PanelMate®
PLC Direct Communication
Driver Manual

Eaton Corporation
Cutler-Hammer Business Unit
811 Green Crest Drive
Columbus, OH 43081

EATON | Cutler-Hammer

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This center, located in Zurich, Switzerland, provides high-level quality support and product repair services for your PanelMate products. You will receive real-time technical and application support.

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Introduction

1

In this chapter, you will learn:

- *How to install driver software*
- *How to download drivers to a PanelMate unit*
- *The supported memory types*

Introduction

The Operator Station can be used with the programmable controllers in the PLC Direct 405 Series (DL430, DL440, and DL450,) using the PLC Direct driver. The driver takes responsibility for communications to the programmable controller, generating the protocol necessary to request information from, and send information to, the PLC. The PLC simply responds to these requests and commands. Ladder logic is required in the PLC to support bit writes to the PLC Direct 405 Series PLCs.

Connection to PLCs using the PLC Direct driver can be accomplished by a direct connection to the Serial Interface Port (port 2), on the PLC. The Serial Interface Port may be either RS232 RS422. The RS232 connection can only be used Point-to-Point. The RS422 connection has multi-drop capabilities.

Note: Check the Cutler-Hammer web site for current information on PanelMate PC connectivity to the PLC Direct driver.

Installing Drivers

PanelMate Configuration Editor software is installed using a CD-ROM. To install the drivers from the CD-ROM, select the **Install Software** option and then **Install Drivers**. From the dialog box, select the driver you wish to install.

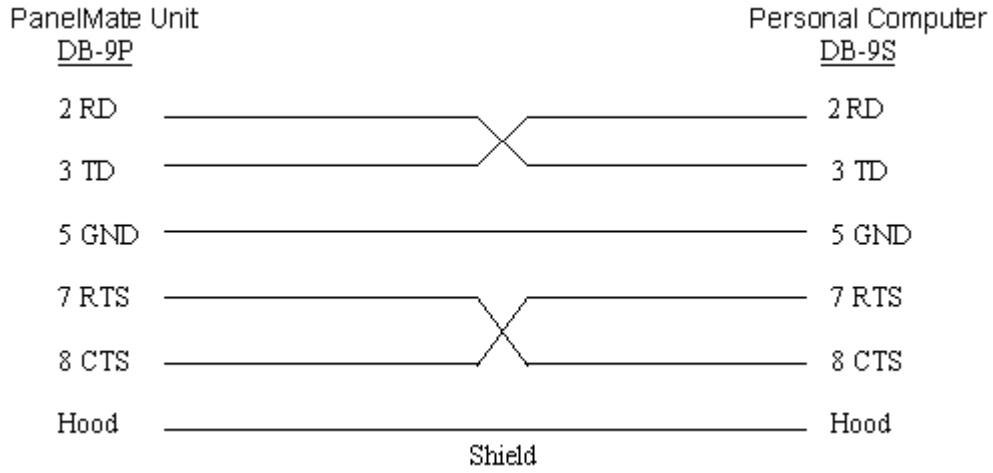
Downloading Drivers to a PanelMate Unit

- In the VCP Transfer Utility, choose the "Executive" tab and select the proper Executive Firmware to download to the PanelMate unit.
- Click the button labeled "Add to Operation List."

