

# D4-450 Key Features

## DL450 CPU

D4-450 <--->

D4-450DC-1 <--->

D4-450DC-2 <--->



### 16 PID loops

The D4-450 CPU can process up to 16 PID loops directly in the CPU. You can select from various control modes including automatic control, manual control, and cascade control. There are a wide variety of alarms including Process Variable, Rate of Change, and Deviation. The various loop operation parameters are stored in V-memory, which allows easy access from operator interfaces. Setup is accomplished with our *DirectSOFT* Programming Software. An overview of the various loop specifications and features is on page 6-17.

### Floating-point math

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

### Power supplies

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

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

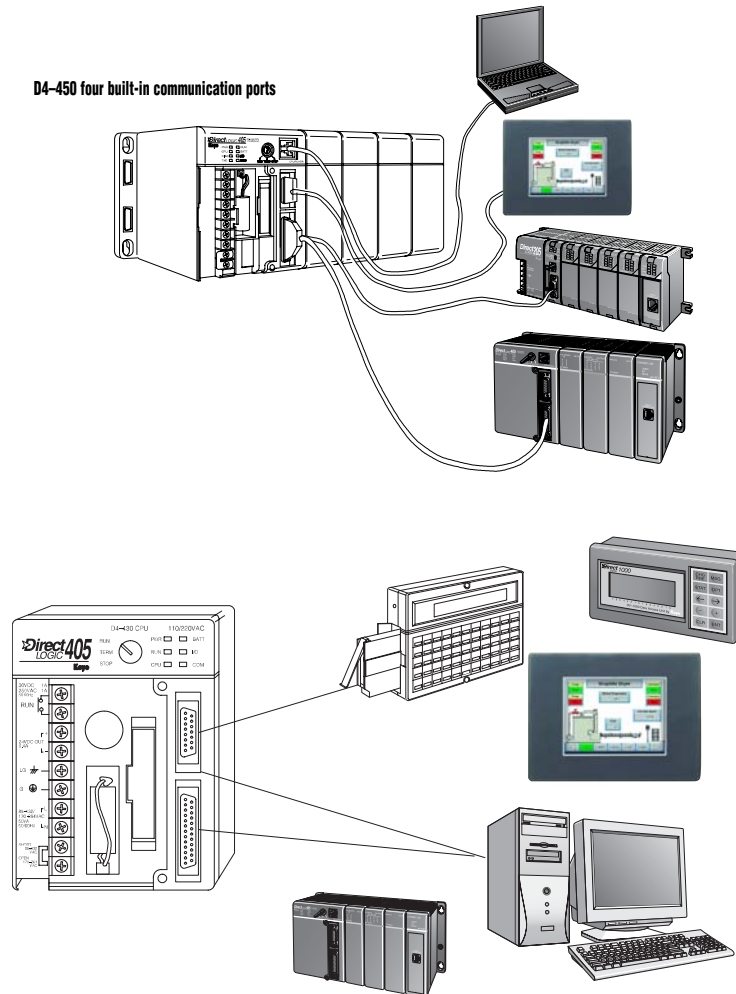
## D4-450 CPU

The D4-450 provides all the capabilities of the D4-430 and D4-440 CPUs, plus several additional features such as *DirectSOFT5* IBox instructions.

