |
|  | 2 | CTS | Clear to Send |
|  | 3 | RXD | Receive data (RS-232) |
|  | 4 | TXD | Transmit data (RS-232) |
| $\checkmark$ | 5 | RTS | Request to Send |
|  | 6 | OV | Signal Ground (GND) |

## H2-SERIO-4 Wiring: RS-422/485

Set DIP switch S2 on the H2-SERIO-4 to:

1. Activate or deactivate the internal $120 \Omega$ termination resistor.
2. Select RS-422 or RS-485 operation.


RS-485


## Ethernet Communications Modules

## ETHERNET <br> COMMUNICATIONS Module

H2-ECOM100 \$423.00


## Overview

Ethernet Communications Modules offer features such as:

- High-speed peer-to-peer networking of PLCs
- Fast updates with DirectSOFT Programming Software
- High-performance access for Human Machine Interface (HMI), ERP, MES or other Windows-based software
- Industry standard Modbus TCP Client/ Server Protocol (H2-ECOM100)
- Free SDK for custom drivers
- Easy setup

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

[^1]
## 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. Distances can be greatly extended with Ethernet/ Fiber media converters like the SE-MC2UST. Fiber optic cables virtually eliminate electrical noise problems. Use repeaters to extend distances and expand the number of nodes.
Stride Ethernet switches are compatible with the ECOM modules. See the Communications Products section for information on these items.

## H2-ECOM100 IBox communications instructions

Over 40 Communications IBox instructions are available when using the H2-ECOM100 with a D2-250-1 or D2262 PLC and DirectSOFT6 programming software. These easy-to-use instructions allow you to:

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

See the following page for example
Communications IBox instructions.


| Specifications | H2-ECOM100 |
| :--- | :--- |
| Communications | $10 / 100$ Base-T Ethernet |
| Data Transfer Rate | 100 Mbps max. |
| Link Distance | 100 meters (328ft) |
| Ethernet Port | RJ45 |
| Ethernet Protocols | TCP/IP, IPX, Modbus TCP, <br> DHCP, HTML configuration |
| Power Consumption | 300 mA @ 5VDC |
| Manufacturer | Host Automation Products, L.L.C. |

## Ethernet Communications Modules

## Modbus TCP support

The H 2 -ECOM100 supports the industry standard Modbus TCP Client/Server protocol in addition to the standard IP and IPX protocols. This allows the DL205 PLC with an H2-ECOM100 module to serve as a client (Client) or as a server (Server) on a Modbus TCP Ethernet network. The H2-ECOM100 can actively issue Modbus commands to other nodes or devices on the Modbus TCP network or simply respond to connected Modbus TCP clients.

## PLC-to-PLC

## communications

PLC-to-PLC or PLC to a Modbus TCP device communications can be accomplished using standard Read from Network (RX) and Write to Network (WX) instructions (H2-ECOM100, all H2 series ECOMs and all DirectSOFT versions). If you're using DirectSOFT programming software, a D2-262 PLC and an H2-ECOM100, you can use fill-in-the-blank IBox instructions to simplify your communications programming. The H2-ECOM100 supports the ECOM100 Configuration IBox for use with the ECRX and ECWX IBox instructions to read/ write to other $\mathrm{ECOM}(100)$ s. All H2 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 D2-262 and a supporting version of DirectSOFT is required). The Communications IBox instructions execute with built-in interlocking to greatly simplify communications programming.

## H2-ECOM100 has e-mail capability!

The H2-ECOM100 Send EMail (ECEMAIL) IBox instruction allows 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 in IBox's To: field. The Body: field allows you to embed real-time data in your e-mail message. The D2-262 CPU and a supporting version of DirectSOFT is required to use the IBox instructions.

## Modbus TCP communications architecture



ECOM100 Configuration IBox

| ( $]_{\text {] 夙 }}$ |  | C |
| :---: | :---: | :---: |
| ECOM100 Config |  |  |
| ECOM100 |  |  |
| ECOM100 \# | K0 | - |
| Slot | K1 | - |
| Status | V400 |  |
| Workspace | V/400 | - |
| Msg Buffer ( 65 WORDs) | V/400 | - |

ECOM100 Read Network IBox


## ECOM100 Send EMail IBox

|  |  | $\bigcirc$ |
| :---: | :---: | :---: |
| ECOM100 Send EMail |  |  |
| ECEMAIL |  | 18-711 |
| ECOM100\# | K0 | $\bullet$ |
| Workspace | V/400 | - |
| Success | C0 | - |
| Error | C1 | - |
| Error Code | V/400 | - |
| To steve@work.com |  | - |
| Subject Machine Offline |  | - |
| Body |  |  |
| "Machine \#' V5010: 日 "went offline at" _time:24 "on" _date:us |  | - 1 |

## NetEdit3 software

NetEdit3 Software is installed with DirectSOFT and it can be downloaded on the AutomationDirect.com website. Use NetEdit3 to configure the ECOM modules for your network. Flexible addressing allows you to use your choice of protocols and identifying methods. Assign each module a number or a name or both. NetEdit3 uses two protocols for PC-to-PLC communications: IPX and TCP/IP. The NetEdit3 screen displays all identifiers and troubleshooting information for each module on the network. You can use NetEdit3 to adjust parameters for PLC-to-PLC communications by clicking on Advanced Settings. The network identifiers can also be changed from DirectSOFT Programming Software.

## Choose your slot

The ECOM modules plug into any I/O slot (excluding slot 0 ) of any local DL205 I/O base. The module maintains identification data, descriptive information, and communication parameters for PLC-toPLC communications in flash memory. Disconnect power before installing or removing any PLC module.


Note: Use D2-262 CPU with the ECOM modules. The D2-CM bases do not support the ECOM modules.

## CoProcessor Module

> TRIPLEPORT BASIC COPROCESSOR

## F2-CP128

## \$604.00



## Overview

The BASIC CoProcessor Module interfaces the DL205 family of programmable controllers with bar code readers, operator interface terminals, instrumentation equipment, computers and other serial devices.

## BASIC CoProcessor applications

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

- Bar code readers
- Welders
- Board level controllers
- Serial printers
- Intelligent sensors
- Almost any device with an RS-232/422/485 port
They are also good solutions for applications requiring complex math: such as, floating point math, sine, cosine, tangent, exponential, square roots, etc.


## Features

- FACTS Extended BASIC and ABM Commander for Windows software for IBM PCs makes program development fast and simple. Allows online, full-screen BASIC program editing and the ability to upload / download programs on disk. The CD-ROM includes Modbus Client and Server BASIC programs and other application examples.
- Non-volatile memory of up to 128 K allows multiple program storage and execution, DL205 register expansion, and retentive data storage and retrieval.
- 26 MHz BASIC CoProcessor provides fast program execution independent of the CPU scan.
- Three buffered ports permit communication from the module to three external devices.
- The module is programmable from port 1 or 2 for complete serial port utilization without switching cables.
- A real-time clock/calendar maintains time/ date with battery backup when power outages occur. Programmable time based BASIC interrupts to 0.010 of a second.
- Direct access of up to 254 bytes of DL205 CPU memory per scan is possible. No supporting ladder logic is required.
- Floating point math solves complex formulas to eight significant digits.

Example Application


## BASIC CoProcessor

| Triple Port BASIC CoProcessor Module Specification |  |
| :---: | :---: |
| Module Type | CoProcessor, Intelligent |
| Modules per CPU | Seven maximum, any slot in CPU base (except slot zero) |
| Communication | 256 character type-ahead input buffer on all ports. Ports are independently programmed by software. Seven or eight data bits, one or two stop bits, even, odd, or no parity. XON/XOFF software flow control and RTS/CTS handshake. |
| F2-CP128 | 128 K bytes of battery-backed RAM. 26 MHz clock rate <br> Port 1: RS-232/422/485, 115.2 Kbaud maximum <br> Port 2: RS-232/422/485, 57.6 Kbaud maximum <br> Port 3*: RS-232, 19.2 Kbaud max. <br> * Port 3 physically located in the same RJ12 jack as Port 1 (RS-232). Port 3 uses the RTS/CTS pins on that jack. If you use these lines for other purposes <br> (e.g. hardware handshaking on Port 1), then Port 3 cannot be used. |
| ABM Commander for Windows (CD included with module) | Programming /documentation software for IBM PCs comes standard. <br> Key features include: <br> - Shipped with each coprocessor module <br> - Runs under Windows 98/2000 <br> - On-line full-screen BASIC program editing (similar to GW Basic, with industrial application enhancements added for easier programming) <br> - Internal Editor for block copy, block move, search and replace <br> - Text upload and download BASIC programs on disk <br> - Binary upload and download BASIC programs and data on disk <br> - Download control statement allows multiple programs to be downloaded and saved with one download file. <br> - CD includes Modbus Client and Server BASIC programs and other application examples |
| Field Termination | Four RJ12 jacks: Port 1/3 RS-232, Port 2 RS-232, Port 1 RS-422/485, Port 2 RS-422/485 |
| Power Consumption | 235mA @ 5VDC |
| Operating Environment | $0^{\circ} \mathrm{C}-60^{\circ} \mathrm{C}\left(32^{\circ} \mathrm{F}-140^{\circ} \mathrm{F}\right)$, $5 \%$ to $95 \%$ humidity (non-condensing) |
| Manufacturer | FACTS Engineering |

## DL205 High-Speed Counter I/O Module

Counter I/O Module

## H2-CTRIO2 <br> $\$ 445.00$

## Overview

The High-Speed Counter I/O (CTRIO) modules are designed to accept high-speed pulse-type input signals for counting or timing applications, and is designed to provide high-speed pulsetype output signals for stepper motor control, monitoring, alarm or other discrete control functions. The H2CTRIO2 module offers great flexibility for applications that call for precise counting or timing, based on an input event or for high-speed control output applications.
The CTRIO modules have their own microprocessor and operates asynchronously with respect to the PLC/ Controller. This means that the on-board outputs respond in real time to incoming signals so there is no delay waiting for the PLC/Controller to scan I/O.
The H2-CTRIO2 module is designed to work with incremental encoders or other field devices that send pulse outputs.


## H2-CTRIO2 features

The H2-CTRIO2 module offers the following I/O features:

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


## Inputs supported:

- Two quadrature encoders up to 250 kHz (H2-CTRIO2), or 4 single channel counters up to 250 kHz (H2-CTRIO2) using module terminals Ch1A, Ch1B, Ch2A and Ch2B
- High-speed edge timers, dual edge timers, pulse catch, count reset, count inhibit or count capture or home search limits using module terminals Ch1C, Ch1D, Ch2C or Ch2D


## Outputs supported:

- Four independently configurable high-speed discrete outputs or 2 channels pulse output control (H2-CTRIO2: 20Hz-250kHz per channel)
- Pulse and direction or cw/ccw pulses supported for pulse output control
- Raw control of a discrete output directly from user control program


## Software Configuration

All scaling and configuration is done via CTRIO Workbench, a Windows software utility program. This eliminates the need for PLC ladder programming or other interface device programming to configure the module.
CTRIO Workbench main configuration screen

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Note: CTRIO Workbench Version 2.2.0 is required to use $\mathrm{H2}$-CTRIO2.

## Typical applications

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


## Supported systems

Multiple CTRIO modules can reside in the same base provided that the backplane power budget is adequate. Depending which CPU/interface module is used, there may be I/O base slot restrictions for the CTRIO module. Refer to the CTRIO HighSpeed Counter Manual (HX-CTRIO-M) for I/O slot restrictions.

## DirectLOGIC DL205 PLC

You can use the H2-CTRIO2 module with the D2-262 CPU (It is not supported in local expansion bases).

## PC-based Ethernet I/O control systems

The H2-CTRIO2 module can be used in PC-based control systems using the H2-EBC100 interface module.

## ERM to EBC systems

The H2-CTRIO2 module is supported in H 2 -EBC100 Servers in $\mathrm{H}^{*}$-ERM(100) systems. This includes the supported DL205 CPUs. The CTRIO module consumes 96 inputs and 96 outputs when used in ERM/EBC expansion bases.

## DL205 High-Speed Counter

## I/O Specifications

| General |  |
| :--- | :--- |
| pulse | H2-CTRIO2 |
| Module Type | Intelligent |
| Modules Per Base | Limited only by power consumption |
| I/O Points Used | Noce, I/O map directly in PLC V-memory or PC control <br> access |
| Field Wiring Connector | Standard removable terminal block |
| Internal Power <br> Consumption | 275 mA Max at +5 V from Base Power Supply, Maximum <br> of 6 Watts (All I/O in ON State at Max Voltage/Current) |
| Operating Environment | $32^{\circ} \mathrm{F}$ to $140^{\circ} \mathrm{F}\left(0^{\circ} \mathrm{C}\right.$ to $\left.60^{\circ} \mathrm{C}\right)$, Humidity (non-condensing) <br> $5 \% \%$ to $95 \%$ |
| Manufacturer | Host Automation Products, L.L.C. |
| Isolation | $1500 \mathrm{~V} / / \mathrm{O}$ to Logic <br> 1000 V among Input Channels and All Outputs |


| H2-CTRI02 Output Specifications |  |  |
| :---: | :---: | :---: |
| Module |  | H2-CTRIO2 |
| Outputs |  | 4 pts, independently isolated, current sourcing or sinking FET Outputs: open drain and source with floating gate drive |
| Voltage Range |  | 5-36 VDC |
| Maximum Voltage |  | 36VDC |
| Output clamp Voltage |  | 60VDC |
| Maximum Load Current |  | $\begin{aligned} & 1.0 \mathrm{~A} \text { at } 23^{\circ} \mathrm{C} \\ & 0.5 \mathrm{~A} \text { at } 60^{\circ} \mathrm{C} \end{aligned}$ |
| Maximum Load Voltage |  | 36VDC |
| Maximum Leakage Current |  | $100 \mu \mathrm{~A}$ |
| Inrush Current |  | 2A for 10 ms |
| OFF to ON Response |  | Less than $1 \mu \mathrm{sec}$ |
| ON to OFF Response |  | Less than $1 \mu \mathrm{sec}$ |
| ON State V Drop |  | 0.45 V max. |
| External Power Supply |  | For loop power only, not required for internal module function* |
| Overcurrent Protection |  | 15A max |
| Thermal Shutdown |  | Tjunction $=150^{\circ} \mathrm{C}$ |
| Overtemperature Reset |  | Tjunction $=130^{\circ} \mathrm{C}$ |
| Duty Cycle Range |  | $1 \%$ to $99 \%$ in $1 \%$ increments (default $=50 \%$ ) |
| Configurable Presets <br> a) Single <br> b) Multiple |  | a) each output can be assigned one preset, or b) each output can be assigned one table of presets, one table can contain max. 128 presets, max. predefined tables $=255$ |
| Maximum Output Frequency | Velocity Mode | 65 kHz |
|  | Run to Limit Mode |  |
|  | Run to Position Mode |  |
|  | Trapezoid |  |
|  | S-Curve |  |
|  | Symmetrical S-Curve |  |
|  | Dynamic Positioning |  |
|  | Home Search |  |
|  | Free Form |  |
|  | Dynamic Velocity | 250 kHz |
|  | Dynamic Positioning Plus |  |
|  | Trapezoid Plus |  |
|  | Trapezoid with Limits |  |

[^2]| H2-CTRIO2 Input Specifications |  |
| :---: | :---: |
| Module | H2-CTRIO2 |
| Inputs | 8 pts sink/source 250 kHz max. |
| Minimum Pulse Width | $0.5 \mu \mathrm{sec}$ |
| Input Voltage Range | 9-30 VDC |
| Maximum Voltage | 30VDC |
| Input Voltage Protection | Zener Clamped at 33VDC |
| Rated Input Current | 8 mA typical, 12 mA maximum |
| Minimum ON Voltage | 9.0 VDC |
| Maximum OFF Voltage | 2.0 VDC |
| Minimum ON Current | 5.0 mA (9VDC required to guarantee ON state) |
| Maximum OFF Current | 2.0 mA |
| OFF to ON Response | Less than $0.5 \mu \mathrm{sec}$ |
| ON to OFF Response | Less than $0.5 \mu \mathrm{sec}$ |


| H2-CTRIO2 Input Resources |  |
| :--- | :--- |
| Counter/Timer | 4, ( 2 per 4 input channel group) |
| Resource Options | $1 \mathrm{X}, 2 \mathrm{X}$, or 4 X Quadrature, Up or Down <br> Counter, Edge Timer, Dual Edge Timer, Input <br> Pulse Catch, Reset, Inhibit, Capture |
| Timer Range / <br> Resolution | 4.2 billion (32 bits); 1 $\mu \mathrm{sec}$ |
| Counter Range | $\pm 2.1$ billion <br> ( 32 bits or 31 bits + sign bit) |


| H2-CTRIO2 Output Resources |  |
| :---: | :---: |
| Module | H2-CTRIO2 |
| Pulse output / Discrete outputs | Pulse outputs: 2 channels (2 outputs each channel; 20Hz-250kHz) <br> Discrete outputs: 4 pts. |
| Resource Options | Pulse outputs: pulse/direction or cw/ccw |
|  | Output Profiles: |
|  | Trapezoid |
|  | S-Curve |
|  | Symmetrical S-Curve Dynamic Positioning |
|  | Dynamic Velocity |
|  | Home Search Free Form |
|  | Dynamic Positioning Plus |
|  | Trapezoid Plus |
|  | Trapezoid w/Limits |
|  | Velocity Mode |
|  | Run to Limit Mode |
|  | Run to Position Mode |
|  | Discrete outputs: 4 configurable for set, reset, pulse on, pulse off, toggle, reset count functions (assigned to respond to Timer/Counter input functions) |
|  | Raw mode: Direct access to discrete output from user application program |
| Target Position Range | $\pm 2.1$ billion ( 32 bits or 31 bits + sign bit) |

## DL205 High-Speed Counter

## Status Indicators

|  | H2-CTRIO2 LED <br> Descrintions |
| :--- | :--- |
| OK | Module OK |
| $E R$ | User Program Error |
| $1 A$ | Channel 1 Status |
| $2 A$ | Channel 2 Status |
| $0-3$ | Output Status |


| H2-CTRIO2 LED Diagnostic Definitions |  |  |
| :---: | :---: | :--- |
| LED 0K | LED ER | Description |
| Blinking | Blinking | Boot Mode - Used for Field OS Upgrades |
| Blinking | OFF | Program Mode |
| OFF | Blinking | Module Self-Diagnostic Failure <br> (Blinks may be coded by counts) |
| OFF | ON | Module Error Due to Watchdog Timeout |
| OFF | OFF | No Power to Module |
| ON | OFF | RUN Mode |


| H2-CTRIO2 LED Diagnostic Definition |  |  |  |
| :--- | :--- | :---: | :---: |
| $1 \mathbf{1 A / 2 A}$ |  |  |  |
| Blinking 7 times per second | Input is configured as Counter and is changing |  |  |
| Following state of input | Input is not configured as counter |  |  |
| $\mathbf{0 - 3}$ |  |  |  |
| Follow actual output state: $\mathrm{ON}=$ output is passing current |  |  |  |

## Installation and Wiring

The H2-CTRIO2 module has two independent input channels, each consisting of 4 optically isolated input points (pts. 1A-1D on common 1M and pts. $2 A-2 D$ on common $2 M$ ). The inputs can be wired to either sink or source current.