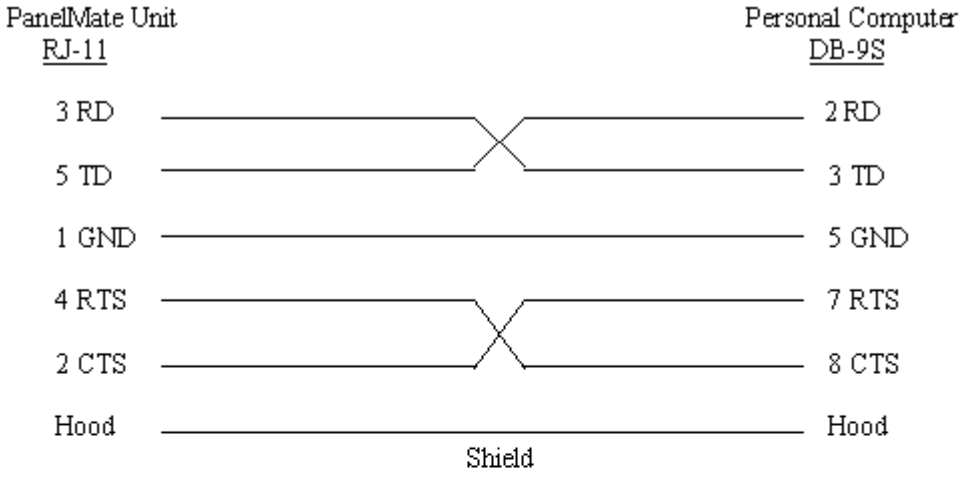
  Note: In order to download to a PanelMate for the first time or to clear the existence of another driver, the PanelMate must first be loaded with Executive Firmware.
- Choose the "Driver" tab.
- Select the appropriate driver to be downloaded to the PanelMate.
- Click the button labeled "Add to Operation List."
- Place the PanelMate unit in Serial Transfer Mode.
- Connect a serial transfer cable from the correct port on the PC to port 1 on the PanelMate. (See cabling below.)
- Click "Start" at the bottom of the VCP Transfer Utility window.
- **Note:** For a more detailed description of downloading procedures and troubleshooting see *PanelMate Power Series, PowerPro, Pro LT Transfer Utility User's Guide.*

Serial Transfer Cables

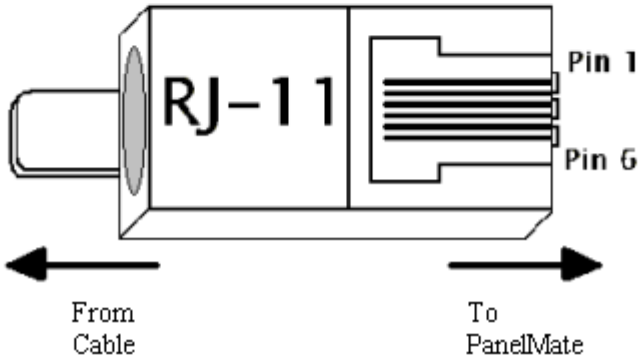
Cable P/N 0518



Cable P/N 0818
(PanelMate Power Series 1500 and PanelMate 500 only)



RJ-11 pin configuration



Memory

The PLC Direct 405 Series driver supports the following memory types:

Memory Type	Memory Address
16-Bit Word	
TMR	Timer
CNT	Counter
V	User Data
V	System Parameter

Memory Type	Memory Address
Byte or Bit	
GX	Remote I/O
X	Input
Y	Output
C	Control Relays
S	Stages
T	Timer Relays (Read Only)
CT	Counter Relays (Read Only)
SP	Special Relays (Read Only)

Memory Ranges for DL430 Driver

The following table shows the memory types and ranges supported by the DL430 driver.

Memory Type	Discrete Memory Address	Word V Memory Addresses
16-Bit Word		
Timer	TMR000-TMR177	V0000-V00177
Counter	CNT000-CNT177	V01000-V01177
User Data		V01400-V07377
System Param		V07400-V07777

Memory Type	Discrete Memory Address	Word V Memory Addresses
Byte or Bit		
Remote I/O	GX000-GX777	V40000-V40037
Inputs	X000-X477	V40400-V40423
Outputs	Y000-Y477	V40500-V40523
Control Relays	C000-C737	V40600-V40635
Stages	S000-S577	V41000-V41027
Timer Relays	T000-T177 (Read Only)	V41100-V41107 (Read Only)
Counter Relays	CT000-CT177 (Read Only)	V41140-V41147 (Read Only)
Special Relays	SP000-SP137 (Read Only)	V41200-V41205 (Read Only)
Special Relays	SP320-SP617 (Read Only)	V41215-V41230 (Read Only)

Memory Ranges for DL440 Driver

The following Table shows the memory types and ranges supported by the DL440 driver.