### Built-in CPU communications ports

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

D4-450 four built-in communication ports

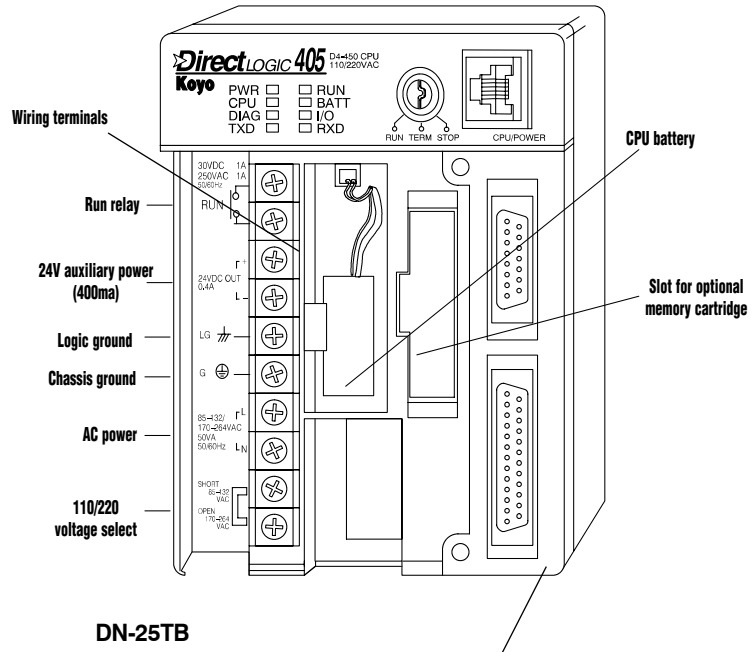


**Note: if you are considering a D4-450 CPU to replace a CPU in an existing system, and the system uses specialty modules with an F4 prefix, then these modules may require an upgrade to operate with the D4-450. Contact our Technical Services group prior to placing your order for more information. (This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

# D4-450 Features

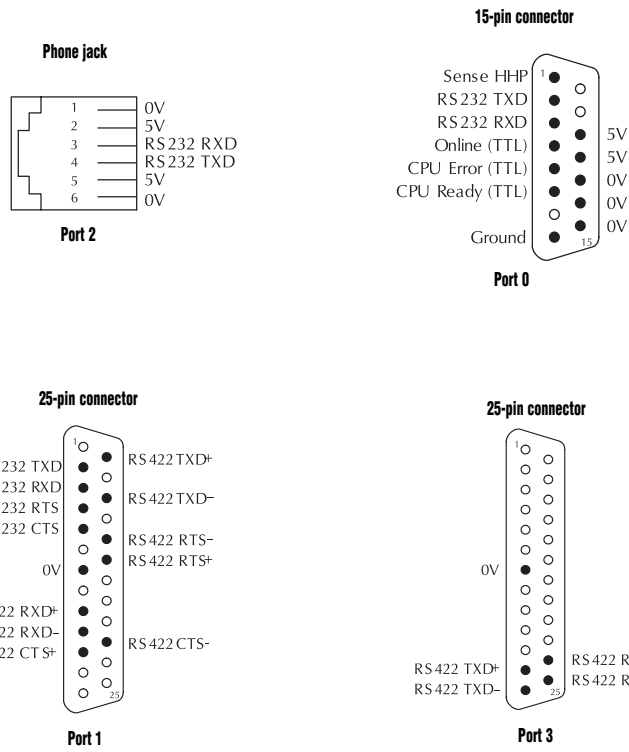
The diagrams on this page show the various hardware features found on the D4-450 CPU.

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



ZIPLink cables and communications adapter modules offer fast and convenient screw terminal connections for the D4-450 lower port. RS-232/422 DIP switch selectable. See the Connection Systems section in this desk reference for part numbers and descriptions.

## D4-450 communications ports pin-out



- PLC Overview
- DL05/06 PLC
- DL105 PLC
- DL205 PLC
- DL305 PLC
- DL405 PLC**
- Field I/O
- Software
- C-more HMIs
- Other HMI
- AC Drives
- Motors
- Steppers/Servos
- Motor Controls
- Proximity Sensors
- Photo Sensors
- Limit Switches
- Encoders
- Pushbuttons/Lights
- Process
- Relays/Timers
- Comm.
- TB's & Wiring
- Power
- Enclosures
- Appendix
- Part Index