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

## Wiring Diagram

Remember that the internal jumpers can be used to connect the input commons or outputs/output commons together.
The modules are 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 ( $1 A, 1 B, 1 C, 1 D$ and $2 A, 2 B, 2 C, 2 D$ ) require user-provided 9-30 VDC power sources. Terminals 1 M and 2 M are the commons for Channel 1 and Channel 2 inputs. Maximum current consumption is 12 mA per input point.
2. Polarity of the input power sources can be reversed. Consideration must be given, however, to the polarity of the field device. Many field devices are designed for only one polarity and can be damaged if power wiring is reversed.
3. Outputs have one polarity only and are powered by userprovided
5-36 VDC power sources. The maximum allowable current per output circuit is 1 .


## DL205 High-Speed Counter

## Solid-state Input Wiring <br> Device

DC type field devices are configured to either sink or source current. This affects the wiring of the device to the CTRIO2 module. Refer to the sinking/sourcing appendix in this catalog for a complete explanation of sinking and sourcing concepts.


PNP Field Device (source)


## Pulse Output Schematic



## Stepper/Servo Drive Wiring

 Examole

## DL205 High-Speed Counter

## Fill-in-the-blank configuration software

The CTRIO Workbench is the software utility used to configure the CTRIO modules and to scale signals to desired engineering units. Workbench also allows you to perform various other functions, such as switching between the CTRIO's Program mode and Run mode, monitoring I/O status and functions, and diagnostic control of module functions. The latest version of the CTRIO Workbench utility can be downloaded for free at 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 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 (D)word parameters and configuration information that can be altered 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.


## 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.

Monitor I/O screen


Scaling Wizard screen


## DL205 High-Speed Counter

## High-speed input operations

The H2-CTRIO2 modules are capable of a wide variety of high-speed input and output operations, all within one module. With flexible 2-channel input and separate 2-channel output design, the H2-CTRIO2 modules can satisfy high-speed counting, timing, and 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 modules. Check out these examples and see how they relate to your high speed application needs.

## High-speed timing

The CTRIO2 modules 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

Using Configure I/O screen to configure H2-CTRI02 for high-speed timing


## High-speed counting

The CTRIO2 modules can be configured for counting functions with an encoder input (up to two quadrature encoders per module), with available connections for external reset, capture and inhibit signals. In a simple cut-to-length application as shown, the encoder provides an input position reference for the material to the module. The module's high-speed outputs are wired to the cutting device and to the clutch and/or braking device. When the count from the encoder is equal to a pre-programmed setpoint within the module, the high-speed outputs are activated to stop and cut the material to a repeatable fixed length. Additionally, the clutch/brake signal can be used as an inhibit signal so counts are not accumulated while the material is being cut.

High-speed cut-to-length application


## DL205 High-Speed Counter

## Pulse output operations

Using Edit Pulse Profile screen to select Trapezoid pulse output profile


## Pulse output for stepper/servo control

The H2-CTRIO2 module is capable of multiple configurations for pulse output control, most often when connected to a stepper or servo drive system. The H2CTRIO2 module can deliver a pulse output signal up to a maximum of 250 kHz , along 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, Home Search, Free Form, Dynamic Positioning Plus, Trapezoid Plus and Trapezoid w/Limits. All profiles can be easily configured using the CTRIO Workbench software with fill-in-theblank parameter fields and a graphic representation of the selected profile. Three additional profiles are available that are completely controlled by the user program (no CTRIO Workbench profile is configured). They are Velocity Mode, Run to Limit Mode, and Run to Position Mode.

## Example application

In a simple rotary indexing application, as shown above, a fixed Trapezoid profile is chosen. For this application the $\mathrm{H} 2-\mathrm{CTRIO} 2$ module 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 an 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 for the Enable Output signal to begin a movement.


## Rotary indexing liquid fill application

## Other common pulse output applications:

- S-Curve accel/decel profile for signaling a stepper or servo drive that needs a curved acceleration and deceleration profile, i.e. for diminishing any initial "jerk" upon movement of static products, boxes on conveyors, liquids in containers on an indexer, printing registrations, etc.
- Dynamic Positioning for any run-to-a-specific-position requirement, either by a pre-programmed count of an external high-speed discrete input wired to the module. This is popular in winding or web control with any dynamic registration mark or variable speed requirement.
- Home search routines to seek a home position based on H2CTRIO2 discrete input limit(s).


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



## DL205 High-Speed Counter

## Combining high-speed input and pulse output operations

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


## Use Encoder for Position

Three profiles available only with the CTRIO2 offer the option to Use Encoder for Position. They are Dynamic Position Plus, Trapezoid Plus and Trapezoid w/ Limits. When Use Encoder for Position is enabled, the target positions are specified in units of the encoder and the move is complete when the encoder reaches that position, not when the output has finished generating a certain number of pulses. This functionality is useful for hitting a target position more accurately with a mechanical system that slips or has excessive lash.

## Example application

In the simple drill head application shown above, the H 2 CTRIO2 pulse outputs are wired to a stepper 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 CTRIO2 module outputs a pulse train to the drive that 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. Proximity 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.


As shown in diagram on left, using an encoder to calculate the appropriate position for a move using H2-CTRIO2 is handled natively on-the-fly when "Use Encoder for Position" is enabled.

## Counter Interface Module



Note: D2-262 does not support the D2-CTRINT

## Overview

The D2-CTRINT offers several modes of operation that can be used to solve simple motion and high-speed machine control applications.

The operating modes and module configuration are explained in detail in the D2-CTRIF-M High Speed Counter Manual. The high-speed input features cannot be used if the pulse output features are in use, and vice versa. Only one D2-CTRINT can be used per CPU and the module must reside in slot 0 , next to the CPU. A brief description of each high-speed mode is listed below:

Mode 10: Up to two 5kHz high-speed counters offer 24 presets each. When the preset is reached, a CPU interrupt routine is executed.

Mode 20: Quadrature encoder input (up/ down) for clockwise and counterclockwise position control (max. pulse range:
$-8,388,608$ to $8,388,607$ ).
Mode 30: Pulse outputs are programmable to follow a predetermined profile. An external interrupt can be used in conjunction with separate acceleration and deceleration profiles for positioning and velocity control supported by D2-
250-1 (max. pulse range: -8,388,608 to $8,388,607$ at 5 K pulses per second max).
Mode 40: Four external interrupt inputs can be used for an immediate response for high-priority events.
Mode 50: Pulse catch feature allows the CPU to read 4 inputs, each having a pulse width as small as 0.1 ms . When an input pulse is detected, the input is set ON for the next scan and then resets.

Counter Interface Module Features

| Mode | Module Points |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Input 0 | Input 1 | Input 2 | Input 3 | Input 4 |
| Mode 10: Two High Speed Up Counters | Up counter 1 | Up counter 2 Filtered input | Reset counter 1 | Reset counter 2 | Not used |
| Mode 20: One Up/Down or Quadrature cntr | Phase A input (up count) | Phase B input (down count) | Counter reset | Filtered input | Not used |
| Mode 30: Pulse Output | Filtered input | Filtered input | Not used | CW pulse output (or Pulse output) | CCW pulse out (or Direction) |
| Mode 40: <br> External Interrupts | Interrupt input (not available when using timed interrupt) | Interrupt input | Interrupt input | Interrupt input | Not used |
| Mode 50: Pulse Catch Inputs | Pulse input | Pulse input | Pulse input | Pulse input | Not used |
| Mode 60: Filtered Input | Filtered input | Filtered input | Filtered input | Filtered input | Not used |

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

| Input Specifications |  |
| :--- | :--- |
| Input | 4 pts . sink/source 5 <br> kHz max. |
| Minimum pulse width | $100 \mu \mathrm{~s}$ |
| Input Voltage Range | 12 or $24 \mathrm{VDC} \pm 15 \%$ |
| Maximum voItage | 30 VDC |
| Rated input current | 10 mA Typical <br> 13 mA Maximum |
| Minimum ON voltage | 8.0 VDC |
| Maximum OFF voltage | 1.0 VDC |
| Minimum ON Current | 8.0 mA |
| Maximum OFF Current | 1.0 mA |
| OFF to ON Response | Less than $30 \mu \mathrm{~s}$ |
| ON to OFF Response | Less than $30 \mu \mathrm{~s}$ |


| Output Specifications |  |
| :--- | :--- |
| Output | 2 pts., current sinking <br> 5 kHz Max |
| Voltage range | $5.0 \mathrm{VDC} \pm 15 \%$ |
| Maximum voltage | 5.5 VDC |
| Maximum load <br> current | 30 mA |
| Minimum load voltage | 4.5 VDC |
| Leakage current | Less than 0.1 mA at <br> 5.5 VDC |
| Inrush current | $0.5 \mathrm{~A} \mathrm{(10ms)}$ |
| OFF to ON Response | Less than $30 \mu \mathrm{~s}$ |
| On to OFF Response | Less than $30 \mu \mathrm{~s}$ |
| External power supply | $5.0 \mathrm{VDC} \pm 10 \%$ |

Mode 60: Input filters are configurable ( $0-99 \mathrm{~ms}$ ) to ensure input signal integrity. The default input mode is a 10 ms filter.
Mode 40 option - A Timed interrupt can be configured for time critical events. Interrupt 0 can be scheduled on a $3 \mathrm{~ms}-$ 999 ms cycle. See the next page for more information on the timed interrupt.

| General | Specifications |
| :--- | :--- |
| Module Type | Discrete |
| Modules per CPU | One only in slot adjacent to <br> CPU |
| I/O Points Used | 8 inputs, 8 outputs |
| Field Wiring <br> Connector | Standard 8 pt. removable <br> terminal block |
| Internal Power <br> Consumption | 50 mA from 5VDC max., <br> (supplied by the CPU base <br> power supply) |
| Operating <br> Environment | $32^{\circ} \mathrm{F}$ to $140^{\circ}$ <br> $0^{\circ} \mathrm{C}$ to $60^{\circ} \mathrm{C}$ ) humidity (non- <br> condensing) $5 \%$ to $95 \%$ |
| Manufacturer | Koyo Electronics |

## Counter Interface Module

Wiring Diagram for Modes 10, 20, 40, 50 and 60


## Wiring Diagram for Mode 30



## Timed Interrupt feature

There is an internal timed interrupt feature available in the D2-262 CPU. You do not need the Counter Interface module to use the timed interrupt. This cyclical interrupt allows you to easily program a time-based interrupt that occurs on a scheduled basis. The CPU's timed interrupt operates in a similar manner to the external interrupt input, but instead of the interrupt subroutine being triggered by an external event, it is now triggered by a cyclical interval of time. This interval can be programmed from 3 ms to 999 ms . Whenever the programmed time elapses, the CPU immediately suspends its routine scan cycle and jumps to interrupt subroutine INT 0 . As with the other modes, when the subroutine execution is complete, the CPU automatically resumes its routine scan cycle starting at the exact location where it was interrupted. Since the CPU scan time and the interrupt time interval are different, the program gets interrupted at various points in the execution over time. The CPU returns to the point where it left to resume the program execution.
If you use a timed interrupt and the Counter Interface module, Input 0 cannot be used on the Counter Interface module. If you're using the timed interrupt and a standard discrete input module, then there are no limitations.

## Timed Interrupt Specifications

| Timed interrupts | One (internal to CPU) |
| :--- | :--- |
| Time interval | 3 ms to 999 ms <br> (1ms increments) |
| Interrupt Subroutine | INTO |

Timed interrupt operation


## ZIIRM Wiring Solutions

## Wiring Solutions using the ZIPLink Wiring System

ZIPLinks eliminate the normally tedious process of wiring between devices by utilizing prewired cables and DIN rail mount connector modules. It's as simple as plugging in a cable connector at either end or terminating wires at only one end. Prewired cables keep
installation clean and efficient, using half the space at a fraction of the cost of standard terminal blocks. There are several wiring
solutions available when using the ZIPLink System ranging from PLC I/O-to-ZIPLink Connector Modules that are ready for field
termination, options for connecting to third party devices, GS, DuraPulse and SureServo Drives, as well as special relay, transorb and communications modules. Pre-printed I/O-specific adhesive label strips for quick marking of ZIPLink modules are provided with ZIPLink cables. See the following solutions to help determine the best ZIPLink system for your application.

## Solution 1: Do-more, DirectLOGIC, CLICK and Productivity Series I/O Modules to ZIPLink Connector Modules

When looking for quick and easy I/O-to-field termination, a
ZIPLink connector module used in conjunction with a prewired
ZIPLink
cable, consisting of an I/O terminal block at one end and a multipin connector at the other end, is the best solution.

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

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


## Solution 2: Do-more, DirectLOGIC, CLICK and Productivity Series I/O Modules to 3rd Party Devices

When wanting to connect I/O to another device within proximity of the I/O modules, no extra terminal blocks are necessary when using the ZIPLink Pigtail Cables. ZIPLink Pigtail Cables are prewired to an I/O terminal block with color-coded pigtail with soldered-tip wires on the other end.

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

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


## Solution 3: GS Series and DuraPulse Drives

## Communication Cables

Need to communicate via Modbus RTU to a drive or a network of drives?
ZIPLink cables are available in a wide range of configurations for connecting to PLCs and SureServo, SureStep, Stellar Soft Starter and AC drives. Add a ZIPLink communications module to quickly and easily set up a multi-device network.

Using the Drives Communication selector tables located in this section,

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


## Zureink Wiring Solutions

## Solution 4: Serial Communications Cables

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

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

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


## Solution 5: Specialty ZIPLink Modules

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

Using the ZIPLink Specialty Modules selector table located in this section,

1. Locate the type of application
2. Select a ZIPLink module.


## Solution 6: ZIPLink Connector Modules to 3rd Party Devices

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

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

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


| Do-more / DL205 PLC Input Module ZIPLink Selector |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| PLC | ZIPLink |  |  |  |
| Input Module | \# of <br> Terms | Component | Module Part No. | Cable Part No. $\dagger$ |
| D2-08ND3 | 10 | Feedthrough | ZL-RTB20 (-1) | ZL-D2-CBL10* |
| D2-16ND3-2 | 19 | Feedthrough |  | ZL-D2-CBL19 |
|  |  | Sensor | ZL-LTB16-24-1 | $\begin{aligned} & \text { ZL-D2-CBL19-1 } \\ & \hline \text { ZL-D2-CBL19-2 } \end{aligned}$ |
| D2-32ND3 ${ }^{1}$ | 40 | Feedthrough | ZL-RTB40 (-1) | 180 deg conn: <br> ZL-D24-CBL40 |
|  |  | Sensor | ZL-LTB32-24-1 | ZL-D24-CBL40-1 |
| D2-32ND3-2 ${ }^{1}$ | 40 | Feedthrough | ZL-RTB40(-1) | ZL-D24-CBL40-2 |
|  |  | Sensor | ZL-LTB32-24-1 | $\begin{aligned} & \text { ZL-D24-CBL40-X } \\ & \text { ZL-D24-CBL40-1X } \\ & \text { ZL-D24-CBL40-2X } \end{aligned}$ |
| D2-08NA-1 | 10 | Feedthrough | ZL-RTB20 (-1) | ZL-D2-CBL10 |
| D2-08NA-2 | 10 |  |  | ZL-D2-CBL10-2 |
| D2-16NA | 19 | Feedthrough |  | ZL-D2-CBL19* |

$\dagger \chi$ in the part number represents a $45^{\circ}$ angle.

| Do-more/DL205 PLC Combo In/Out Module Z/PLink Selector |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| PLC | Z/PLink |  |  |  |
| Combo <br> Module | \# of <br> Terms | Component | Module Part <br> No. | Cable Part No. |
| D2-08CDR | 10 | Feedthrough | ZL-RTB20 (-1) | ZL-D2-CBL10 * |


| Do-more/DL205 PLC Analog Module ZIPLink Selector |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| PLC | ZIPLink |  |  |  |
| Analog Module | \# of <br> Terms | Component | Module | Cable |
| F2-04AD-1 | 10 | Feedthrough | ZL-RTB20 (-1) | $\begin{aligned} & \text { ZL-D2-CBL10 } \\ & \text { ZLLD2-CBL10-1 } \\ & \text { ZL-D2-CBL10-2 } \\ & \hline \end{aligned}$ |
| F2-08AD-1 |  |  |  |  |
| F2-04AD-2 |  |  |  |  |
| F2-08AD-2 |  |  |  |  |
| F2-02DA-1 |  |  |  |  |
| F2-02DAS-1 |  |  |  |  |
| F2-08DA-1 |  |  |  | $\begin{aligned} & \hline \text { ZL-D2-CBL19 } \\ & \text { ZL-D2-CBL19-1 } \\ & \hline \end{aligned}$ |
| F2-02DA-2 |  |  |  | ZL-D2-CBL19-2 |
| F2-02DAS-2 |  |  |  | ZL-D2-CBL10 |
| F2-08DA-2 |  |  |  | ZL-D2-CBL10-1 |
| F2-4AD2DA |  |  |  | ZL-D2-CBL10-2 |
| F2-8AD4DA-1 | 19 |  |  | ZL-D2-CBL19 |
| F2-8AD4DA-2 |  |  |  | $\frac{\text { ZL-D2-CBL19-1 }}{\text { ZL-D2-CBL19-2 }}$ |
| F2-04RTD | Matched Only | These modules are not supported by the ZIPLink wiring system |  |  |
| F2-04THM |  |  |  |  |  |  |


| Do-more/ DL205 PLC Output Module ZIPLink Selector |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| PLC | ZIPLink |  |  |  |
| Output Module | \# of <br> Terms | Component | Module Part No. | Cable Part No. $\dagger$ |
| D2-04TD ${ }^{2}$ | 10 | Feedthrough | ZL-RTB20 (-1) | $\frac{\text { ZL-D2-CBL10 }}{\frac{\text { ZL-D2-CBL10-1 }}{\text { ZL-D2-CBL10-2 }}}$ |
| D2-08TD1 |  |  |  |  |
| D2-08TD2 |  |  |  |  |
| D2-16TD1-2 | 19 | Feedthrough |  | $\frac{\text { ZL-D2-CBL19 }}{\frac{\text { ZLLD2-CBL19-1 }}{\text { ZL-D2-CBL19-2 }}}$ |
|  |  | Fuse | ZL-RFU20 ${ }^{4}$ |  |
| D2-16TD2-2 |  | Feedthrough | ZL-RTB20 (-1) |  |
|  |  | Fuse | ZL-RFU20 ${ }^{4}$ |  |
|  |  | Relay | $\begin{aligned} & \quad \begin{array}{l} \text { ZL-RRL16-24-2 } \\ \text { ZL-RRL16W-24-2 } \\ \text { ZL-RRL16F-24-2 } \\ \text { ZL-RRL16HDF-24-2 } \end{array} \end{aligned}$ |  |
| F2-16TD1P |  | Feedthrough | ZL-RTB20 (-1) |  |
| F2-16TD2P |  |  |  |  |
| D2-32TD1 ${ }^{1}$ | 40 | Feedthrough | ZL-RTB40 (-1) | $\begin{aligned} & 180 \text { deg conn: } \\ & \text { ZL-D24-CBL40 } \\ & \text { ZLL-D24-CBL40-1 } \\ & \hline \text { ZL-D24-CBL40-2 } \\ & \text { 45-D24 denn: } \\ & \text { ZLL-D24-CBL40-X } \\ & \text { ZLL-D24-CBL40-1X } \\ & \hline \end{aligned}$ |
|  |  | Fuse | ZL-RFU40 ${ }^{4}$ |  |
| D2-32TD2 ${ }^{1}$ |  | Feedthrough | ZL-RTB40 (-1) |  |
|  |  | Fuse | ZL-RFU40 ${ }^{4}$ |  |
| D2-08TA | 10 | Feedthrough | ZL-RTB20 (-1) | ZL-D2-CBL10 |
| F2-08TA |  |  |  | ZL-D2-CBL10-2 |
| D2-12TA | 19 | Feedthrough |  |  |
|  |  | Fuse | ZL-RFU20 ${ }^{4}$ |  |
| D2-04TRS ${ }^{2}$ | 10 | Feedthrough | ZL-RTB20 (-1) | ZL-D2-CBL10 |
| D2-08TR |  |  |  | $\frac{\text { ZL-D2-CBL10-1 }}{\text { ZL-D2-CBL10-2 }}$ |
| F2-08TRS ${ }^{2}$ | 19 | Feedthrough |  | ZL-D2-CBL19* |
| F2-08TR $^{3}$ | 10 |  |  | ZL-D2-CBL10* |
| D2-12TR | 19 | Feedthrough |  | $\begin{aligned} & \hline \text { ZL-D2-CBL19 } \\ & \text { ZL-D2-CBL19-1 } \\ & \text { ZL-D2-CBL19-2 } \end{aligned}$ |
|  |  | Fuse | ZL-RFU20 ${ }^{4}$ |  |

$\dagger X$ in the part number represents a $45^{\circ}$ angle plug

* Select the cable length by replacing the *with: Blank $=0.5 \mathrm{~m},-1=1.0 \mathrm{~m}$, or $-2=2.0 \mathrm{~m}$.
1 To make a custom cable for the 32-point modules, use: Solder-style $180^{\circ}$ connector ZL-D24CON or Solder-style $45^{\circ}$ connector ZL-D24-CON-X
2 Caution: The D2-04TD1, D2.04TRS, and F2-08TRS outputs are derated not to exceed module specs 2 A per point and 2 A per common when used with the ZIPLink wiring system.
3 The F2-08TR outputs are derated not to exceed $2 A$ per point and $4 A$ per common when used with the ZIPLink wiring system.
4 Fuses ( $5 \times 20 \mathrm{~mm}$ ) are not included. See Edison Electronic Fuse section for ( $5 \times 20 \mathrm{~mm}$ ) fuse. S500 and GMA electronic circuit protection for fast-acting maximum protection. S506 and GMC electronic circuit protection for time-delay performance. Ideal for inductive circuits.
To ensure proper operation, do not exceed the voltage and current rating of ZIPLink module. $Z L$-RFU2O $=2 A$ per circuit; ZL-RFU40 $=400 \mathrm{~mA}$ per circuit.