Memory Type	Discrete Memory Address	Word V Memory Addresses
16-Bit Word		
Timer	TMR000-TMR377	V0000-V00377
Counter	CNT000-CNT177	V01000-V01177
User Data		V01400-V07377
		V10000-V1777
System Param		V0700-V0737
		V07400-V07777

Memory Type	Discrete Memory Address	Word V Memory Addresses
Byte or Bit		
Remote I/O	GX0000-GX1777	V40000-V40077
Inputs	X000-X477	V40400-V40423
Outputs	Y000-Y477	V40500-V40523
Control Relays	C0000-C1777	V40600-V40677
Stages	S0000-S1777	V41000-V41077
Timer Relays	T000-T377 (Read Only)	V41100-V41117 (Read Only)
Counter Relays	CT000-CT177 (Read Only)	V41140-V41147 (Read Only)
Special Relays	SP000-SP137 (Read Only)	V41200-V41205 (Read Only)
Special Relays	SP320-SP717 (Read Only)	V41215-V41234 (Read Only)

Memory types supported by the DL450 are the same memory types supported by the DL440. Memory ranges for DL450 were not available at the time of printing of this manual. Consult the DL450 user manual for memory range information.

Possible Configurations

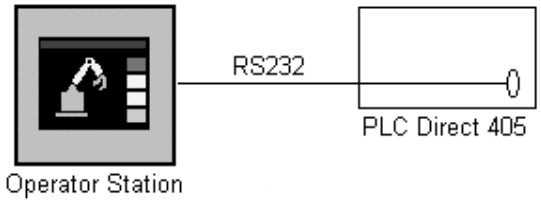
2

In this chapter, you will learn:

- *How to connect an operator station to PLC Direct 405 Series PLCs*

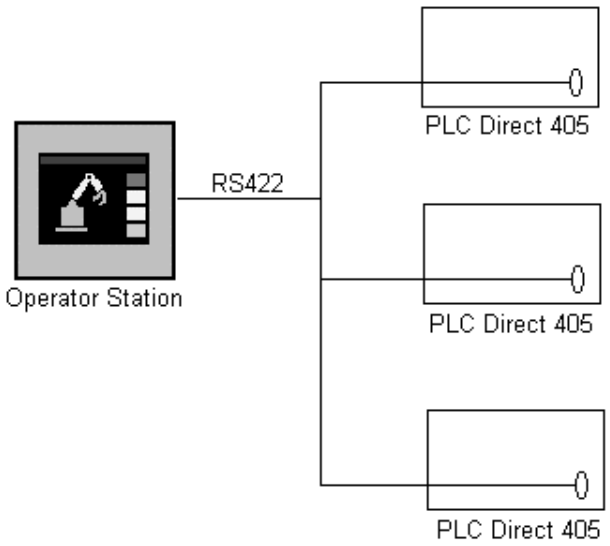
Direct Connection

Direct connection between one Operator Station and one PLC Direct 405 Series PLC.



Multidrop Connection

A Multidrop connection between one Operator Station and multiple PLC Direct 405 Series PLCs.



Cabling

3

In this chapter, you will learn:

- *The cabling requirements for PLC Direct 405 Series PLCs*

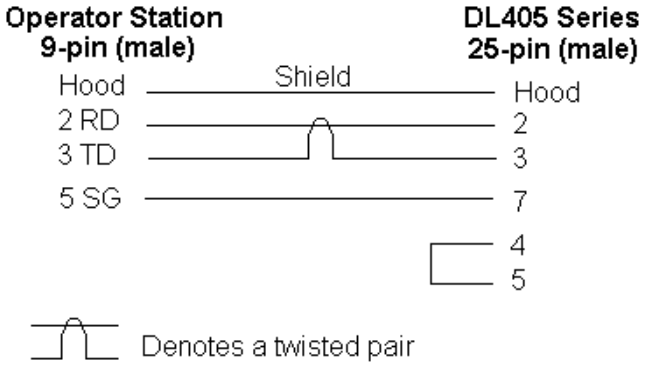
Communication between the Operator Station and the PLC Direct 405 Series PLCs

Communications between the Operator Station and PLC Direct 405 Series PLCs can be achieved via RS232 or RS422. The maximum cable length when using RS232 is 50 feet, while the maximum cable length for RS422 is 4000 feet. RS422 cable must be a twisted double-wire shielded cable.

