# Select an I/O Configuration

## Four configurations for system flexibility

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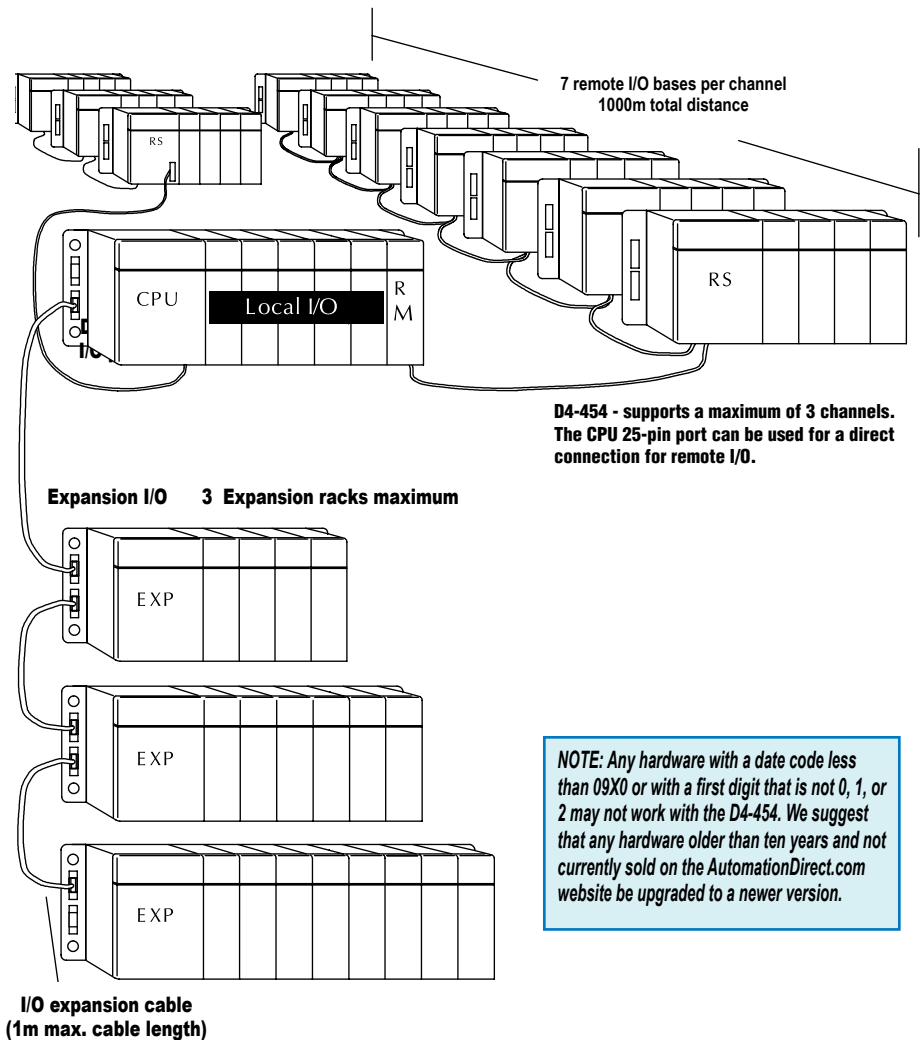
## Local I/O

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

## Expansion I/O

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

## Example of I/O system configuration



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

CPU   Local I/O   R M

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

Expansion I/O   3  Expansion racks maximum

EXP

EXP

EXP

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

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

# I/O Configurations

## Ethernet remote I/O

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

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

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

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

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

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

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

## Serial remote I/O

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

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

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

# Module Placement and I/O Usage Tables

## I/O module placement restrictions

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

## I/O point usage table for modules

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

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

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

### I/O points required per module

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

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

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

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

# DL405 I/O Addressing

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

## Octal addressing

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

## Automatic addressing

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

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

## Manual addressing

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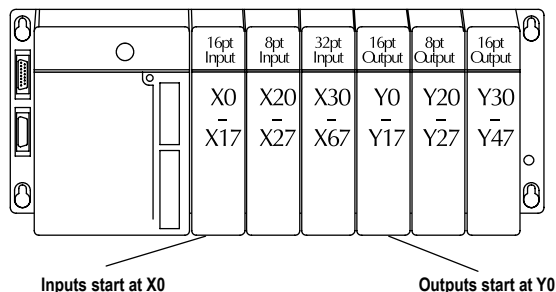
## Remote I/O addressing

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

## Manual addressing and choice of data type designators

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

**Automatically Assigned Module Addresses**

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

Inputs start at X0          Outputs start at Y0

**Manually Assigned Module Addresses**

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

New modules do not cause conflicts

8-point modules still consume 16 points