Note: ZIPLink Connector Module specifications follow the Compatibility Matrix tables. ZIPLink Cables specifications are at the end of this ZIPLink section.

## DC Input Modules

| 1208808 | Inyl 88100 |
| :---: | :---: |
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|  |  |
| Fement Theemememeon | mememe |
|  | ${ }^{\text {a }}$ |

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



12-24VDC
For "Sinking and Sourcing Concepts", see the Appendix section.

D2-16ND3-2 DC Input \$137.00

| Inputs per Module | 16 (sink/source) |
| :--- | :--- |
| Commons per Module | 2 isolated (8 //O terminal points / com) |
| Input Voltage Range | $20-28 \mathrm{VDC}$ |
| Peak VoItage | $30 \mathrm{VDC}(10 \mathrm{~mA})$ |
| ON Voltage Level | 19 VDC minimum |
| OFF Voltage Level | 7 VDC maximum |
| AC Frequency | $\mathrm{N} / \mathrm{A}$ |
| Input Impedance | $3.9 \mathrm{k} \Omega$ |
| Input Current | 6 mA @ 24VDC |
| Minimum ON Current | 3.5 mA |
| Maximum OFF Current | 1.5 mA |
| Base Power Required 5VDC | 100 mA |
| OFF to ON Response | 3 to 9 ms |
| ON to OFF Response | 3 to 9 ms |
| Terminal Type (included) | Removable, D2-16IOCON |
| Status Indicator | Logic side |
| Weight | 2.3 oz. (65g) |

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


For "Sinking and Sourcing Concepts" see the Appendix section.

## DC Input Modules

| D2-32ND3 DC | Input \$190.00 |
| :---: | :---: |
| Inputs per Module | 32 (sink/source) |
| Commons per Module | 4 isolated (8 I/O terminal points / com) |
| Input Voltage Range | 20-28 VDC |
| Peak Voltage | 30VDC |
| ON Voltage Level | 19VDC minimum |
| OFF Voltage Level | 7VDC maximum |
| AC Frequency | N/A |
| Input Impedance | $4.8 \mathrm{k} \Omega$ |
| Input Current | 8.0 mA @ 24VDC |
| Minimum ON Current | 3.5 mA |
| Maximum OFF Current | 1.5 mA |
| Base Power Required 5VDC | 25 mA |
| OFF to ON Response | 3 to 9 ms |
| ON to OFF Response | 3 to 9 ms |
| Terminal Type (not included) | 40-pin Connector ${ }^{1}$ |
| Status Indicator | Module Activity LED |
| Weight | 2.1 oz. (60g) |
| 1 Connector sold separately. See Terminal Blocks and Wiring for wiring options. |  |

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


For "Sinking and Sourcing Concepts", see the Appendix section.

| D2-32ND3-2 | Input \$190.00 |
| :---: | :---: |
| Inputs per Module | 32 (Sink/Source) |
| Commons per Module | 4 isolated (8//O terminal points / com) |
| Input Voltage Range | 4.50 to 15.6 VDC min. to max. |
| Peak Voltage | 16VDC |
| ON Voltage Level | 4VDC minimum |
| OFF Voltage Level | 2VDC maximum |
| AC Frequency | N/A |
| Input Impedance | $1.0 \mathrm{k} \Omega$ @ 5-15 VDC |
| Input Current | $\begin{aligned} & \text { 4mA @ 5VDC } \\ & 11 \mathrm{~mA} @ 12 \mathrm{VDC} \\ & 14 \mathrm{~mA} @ 15 \mathrm{VDC} \end{aligned}$ |
| Maximum Input Current | 16 mA @ 15.6 VDC |
| Minimum ON Current | 3 mA |
| Maximum OFF Current | 0.5 mA |
| Base Power Required 5VDC | 25 mA |
| OFF to ON Response | 3 to 9 ms |
| ON to OFF Response | 3 to 9 ms |
| Terminal Type (not included) | 40 -pin connector ${ }^{1}$ |
| Status Indicator | Module activity LED |
| Weight | 2.1 oz (60g) |
| 1 Connector sold separately. <br> See Terminal Blocks and Wiring for wiring options. |  |

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


For "Sinking and Sourcing Concepts" see the Appendix section.

## Simulator/AC Input Modules

F2-08SIM Input Simulator \$107.00

| Inputs per Module | 8 |
| :--- | :--- |
| Base Power Required 5VDC | 50 mA |
| Terminal Type | None |
| Status Indicator | Switch side |
| Weight | 2.65 oz. $(75 \mathrm{~g})$ |



| D2-08NA-1 AC | Input \$116.00 |
| :---: | :---: |
| Inputs per Module | 8 |
| Commons per Module | 1 (2 I/O terminal points) |
| Input Voltage Range | 80-132 VAC |
| Peak Voltage | 132 VAC |
| ON Voltage Level | 75VAC minimum |
| OFF Voltage Level | 20VAC maximum |
| AC Frequency | $47-63 \mathrm{~Hz}$ |
| Input Impedance | $12 \mathrm{k} \Omega$ @ 60Hz |
| Input Current | 13 mA @ 100VAC, 60Hz 11 mA @ 100VAC, 50Hz |
| Minimum ON Current | 5 mA |
| Maximum OFF Current | 2 mA |
| Base Power Required 5VDC | 50 mA |
| OFF to ON Response | 5 to 30 ms |
| ON to OFF Response | 10 to 50 ms |
| Terminal Type (included) | Removable; $\underline{\text { D2-81OCON }}$ |
| Status Indicator | Logic side |
| Weight | 2.5 oz. (70g) |

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




## AC Input Modules

## D2-08NA-2 AC Input $\$ 148.00$

| Inputs per Module | 8 |
| :---: | :---: |
| Commons per Module | 1 (2 I/O terminal points) |
| Input Voltage Range | 170-265 VAC |
| Peak Voltage | 265VAC |
| ON Voltage Level | 150VAC minimum |
| OFF Voltage Level | 40VAC maximum |
| AC Frequency | $47-63 \mathrm{~Hz}$ |
| Input Impedance | 18k @ 60Hz |
| Input Current | 9mA@ 220VAC, 50Hz 11mA @ 265VAC, 50Hz 10 mA @ 220VAC, 60Hz 12 mA @ 265VAC, 60Hz |
| Minimum ON Current | 10 mA |
| Maximum OFF Current | 2 mA |
| Base Power Required 5VDC | 100 mA |
| OFF to ON Response | 5 to 30 ms |
| ON to OFF Response | 10 to 50 ms |
| Terminal Type (included) | Removable; D2-8IOCON |
| Status Indicator | Logic side |
| Weight | 2.5 oz. (70g) |


| Operating Temperature | $32^{\circ} \mathrm{F}$ to $131^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $\left.55^{\circ} \mathrm{C}\right)$ |
| :--- | :--- |
| Storage Temperature | $-4^{\circ} \mathrm{F}$ to $158^{\circ} \mathrm{F}\left(-20^{\circ} \mathrm{C}\right.$ to $\left.70^{\circ} \mathrm{C}\right)$ |
| Humidity | $35 \%$ to $95 \%$ (non-condensing) |
| Atmosphere | No corrosive gases permitted |
| Vibration | MIL STD 810 C 514.2 |
| Shock | MIL STD 810 C 516.2 |
| Insulation Withstand Voltage | $1,500 \mathrm{VAC} 1$ minute (COM-GND) |
| Insulation Resistance | $10 \mathrm{M} \simeq @ 500 \mathrm{VDC}$ |
| Noise Immunity | NEMA $1,500 \mathrm{~V} 1$ minute <br> SANKI $1,000 \mathrm{~V} 1$ minute |
| RFI | $150 \mathrm{MHz}, 430 \mathrm{MHz}$ |



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



## AC Input Modules

| D2-16NA AC Input \$204.00 |  |
| :---: | :---: |
| Inputs per Module | 16 |
| Commons per Module | 2 (isolated) |
| Input Voltage Range | 80-132 VAC |
| Peak Voltage | 132VAC |
| ON Voltage Level | 70VAC minimum |
| OFF Voltage Level | 20VAC maximum |
| AC Frequency | $47-63 \mathrm{~Hz}$ |
| Input Impedance | $12 \mathrm{k} \Omega$ @ 60 Hz |
| Input Current | $\begin{aligned} & 11 \mathrm{~mA} @ 100 \mathrm{VAC}, 50 \mathrm{~Hz} \\ & 13 \mathrm{~mA} @ 100 \mathrm{VAC}, 6 \mathrm{~Hz} \\ & 15 \mathrm{~mA} @ 132 \mathrm{VAC}, 60 \mathrm{~Hz} \\ & \hline \end{aligned}$ |
| Minimum ON Current | 5 mA |
| Maximum OFF Current | 2 mA |
| Base Power Required 5VDC | 100 mA |
| OFF to ON Response | 5 to 30 ms |
| ON to OFF Response | 10 to 50 ms |
| Terminal Type (included) | Removable; D2-16IOCON |
| Status Indicator | Logic side |
| Weight | 2.4 oz. (68g) |



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

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

## DC Output Modules

| D2-04TD1 DC Output \$103.00 |  |
| :--- | :--- |
| Outputs per Module | 4 (current sinking) |
| Output Points Consumed | 8 points (only first 4 pts. used) |
| Commons per Module | 1 (4 I/O terminal points) |
| Output Type | NMOS FET (open drain) |
| Operating Voltage | $10.2-26.4 \mathrm{VDC}$ |
| Peak Voltage | 40 VDC |
| ON Voltage Drop | 0.72 VDC maximum |
| AC Frequency | N/A |
| Max Load Current (resistive) | $4 \mathrm{~A} / \mathrm{point}$ |
| 8A/common |  |
| Max Leakage Current | $0.1 \mathrm{~mA} @ 40 \mathrm{VDC}$ |
| Max Inrush Current | 6 A for 100ms, 15A for 10ms |
| Minimum Load Current | 50 mA |


| External DC Required | 24 VDC @ 20mA max. |
| :--- | :--- |
| Base Power Required 5VDC | 60 mA |
| OFF to ON Response | 1 ms |
| ON to OFF Response | 1 ms |
| Terminal Type (included) | Removable; D2-8IOCON |
| Status Indicator | Logic side |
| Weight | 2.8 oz. (80g) |
| Fuses | 4 (1 per point) <br> (6.3 A slow blow, non-replaceable) |



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




Inductive Load
Maximum Number of Switching Cycles per Minute

| Load | Duration of output in ON state |  |  |
| :---: | :---: | :---: | :---: |
| Current | 7 ms | 40 ms | 100 ms |
| 0.1 A | 8000 | 1400 | 600 |
| 0.5 A | 1600 | 300 | 120 |
| 1.0 A | 800 | 140 | 60 |
| 1.5 A | 540 | 90 | 35 |
| 2.0 A | 400 | 70 | - |
| 3.0 A | 270 | - | - |
| 4.0 A | 200 | - | - |

At 40 mS duration, loads of 3.0 A or greater cannot be used. At 100 mS duration, loads of 2.0 A or greater cannot be used. Find the load current you expect to use and the duration that the output is ON. The number at the intersection of the row and column represents the switching cycles per minute. For example, a 1 A inductive load that is on for 100 ms can be switched on and off a maximum of 60 times per minute. To convert this to duty cycle percentage use: (duration x cycles)/60. In this example,
$(60 \times .1) / 60=.1$, or $10 \%$ duty cycle.


## DC Output Modules

| D2-081D1 DC Output \$887.00 |  |
| :---: | :---: |
| Outputs per Module | 8 (current sinking) |
| Commons per Module | 1 (2 I/O terminal points) |
| Output Type | NPN open collector |
| Operating Voltage | 10.2-26.4 VDC |
| Peak Voltage | 40VDC |
| ON Voltage Drop | 1.5 VDC maximum |
| AC Frequency | N/A |
| Minimum Load Current | 0.5 mA |
| Max Load Current | 0.3 A/point; 2.4 A/common |
| Max Leakage Current | 0.1 mA @ 40VDC |
| Max Inrush Current | 1 A for 10 ms |
| Base Power Required 5VDC | 100 mA |
| OFF to ON Response | 1 ms |
| ON to OFF Response | 1 ms |
| Terminal Type (included) | Removable; D2-8IOCON |
| Status Indicator | Logic side |
| Weight | 2.3 oz. (65g) |
| Fuses | 1 per common 5A fast blow, non-replaceable |

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


| D2-08TD2 DC Output \$886.00 |  |
| :---: | :---: |
| Outputs per Module | 8 (current sourcing) |
| Commons per Module | 1 |
| Output Type | PNP open collector |
| Operating Voltage | 12 to 24 VDC |
| Output Voltage | 10.8 to 26.4 VDC |
| Peak Voltage | 40VDC |
| ON Voltage Drop | 1.5 VDC |
| AC Frequency | N/A |
| Minimum Load Current | N/A |
| Max Load Current | 0.3 A per point; 2.4 A per common |
| Max Leakage Current | 1.0 mA @ 40VDC |
| Max Inrush Current | 1 A for 10 ms |
| Base Power Required 5VDC | 100 mA |
| OFF to ON Response | 1 ms |
| ON to OFF Response | 1 ms |
| Terminal Type (included) | Removable; D2-8IOCON |
| Status Indicator | Logic side |
| Weight | 2.1 oz. (60g) |
| Fuse | 5A fast blow, non-replaceable |

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



## DC Output Modules

| D2-16TD1-2 DC | Output \$152.00 |
| :---: | :---: |
| Outputs per Module | 16 (current sinking) |
| Commons per Module | 1 (2 I/O terminal points) |
| Output Type | NPN open collector |
| External DC required | $24 \mathrm{VDC} \pm 4 \mathrm{~V}$ @ 80mA max |
| Operating Voltage | 10.2-26.4 VDC |
| Peak Voltage | 30VDC |
| ON Voltage Drop | 0.5 VDC maximum |
| AC Frequency | N/A |
| Minimum Load Current | 0.2 mA |
| Max Load Current | 0.1 A/point 1.6 A/common |
| Max Leakage Current | 0.1 mA @ 30VDC |
| Max Inrush Current | 150 mA for 10 ms |
| Base Power Required 5VDC | 200 mA |
| OFF to ON Response | 0.5 ms |
| ON to OFF Response | 0.5 ms |
| Terminal Type (included) | Removable; D2-16IOCON |
| Status Indicator | Logic side |
| Weight | 2.3 oz. (65g) |
| Fuses | None |

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


D2-16TD2-2 DC Output \$152.00

| Outputs per Module | 16 (current sourcing) |
| :--- | :--- |
| Commons per Module | 2 |
| Output Type | NPN open collector |
| Operating Voltage | $10.2-26.4 \mathrm{VDC}$ |
| Peak Voltage | 30 VDC |
| ON Voltage Drop | 1.0 VDC maximum |
| AC Frequency | $\mathrm{N} / \mathrm{A}$ |
| Minimum Load Current | 0.2 mA |
| Max Load Current | $0.1 \mathrm{~A} / p o i n t$ |
| Max Leakage Current | 0.1 mA @ 30VDC |
| Max Inrush Current | 150 mA for 10ms |
| Base Power Required 5VDC | 200 mA |
| OFF to ON Response | 0.5 ms |
| ON to OFF Response | 0.5 ms |
| Terminal Type (included) | Removable; D2-16IOCON |
| Status Indicator | Logic side |
| Weight | 2.8 oz. (80g) |
| Fuses | None |

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


## DC Output Modulles

| D2-32TD1 DC Output \$193.00 |  |
| :--- | :--- |
| Outputs per Module | 32 (current sinking) |
| Commons per Module | 4 (8 I/O terminal points) |
| Output Type | NPN open collector |
| Operating Voltage | $12-24 \mathrm{VDC}$ |
| Peak Voltage | 30 VDC |
| ON VoItage Drop | 0.5 VDC maximum |
| Minimum Load Current | 0.2 mA |
| Max Load Current | 0.1 A/point; 3.2 A per module |
| Max Leakage Current | 0.1 mA @ 30VDC |
| Max Inrush Current | 150 mA for 10ms |
| Base Power Required 5VDC | 350 mA |
| OFF to ON Response | 0.5 ms |
| ON to OFF Response | 0.5 ms |
| Terminal Type (not included) | 40 -pin connector1 |
| Status Indicator | Module activity (no I/O status <br> indicators) |
| Weight | 2.1 oz. (60g) |
| Fuses | None |
| External DC Power Required | $20-28 \mathrm{VDC}$ max. 120mA (all points on) |
| 1 Connector sold separately. | See Terminal Blocks and Wiring for wiring options. |

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


| D2-32TD2 DC Output \$193.00 |  |
| :---: | :---: |
| Outputs per Module | 32 (current sourcing) |
| Commons per Module | 4 (8 //O terminal points) |
| Output Type | Transistor |
| Operating Voltage | 12 to 24 VDC |
| Peak Voltage | 30VDC |
| ON Voltage Drop | 0.5 VDC @ 0.1 A |
| Minimum Load Current | 0.2 mA |
| Max Load Current | 0.1 A/point; 0.8 A/common |
| Max Leakage Current | 0.1 mA @ 30VDC |
| Max Inrush Current | 150mA @ 10ms |
| Base Power Required 5VDC | 350 mA |
| OFF to ON Response | 0.5 ms |
| ON to OFF Response | 0.5 ms |
| Terminal Type (not included) | 40-pin connector ${ }^{1}$ |
| Status Indicator | Module activity (no l/O status indicators) |
| Weight | 2.1 oz (60g) |
| Fuses | None |
| 1 Connector sold separately. See Terminal Blocks and Wiring for wiring options. |  |