A 15-foot PLC cable can be purchased from Cutler-Hammer. Contact the Customer Support Group (see the Customer Support section in the Preface,) or your local distributor for more information. Refer to the PLC Cabling Cross-Reference List section for cabling catalog numbers.

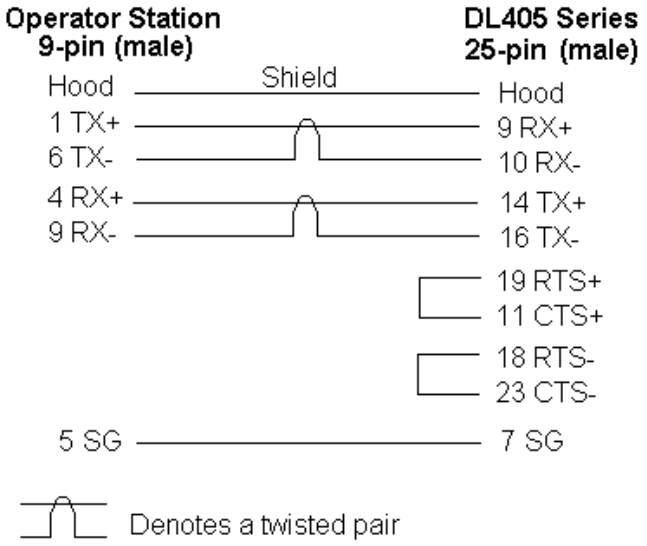
RS232 Cabling for PLC Direct 405 Series PLCs

The Operator Stations that have 9-pin female connectors (DP-9S) must have cables configured male connectors (DB-9P).



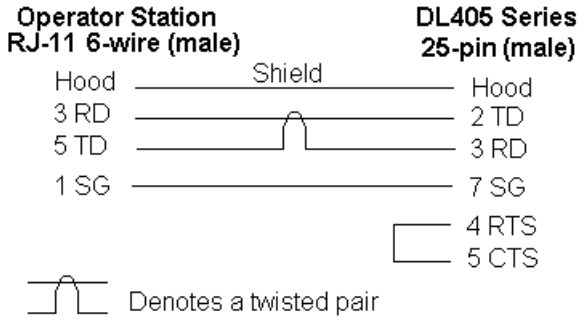
Note: Additional Pins are not recommended for RS232 communication to the PLC Direct 405 Series.

RS422 Cabling for PLC Direct 405 Series PLCs



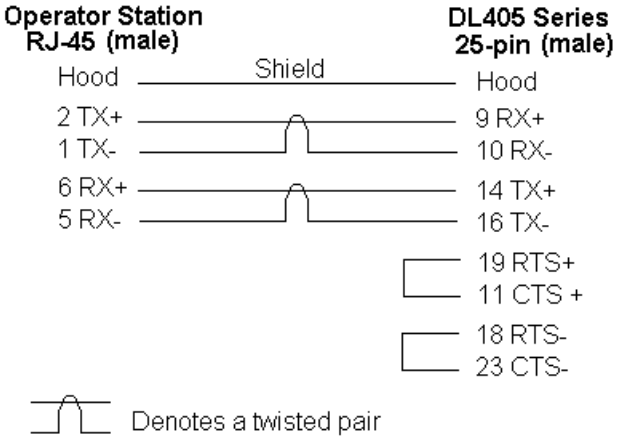
RS232 Cabling for PLC Direct 405 Series PLCs

The Operator Stations that have RJ-11 6-wire and RJ 45 modular jacks must have cables configured with modular connections.



