Select the I/O Modules

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

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

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

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

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

Check the environmental specifications

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

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

***Storage temperature for the Handheld Programmer is 14° to 149°F (-10° to 65°C).**
****Ambient humidity for the Handheld Programmer is 20% to 90% non-condensing.**

Review hardware specifications

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

Understand the factors affecting field termination

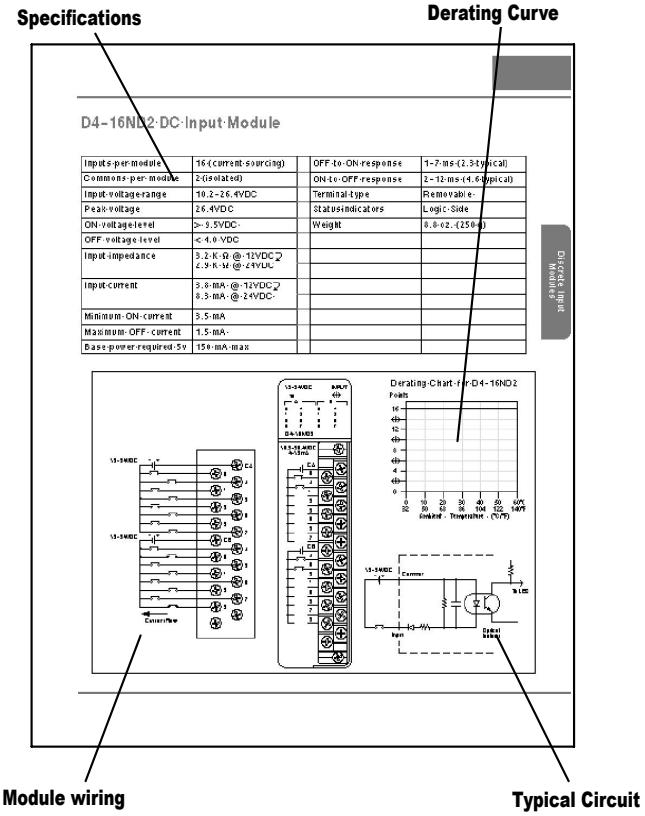
Physical wire terminations: In general, DL405 modules use four types of field terminations. They include: removable terminal blocks (included on all 8 and 16 point modules), specialty D-sub connectors (used on 32 and 64 point modules), standard D-sub connectors (used on most specialty intelligent modules),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

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

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

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

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



I/O Modules

H4-CTRIO high-speed counter module

Select the H4-CTRIO if your application requires:

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

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

Analog module selection tips

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

*ZIP*Link connection systems

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

DIN*nector*s terminal blocks

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

Need spare parts?

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

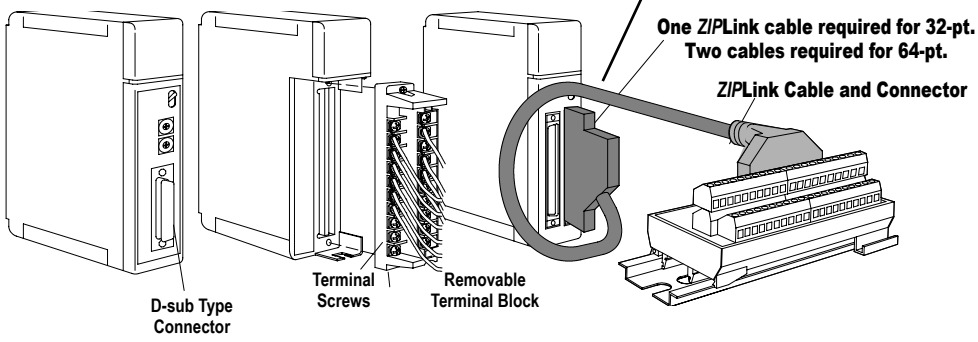
• D4-FUSE-2 ($23.00)	Fuses for F4-08TRS-2
• D4-FILL ($28.00)	Filler module to cover empty I/O slots
• (retired)	16-pt. module terminal blocks
• D4-IOCVR ($11.00)	Replacement terminal block covers
• ZL-D24-CON-R (Retired)	32/64-pt. ribbon-style connectors
• ZL-D24-CON-X ($89.00)	32/64-pt. solder-style connectors

Next steps?

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

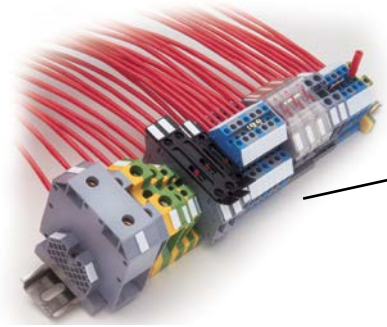
ZIPLinks eliminate the tedious process of wiring the PLC I/O to terminal blocks. See the Wiring Solutions section for details.

ZIPLink connection system



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

DIN*nectors* ***terminal blocks***



DIN*nector*s provide a means of connecting and identifying two or more wires within the demands of an industrial environment. See the Terminal Blocks section for details.