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


## DC Output Modules

Not supported in D2-250 CPUs.

| F2-16TD1P DC Output with Fault Protection \$162.00 |  |
| :---: | :---: |
| Inputs per module | 16 (status indication) |
| Outputs per module | 16 (current sinking) |
| Commons per module | 1 (2 I/O terminal points) |
| Output type | NMOS FET (open drain) |
| Operating voltage | 10.2-26.4 VDC, external |
| Peak voltage | 40VDC |
| AC frequency | N/A |
| ON voltage drop | 0.7 V (output current 0.5 A ) |
| Overcurrent trip | 0.6 A min., 1.2 A max. |
| Minimum load current | 0.2 mA |
| Maximum load current | 0.25 A/point; 4A/common |
| Max leakage current | 0.2 mA (load detect enabled); 0.3 mA disabled |
| Max inrush current | Self-limited |
| Base power required 5V | 70 mA |
| OFF to ON response | 0.5 ms |
| ON to OFF response | 0.5 ms |
| Terminal type | Removable ( ${ }^{\text {2-16IOCON }}$ ) |
| Status indicators | Logic Side |
| Weight | 2.0 oz. (25g) |
| Fuses | None |
| External DC required | 24VDC $\pm 10 \%$ @ 50mA |
| External DC overvoltage shutdown | 27 V , outputs are restored when voltage is within limits |

Module detects the following faults:

1. Missing external 24VDC
2. Open load
3. Over temperature
4. Over load current


| CPU | Firmware Required |
| :---: | :---: |
| D2-250-1 | Version 4.80 or later |
| $\underline{D 2-262}$ | Version 1.0 or later |

Not supported in D2-250 CPUs.
F2-16TD2P DC Output with Fault Protection $\$ 163.00$

| Inputs per module | 16 (status indication) |
| :--- | :--- |
| Outputs per module | 16 (current sourcing) |
| Commons per module | 1 |
| Output type | NMOS FET (open source) |
| Operating voltage | 10.2 -26.4 VDC, external |
| Peak voltage | 40 VDC |
| AC frequency | $\mathrm{N} / \mathrm{A}$ |
| ON voltage drop | 0.7 V (output current 0.5 A) |
| Overcurrent trip | $0.6 \mathrm{~A} \mathrm{~min} ., 1.2 \mathrm{~A} \mathrm{max}$. |
| Minimum load current | 0.2 mA |
| Maximum load current | $0.25 \mathrm{~A} / p o i n t ; ~ 4 \mathrm{~A} / c o m m o n$ |
| Max leakage current | 0.2 mA (load detect enabled); 0.3 mA disabled |
| Max inrush current | Self-limited |
| Base power required 5V | 70 mA |
| OFF to ON response | 0.5 ms |
| ON to OFF response | 0.5 ms |
| Terminal type | Removable (D2-16IOCON) |
| Status indicators | Logic Side |
| Weight | 2.0 oz. (25g) |
| Fuses | None |
| External DC |  |
| required | $24 \mathrm{VDC} \pm 10 \%$ @ 50mA |
| External DC overvoltage | 27 V, outputs are restored when voltage is within |
| shutdown | limits |

Module detects the following faults:

1. Missing external 24VDC
2. Open load
3. Over temperature
4. Over load current


## AC Output Modules

| D2-08TA AC Output \$165.00 |  |
| :---: | :---: |
| Outputs per Module | 8 |
| Commons per Module | 1 (2 //O terminal points) |
| Output Type | SSR (Triac) |
| Operating Voltage | 15-264 VAC |
| Peak Voltage | 264VAC |
| ON Voltage Drop | $\begin{aligned} & <1.5 \mathrm{VAC}(>0.1 \mathrm{~A}) \\ & <3.0 \mathrm{VAC}(<0.1 \mathrm{~A}) \end{aligned}$ |
| AC Frequency | 47 to 63 Hz |
| Minimum Load Current | 10 mA |
| Max Load Current | 0.5 A/point; 4A/common |
| Max Leakage Current | $4 \mathrm{~mA}(264 \mathrm{VAC}, 60 \mathrm{~Hz})$ $1.2 \mathrm{~mA}(100 \mathrm{VAC}, 60 \mathrm{~Hz})$ $0.9 \mathrm{~mA}(100 \mathrm{VAC}, 50 \mathrm{~Hz})$ |
| Max Inrush Current | 10A for 10 ms |
| Base Power Required 5VDC | 250 mA |
| OFF to ON Response | 1 ms |
| ON to OFF Response | $1 \mathrm{~ms}+1 / 2$ cycle |
| Terminal Type (included) | Removable; D2-81OCON |
| Status Indicator | Logic side |
| Weight | 2.8 oz. (80g) |
| Fuses | 1 per common, 6.3 A slow blow, non-replaceable |

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

| F2-08TA AC Output \$208.00 |  |
| :---: | :---: |
| Outputs per Module | 8 |
| Commons per Module | 2 (Isolated) |
| Output Type | SSR (Triac with zero crossover) |
| Operating Voltage | 24-140 VAC |
| Peak Voltage | 140VAC |
| ON Voltage Drop | 1.6 V (rms) @ 1.5 A |
| AC Frequency | 47 to 63 Hz |
| Minimum Load Current | 50 mA |
| Max Load Current | $\begin{aligned} & 1.5 \mathrm{~A} / \mathrm{pt} @ 30^{\circ} \mathrm{C} \\ & 1.0 \mathrm{~A} / \mathrm{pt} @ 60^{\circ} \mathrm{C} \\ & 4.0 \mathrm{~A} / \text { common; } 8.0 \mathrm{~A} / \text { module @ } \\ & 60^{\circ} \mathrm{C} \end{aligned}$ |
| Max Leakage Current | $0.7 \mathrm{~mA}(\mathrm{~ms})$ |
| Peak One Cycle Surge Curren | 15A |
| Base Power Required 5VDC | 250 mA |
| OFF to ON Response | 0.5 ms - $1 / 2$ cycle |
| ON to OFF Response | 0.5 ms - $1 / 2 \mathrm{cycle}$ |
| Terminal Type (included) | Removable; D2-81OCON |
| Status Indicator | Logic side |
| Weight | 3.5 oz. (99g) |
| Fuses | None |

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


Derating Note: All outputs can be run at the current per point shown.


## AC Output Modulles

## D2-12TA AC Output \$204.00

| Outputs per Module | 12 |
| :---: | :---: |
| Outputs Points Consumed | 16 (four unused, see chart below) |
| Commons per Module | 2 (isolated) |
| Output Type | SSR (Triac) |
| Operating Voltage | 15-132 VAC |
| Peak Voltage | 132 VAC |
| ON Voltage Drop | $\begin{aligned} & <1.5 \mathrm{VAC}(>50 \mathrm{~mA}) \\ & <4.0 \mathrm{VAC}(<50 \mathrm{~mA}) \end{aligned}$ |
| AC Frequency | 47 to 63 Hz |
| Minimum Load Current | 10 mA |
| Max Load Current | 0.3 A/point; $1.8 \mathrm{~A} / \mathrm{common}$ |
| Max Leakage Current | 2 mA (132VAC, 60Hz) |
| Max Inrush Current | 10 A for 10 ms |
| Base Power Required 5VDC | 350 mA |
| OFF to ON Response | 1 ms |
| ON to OFF Response | $1 \mathrm{~ms}+1 / 2$ cycle |
| Terminal Type (included) | Removable; [2-16IOCON |
| Status Indicator | Logic side |
| Weight | 2.8 oz. (80g) |
| Fuses | (2) 1 per common 3.15 A slow blow, replaceable Order D2-FUSE-1 (5 per pack) |

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

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


| Points | Addresses Used |  |  |
| :---: | :---: | :---: | :---: |
|  | Used? | Points | Used? |
| $Y \mathrm{n}+0$ | Yes | Yn+10 | Yes |
| $Y \mathrm{n}+1$ | Yes | Yn+11 | Yes |
| $Y \mathrm{n}+2$ | Yes | $\mathrm{Y} \mathrm{n}+12$ | Yes |
| $Y \mathrm{n}+3$ | Yes | Yn+13 | Yes |
| $Y \mathrm{n}+4$ | Yes | Yn+14 | Yes |
| $Y \mathrm{n}+5$ | Yes | Yn+15 | Yes |
| $Y \mathrm{n}+6$ | No | Yn+16 | No |
| Yn+7 | No | Yn+17 | No |

n is the starting address


## Relay Output Modules

| D2-04TRS Relay Output |  |
| :--- | :--- |
| Outputs per Module | 4 |
| Outputs Points Consumed | 8 (only 1st 4pts. are used) |
| Commons per Module | 4 (isolated) |
| Output Type | Relay, form A (SPST) |
| Operating Voltage | $5-30 \mathrm{VDC} / 5-240 \mathrm{VAC}$ |
| Peak Voltage | $30 \mathrm{VDC}, 264 \mathrm{VAC}$ |
| ON VoItage Drop | 0.72 VDC maximum |
| AC Frequency | 47 to 63 Hz |
| Minimum Load Current | 10 mA |
| Max Load Current (resistive) | $4 \mathrm{~A} / \mathrm{point} ; 8 \mathrm{~A} / \mathrm{module}$ (resistive) |
| Max Leakage Current | 0.1 mA @ 264 VAC |
| Max Inrush Current | 5 A for < 10ms |
| Base Power Required 5VDC | 250 mA |
| OFF to ON Response | 10 ms |
| ON to OFF Response | 10 ms |
| Terminal Type (included) | Removable; D2-8IOCON |
| Status Indicator | Logic side |
| Weight | 2.8 oz. (80g) |
| Fuses | 1 per point <br> $6.3 \mathrm{~A} \mathrm{slow} \mathrm{blow} replaceable$, <br> Order D2-FUSE-3 (5 per pack) |


| Typica |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: |
| Relage \& Load Current |  |  |  |  |
| Type of Load | 1 A | 2A | 3 A | 4 A |
| 24VDC Resistive | 500 K | 200 K | 100 K | 50 K |
| 24VDC Solenoid | 100 K | 40 K | - | - |
| 110VAC Resistive | 500 K | 250 K | 150 K | 100 K |
| 110VAC Solenoid | 200 K | 100 K | 50 K | - |
| 220VAC Resistive | 350 K | 150 K | 100 K | 50 K |
| 220VAC Solenoid | 100 K | 50 K | - | - |
| At 24VDC, solenoid (inductive) loads over 2A cannot be used. |  |  |  |  |
| At 100VAC, solenoid (inductive) loads over 3A cannot be used. |  |  |  |  |
| At 20VAC, solenoid (inductive) loads over 2A cannot be used. |  |  |  |  |



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


## Relay Output Modules

## D2-08TR Relay Output $\$ 104.00$

| Outputs per Module | 8 |
| :--- | :--- |
| Outputs Points Consumed | 8 |
| Commons per Module | 1 (2 I/O terminals) |
| Output Type | Relay, form A (SPST) |
| Operating Voltage | $5-30 \mathrm{VDC} ; 5-240 \mathrm{VAC}$ |
| Peak Voltage | $30 \mathrm{VDC}, 264 \mathrm{VAC}$ |
| ON VoItage Drop | $\mathrm{N} / \mathrm{A}$ |
| AC Frequency | 47 to 60 Hz |
| Minimum Load Current | 5 mA @ 5VDC |
| Max Load Current (resistive) | $1 \mathrm{~A} /$ point; 4A/common |
| Max Leakage Current | 0.1 mA @ 265VAC |
| Max Inrush Current | Output: 3A for 10ms |
| Common: 10A for 10ms |  |
| Base Power Required 5VDC | 250 mA |
| OFF to ON Response | 12 ms |
| ON to OFF Response | 10 ms |
| Terminal Type (included) | Removable; D2-8IOCON |
| Status Indicator | Logic side |
| Weight | 3.9 oz. (110g) |
| Fuses | One 6.3 A slow blow, replaceable |
| Order D2-FUSE-3 (5 per pack) |  |

Typical Relay Life (Operations)

| Voltage/Load | Current | Closures |
| :--- | :---: | :---: |
| 24VDC Resistive | 1 A | 500 K |
| 24VDC Solenoid | 1 A | 100 K |
| 110VAC Resistive | 1 A | 500 K |
| 110VAC Solenoid | 1 A | 200 K |
| 220VAC Resistive | 1A | 350 K |
| 220VAC Solenoid | 1A | 100 K |

## Relay Output Modules

## F2-08TRS Relay Output $\$ 182.00$

| Outputs per Module | 8 |
| :---: | :---: |
| Outputs Points Consumed | 8 |
| Commons per Module | 8 (isolated) |
| Output Type | 3, Form C (SPDT) <br> 5, Form A (SPST normally open) |
| Operating Voltage | $\begin{aligned} & \text { 7A @ 12-28 VDC, 12-250 VAC } \\ & 0.5 \text { A @ 120VDC } \end{aligned}$ |
| Peak Voltage | 150VDC, 265VAC |
| ON Voltage Drop | N/A |
| AC Frequency | 47 to 63 Hz |
| Minimum Load Current | 10 mA @ 12VDC |
| Max Load Current (resistive) | 7A/point ${ }^{3}$ (subject to derating) |
| Max Leakage Current | N/A |
| Max Inrush Current | 12A |
| Base Power Required 5VDC | 670mA |
| OFF to ON Response | 15ms (typical) |
| ON to OFF Response | 5 ms (typical) |
| Terminal Type (included) | Removable; D2-810CON |
| Status Indicator | Logic side |
| Weight | 5.5 oz. (156g) |
| Fuses | None |

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

| Typical Relay Life (Operations) at Room Temperature |  |  |  |
| :---: | :---: | :---: | :---: |
|  | Voltage \& Load Current |  |  |
| Type of Load | 50 mA | 5A | 7A |
| 24VDC Resistive | 10M | 600K | 300K |
| 24VDC Solenoid |  | 150K | 75K |
| 110VAC Resistive |  | 600K | 300K |
| 110VAC Solenoid | - | 500K | 200K |
| 220VAC Resistive | - | 300K | 150K |
| 220VAC Solenoid | - | 250K | 100K |
| 1) Contact life may be extended beyond those values shown with the use of arc suppression techniques described in the DL205 User Manual. Since these modules have no leakage current, they do not have built-in snubber. For example, if you place a diode across a 24VDC inductive load, you can significantly increase the life of the relay. <br> 2) At 120 VDC 0.5 A resistive load, contact life cycle is 200 K cycles. <br> 3) Normally closed contacts have $1 / 2$ the current handling capability of the normally open contacts. |  |  |  |




Typical Circuit


Typical Circuit (Points 0, 6, \& 7 only)


## Relay Output Modules

F2-08TR Relay Output \$135.00

| Outputs per Module | 8 |
| :--- | :--- |
| Outputs Points Consumed | 8 |
| Commons per Module | 2 (isolated), 4-pts. per common |
| Output Type | 8, Form A (SPST normally open) |
| Operating Voltage | $7 \mathrm{~A} @ 12-28 \mathrm{VDC}, 12-250 ~ \mathrm{VAC}$ <br> $0.5 \mathrm{~A} @ 120 \mathrm{VDC}$ |
| Peak Voltage | $150 \mathrm{VDC}, 265 \mathrm{VAC}$ |
| ON VoItage Drop | $\mathrm{N} / \mathrm{A}$ |
| AC Frequency | 47 to 63 Hz |
| Minimum Load Current | 10 mA @ 12 VDC |
| Max Load Current (resistive) | $10 \mathrm{~A} /$ /point ${ }^{3}$ (subject to derating) <br> Max of 10A/common |
| Max Leakage Current | $\mathrm{N} / \mathrm{A}$ |
| Max Inrush Current | 12 A |
| Base Power Required 5VDC | 670 mA |
| OFF to ON Response | $15 \mathrm{~ms} \mathrm{(typical)}$ |
| ON to OFF Response | 5 ms (typical) |
| Terminal Type (included) | Removable; $\underline{\text { D2-8lOCON }}$ |
| Status Indicator | Logic side |
| Weight | 5.5 oz. (156g) |
| Fuses | None |

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


Typical Relay Life (Operations) at Room Temperature

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

1) Contact life may be extended beyond those values shown with the use of arc suppression techniques described in the DL205 User Manual. Since these modules have no leakage current, they do not have built-in snubber. For example, if you place a diode across a 24VDC inductive load, you can significantly increase the life of the relay.
2) At 120VDC 0.5 A resistive load, contact life cycle is 200 K cycles.
3) Normally closed contacts have $1 / 2$ the current handling capability of the normally open contacts.