Note: Additional pins are not recommended for RS232 communication to the PLC Direct 435 Series.

RS422 Cabling for PLC Direct 405 Series PLCs



Communication Parameters

4

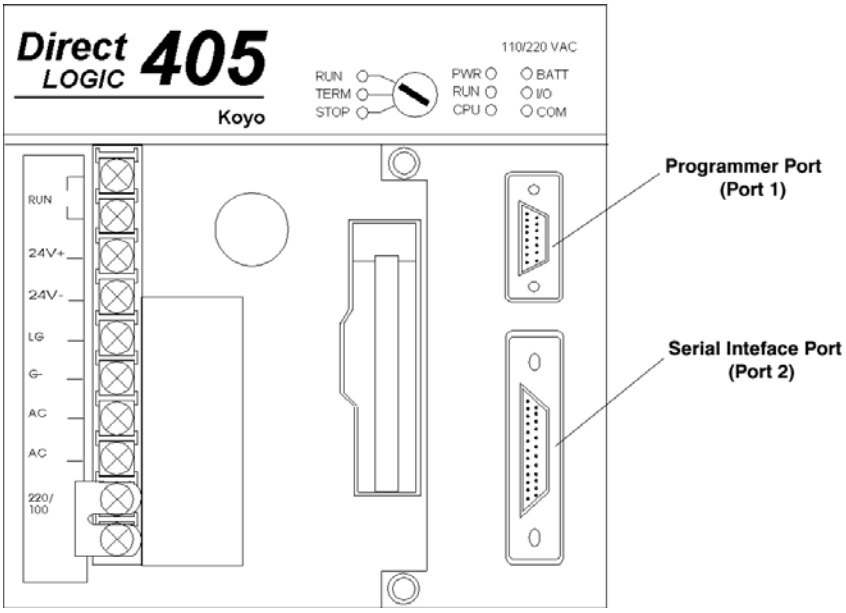
In this chapter, you will learn:

- *The different switch settings*

Serial Interface Port

PLC Direct 405 Series CPU

The Serial Interface port (port 2) enables the PLC Direct 405 Series to interface directly to the Operator Station.



Note: The Operator Station does not support communications with the Programmer Port (port 1).

Serial Interface Port (Port 2)

The following table shows the pinouts for the Serial Interface Port (port 2).

Pin	Name	Pin	Name
1	Not Used	14	TXD+ (RS422)
2	TXD (RS232)	15	Not Used
3	RXD (RS232)	16	TXD- (RS422)
4	RTS (RS232)	17	Not Used
5	CTS (RS232)	18	RTS- (RS422)
6	Not Used	19	RTS+ (RS422)
7	SG (RS232/RS422)	20	Not Used
8	Not Used	21	Not Used
9	RXD+ (RS422)	22	Not Used
10	RXD- (RS422)	23	CTS- (RS422)
11	CTS+ (RS422)	24	Not Used
12	Not Used	25	Not Used
13	Not Used		

Communication to the PLC Direct 405 Series is through the DirectNET Protocol in Master/Slave mode. The Operator Station uses hexadecimal data protocol, not ASCII. Note that the data protocol and parity are set with the PLC Direct programming software. Standard communication parameters for communicating directly with the PLC Direct 405 Series Serial Interface Port are shown below.

RS232 or RS422

8 Data Bits

1 Stop Bit

Odd Parity

19200 Baud Rate*

* The Baud is dipswitch selectable.

Dipswitch Settings

The dipswitch block is located at the rear of the CPU. The table below summarizes the dipswitch settings for the CPU dipswitch.

Switch	ON	OFF
SW1	CPU battery disabled.	CPU battery enabled
SW2	Station Address is 1	Station address is set via MIU (Machine Interface Unit) or programming software
SW3	Baud rate selection for Serial Interface Port	
SW4	Baud rate selection for Serial Interface Port	

Dipswitch Settings for Baud Rate

SW3 and SW4 on the dipswitch control the baud rate at which the Serial Interface Port will operate. Refer to the table below for the baud rates corresponding to the settings of SW3 and SW4.