Select an I/O Configuration

Four configurations for system flexibility

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

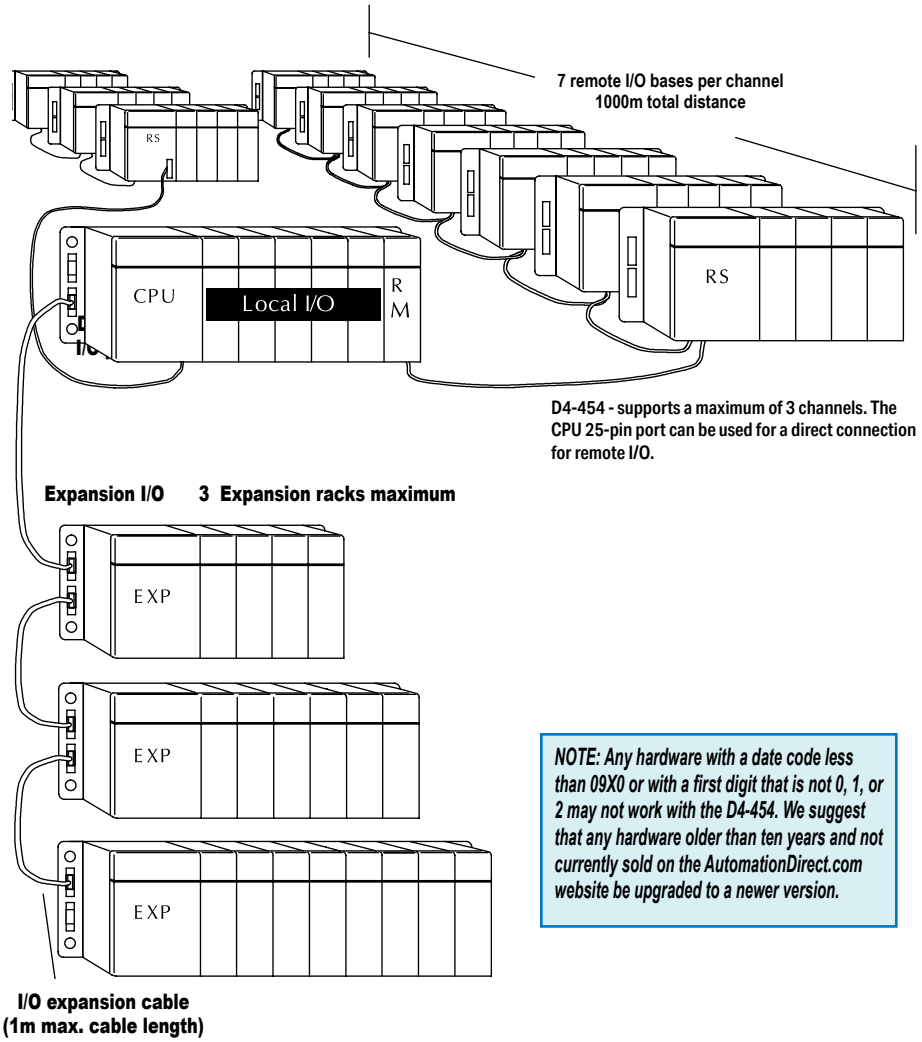
Local I/O

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

Expansion I/O

Expansion bases are commonly used when there are not enough I/O slots available in the local base, or when the power budget for the base will be exceeded with the addition of I/O. This configuration requires additional base(s), each of which require a D4-EX Local Expansion Unit in place of the CPU, and a cable to connect the expansion bases to the local CPU base. Up to three expansion bases can be connected to a local CPU base, for a total of four bases. The CPU updates expansion I/O points on every scan. The total number of local and expansion I/O points for the D4-454 is 2048 points.

Example of I/O system configuration



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

I/O Configurations

Ethernet remote I/O

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

The Ethernet Remote Client module (H4-ERM100) is placed in an I/O slot of the local CPU base. Ethernet Base Controller (EBC) modules serve as the Remote Server Units and are placed in the CPU slot of one or more remote bases. You can use standard DL405 modules in the remote bases. The Remote Servers are connected to the Client using Category 5 UTP cables for cable runs up to 100 meters. Use repeaters to extend distances and hubs to expand the number of nodes.

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

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

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

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

I/O Configuration Specifications		D4-454
Total Channels Available	Total number of Remote channels available	3
Remote I/O	Maximum number of D4-RM per system	2
	Number of Clients built into CPU port	1
	Maximum I/O points supported per channel	512
	Maximum I/O points supported	1536
	Maximum number of remote I/O bases per channel	7

Serial remote I/O

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

Remote I/O requires a remote Client to control the remote I/O channel. This Client can be a module (D4-RM) in the local CPU base, or the D4-454 CPU (through the 25-pin port). For the D4-RM solution, the CPU updates the remote Client, then the remote Client handles all communication to and from the remote I/O base by communicating to the remote Server module (D4-RS) installed in each remote base. The D4-454 CPU communicates directly with the D4-RS.

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

Module Placement and I/O Usage Tables

I/O module placement restrictions

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

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

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

I/O point usage table for modules

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

I/O points required per module

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

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

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

Remote I/O	I/O pt.
H4-ERM100	0
D4-RM	0
D4-RS	0
Specialty Modules	
H4-CTRIO	0
D4-16SIM	8 or 16 in
F4-4LTC	0

DL405 I/O Addressing

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

Octal addressing

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

Automatic addressing

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

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

Manual addressing

The D4-454 CPU allows you to manually assign I/O addresses for any or all I/O slots on the local or expansion bases. This feature is useful if you have a standard configuration that you must sometimes change slightly to accommodate special requests. It is also useful if you have to leave empty slots in between I/O modules and you do not want an added module to cause addressing problems. In automatic configuration, the addresses are assigned on 8-point boundaries. Manual configuration assumes that all modules are at least 16 points, so you can only assign addresses that are a multiple of 20 (octal). This does not mean you can only use 16, 32, or 64-point modules with manual configuration. You can use 8-point modules, however 16 addresses will be assigned and 8 are unused.

Remote I/O addressing

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

Manual addressing and choice of data type designators

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