Typical Circuit


## Relay Output Modulles

## D2-12TR Relay Output \$166.00

| Outputs per Module | 12 |
| :---: | :---: |
| Outputs Points Consumed | 16 (four unused, see chart below) |
| Commons per Module | 2 (6-pts. per common) |
| Output Type | Relay, form A (SPST) |
| Operating Voltage | 5-30 VDC; 5-240 VAC |
| Peak Voltage | 30VDC; 264VAC |
| ON Voltage Drop | N/A |
| AC Frequency | 47 to 60 Hz |
| Minimum Load Current | 5 mA @ 5VDC |
| Max Load Current (resistive) | 1.5 A/point; Max of 3A/common |
| Max Leakage Current | 0.1 mA @ 265 VAC |
| Max Inrush Current | Output: 3A for 10 ms Common: 10A for 10 ms |
| Base Power Required 5VDC | 450 mA |
| OFF to ON Response | 10 ms |
| ON to OFF Response | 10 ms |
| Terminal Type (included) | Removable; D2-81OCON |
| Status Indicator | Logic side |
| Weight | 4.6 oz. (130g) |
| Fuses | (2) 4A slow blow, replaceable Order D2-FUSE-4 (5 per pack) |

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


Typical Relay Life (Operations)

| Voltage/Load | Current | Closures |
| :--- | :---: | :---: |
| 24VDC Resistive | 1 A | 500 K |
| 24VDC Solenoid | 1 A | 100 K |
| 110VAC Resistive | 1 A | 500 K |
| 110VAC Solenoid | 1 A | 200 K |
| 220VAC Resistive | 1 A | 350 K |
| 220VAC Solenoid | 1 A | 100 K |


| Addresses USEd |  |  |  |
| :--- | :--- | :--- | :--- |
| Points | Used? | Points | Used? |
| $Y n+0$ | Yes | $Y n+10$ | Yes |
| $Y n+1$ | Yes | $Y n+11$ | Yes |
| $Y n+2$ | Yes | $Y n+12$ | Yes |
| $Y n+3$ | Yes | $Y n+13$ | Yes |
| $Y n+4$ | $Y e s ~$ | $Y n+14$ | Yes |
| $Y n+5$ | $Y e s$ | $Y n+15$ | Yes |
| $Y n+6$ | No | $Y n+16$ | No |
| $Y n+7$ | No | $Y n+17$ | No |
| $n$ is the starting address |  |  |  |




## DC Input/Relay Output Module

| D2-08CDR 4-pt. DC In / 4pt. Relay Out $\$ 100.00$ |  |
| :---: | :---: |
| General Specifications |  |
| Base Power Required 5VDC | 200mA |
| Terminal Type (included) | Removable; D2-8IOCON |
| Status Indicator | Logic side |
| Weight | 3.5 oz. (100g) |
| Input Specifications |  |
| Inputs per Module | 4 (sink/source) |
| Input Points Consumed | 8 (only first 4-pts. are used) |
| Commons per Module | 1 |
| Input Voltage Range | 20-28 VDC |
| Peak Voltage | 30VDC |
| ON Voltage Level | 19VDC minimum |
| OFF Voltage Level | 7VDC maximum |
| AC Frequency | N/A |
| Input Impedance | $4.7 \mathrm{k} \Omega$ |
| Input Current | 5 mA @ 24VDC |
| Maximum Current | 8mA @ 30VDC |
| Minimum ON Current | 4.5 mA |
| Maximum OFF Current | 1.5 mA |
| OFF to ON Response | 1 to 10 ms |
| ON to OFF Response | 1 to 10 ms |
| Fuses (input circuits) | None |


| Typical Relay Life (Operations) |  |  |  |
| :---: | :---: | :---: | :---: |
| Voltage/Load | Current | Closures |  |
| 24VDC Resistive | 1A | 500K |  |
| 24VDC Solenoid | 1A | 100K |  |
| 110VAC Resistive | 1 A | 500K |  |
| 110VAC Solenoid | 1 A | 200K |  |
| 220VAC Resistive | 1A | 350K |  |
| 220VAC Solenoid | 1A | 100K |  |
|  | Source <br> Sink | $\qquad$ <br> L $\qquad$ <br> $\circ$ <br> L <br> $\circ$ $\qquad$ <br> - <br> L <br> - <br> 5-30 VDC | $A^{(F)^{C A}}$ |

For "Sinking and Sourcing Concepts", see the Appendix section in this catalog.

| Output Specifications |  |
| :--- | :--- |
| Outputs per Module | 4 |
| Outputs Points Consumed | 8 (only first 4-pts. are used) |
| Commons per Module | 1 |
| Output Type | Relay, form A (SPST) |
| Operating Voltage | $5-30 \mathrm{VDC} ; 5-240$ VAC |
| Peak Voltage | $30 \mathrm{VDC} ; 264 \mathrm{VAC}$ |
| ON Voltage Drop | $\mathrm{N} / \mathrm{A}$ |
| AC Frequency | 47 to 63 Hz |
| Minimum Load Current | 5 mA @ 5VDC |
| Max Load Current (resistive) | $1 \mathrm{~A} / \mathrm{point} ; 4 \mathrm{~A} / \mathrm{module}$ |
| Max Leakage Current | 0.1 mA @ 264VAC |
| Max Inrush Current | 3 A for < 100ms |
| $10 \mathrm{~A} \mathrm{for} \mathrm{<} \mathrm{10ms} \mathrm{(common)}$ |  |$|$| OFF to ON Response | 12 ms |
| :--- | :--- |
| ON to OFF Response | 10 ms |
| Fuses (output circuits) | Order D2-FUSE-3 (5 per pack); |

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


## Analog Current Input Modules

F2-04ADD-1 4-Channel 4-20mA Analog In $\$ 360.00$
This module can be powered by either a 12VDC or 24VDC power supply, and is a direct replacement for F2-04AD-1L modules.

| Number of Channels | 4 , single ended (1 common) |
| :--- | :--- |
| Input Ranges | 4 to 20 mA current |
| Resolution | 12 -bit (1 in 4096 ) |
| Active Low-pass Filtering | -3 dB at $120 \mathrm{~Hz}, 2$ poles <br> $(-12 \mathrm{~dB}$ per octave) |
| Input Impedance | $250 \Omega \pm 0.1 \%, 1 / 2 \mathrm{~W}$ current input |
| Absolute Maximum Ratings | -40 mA to +40 mA, current input |
| Converter Type | Successive approximation |
| Conversion Time <br> (PLC Update Rate) | 4 channels per scan maximum <br> (D2-262 CPU) |
| Linearity Error (End to End) | $\pm 1$ count (0.025\% of full scale) maximum |
| Input Stability | $\pm 1$ count |
| Full Scale Calibration Error <br> (offset error not included) | $\pm 12$ counts max., @ 20mA current input |
| Offset Calibration Error | $\pm 7$ counts max.,@ 4mA current input |
| Step Response | 4.9 ms to $95 \%$ of F.S. change |

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

| Maximum Inaccuracy | $\begin{aligned} & \pm .5 \% @ 77{ }^{\circ} \mathrm{F}\left(25^{\circ} \mathrm{C}\right) \\ & \pm .65 \% 32^{\circ} \text { to } 140^{\circ} \mathrm{F}\left(0^{\circ} \text { to } 60^{\circ} \mathrm{C}\right) \end{aligned}$ |
| :---: | :---: |
| Accuracy vs. Temperature | $\pm 50 \mathrm{ppm} /{ }^{\circ} \mathrm{C}$ maximum full scale (including max. offset change) |
| Recommended Fuse | 0.032 A, Series 217 fast-acting, current inputs |
| Digital Input Points Required | 16 (X) input points (12 binary data bits, 2 channel ID bits, 2 diagnostic bits) |
| Base Power Required 5 VDC | 100 mA |
| External Power Supply | 5 mA maximum, +10 to +30 VDC |
| Operating Temperature | $32^{\circ}$ to $140^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $\left.60^{\circ} \mathrm{C}\right)$ |
| Storage Temperature | $-4^{\circ}$ to $158^{\circ} \mathrm{F}\left(-20^{\circ}\right.$ to $\left.70^{\circ} \mathrm{C}\right)$ |
| 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 |
| Terminal Type (included) | Removable; $\underline{\text { D2-81OCON }}$ |

Note 1: Shields should be grounded at the signal source


[^3]
## Analog Current Input Modules

| F2-08AD-1 8-Channel 4-20mA Analog In $\$ 442.00$ |  |
| :---: | :---: |
| Number of Channels | 8 , single ended (1 common) |
| Input Ranges | 4 to 20 mA current |
| Resolution | 12 bit (1 in 4096) |
| Low-pass Filtering | -3 dB at $200 \mathrm{~Hz},(-6 \mathrm{~dB}$ per octave) |
| Input Impedance | $250 \Omega \pm 0.1 \%, 1 / 2 \mathrm{~W}$ current input |
| Absolute Maximum Ratings | -45mA to +45 mA |
| Converter Type | Successive approximation |
| Conversion Time (PLC Update Rate) | 8 channels per scan maximum (D2-250-1 and D2-262 CPUs) |
| Linearity Error (End to End) | $\pm 1$ count ( $0.025 \%$ of full scale) maximum |
| Input Stability | $\pm 1$ count |
| Full Scale Calibration Error (offset error not included) | $\pm 5$ counts max., @ 20mA current input |
| Offset Calibration Error | $\pm 2$ counts max., @ 4mA current input |
| Step Response | $1 \mathrm{~ms} \mathrm{to} 95 \%$ of F.S. change |


| Maximum Inaccuracy | $\pm .1 \% ~ @ ~$ <br> $\pm 7^{\circ} \mathrm{F}\left(25^{\circ} \mathrm{C}\right)$ <br> $\pm .25^{\circ} \% 32^{\circ}$ to $140^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $\left.60^{\circ} \mathrm{C}\right)$ |
| :--- | :--- |
| Accuracy vs. Temperature | $\pm 50$ ppm $/{ }^{\circ} \mathrm{C}$ maximum full scale <br> (including max. offset change of two counts) |
| Recommended Fuse | 0.032 A, Series 217 fast-acting, current inputs |\(\left|\begin{array}{ll|}\hline 16(\mathrm{X}) input points <br>

(12 binary data bits, 3 channel ID bits, 1 <br>
broken transmitter bit)\end{array}\right|\)

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


Note 1: Shields should be grounded at the
signal source.


More than one external power supply can be used provided all the power supply commons are connected. A Series $217,0.032 \mathrm{~A}$, fast-acting fuse is recommended for $4-20 \mathrm{~mA}$ current loops. If the power supply common of an external power supply is not connected to OVDC on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20 mA transmitter types are:
2 or 3 wire: Isolation between input signal and power supply.
4 wire: Isolation between input signal, power supply, and 4-20 mA output

## Analog Voltage Input Modules

| F2-04AD-2 4-Channel Voltage Analog In $\$ 393.00$ |  |
| :---: | :---: |
| This module can be powered by either a 12VDC or 24VDC power supply, and is a direct replacement for F2-04AD-2L modules. |  |
| Number of Channels | 4, single ended (1 common) |
| Input Ranges | 0 to $5 \mathrm{~V}, 0$ to $10 \mathrm{~V}, \pm 5 \mathrm{~V}, \pm 10 \mathrm{~V}$ |
| Resolution | 12 bit (1 in 4096) |
| Active Low-pass Filtering | -3 dB at $80 \mathrm{~Hz}, 2$ poles (-12dB per octave) |
| Input Impedance | >20M $\Omega$ |
| Absolute Maximum Ratings | -75 to +75VDC |
| Converter Type | Successive approximation |
| Conversion Time (PLC Update Rate) | 4 channels per scan maximum (D2-262 CPU) |
| Linearity Error (End to End) | $\pm 1$ count ( $0.025 \%$ of full scale) maximum $\pm 2$ counts maximum (bi-polar) |
| Input Stability | $\pm 1$ count |
| Full Scale Calibration Error (offset error not included) | $\pm 3$ counts maximum |
| Offset Calibration Error | $\pm 1$ count maximum ( 0 V input) |
| Step Response | 8.2 ms to $95 \%$ of F.S change |

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

| Maximum Inaccuracy | $\pm 0.1 \% @ 17^{\circ} \mathrm{F}\left(25^{\circ} \mathrm{C}\right)$ <br> $\pm 0.3 \% 32^{\circ}$ to $140^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $\left.60^{\circ} \mathrm{C}\right)$ |
| :--- | :--- |
| Accuracy vs Temperature | $\pm 50$ ppm $/{ }^{\circ} \mathrm{C}$ full scale calibration change <br> (including maximum offset change $)$ |
| Digital Input Points Required | $16(\mathrm{x})$ input points <br> $(12$ binary data bits, 2 channel ID bits) |
| Base Power Required 5VDC | 110 mA |
| External Power Supply | $5 \mathrm{~mA} \mathrm{maximum}+$,10 to +30 VDC |
| Operating Temperature | $32^{\circ}$ to $140^{\circ} \mathrm{F}\left(0\right.$ to $\left.60^{\circ} \mathrm{C}\right)$ |
| Storage Temperature | $-4^{\circ}$ to $158^{\circ} \mathrm{F}\left(-20^{\circ}\right.$ to $\left.70^{\circ} \mathrm{C}\right)$ |
| Relative Humidity | $5 \%$ to $95 \%$ (non-condensing) |
| Environmental Air | No corrosive gases permitted |
| Vibration | MIL STD 810 C 514.2 |
| Shock | MIL STD 810 C 516.2 |
| Noise Immunity | NEMA ICS3-304 |
| Terminal Type (included) | Removable; $\mathrm{D2}-810 \mathrm{CON}$ |

Note 1: Shields should be grounded at the signal source.
Note 2: Unused inputs should be jumpered together (i.e. CH4- to CH4+).
Note 3: More than one external power supply can be used provided the commons are connected together.


## Analog Voltage Input Modulles

F2-08AD-2 8-Channel Voltage Analog In

## $\$ 469.00$

| Number of Channels | 8, single ended (1 common) |
| :--- | :--- |
| Input Ranges | 0 to $5 \mathrm{~V}, 0$ to $10 \mathrm{~V}, \pm 5 \mathrm{~V}, \pm 10 \mathrm{VDC}$ |
| Resolution | 12 bit $(1$ in 4095$)$ uni-polar <br> 13 bit ( -40955 to 4095) bi-polar |
| Active Low-pass Filtering | -3 dB at 200 Hz, <br> $(-6 \mathrm{~dB}$ per octave) |
| Input Impedance | $>20 \mathrm{M} \Omega$ |
| Absolute Maximum Ratings | -75 to +75 VDC |
| Converter Type | Successive approximation |
| Conversion Time (PLC <br> Update Rate) | 8 channels per scan maximum <br> (D2-262 CPU) |
| Linearity Error (End to End) | $\pm 1$ count ( $0.025 \%$ of full scale) maximum |
| Input Stability | $\pm 1$ count |
| Full Scale Calibration Error | $\pm 3$ counts maximum |
| (offset error not included) | $\pm 1$ count maximum (0V input) |
| Offset Calibration Error | $1 \mathrm{~ms} \mathrm{to} 95 \%$ of F.S. change |
| Step Response |  |


| Maximum Inaccuracy | $\begin{aligned} & \pm .1 \% @ 77^{\circ} \mathrm{F}\left(25^{\circ} \mathrm{C}\right) \\ & \pm .3 \% 32^{\circ} \text { to } 140^{\circ} \mathrm{F}\left(0^{\circ} \text { to } 60^{\circ} \mathrm{C}\right) \end{aligned}$ |
| :---: | :---: |
| Accuracy vs Temperature | $\pm 50 \mathrm{ppm} /{ }^{\circ} \mathrm{C}$ maximum full scale (including max. offset change of 2 counts) |
| Digital Input Points Required | 16 (X) input points, (12 binary data bits, 3 channel ID bits, 1 sign bit, 1 diagnostic bit) |
| Base Power Required 5VDC | 100 mA |
| External Power Supply | 5 mA maximum, +10 to +30 VDC |
| Operating Temperature | $32^{\circ}$ to $140^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $\left.60^{\circ} \mathrm{C}\right)$ |
| Storage Temperature | $-4^{\circ}$ to $158^{\circ} \mathrm{F}\left(-20^{\circ}\right.$ to $70^{\circ} \mathrm{C}$ ) |
| 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 |
| Terminal Type (included) | Removable; D2-810CON |

Includes circuitry to automatically detect broken or open transmitters.


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

## Typical user wiring



Note 1: Shields should be grounded at the signal source.
Note 2: Connect all external power supply commons.
Note 3: Connect unused channels (CH5+, $\mathrm{CH}^{+}+\mathrm{CH}^{2}+$, $\mathrm{CH} 8+$ in this example) to OVDC.

## Temperature Input Modules

| F2-04RTD 4-Channel RTD In \$539.00 |  |
| :---: | :---: |
| Number of Channels | 4 |
| Input Ranges | Type Pt100: -200.0 to $850.0^{\circ} \mathrm{C},-328$ to $1562^{\circ} \mathrm{F}$ Type Pt1000: -200.0 to $595.0^{\circ} \mathrm{C},-328$ to $1103^{\circ} \mathrm{F}$ Type jPt100: -38.0 to $450.0^{\circ} \mathrm{C},-36$ to $842^{\circ} \mathrm{F}$ Type Cu-10 $/$ /Cu-25 $\Omega$ : -200.0 to $260.0^{\circ} \mathrm{C},-328$ to $500^{\circ} \mathrm{F}$ |
| Resolution | 16 bit (1 in 65535) |
| Display Resolution | $\pm 0.1^{\circ} \mathrm{C}, \pm 0.1^{\circ} \mathrm{F}( \pm 3276.7)$ |
| RTD Excitation Current | $210 \mu \mathrm{~A}$ |
| Input Type | Differential |
| Notch Filter | $>50 \mathrm{~dB}$ notches at $50 / 60 \mathrm{~Hz}$ $-3 \mathrm{~dB}=13.1 \mathrm{~Hz}$ |
| Maximum Setting Time | 100 ms (full-scale step input) |
| Common Mode Range | 0-5 VDC |
| Absolute Maximum Ratings | Fault protected inputs to $\pm 50 \mathrm{VDC}$ |
| Sampling Rate | 160 ms per channel |


| Converter Type | Charge Balancing |
| :--- | :--- |
| Linearity Error | $\pm .05^{\circ} \mathrm{C}$ maximum, $\pm .01^{\circ} \mathrm{C}$ typical |
| Maximum Inaccuracy | Type Pt100, Pt1000, jPt100: $\pm 1^{\circ} \mathrm{C}$ |
|  | 4 channel/scan max., $\mathrm{D} 2-262 \mathrm{Cu}-10 \Omega / \mathrm{Cu}-25 \Omega: \pm 5^{\circ} \mathrm{C}$ |
| Digital Input Points Required | 32 input points (16 binary data bits, <br> 2 channel ID bits, 4 fault bits) |
|  | 90 A |
| Operating Temperature | $32^{\circ}$ to $140^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $\left.60^{\circ} \mathrm{C}\right)$ |
| Storage Temperature | $-4^{\circ}$ to $158^{\circ} \mathrm{F}\left(-20^{\circ}\right.$ to $\left.70^{\circ} \mathrm{C}\right)$ |
| Temperature Drift | None (self-calibrating) |
| Relative Humidity | $5^{\circ} \%$ to $95 \%$ (non-condensing) |
| Environmental Air | No corrosive gases permitted |
| Vibration | MIL STD 810 C 514.2 |
| Shock | MIL STD 810 C 516.2 |
| Noise Immunity | NEMA ICS3-304 |
| Terminal Type (included) | Removable; D2-8IOCON |

Typical user wiring


## Temperature Input Modulles

| F2-04THIM 4-Cha | anne Thermocouple In 529.00 |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| General | Specifications | Thermoc | le Specifications |  |
| Number of Channels | 4, differential |  | Type J -190 to $760^{\circ} \mathrm{C}$ | $-310 \text { to } 1400^{\circ} \mathrm{F}$ |
| Common Mode Range | $\pm 5 \mathrm{VDC}$ |  | Type E -210 to $1000^{\circ} \mathrm{C}$ <br> Type K -150 to $1372^{\circ} \mathrm{C}$ | $\begin{aligned} & -346 \text { to } 1832^{\circ} \mathrm{F} \\ & -238 \text { to } 2502^{\circ} \mathrm{F} \end{aligned}$ |
| Common Mode Rejection | 90dB min. @ DC, 150dB min. @ 50/60 Hz. |  | Type R 65 to $1768^{\circ} \mathrm{C}$ | 149 to $3214^{\circ} \mathrm{F}$ |
| Input Impedance | $1 \mathrm{M} \Omega$ | Input Ranges | Type S 65 to $1768^{\circ} \mathrm{C}$ <br> Type T -230 to $400^{\circ} \mathrm{C}$ | $\begin{aligned} & 149 \text { to } 3214^{\circ} \mathrm{F} \\ & -382 \text { to } 752^{\circ} \mathrm{F} \end{aligned}$ |
| Absolute Maximum Ratings | Fault-protected inputs to $\pm 50 \mathrm{VDC}$ |  | Type B 529 to $1820^{\circ} \mathrm{C}$ | 984 to $3308^{\circ} \mathrm{F}$ -94 to $2372^{\circ} \mathrm{F}$ |
| Accuracy vs. Temperature | $\pm 5 \mathrm{ppm} /{ }^{\circ} \mathrm{C}$ maximum full scale calibration (including maximum offset change) |  | Type C 65 to $2320^{\circ} \mathrm{C}$ | $149 \text { to } 4208^{\circ} \mathrm{F}$ |
|  | 4 channels per scan max. | Display Resolution | $\pm 0.1^{\circ} \mathrm{C}$ or $\pm 0.1^{\circ} \mathrm{F}$ |  |
| PLC Update Rate | D2-262 CPU | Cold Junction Compensation | Automatic |  |
| Digital Input Points Required | 32 (X) input points (16 binary data bits, 2 channel ID bits, 4 diagnostic bits) | Conversion Time | 100 ms per channel |  |
|  |  | Warm-Up Time | 30 minutes typically $\pm$ | repeatability |
| External Power Supply | 60 mA maximum, 18 to 26.4 VDC | Linearity Error (End to End) | $\pm .05^{\circ} \mathrm{C}$ maximum, $\pm .01$ | typical |
| Base Power Required 5VDC | 110 mA | Maximum Inaccuracy | $\pm 3^{\circ} \mathrm{C}$ (excluding thermo | uple error) |
| Operating Temperature | $32^{\circ}$ to $140^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $\left.60^{\circ} \mathrm{C}\right)$ | Naximum Inaccuracy | $\pm$ (excluding themoco | ( |
| Storage Temperature | $-4^{\circ}$ to $158^{\circ} \mathrm{F}\left(-20^{\circ}\right.$ to $\left.70^{\circ} \mathrm{C}\right)$ |  |  |  |
| Relative Humidity | 5 to 95\% (non-condensing) | Voltage Ranges | O-5V, $\pm 5 \mathrm{~V}, 0-156.25 \mathrm{mV}$ | 56.25 mVDC |
| Environmental Air | No corrosive gases permitted | Resolution | 16-bit (1 in 65535) |  |
| Environmental Air | No corrosive gases permitted | Full Scale Calibration Error (Offset |  |  |
| Vibration | MIL STD 810C 514.2 | Error Included) | $\pm 13$ counts typical $\pm 33$ | ximum |
| Shock | MIL STD 810C 516.2 | Offset Calibration Error | $\pm 1$ count maximum, @ | input |
| Noise Immunity | NEMA ICS3-304 | Linearity Error (End to End) | $\pm 1$ count maximum |  |
| Terminal Type (included) | Non-removable | Maximum Inaccuracy | $\pm .02 \%$ @ $25^{\circ} \mathrm{C}\left(77^{\circ} \mathrm{F}\right)$ |  |


| CPU Firmware Required |  |
| :--- | :--- |
| CPU | Firmware Required |
| D2-250 | V1.06 |
| D2-250-1 | All firmware versions work |
| D2-262 | Version 1.0 or later |