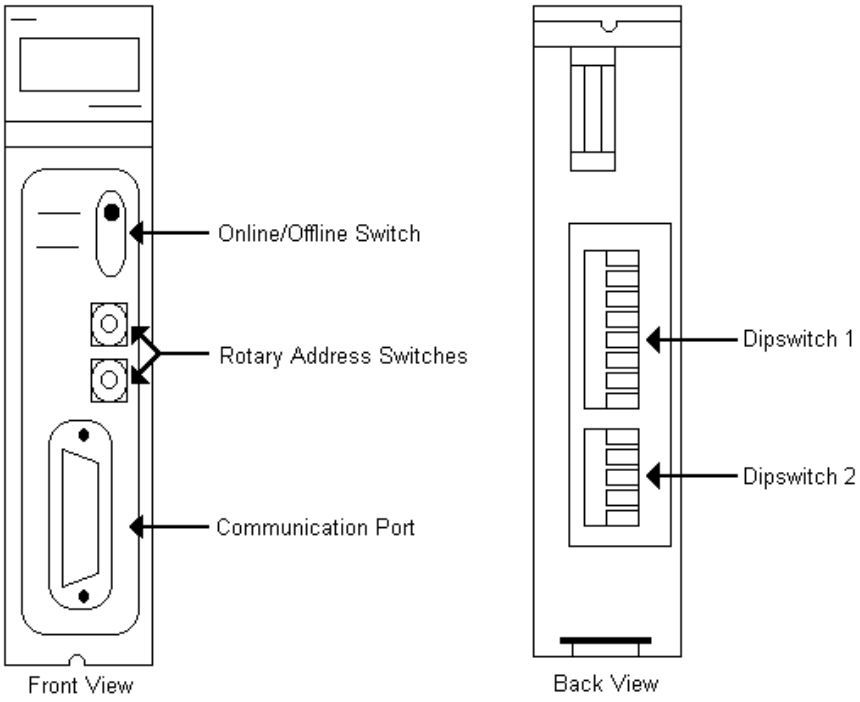
Baud	SW3	SW4
300	Off	Off
1200	Off	On
9600	On	Off
19200	On	On

Data Communication Module for the PLC Direct 405 Series

The Data Communication Module (DCM) enables the PLC Direct 405 Series to interface with the Operator Station. The DCM supports the DirectNET protocol either Master/Slave or Peer-to-Peer. In the Master/Slave configuration, the Operator Station will be the Master device and the DCM will be the slave device in both the Point-to-Point and the Multidrop configurations. The DCM has a serial connection that will connect to the multi-drop network or directly point-to-point to the Operator Station.