# D4-450 Fixed or Variable Scan

## D4-450 Scan control

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

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

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

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

## Memory

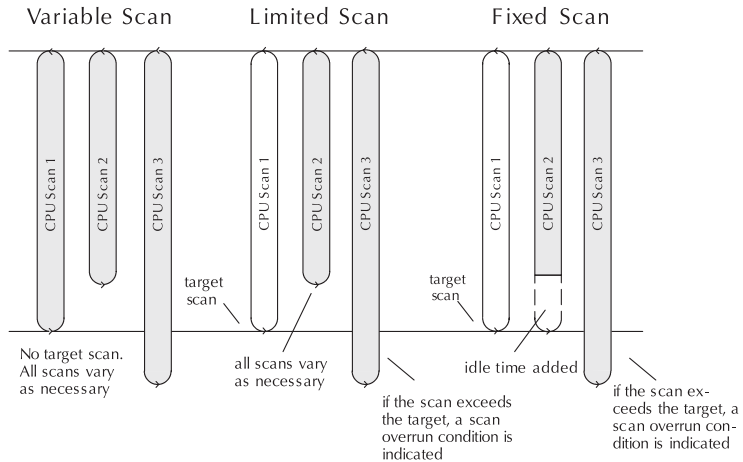
The D4-450 has 7.5K of flash memory on board. Upgrade to 15.5K by choosing an optional memory cartridge. The memory cartridge is recommended since it is removable in the event of problems.

## Full array of instructions

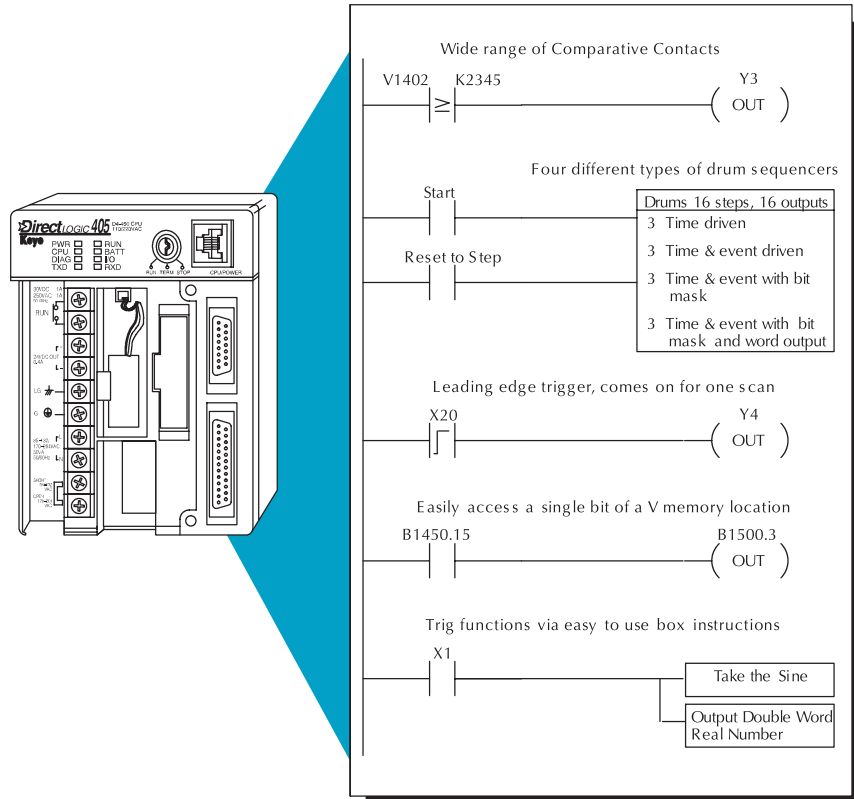
Imagine if someone asked you to write a book, but then told you that you could only use 50 different words? That would be a tough job! The same is true for writing a PLC program. The right instruction can greatly simplify your control program.

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

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



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



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

# D4-450 PID loops

PLC Overview

DL05/06 PLC

DL105 PLC

DL205 PLC

DL305 PLC

**DL405 PLC**

Field I/O

Software

C-more HMI

Other HMI

AC Drives

Motors

Steppers/Servos

Motor Controls

Proximity Sensors

Photo Sensors

Limit Switches

Encoders

Pushbuttons/Lights

Process

Relays/Timers

Comm.