## Analog Current Output Modules

| F2-02DA-1 2-Channel 4-20mA Analog Output <br> $\$ 282.00$ |  |
| :---: | :---: |
| This module requires a $24 \mathrm{~V} D \mathrm{DC}$ user power supply for operation. |  |
| Number of Channels | 2 |
| Output Ranges | 4 to 20 mA |
| Resolution | 12-bit (1 in 4096) |
| Output Type | Single ended, one common |
| Digital Output Points Required | 16 (Y) output points <br> (12 binary data bits, 2 channel ID bits) |
| Maximum Loop Supply | 30VDC |
| Peak Output Voltage | 40VDC <br> (clamped by transient voltage suppressor) |
| Load Impedance | Zero $\Omega$ minimum |
| Maximum Load/Power Supply | 620 / /18V, $910 \Omega / 24 \mathrm{~V}, 1200 \Omega / 30 \mathrm{~V}$ |
| PLC Update Rate | 2 channels per scan maximum (D2-262 CPU) |
| Linearity Error (end to end) | $\pm 1$ count ( $\pm 0.025 \%$ of full scale) maximum |
| Conversion Settling Time | $100 \mu \mathrm{~s}$ maximum (full scale change) |
| Full Scale Calibration Error (offset error included) | $\pm 5$ counts max., $20 \mathrm{~mA} @ 77^{\circ} \mathrm{F}\left(25^{\circ} \mathrm{C}\right)$ |
| Offset Calibration Error | $\pm 3$ counts max., 4mA @ $77^{\circ} \mathrm{F}\left(25 \mathrm{C}^{\circ}\right)$ |


| Accuracy vs. Temperature | $\pm 50$ ppm $/{ }^{\circ} \mathrm{C}$ full scale calibration change <br> (including maximum offset change of 2 <br> counts) |
| :--- | :--- |
| Maximum Inaccuracy | $0.1 \% ~ @ ~$ <br> 0 <br> $0.3 \%$ <br> 0$\left(25^{\circ} \mathrm{C}\right)$ |
| Base Power Required 5VDC | 40 mA |
| External Power Supply $140^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $\left.60^{\circ} \mathrm{C}\right)$ |  |
| Operating Temperature | $24 \mathrm{VDC}, 60 \mathrm{~mA}$. <br> (add 20 mA for each current loop used) |
| Storage Temperature | $32^{\circ}$ to $140^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $\left.60^{\circ} \mathrm{C}\right)$ |
| Relative Humidity | -4 to $158^{\circ} \mathrm{F}\left(-20\right.$ to $\left.70^{\circ} \mathrm{C}\right)$ |
| Environmental Air | $5 \%$ to $95 \%$ (non-condensing) |
| Vibration | No corrosive gases permitted |
| Shock | MLL STD 810 C 514.2 |
| Noise Immunity | MIL STD 810 C 516.2 |
| Terminal Type (included) | NEMA ICS3-304 |
|  | Removable; D2-810CON |

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


NOTE 1: Shields should be connected to the OV of the module or the OV of the $\mathrm{R} / \mathrm{S}$.
NOTE 2: Unused current outputs should remain open (no connections) for minimum power consumption.


## Analog Currrent Output Modules

## F2-02DAS-1 2-Channel Isolated 4-20mA

 Analog Output \$393.00| Number of Channels | 2, isolated |
| :--- | :--- |
| Output Ranges | 4 to 20 mA |
| Resolution | 16 bit (1 in 65536) |
| Output Type | 32 (Y) output points <br> 16 binary data bits, 2 channel ID bits, <br> 1 output enable bit) |
| Digital Output Points <br> Required | $\pm 750 \mathrm{~V}$ continuous, channel to channel, <br> channel to logic |
| Isolation Voltage | 100 mA |
| Base Power Required 5VDC | $18-32 \mathrm{VDC}$ |
| Loop Supply | $18-32 \mathrm{VDC} @ 50 \mathrm{~mA}$ per channel |
| External Power Supply | Vin - 2.5 V |
| Output Loop Compliance | $525 \Omega$ |
| Max Load Impedance | $375 \Omega / 12 \mathrm{~V}, 975 \Omega / 24 \mathrm{~V}, 1375 \Omega / 32 \mathrm{~V}$ |
| Maximum Load/ Power |  |
| Supply | 2 channels per scan maximum <br> $(\underline{\mathrm{D} 2-262 ~ \mathrm{CPU})}$ |
| PLC Update Rate | $3 \mathrm{~ms} \mathrm{to} \mathrm{0.1} \mathrm{\%} \mathrm{of} \mathrm{full} \mathrm{scale}$ |
| Conversion Settling Time |  |


| Linearity Error (end to end) | $\pm 10$ count $( \pm 0.015 \%$ of full scale) maximum |
| :--- | :--- |
| Gain Calibration Error | \pm 32 counts ( $\pm 0.05 \%)$ |
| Offset Calibration Error | $\pm 13$ counts $( \pm 0.02 \%)$ |
| Output Drift | 50 ppm $/{ }^{\circ} \mathrm{C}$ |
| Maximum Inaccuracy | $0.07 \% @ 25^{\circ} \mathrm{C}\left(77^{\circ} \mathrm{F}\right)$ |
| $0.18 \% 0$ to $60^{\circ} \mathrm{C}\left(32^{\circ}\right.$ to $\left.140^{\circ} \mathrm{F}\right)$ |  |
| Operating Temperature | $0^{\circ}$ to $60^{\circ} \mathrm{C}\left(32^{\circ}\right.$ to $\left.140^{\circ} \mathrm{F}\right)$ |
| Storage Temperature | $-20^{\circ}$ to $70^{\circ} \mathrm{C}\left(-4^{\circ}\right.$ to $\left.158^{\circ} \mathrm{F}\right)$ |
| Relative Humidity | $5 \%$ to $95 \%$ (non-condensing) |
| Environmental air | No corrosive gases permitted |
| Vibration | MIL STD 810 C 514.2 |
| Shock | MIL STD 810 C 516.2 |
| Noise Immunity | NEMA ICS3-304 |
| Terminal Type (included) | Removable; $\underline{\text { D2-810CON }}$ |

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


## Analog Currrent Output Modules

## F2-08DA-1 8-Channel 4-20mA Analog Output \$535.00

| Number of Channels | 8, single-ended |
| :--- | :--- |
| Output Ranges | 4 to 20 mA |
| Resolution | 12 -bit (1 in 4096) |
| Output Type | Current sinking or current sourcing |
| Digital Output Points <br> Required | $16(\mathrm{Y})$ output points <br> $(12$ binary data bits, 3 channel ID bits, 1 output <br> enable bit) |
| Base Power Required 5VDC | 30 mA |
| Maximum Loop VoItage | 30 VDC |
| External Power Supply | 18 to $30 \mathrm{VDC}, 50 \mathrm{~mA} .$, class 2 <br> (add 20mA for each current loop used) |
| Source Load | $0-400 \Omega$ @ $18-30 \mathrm{VDC}$ |
| Sink Load | $0-600 \Omega / 18 \mathrm{~V}, 0-900 \Omega / 24 \mathrm{~V}, 0-1200 \Omega / 30 \mathrm{~V}$ |
| Total Load (sink + source) | $600 \Omega / 18 \mathrm{~V}, 900 \Omega / 24 \mathrm{~V}, 1200 \Omega / 30 \mathrm{~V}$ |
| PLC Update Rate | 8 channels per scan maximum <br> $(\mathrm{D2} 262 \mathrm{CPU})$ |
| Conversion Settling Time | $400 \mu \mathrm{~s} \mathrm{maximum} \mathrm{(full} \mathrm{scale} \mathrm{change)}$ |

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

| Linearity Error (end to end) | $\pm 2$ count ( $\pm 0.050 \%$ of full scale) maximum |
| :---: | :---: |
| Full Scale Calibration Error | $\pm 12$ counts max. sinking @ any load $\pm 12$ counts max. sourcing @ $125 \Omega$ load $\pm 18$ counts max. sourcing @ $250 \Omega$ load <br> $\pm 26$ counts max. sourcing @ $400 \Omega$ load |
| Offset Calibration Error | $\pm 9$ counts max. sinking @ any load <br> $\pm 9$ counts max. sourcing @ $125 \Omega$ load <br> $\pm 11$ counts max. sourcing @ $250 \Omega$ load <br> $\pm 13$ counts max. sourcing @ $400 \Omega$ load |
| Maximum Full Scale Inaccuracy @ $60^{\circ} \mathrm{C}$ | $0.5 \%$ sinking (any load) sinking \& sourcing @ $125 \Omega$ load <br> 0.64\% sourcing @ $250 \Omega$ load <br> 0.83\% sourcing @ 400 $\Omega$ load |
| Maximum Full Scale Inaccuracy @ $25^{\circ} \mathrm{C}$ (Incudes all errors and temp drift) | $0.3 \%$ sinking (any load) sinking \& sourcing @ $125 \Omega$ load <br> 0.44\% sourcing @ 250 $\Omega$ load <br> 0.63\% sourcing @ 400 $\Omega$ load |
| Operating Temperature | $32^{\circ}$ to $140^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $60^{\circ} \mathrm{C}$ ) |
| Storage Temperature | -4 to $158^{\circ} \mathrm{F}\left(-20\right.$ to $\left.70^{\circ} \mathrm{C}\right)$ |
| 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 |
| Terminal Type (included) | Removable; D2-1610CON |

Typical user wiring


NOTE 1: Shields should be connected to the OV of the module.

## Analog Voltage Output Modules

## F2-02DA-2 2-Channel Voltage Analog Output $\$ 295.00$

This module requires a 24 VDC user power supply for operation. All other specifications are the same.

| Number of Channels | 2 |
| :--- | :--- |
| Output Ranges | 0 to $5 \mathrm{~V}, 0$ to $10 \mathrm{~V}, \pm 5 \mathrm{~V}, \pm 10 \mathrm{~V}$ |
| Resolution | 12 -bit (1 in 4096) |
| Output Type | Single ended, 1 common |
| Digital Output Points <br> Required | 16 (Y) output points <br> $(12$ binary data bits, 2 channel ID bits) |
| Peak Output Voltage | 15 VDC (clamped by transient voltage <br> suppressor) |
| Load Impedance | $2000 \Omega$ minimum |
| Load Capacitance | $0.01 \mu \mathrm{~F}$ maximum |
| PLC Update Rate | 2 channels per scan, maximum |
| $(\underline{\mathrm{D} 2-262 ~ \mathrm{CPU})}$ |  |


| Accuracy vs. Temperature | $\pm 50$ ppm $/{ }^{\circ} \mathrm{C}$ full scale calibration change <br> (including maximum offset change of 2 <br> counts) |
| :--- | :--- |
| Maximum Inaccuracy | $+0.3 \%$ unipolar ranges @ $77^{\circ} \mathrm{F}\left(25^{\circ} \mathrm{C}\right)$ <br> $\pm 0.45 \%$ unipolar ranges $>77^{\circ} \mathrm{F}\left(25^{\circ} \mathrm{C}\right)$ <br> $\pm 0.4 \%$ bipolar ranges @ $777^{\circ} \mathrm{F}\left(25^{\circ} \mathrm{C}\right)$ <br> $\pm 0.55 \%$ bipolar ranges $>77^{\circ} \mathrm{F}\left(25^{\circ} \mathrm{C}\right)$ |
| Base Power Required 5VDC | 40 mA |
| External Power Supply | $24 \mathrm{VDC}, 60 \mathrm{~mA}$ (outputs fully loaded) |
| Operating Temperature | $32^{\circ}$ to $140^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $\left.60^{\circ} \mathrm{C}\right)$ |
| Storage Temperature | $-4^{\circ}$ to $158^{\circ} \mathrm{F}\left(-20^{\circ}\right.$ to $\left.70^{\circ} \mathrm{C}\right)$ |
| Relative Humidity | $5 \%$ to $95 \%$ (non-condensing) |
| Environmental Air | No corrosive gases permitted |
| Vibration | MIL STD 810 C 514.2 |
| Shock | MIL STD 810 C 516.2 |
| Noise Immunity | NEMA ICS3-304 |
| Terminal Type (included) | Removable; D2-810CON |

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


## Analog Voltage Output Modules

| F2-02DAS-2 2-Channel 0-5V, 0-10V |  |
| :---: | :---: |
| Isolated Analog Output \$428.00 |  |
| Number of Channels | 2, isolated |
| Output Ranges | 0-5 V, 0-10 V |
| Resolution | 16-bit (1 in 65536) |
| Output Type | Sourced through external loop supply |
| Digital Output Points Required | 32 (Y) output points (16 binary data bits, 2 channel ID bits) |
| Isolation Voltage | $\pm 750 \mathrm{~V}$ continuous, channel to channel, channel to logic |
| Base Power Required 5VDC | 60 mA |
| External Power Supply | 21.6-26.4 VDC @ 60mA per channel |
| Load Impedance | $2 \mathrm{k} \Omega$ min. |
| PLC Update Rate | 2 channels per scan, maximum (D2-262 CPU) |
| Conversion Settling Time | $3 \mathrm{~ms} \mathrm{to} 0.1 \%$ of full scale |

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


| Linearity Error (end to end) | $\pm 10$ count $( \pm 0.015 \%$ of full scale) maximum |
| :--- | :--- |
| Gain Calibration Error | \pm 32 counts ( $\pm 0.05 \%)$ |
| Offset Calibration Error | \pm 13 counts ( $\pm 0.02 \%)$ |
| Output Drift | 50 ppm $/{ }^{\circ} \mathrm{C}$ |
| Maximum Inaccuracy | $0.07 \% @ 25^{\circ} \mathrm{C}\left(77^{\circ} \mathrm{F}\right)$ |
| $0.18 \% 0$ to $60^{\circ} \mathrm{C}\left(32^{\circ}\right.$ to $\left.140^{\circ} \mathrm{F}\right)$ |  |
| Operating Temperature | $0^{\circ}$ to $60^{\circ} \mathrm{C}\left(32^{\circ}\right.$ to $\left.140^{\circ} \mathrm{F}\right)$ |
| Storage Temperature | $-20^{\circ}$ to $70^{\circ} \mathrm{C}\left(-4^{\circ}\right.$ to $\left.158^{\circ} \mathrm{F}\right)$ |
| Relative Humidity | 5 to $95 \%$ (non-condensing) |
| Environmental air | No corrosive gases permitted |
| Vibration | MIL STD 810 C 514.2 |
| Shock | MIL STD 810 C 516.2 |
| Noise Immunity | NEMA ICS3-304 |
| Terminal Type (included) | Removable; D2-810CON |



## Analog Voltage Output Modules

## F2-08DA-2 8-Channel Voltage Analog Output $\$ 482.00$

| Number of Channels | 8, single-ended, 1 common |
| :---: | :---: |
| Output Ranges | 0 to 5V, 0 to 10V |
| Resolution | 12-bit (1 in 4096) |
| Output Type | Voltage sourcing |
| Digital Output Points Required | 16 (Y) output points (12 binary data bits, 3 channel ID bits, 1 output enable bit) |
| Base Power Required 5VDC | 60 mA |
| External Power Supply | 21.6-26.4 VDC, 140mA (outputs fully loaded) |
| Peak Output Voltage | 15VDC <br> (clamped by transient voltage suppressor) |
| Load Impedance | 1-10k $\Omega$ |
| Load Capacitance | $0.01 \mu \mathrm{~F}$ maximum |
| PLC Update Rate | 8 channels per scan maximum (D2-262 CPU) |
| Conversion Settling Time | $400 \mu \mathrm{~s}$ maximum (full scale change) 4.5 ms to 9 ms for digital out to analog out |


| Linearity Error (end to end) | $\pm 1$ count ( $\pm 0.025 \%$ of full scale) maximum |
| :--- | :--- |
| Full Scale Calibration Error | $\pm 12$ counts max. unipolar @ $25^{\circ} \mathrm{C}\left(77^{\circ} \mathrm{F}\right)$ |
| Offset Calibration Error | $\pm 3$ counts max., unipolar @ $25^{\circ} \mathrm{C}\left(77^{\circ} \mathrm{F}\right)$ |
| Accuracy vs. Temperature | $\pm 57$ ppm/ $/{ }^{\circ} \mathrm{C}$ full scale calibration change <br> (including maximum offset change of 2 <br> counts) |
| Maximum Inaccuracy | $\pm 0.3 \% ~ @ ~$ <br> $\pm 5^{\circ} \mathrm{C}\left(77{ }^{\circ} \mathrm{F}\right)$ <br> $\pm 0.45 \% ~ @ ~$ <br> $0.60^{\circ} \mathrm{C}\left(32-140^{\circ} \mathrm{F}\right)$ |
| Operating Temperature | $0^{\circ}$ to $60^{\circ} \mathrm{C}\left(32^{\circ}\right.$ to $\left.140^{\circ} \mathrm{F}\right)$ |
| Storage Temperature | $-20^{\circ}$ to $70^{\circ} \mathrm{C}\left(-4^{\circ}\right.$ to $\left.158^{\circ} \mathrm{F}\right)$ |
| Relative Humidity | 5 to $95 \%$ (non-condensing) |
| Environmental air | No corrosive gases permitted |
| Vibration | MIL STD 810C 514.2 |
| Shock | MLL STD 810 C 516.2 |
| Noise Immunity | NEMA ICS3-304 |
| Terminal Type (included) | Removable; D2-810CON |