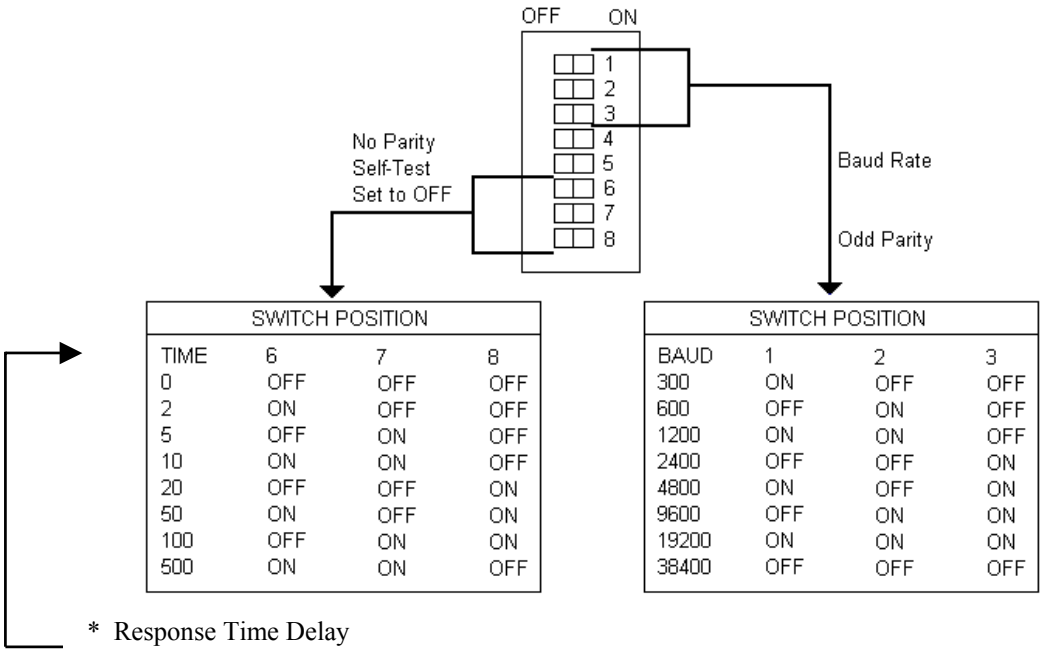
Switch Locations

The figure below shows the switch locations.



Dipswitch 1

There are two rotary switches on the DCM that select the network address of the PLC. This address must match the assigned PLC ID in the PLC Name and Port Table. There are two dipswitches located on the DCM. Dipswitch 1 sets the communication parameters. Switches 1, 2, and 3 of dipswitch 1 select the baud rate. Switch 4 sets the parity. Switch 5 must be set to OFF. Switches 6 through 8 set the Response Time Delay. This should be set to 0ms.



SWITCH POSITION			
TIME	6	7	8
0	OFF	OFF	OFF
2	ON	OFF	OFF
5	OFF	ON	OFF
10	ON	ON	OFF
20	OFF	OFF	ON
50	ON	OFF	ON
100	OFF	ON	ON
500	ON	ON	OFF

SWITCH POSITION			
BAUD	1	2	3
300	ON	OFF	OFF
600	OFF	ON	OFF
1200	ON	ON	OFF
2400	OFF	OFF	ON
4800	ON	OFF	ON
9600	OFF	ON	ON
19200	ON	ON	ON
38400	OFF	OFF	OFF

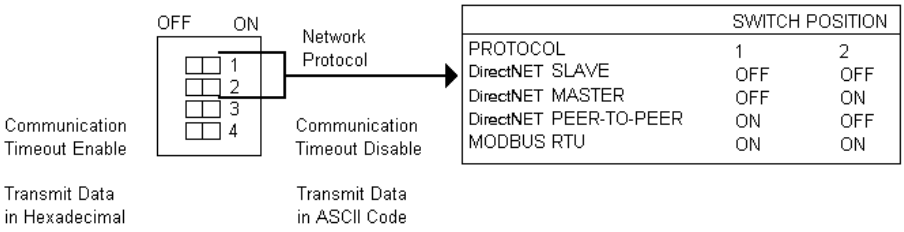
* Response Time Delay

Dipswitch 2.

Dipswitch 2 sets the communication protocol and communication functions. Switch 1 and 2 select the protocol to be used. The following table shows the valid switch setting for the Operator Station Interface.

Operator Station Port	Protocol	Switch 1	Switch 2
DirectNET/M	DirectNET Slave	OFF	OFF
DirectNET/P	DirectNET P/P	ON	OFF

Switch 3 and 4 of dipswitch 2 should be set to OFF to enable communication timeout and to allow data to be transmitted in hexadecimal.



	SWITCH POSITION	
PROTOCOL	1	2
DirectNET SLAVE	OFF	OFF
DirectNET MASTER	OFF	ON
DirectNET PEER-TO-PEER	ON	OFF
MODBUS RTU	ON	ON

The following parameters are the default port characteristics of the DCM.