TB's & Wiring

Power

Enclosures

Appendix

Part Index

PID Loop Specifications and Key Features	
<b>Number of Loops</b>	Selectable, 16 maximum
<b>CPU V-memory Required</b>	32 V-memory locations per loop selected (An additional 32 V-memory locations per loop required if using Ramp/Soak)
<b>PID Algorithm</b>	Position or velocity form of the PID equation. Optionally specify direct or reverse acting, square root of the error and error squared control.
<b>Auto Tuning</b>	Open loop step response method and closed loop limit cycle method.
<b>Sample Rate</b>	Specify the time interval between PV samples, 0.05 to 99.99 in units of seconds or minutes. If using all 16 loops, the smallest sample rate is limited to either 0.2 seconds or (PLC scan time x number of loops).
<b>Loop Operation Modes</b>	Loop can be in automatic control, manual (operator) control, or cascade control. PV alarm monitoring continues when loops are in manual mode.
<b>Ramp/Soak</b>	Up to 16 steps (8 ramp, 8 soak) per loop, with indication of Ramp/Soak step.
<b>Square Root PV</b>	Specify a square root of the PV for a flow control application.
<b>Limit SP</b>	Specify a maximum and minimum value for allowable setpoint changes.
<b>Limit OUT</b>	Specify a maximum and minimum value for the output range.
<b>Gain</b>	Specify proportional gain of 0.01 to 99.99.
<b>Reset</b>	Specify integral time of 0.1 to 99.98 in units of seconds or minutes.
<b>Rate</b>	Specify the derivative time, 0.00 to 99.99 seconds.
<b>Rate Limiting</b>	Specify a derivative gain limiting coefficient to filter the PV used in calculating the derivative term (0 to 20).
<b>Bumpless Transfer I</b>	Bias and setpoint are initialized automatically when the loop is switched from manual to automatic. This provides for a bumpless transfer, which reduces the chance of sharp changes in the output as a result of entering automatic mode.
<b>Bumpless Transfer II</b>	Bias is set equal to the Output when the module is switched from manual to automatic. This allows switching in and out of automatic mode without having to re-enter the setpoint.
<b>Step Bias</b>	Provides proportional bias adjustment for large setpoint changes. This may stabilize the loop faster and reduce the chance of the output going out of range. Step bias should be used in conjunction with the normal adjusted bias operation.
<b>Anti-windup</b>	If the position form of the PID equation is specified, the reset action is stopped when the PID output reaches 0 or 100%. Select adjusted bias or freeze bias operation.
<b>Error Deadband</b>	Specify an incremental value above and below the setpoint in which no change in output is made.
<b>Error Squared</b>	Squaring the error minimizes the effect a small error has on the Loop output, however, both Error Squared and Error Deadband control may be enabled.
Alarm Specifications	
<b>Deadband</b>	Specify 0.1% to 5% alarm deadband on all alarms except Rate of Change.
<b>PV Alarm Points</b>	Specify PV alarm settings for low-low, low, high, and high-high conditions. You can also specify a deadband to minimize the alarm cycles when the PV approaches alarm limits.
<b>PV Deviation</b>	Specify alarms to indicate two ranges of PV deviation from the setpoint value (yellow and red deviation).
<b>Rate of Change</b>	Specify a rate-of-change limit for the PV.
<p><b>Need Temperature Control?</b>  <i>If you're only interested in controlling temperature, then there may be a better solution than the D4-450 CPU. Check out the F4-4LTC module. This module has the capabilities of our single loop controllers built into one economical module! Detailed specifications can be found later in this section. This module can directly control up to four loops and it even includes built-in relay outputs for heater or chiller control! If you use the built-in PID capability of the D4-450 CPU, you still have to purchase the analog input modules and the output modules (either discrete or analog) in order to complete the loop. This can result in a much higher overall cost when compared to the F4-4LTC.</i></p>	