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


## Analog In/Out Combination Module

| F2-4AD2DA 4-Channel Analog Input |  |
| :---: | :---: |
| 2-Channel Ana | 00 Output \$505.00 |
| Number of Input Channels | 4, single-ended (1 common) |
| Number of Output Channels | 2, single-ended (1 common) |
| Ranges | 4 to 20 mA current (current sinking) |
| Resolution | 12 bit (1 in 4096) |
| Peak Withstanding Voltage | 75VDC, current outputs |
| Maximum Continuous Overload | -40 to +40 mA , each current output |
| Input Impedance | $\begin{aligned} & 250 \Omega, \pm 0.1 \%, 1 / 2 \mathrm{~W}, \\ & 25 \mathrm{ppm} /{ }^{\circ} \mathrm{C} \text { current input resistance } \end{aligned}$ |
| External Load Resistance | $0 \Omega$ minimum, current outputs |
| Maximum Loop Supply | 30VDC |
| Recommended Fuse | 0.032 A, series 217 fast-acting, current inputs |
| Maximum Load/Power Supply | $910 \Omega / 24 \mathrm{~V}$, current outputs $620 \Omega / 18 \mathrm{~V}, 1200 \Omega / 30 \mathrm{~V}$ |
| Active Low-pass Filter | -3dB @ 20Hz, 2 poles (-12 dB per octave) |
| Linearity Error (best fit) | $\pm 1$ count ( $\pm 0.025 \%$ of full scale) maximum |
| Output Settling Time | $100 \mu$ s maximum (full scale change) |

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

| Accuracy vs. Temperature | $\pm 50 \mathrm{ppm} /{ }^{\circ} \mathrm{C}$ full scale calibration change (including maximum offset change) |
| :---: | :---: |
| Maximum Inaccuracy | $\begin{aligned} & \pm 0.1 \% \text { @ } 777^{\circ} \mathrm{F}\left(25^{\circ} \mathrm{C}\right) \\ & \pm 0.3 \% \text { to } 32140^{\circ} \mathrm{F}\left(0 \text { to } 60^{\circ} \mathrm{C}\right) \end{aligned}$ |
| Digital Input and Output Points Required | 16 (X) input points (12 binary data bits, 2 channel ID bits, 2 diagnostic bits) 16 (Y) output points (12 binary data bits, 2 channel enable bits) |
| PLC Update Rate | 4 channels per scan maximum: <br> (D2-250-1 and D2-262 CPUs) <br> 2 output channels per scan maximum: <br> (D2-262 CPU) |
| Base Power Required 5VDC | 90 mA |
| External Power Supply Requirement | 18-26.4 VDC @ 80mA 20 mA per loop |
| Operating Temperature | $32^{\circ}$ to $140^{\circ} \mathrm{F}\left(0^{\circ}\right.$ to $60^{\circ} \mathrm{C}$ ) |
| Storage Temperature | $-4^{\circ}$ to $158^{\circ} \mathrm{F}\left(-20^{\circ}\right.$ to $\left.70^{\circ} \mathrm{C}\right)$ |
| 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 |
| Terminal Type (included) | Removable; $\underline{\text { D2-81OCON }}$ |

Note 1: Shields should be connected at their respective signal source.
Note 2: Unused channel should remain open for minimum power consumption.
Note 3: More than one external power supply can be used provided the power supply commons are connected.
Note 4: A Series $217,0.032 \mathrm{~A}$ fast-acting fuse is recommended for $4-20 \mathrm{~mA}$ current input loops.
Note 5: If the power supply common of an external power supply is not connected to O VDC on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20 $m A$ transmitter types are:
2 or 3 wire: isolation between Input signal and power supply
4 wire: Isolation between input signal, power supply, and $4-20 \mathrm{~mA}$ output.

## Typical user wiring



Note 6: If an analog channel is connected backwards, then erroneous data values will be returned for that channel.
Note 7: To avoid small errors due to terminal block losses, connect O VDC, IN., and OUT. on the terminal block as shown. The module's internal connection alone of these nodes is not sufficient to permit module performance up to the accuracy specifications.
Note 8: Choose an output transducer resistance according to the maximum load/power listed in the Output Specifications.

## Analog In/Out Combination Module

Requires D2-250-1 or D2-262 CPU.

| F2-8ADADA-1 8-Channel analog Current lnput |  |
| :---: | :---: |
| 4-Channel An8log C | urrent Output \$634.00 |
| Input Channels per Module | 8 , single ended (one common) |
| Input Range | 0 to 20 mA |
| Resolution | 12, 14, 16-bit selectable |
| External DC Power Required | 100mA @ 18-26.4 VDC |
| Max. Continuous Overload | $\pm 45 \mathrm{~mA}$ |
| Input Impedance | $100 \Omega 0.1 \% 1 / 4 \mathrm{~W}$ |
| Filter Characteristics | Active low pass, -3dB @ 80Hz |
| Conversion Time | $\begin{aligned} & 12 \text {-bit }=1.5 \mathrm{~ms} \text { per channel } \\ & 14 \text {-bit }=6 \mathrm{~ms} \text { per channel } \\ & 16 \text {-bit }=25 \mathrm{~ms} \text { per channel } \end{aligned}$ |
| Conversion Method | Over sampling successive approximation |
| Accuracy vs. Temperature | $\pm 25 \mathrm{ppm} /{ }^{\circ} \mathrm{C}$ Max. |
| Maximum Inaccuracy | 0.1\% of range |
| Linearity Error (End to End) | $\begin{aligned} & 12 \text {-bit }= \pm 2 \text { count max. }( \pm 0.06 \% \text { of range }) \\ & 14 \text {-bit }= \pm 10 \text { count max. ( } \pm 0.06 \% \text { of range }) \\ & 16 \text {-bit }= \pm 20 \text { count max. }( \pm 0.06 \% \text { of range }) \\ & \text { Monotonic with no missing codes } \end{aligned}$ |
| Full Scale Calibration Error (not including offset error) | $\pm 0.07 \%$ of range max. |
| Offset Calibration Error | $\pm 0.03 \%$ of range max. |
| Rec. Fuse (external) | 0.032 A, Littelfuse Series 217 fast-acting |
| Base Power Required 5VDC | 35 mA |


| Output Channels per Module | 4 |
| :---: | :---: |
| Output Range | 4 to 20 mA |
| Resolution | 16-bit, $0.244 \mathrm{~mA} / \mathrm{bit}$ |
| Output Type | Current sourcing at 20 mA , max. |
| Load Impedance | 0-750 $\Omega$ |
| Max. Inaccuracy | 0.25\% of range |
| Max. Full Scale Calibration Error (not incl. offset error) | $\pm 0.075 \%$ of range max. |
| Max. Offset Calibration Error | $\pm 0.1 \%$ of range max. |
| Accuracy vs. Temperature | $\pm 25 \mathrm{ppm} /{ }^{\circ} \mathrm{C}$ max. full scale calibration change <br> $\left( \pm 0.0025 \%\right.$ of range $/{ }^{\circ} \mathrm{C}$ ) |
| Max. Crosstalk at DC, 50/60Hz | -70dB, 1 LSB |
| Linearity Error (End to End) | $\pm 1$ count max. ( $\pm 0.025 \%$ of full scale) Monotonic with no missing codes |
| Output Stability and Repeatability | $\pm 1$ LSB after 10 minute warm-up typical |
| Output Ripple | 0.005\% of full scale |
| Output Settling Time | $0.5 \mathrm{~ms} \mathrm{max.} ,5 \mu \mathrm{~s}$, min. (full scale change) |
| Max. Continuous Overload | Outputs open circuit protected |
| Type of Output Protection | Electronically current limited to 20 mA or less |
| Output Signal at Power-up and Power-down | 4mA |
| Terminal Type (included) | Removable; D2-1610CON |



Note 2: Connect shields to the 0 V of the module; do not connect both ends of shield.

## Analog In/Out Combination Module

Requires D2-250-1 or D2-262 CPU.

## F2-8AD4DA-2 8-Channel Analog Voltage Input 4-Channel Analog Voltage Output $\$ 626.00$

| Input Channels per Module | 8 , single ended (one common) |
| :---: | :---: |
| Input Range | 0 to 10 V |
| Resolution | 12, 14, 16-bit selectable |
| External DC Power Required | 80mA @ 18-26.4 VDC |
| Max. Continuous Overload | $\pm 100 \mathrm{~V}$ |
| Input Impedance | >10M $\Omega$ |
| Filter Characteristics | Active low pass, -3dB @ 80Hz |
| Conversion Time | $\begin{aligned} & 12 \text {-bit }=1.5 \mathrm{~ms} \text { per channel } \\ & 14 \text {-bit }=6 \mathrm{~ms} \text { per channel } \\ & 16 \text {-bit }=25 \mathrm{~ms} \text { per channel } \end{aligned}$ |
| Conversion Method | Over sampling successive approximation |
| Accuracy vs. Temperature | $\pm 50 \mathrm{ppm} /{ }^{\circ} \mathrm{C}$ Max. |
| Maximim Inaccuracy | 0.1\% of range |
| Linearity Error (End to End) | $\begin{aligned} & 12 \text {-bit }= \pm 1 \text { count max. }( \pm 0.025 \% \text { of range }) \\ & 14 \text {-bit }= \pm 4 \text { count max. ( } \pm 0.025 \% \text { of range) } \\ & 16 \text {-bit }= \pm 16 \text { count max. ( } \pm 0.025 \% \text { of range }) \\ & \text { Monotonic with no missing codes } \end{aligned}$ |
| Full Scale Calibration Error (not including offset error) | $\pm 0.075 \%$ of range max. |
| Offset Calibration Error | $\pm 0.025 \%$ of range max. |
| Base Power Required 5VDC | 35 mA |


| Output Channels per Module | 4 |
| :---: | :---: |
| Output Range | 0-5 V, 0-10 V |
| Resolution | 16-bit |
| Output Type | Voltage sourcing/sinking at 10 mA max. |
| Load Impedance | >1000 ${ }^{\text {a }}$ |
| Max. Inaccuracy | 0.15\% of range |
| Max. Full Scale Calibration Error (not incl. offset error) | $\pm 0.075 \%$ of range max. |
| Max. Offset Calibration Error | $\pm 0.025 \%$ of range max. |
| Accuracy vs. Temperature | $\pm 50 \mathrm{ppm} /{ }^{\circ} \mathrm{C}$ max. full scale calibration change $\left( \pm 0.005 \% \text { of range } /{ }^{\circ} \mathrm{C}\right)$ |
| Max. Crosstalk <br> @ DC, 50/60Hz | -70dB, 1 LSB |
| Linearity Error (End to End) | $\pm 1$ count max. ( $\pm 0.025 \%$ of full scale) Monotonic with no missing codes |
| Output Stability and Repeatability | $\pm 1$ LSB after 10 minute warm-up typical |
| Output Ripple | 0.005\% of full scale |
| Output Settling Time | $0.5 \mathrm{~ms} \mathrm{max}$. . $5 \mu \mathrm{~s}$ min. (full scale change) |
| Max. Continuous Overload | Outputs current limited to 15mA typical |
| Type of Output Protection | 1VDC peak output voltage (clamped by transient voltage suppressor) |
| Output Signal at <br> Power-up and Power-down | OV |
| Terminal Type (included) | Removable; D2-1610CON |



## DL205 Instruction Set

Store (STR)
Begins a new rung or an additional branch in a rung with a normally open contact.
Store Not (STRN)
Begins a new rung or an additional branch in a rung with a
normally closed contact.
Store Bit-of-Word (STRB)
D2-250-1 and D2-262 only. Begins a new rung or an additional
branch in a rung with a normally open contact
Store Not Bit-of-Word (STRNB)
D2-250-1 and D2-262 only. Begins a new wrung or an additional
Or (OR)
Logically ORs a normally open contact in parallel with another
contact in a rung.
Logically ORs a normally closed contact in parallel with another contact in a rung.
Or Bit-of-Word (ORB)
D2-250-1 and D2-262 only. ORs a normally open contact in parallel
with another contact in a rung.
Or Not Bit-of-Word (ORNB)
D2-250-1 and D2-262 only. ORs a normally closed contact in parallel with another contact in a rung
And (AND)
Logically ANDs a normally open contact in series with another And Not (ANDN)
Logically ANDs a normally closed contact in series with another contact in a rung.
And Bit-of-Word (ANDB)
D2-250-1 and D2-262 only. ANDs a normally open contact in series with another contact in a rung.
And Not Bit-of-Word (ANDNB)
D2-250-1 and D2-262 only. 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/ referencing the samage register. Multiple OR OUT instructions
Out Bit-of-Word (OUTB)
D2-250-1 and D2-262 only. Reflects status of the rung (on/off) and outputs the discrete (on/off) state to the specified bit in the referenced memory location
Not (NOT)
D2-250-1 and D2-262 only. Inverts the status of the rung at the
positive differential (PD)
Positive differential (PD)
One-shot output coil. When the input logic produces an off to on Dite
Store Positive Differential (STRPD)
D2-250-1 and D2-262 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)
D2-250-1 and D2-262 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 (ORPD)
D2-250-1 and D2-262 only. Logically ORs a leading edge triggered
one-shot contact in parallel with another contact in a rung
Or Negative Differential (ORND)
D2-250-1 and D2-262 only. Logically ORs a trailing edge triggered
one-shot contact in parallel with another contact in a rung.
And Positive Differential (ANDPD)
D2-250-1 and D2-262 only. Logically ANDs a leading edge
nger in series with another contact in a rung.
D2-250-1 and D2-262 only. Logically ANDs a trailing edge triggered one-shot contact in series with another contact in a rung.
Set (SET)
An output that turns on a point or a range of points. The reset instruction is used to turn the point(s) OFF that were set ON with the set instruction.
Reset (RST)
An output that resets a point or a range of points.
Set Bit-of-Word (SETB)
D2-250-1 and D2-262 only. Sets or turns on a bit in a V-memory
Reset Bit-of-Word (RSTB)
D2-250-1 and D2-262 only. Resets or turns off a bit in a V-memory location.
Pause outputs (PAUSE)
Disables the update for a range of specified output points.

## Comparative Boolean Instructions

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

Or if Equal (OR
Connects a normally open comparative contact in parallel with another contact. The contact will be on when $A=B$.
Or if Not Equal (ORNE)
Connects a normally closed comparative contact in parallel with another contact. The contact will be on when $A$ is not equal to $B$.
And if Equal (ANDE)
Connects a normally open comparative contact in series with another contact. The contact will be on when $\mathrm{A}=\mathrm{B}$.
And if Not Equal (ANDNE)
Connects a normally closed comparative contact in series with
Store (STR)
Begins a new rung or additional branch in a rung with a normally open comparative contact. The will be on when $A \geq B$.

Begins a new rung or additional branch in a rung with a normally
Or (OR)
Connects a normally open comparative contact in parallel with
another contact. The contact will be on when $A \geq B$.
Or Not (ORN)
Connects a normally open comparative contact in parallel with And (AND)
Connects a normally open comparative contact in series with another contact. The contact will be on when $\mathrm{A} \geq \mathrm{B}$.
And Not < (ANDN)
Connects a normally closed comparative contact in parallel with another contact. The contact will be on when $\mathrm{A}<\mathrm{B}$

## Immediate Instruction

Store Immediate (STRI)
Begins a rung/branch of logic with a normally open contact. The contact will be updated with the current input field status when processed in the program scan.
Begins a rung/branch of logic with a normally closed contact. The contact will be updated with the current input field status when
processed in the program scan.
Or Immediate (ORI)
Connects a normally open contact in parallel with another contact. The contact will be updated with the current input field status when processed in the program scan
Connects a normally closed contact in parallel with another contact. The contact will be updated with the current input field status when processed in the program scan.
And Immediate (ANDI)
Connects a normally open contact in series with another contact. The contact will be updated with the current input field status when processed in the program scan.
And Not Immediate (ANDNI)
Connects a normally closed contact in series with another contact. The contact will be updated with the current input field status when processed in the program
ut Immediate (OUTI)
Reflects the status of the rung. The output field device status is Reflects the status of the rung. The output field device status is
updated when the instruction is processed in the program scan.
Or Out Immediate (OROUTI)
Reflects the status of the rung and outputs the discrete (ON/ OFF) state to the image register. Multiple OR OUT instructions referencing the same discrete point can be used in the program. The output field device status is updated when the instruction is processed in the program scan.
Out Immediate Formatted (OUTIF)
D2-262 only. Outputs the contents of the accumulator to a specified number of consecutive outputs The output field devices are

Set Immediate (SETI)
An output that turns on a point or a range of points. The reset
instruction is used to turn the point(s) off that were set The field device status is updated when the instruction is processed in the program scan.
Reset Immediate (RSTI)
An output that resets a point or a range of points. The output field device status is updated when the instruction is processed in the program scan.
Load Immediate (LDI)
D2-262 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)
D2-262 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.
Timer, Counter, and Shift Register Instructions
Timer (TMR)
single input incremental timer with 0.1 second resolution
Fast Timer (TMRF)
Single input incremental timer with 0.01 second resolution $(0-99.99 \mathrm{sec})$.
Accumulating Timer (TMRA)
Two input incremental timer with 0.1 second resolution ( $0-$
$9,999,999.9 \mathrm{sec}$ ). Time and enable/reset inp
Accumulating Fast Timer (TMRAF)
Two input incremental timer with 0.1 second resolution
(0-999,999.99 s). Time and enable/reset inputs control the timer.
Counter (CNT)
Two input incremental counter (0-9999). Count and reset inputs
Sage Counter (SGCNT)
Single input incremental counter (0-9999) RST instruction must be used to reset count.
Up Down Counter (UDC)
Three input counter (0-99,999,999). Up, down and reset inputs control the counter.
Shift Register (SR)
Shifts data through a range of control relays with each clock pulse. The data clock and reset inputs control the shift register. Accumulator/Stack Load and Output Data Load (LD)
Loads a 16-bit word into the lower 16 bits of the accumulator/stack. Load Double (LDD)
Loads a 32 -bit word into the accumulator/stack.
Load Formatted (LDF)
Loads the accumulator with a specified number of consecutive
Load Address (LDA)
Loads the accumulator with the HEX value for an octal constant (address).
Load Accumulator Indexed (LDX)
Specifies a source address (V-memory) which will be offset by the value in the first stack location.
Load Accumulator Indexed from Data Constants (LDSX) D2-250-1 and D2-262 only. Specifies a Data Label Area (DLBL) where numerical or ASCII constants are stored.

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
Out Formatted (OUTF)
Outputs a specified number of bits (1-32) from the accumulator to the specified discrete memory locations.
Out Least (OUTL)
D2-262 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)
D2-262 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)
D2-250-1 and D2-262 only. Copies a 16-bit value from the first level of 250-1 and D2-262 only. Copies a 16-bit value from the first level
of the accumulator stack to a source address offset by the value in the accumulator.
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.

## Logical Instructions (Accumulator)

## And (AND)

Logically ANDs the lower 16 bits in the accumulator with a
$\checkmark$-memory location.
And Double (ANDD)
Logically ANDs the value in the accumulator with an 8 -digit
Logically ANDs the value in the accumulator with an 8-digit
constant or a value in two consecutive V -memory locations.
And Formatted (ANDF)
D2-250-1 and D2-262 only. Logically ANDs the value in the
accumulator and a specified range of discrete memory bits (1-32).
And with stack (ANDS)
D2-262 only. Logically ANDs the value in the accumulator with the first value in the accumulator stack.
Or (OR)
Logically ORs the lower 16 bits in the accumulator with a V-memory location.
Or Double (ORD)
Logically ORs the value in the accumulator with an 8-digit constant
or a value in two consecutive $V$-memory locations.
Or Formatted (ORF)
D2-250-1 and D2-262 only. Logically ORs the value in the
accumulator with a range of discrete bits (1-32).
Or with Stack (ORS)
Di-262 only. Logically ORs the value in the accumulator with the
Exclusive Or (XOR)
Performs an Exclusive OR of the value in the lower 16 bits of the accumulator and a V-memory location.
Exclusive Or Double (XORD)
Performs an Exclusive OR of the value in the accumulator and an
8 -digit constant or a value in two consecutive V -memory locations.
Exclusive Or Formatted (XORF)
D2-250-1 and D2-262 only. Performs an exclusive or of the value in
the accumulator and a range of discrete bits (1-32),
Exclusive Or with Stack (XORS)
2-262 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
$\checkmark$-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)
D2-250-1 and D2-262 only. Compares the value in the accumulator
with a specified number of discrete locations (1-32).
Compare with Stack (CMPS)
D2-262 only. Compares the value in the accumulator with the first accumulator stack location.
Compare Real Number (CMPR)
D2-250-1 and D2-262 only. Compares the real number in the accumulator with two consecutive V -memory locations or a real number constant.

## DL205 Instruction Set

## Math Instructions (Accumulator)

## Add (ADD)

Adds a BCD value in the lower 16 bits in the accumulator with a
V -memory location. The result resides in the accumulator
Add Double (ADDD)
Adds a BCD value in the accumulator with two consecutive $V$-memory locations or an 8 -digit constant. The result resides in
Add Real Number (ADDR)
D2-250-1 and D2-262 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, which is either a V-memory location or a 4 -digit constant from the lower 16 bits in the accumulator. The esult resides in the accumulator.
Subtract Double (SUBD)
Subtracts a BCD value, which is either two consecutive V-memory ocations or an 8 -bit constant, from a value in the accumulator.
Subtract Real Number (SUBR)
D2-250-1 and D2-262 only. Subtracts a real number, which is either two consecutive V -memory locations or an 8 -digit constant, from the real number in the accumulator. The result resides in the 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)
D2-250-1 and D2-262 only. Multiplies a BCD value contained in two consecutive $V$-memory locations by the value in the

Multiply Real Number (MULR)
D2-250-1 and D2-262 only. Multiplies a real number, which is constant, by the real number in the accumulator. The result resides in the accumulator.
Divide (DIV)
Divides a $B C D$ value in the accumulator by a $B C D$ value which is either a $V$ memory location or a 4-digit constant. The result resides
in the accumulator. in the accumulator.
Divide Double (DIVD)
D2-250-1 and D2-262 only. Divides a BCD value in the V -memory locations or a 8 -digit constant. The result resides in the accumulator.
Divides Real Number (DIVR)
D2-250-1 and D2-262 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 in the accumulator.
Increment (INC)
D2-250-1 and D2-262 only. Increments a BCD value in a specified $V$-memory location by 1 each time the instruction is executed
Decrement (DEC)
D2-250-1 and D2-262 only. Decrements a BCD value in a specified
Add Binary (ADDB)
D2-250-1 and D2-262 only. 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. location or a 16 -bit constant. The result resides in the accumulator.
Subtract Binary (SUBB)
D2-250-1 and D2-262 only. 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
Multiply Binary (MULB)
D2-250-1 and D2-262 only. Multiples a 16-bit binary value, which is either a $V$-memory location or a 16 -bit constant, by the lower 16
bits in the accumulator. The result resides in the accumulator Divide Binary (DIVB)

D2-250-1 and D2-262 only. Divides the binary value in the lower 16 bits in the accumulator by a value which is either a V -memory location or a 16-bit constant. The result resides in the accumulator.
Increment Binary (INCB)
Increments a binary value in a specified V -memory location by 1 each time the instruction is executed.
Decrement Binary (DECB)
Decrements a binary value in a specified V -memory location by 1 each time the instruction is executed
Add Formatted (ADDF)
D2-262 only. Ads s which is a range of discrete bits (1-32). The result resides in the
Subtract Formatted (SUBF)
D2-262 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)
D2-262 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)
D2-262 only. Divides the BCD value in the lower 16-bits in the accumulator by the BCD value which is a range of discrete bits
Add Top of Stack (ADDS)
D2-262 only. Adds the BCD value in the accumulator with the BCD value in the first level of the accumulator stack. The result resides in the accumulator.
Subtract Top of Stack (SUBS)
D2-262 only. Subtracts the BCD value in the first level of the accumulator stack from the BCD value in the accumulator. The result resides in the accumulator.
Multiply Top of Stack (MULS)
2-262 only. Multiplies a 4-digit BCD value in the first level of the accumulator stack by a 4 -digit BCD value in the accumulator. The
Divide by Top of Stack (DIVS)
Divide by Top of Stack (DIVS)
D2-262 only. Divides the 8 -digit BCD value in the accumulator by the 4 -digit BCD value in the first level of the accumulator by the 4 -digit BCD value in the first level of the accumulator stack. The result resides in the accumulator.
Add Binary Top of Stack (ADDBS)
D2-262 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)
D2-262 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)
D2-262 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)
D2-262 only. Divides a value in the accumulator by the binary value in the top location of the stack. The accumulator contains the result
Transcendental Instructions (D2-262 Only)
Square Root Real (SQRTR)
Takes the square root of the real number stored in the
accumulator. The result resides in the accumulator.
Sine Real (SINR)
Takes the sine of the real number stored in the accumulator. The
result resides in the accumulator.
Cosine Real (COSR)
Takes the cosine of the real number stored in the accumulator. The result resides in the accumulator:
Tangent Real (TANR)
Takes the tangent of the real number stored in the accumulator
The res (ASINR) accumulator
ARC Sine Real (ASINR)
Takes the inverse sine of the real number stored in the
ARC Cosine Real (ACOSR)
Takes the inverse cosine of the real number stored in the
accumulator. The result resides in the accumulator.
ARC Tangent Real (ATANR)
Takes the inverse tangent of the real number stored in the
accumulator. The result resides in the accumulator.

## Bit Instructions (Accumulator)

Sum (SUM)
D2-250-1 and D2-262 only. Counts the number of bits set to "1" in
the accumulator. The HEX result resides in the accumulator. Shift Left (SHFL)
Shifts the bi
to the left.
Shift Right (SHFR)
Shifts the bits in the accumulator a specified number of places to the right.
Rotate Left (ROTL)
D2-250-1 and D2-262 only. Rotates the bits in the accumulator a specified number of places to the left.
Rotate Right (ROTR)
D2-250-1 and D2-262 only. Rotates the bits in the accumulator a specified number of places to the right.
Encode (ENCO)
Encodes the bit position set to 1 in the accumulator, and returns
Decodes (DECO)
Decodes a 5 bit binary value (0-31) in the accumulator by setting the appropriate bit position to a 1 . If the accumulator contains the value $F$ (HEX), bit 15 will be set in the accumulator. If the value to the value is less than 32 and then the value is decoded.
Number Conversion Instructions (Accumulator)
Binary (BIN)
Converts the BCD value in the accumulator to the equivalent
binary value. The result resides in the accumulator.
Binary Coded Decimal (BCD)
Converts the binary value in the accumulator to the equivalent
.

## nvert (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 10's complement (BCD) of the 8-digit accumulator
ASCII to HEX (ATH)
D2-250-1 and D2-262 only. Converts a table of ASCII values to a
table of hexadecimal values.
HEX to ASCII (HTA)
D2
Segment (SEG)
D2-250-1 and D2-262 only. Converts four digit HEX value in accumulator to seven segment display format.
Gray Code to BCD (GRAY)
D2-250-1 and D2-262 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)
D2-250-1 and D2-262 only. Shuffles a maximum of 8 digits, rearranging them in a specified order. The result resides in the
accumulator. accumulator.
Radian Real Conversion (RADR)
D2-262 only. Converts the real degree value in the accumulator to the equivalent real number in radians. The result resides in the ulator.
Degree Real Conversion (DEGR)
the equivalent real the real radian value in the accumulator to the equivalen
Binary to Real Number (BTOR)
D2-250-1 and D2-262
D2-250-1 and D2-262 only. Converts the binary value in the accumulator into a real number. The result resides in the
accumulator. ulator
Real to Binary (RTOB)
D2-250-1 and D2-262 only. Converts the real number in the accumulator into a binary value. The result resides in the

## Table Instructions

Move (MOV)
Moves the values from one V-memory table to another V-memory
table.
Move Memory Cartridge/Load Label (MOVMC/LDLBL)
Copies data betwen V memory and program ladder memory
Copies data between V memory and program ladder memory
Set Bit (SETBIT)
Reset Bit (RSTBIT) single bit (to a 0 ) in a V-memory location.
Reset Bit (RSTBIT)
D2-262 only. Resets a single bit (to a 0 ) in a V-memory location.

Extended Table Instructions (D2-262 Only)
Fill (FILL)
Fills a table of specified $V$-memory locations with a value which is either a V-memory location or a 4-digit constant.
Find (FIND)
Finds a value in a V -memory table and returns the table position containing the value to the accumulator.
Find Greater Than (FDGT)
Finds a value in a V-memory table which is greater than the
specified search value. The table position containing the value is
Find Block (FINDB)
Finds a block of data values in a V -memory table and returns the starting address of the table containing the values to the accumulator.
Table to Destination (TTD)
Moves the value form the top of a $V$-memory table to a specified
$V$-memory location. The table pointer increments each scan.
Remove from Bottom (RFB)
specifed V-memory location. The of a V-memory table to a
specified V-memory location. The table pointer increments each
Source To Table (STT)
Moves a value from a specified $V$-memory location to a $V$-memory table. The table pointer increments each scan.
Remove from Top (RFT)
Pops a value from the top of a $V$-memory table and stores it in a specified $V$-memory location. All other values in the V -memory
table are shifted up each time a value is popped from the table
Add To Top of Table (ATT)
Pushes a value from a specifed $V$-memory location onto the top
of a $V$-memory table. All other values in the $V$-memory table are of a V-memory table. All other values in the $V$-memory table are
Table Shift Left (TSHFL)
Shifts s specified number of bits to the left in a V-memory table.
Table Shift Right (TSHFR)
Shifts a specined number of bits to the right in a V -memory table.
And Move (ANDMOV)
copies data from a table to the specified location, ANDing each
Or Move (ORMOV)
Copies data from a table to the specified memory location, ORing each word with the accumulator data as it is written.
Exclusive Or Move (XORMOV)
Copies data from a table to the specified memory location,
XORing each word with the accumulator data as it is written.
Swap (SWAP)
Exchanges the data in two tables of equal length.

## Clock/Calendar Instructions

## Date (DATE) <br> D2-250-1 and D2-262 only. Use to set the date in the CPU.

Time (TIME)
D2-250-1 and D2-262 only. Use to set the time in the CPU.
CPU Control Instructions
No Operation (NOP)
Inserts a no operation coil at specified program address.
End (END)
Marks the termination point for the normal program scan. An End instruction is required at the end of the main program body.
Stop (STOP)
Changes the operational mode of the CPU from Run to Program
Reset Wa
Reset Watchdog Timer (RSTWT)
D2-250-1 and D2-262 only. Resets the CPU watchdog timer.

## DL205 Instruction Set

## Program Control Instructions

Goto Label (GOTO) (LBL)
D2-250-1 and D2-262 only. Skips all instructions between the Goto and corresponding LBL instructions.
For/Next (FOR/NEXT)
D2-250-1 and D2-262 only. Executes the logic between the FOR and
Goto Subroutine (GTS/SBR number of times.
GTS, SBR, RT: D2-250-1 and D2-262 only
RTC: D2-250-1 and D2-262 only.
When a GTS instruction is executed the program jumps to the SBR (Subroutine). The subroutine is terminated with a RT instruction (unconditional return). When a return is executed, the program continues from the instruction after the calling GTS instruction. The
RTC (Subroutine return conditional) instruction is used with an input contact to implement a conditional return from the subroutine.
Client Line Set/Client Line Reset (MLS/MLR)
Allows the program to control sections of ladder logic by forming
a new power rail. The MLS marks the beginning of a power rail and
the MLR marks the end of the power rail control.

## Interrupt Instructions

Interrupt Routine/Interrupt Return/Interrupt Return
Conditional (INT/IRT/IRTC)
INT, IRT: D2-250-1 and D2-262 only.
IRTC: D2-250-1 and D2-262 only.
When a hardware or softe only.
routine will be executed The INT inst occurs, the interrupt interrupt routine. The interrupt routine is termine beginning of the the interrupt routine. The in interrupt routine is terminated with an IRT instruction (unconditional interrupt return). When a interrupt return is reached the execution of the program continues from the instruction where the program execution was prior to the interrupt.
Enable Interrupt (ENI)
D2-250-1 and D2-262 only. Enables hardware and software
isted.
D2-250-1 and D2-262
D2
interrupts from being acknowledged.

## Intelligent I/O Instructions

Read from Intelligent Module (RD)
Reads a block of data from an intelligent I/O module into CPU's V -memory.
Write to Intelligent Module (WT)
Writes a block of data to an intelligent I/O module from a block of
CPU's V-memory.
Message Instructions
Fault/Data Label (FAULT/DLBL)
FAULT: D2-250-1 and D2-262 only
DLBL: All D2 CPUs.
Displays a V-memory value or a data label constant to the hand
held programmer or personal computer using DirectSOFT.
Numerical Constant/ASCII constant (NCON/ACON)
Stores constants in numerical or ASCII form for use with other
instructions. instructions.
Print Message (PRINT)
Prints the embedded text or text/data variable message to the Prints the embeduded text or text/data variable message to the
specified communications port. Maximum message length is 255 specifie
words.
Network Instructions
Read from network (RX)
D2-250-1 and D2-262 only. Reads a block of data from another CPU on the network.
Write to network (WX)
D2-250-1 and D2-262 only. Writes a block of data from the Clien device to a Server device on the network

Modbus Instructions (D2-262)
Modbus Read (MRS)
Used CPU port 2 to read a block of data from Modbus RTU devices on the network.
Modbus Write (MWX)
Writes a block of data from CPU port 2 to Modbus RTU devices on the network.

## ASCII Instructions (D2-262)

ASCII IN (AIN)
Configures port 2 to read raw ASCII input strings.
ASCII Find (AFIND)
Searches ASCII strings in V-memory to find a specific portion of the string.
Extracts a specific portion from an ASCII string.
Compare V-memory (CMPV)
Compares two blocks of V -memory
Swap Bytes (SWAPB)
Swaps V-memory bytes
Swaps V-memory bytes.
Print to V-memory (VPRINT) Used to send pre-coded ASCll strings to a pre-defined V-memory address when enabled.
Print from V-memory (PRINTV)
Used to write raw ASCII string out of port 2 when enabled.

## Drum Instructions (D2-250-1 and D2-262)

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

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.

RLLPLUS Programming Instructions

## (D2-262)

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 instructions are used to create structured programs. They are program segments which can be activated or deactivated with control logic.
ump (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)
Normeifed coil that deactivates the active stage and activates a specified stage when there is power flow to the coil.
Converge Stages (CV)
Converge stages are a group of stages that when all stages are active the associated converge jump(s). (CVJMP)will activate another stage(s). One scan after the CVJMP is executed, the converge stages will be deactivated.
Converge Jump (CVJMP) Normally open coil that deactivates the active CV stages and activates a specified stage when there is power flow to the coil
Block Call/Block/Block End (BCALL w/BLK and BEND) BCALL is a normally open coil that activates a block of stages when beginning of a block of stages. Bend is a label used to mark the end of a block of stages.

## Here are some of the ||Box Instructions available

## The IBox instructions are available when using a <br> D2-250-1 CPU with firmware version 4.60 or later, D2-262 CPU with firmware version 1.0 and a supporting version <br> of DirectSOFT.

## IBox Instructions - Analog Helper

Analog Input/Output Combo Module Pointer Setup (ANLGCMB)

Generates the logic to configure the pointer method for an analog input/output combination module
Analog Input Module Pointer Setup (ANLGIN) Generates the logic to configure the pointer method for an analog input module.
Analog Output Module Pointer Setup (ANLGOUT) Generates the logic to configure the pointer method for an analog output module
Analog Scale 12-Bit BCD to BCD (ANSCL) Scales a 12 bit BCD analog value (0-4095 BCD) into BCD engineering
Analog Scale 12-Bit Binary to Binary (ANSCLB)
Analog scale 12 -Bit Binary to Binary (ANSCLB)
Scales a 12 bit binary analog value ( $0-4095$ decimal) into Binary Scales a 12 bit binary analog value ( 0 -4095 decimal) into 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 memory location and sets four possible alarm states, High-High, High, Low, and Low-Low.
Hi/Low Alarm - Binary (HILOALB)
possible alarm states, High-High High,
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 mount of time (in hundredths of a second).
One Shot - (ONESHOT)
Turns on the given bit output parameter for one scan on an OFF to
Push On / Push Off Circuit (PONOFF)
Toggles an output state whenever its input power flow transitions IBox Instructions - Memor
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)
directly or indirectly via word 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
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 up to 4 levels deep. Every V-memory reference MUST be to a sing Math - Binary (MATHBIN)

Allows entry of complex mathematical expressions like in Visual Basic, Excel, or $\mathrm{C}++$ 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 (KO-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 (KO-K8) and performs rounding.
Square BCD (SQUARE)
8-digit DWORD BCD result.
Square Binary (SQUAREB)
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 a 32 -bit OWORD binary result.
Sum Real Numbers (SUMR)
Sums a list of consecutive Real DWORD numbers into a Real DWORD result.

## |Box 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 ECOM100 Disable DHCP (ECDHCPD)
ECOM100 Disable DHCP (ECDHCPD)
ECOM100 Enabl DHCP (ECDHCPE)
CM100 Enable DHCP (ECDHCPE)
(t)
-
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 EMai addresses in the To: field and also to those listed in the 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
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 EOM100 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
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)
COM100 Wit
ECOM100 Write Module ID (ECWRMID)
Writes the specified Module
ECOM100 Write Name (ECWRNAM)
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 Pol
ECOM100 WX Network Write (ECWX) Performs the $W X$ instruction with bullt-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/ local CPU serial using the NETRX and NETWX IBox instructions via 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

CTRIO Configuration (CTRIO) - Counter I/O 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 any 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 till take mon 1 PLC scan specific CTRIO Output
TRIO Edit Preset Table Entry and Reload (CTREDRL)
Performs 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 but 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
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)
ooads the Run to Limit command and given parameters on a specific Output resource. The CRer sill input(s) must be configured as Limit(s) for this function to operate. Will take more than 1 PLC scan to execute
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.


[^0]:    1 16,384 /O pts. can be achieved with 16 fully expanded H4-EBC Servers using V-memory and bit-of-word instructions.

[^1]:    * KEPSeverEX may be purchased from Kepware and will support any existing applications. (https://www.kepware.com/en-us/products/ kepserverex)

[^2]:    * User supplied power source required for stepper drive configuration.

[^3]:    More than one external power supply can be used provided all the power supply commons are connected. A Series $217,0.032 \mathrm{~A}$, fast-acting fuse is recommended for $4-20 \mathrm{~mA}$ current loops. If the power supply common of an external power supply is not connected to OVDC on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20 mA transmitter types are:
    2 or 3 wire: Isolation between input signal and power supply.
    4 wire: Isolation between input signal, power supply, and $4-20 \mathrm{~mA}$ output