RS422

8 Data Bits

1 Stop Bit

Odd Parity

Baud Rate 9600

Master-Slave

Bit Writes with Ladder Logic – PLC Direct 405 Series

The DirectNET protocol does not permit an external intelligent device to directly alter the state of a single bit without over-writing the entire byte in which that bit exists. As a result, the Operator Station will write values to designated registers in the PLC, specifying which bit should be set or cleared. It is necessary to write a section of Ladder Logic/Stage Programming to interpret this value in order to change the appropriate bit. The Operator Station will write to four V memory registers to set or reset a bit. The four registers will be consecutive starting with the Bit Write register entered in the PLC ID field. If a Bit Write register is not entered, the register will default to V7374. When the default register is used, V7374, V7375, V7376 and V7377 will be used to accomplish the Bit Writes.

Register 1 This register contains a 16-bit mask in which the bit position to be set will be set to 1 and all other bits will be set to 0.

Register 2 Each memory type has a corresponding V memory address. Register 2 contains the V memory address in which the bit to be set is located.

Register 3 This register contains a 16-bit mask in which the bit position to be reset will be set to 0 and all other bits will be set to 1.

Register 4 This register contains the V memory address in which the bit to be reset is located.

PLC ID Field (Remote ID in the PLC and Port Name Table)

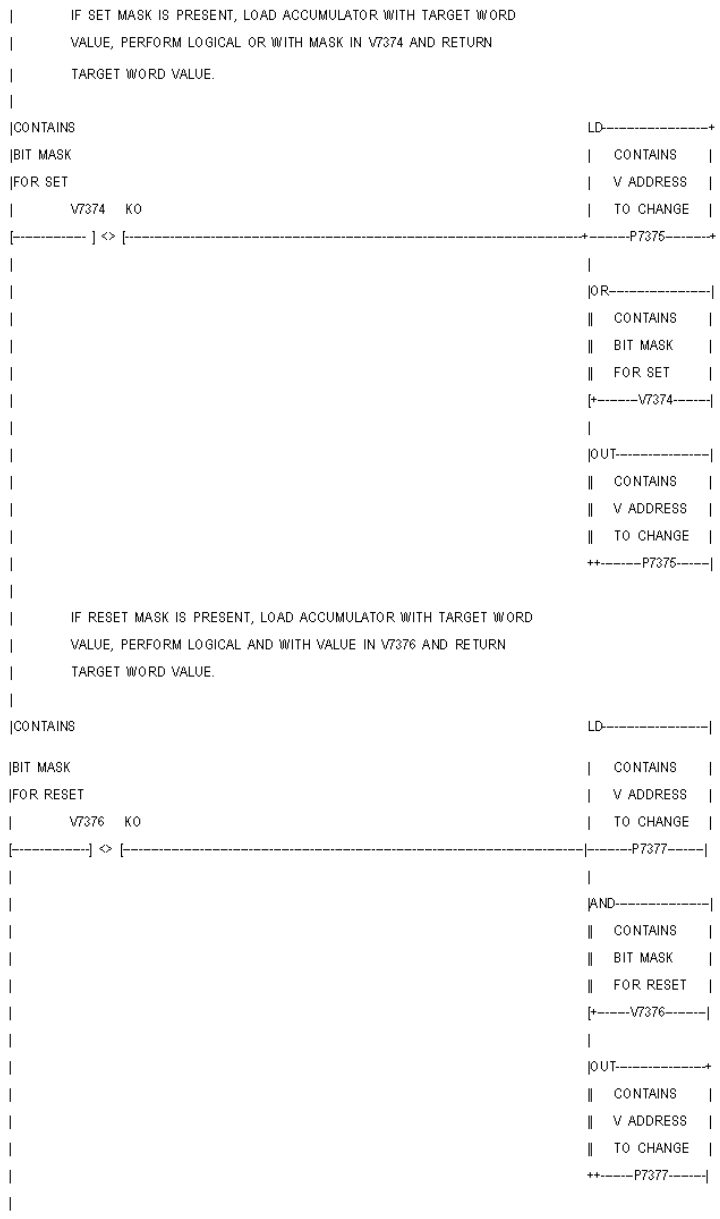
The format for the PLC ID for PLC Direct 405 Series will include both the PLC ID and a memory register used for the four Bit Write Registers. The format will be the PLC ID followed by the memory address.

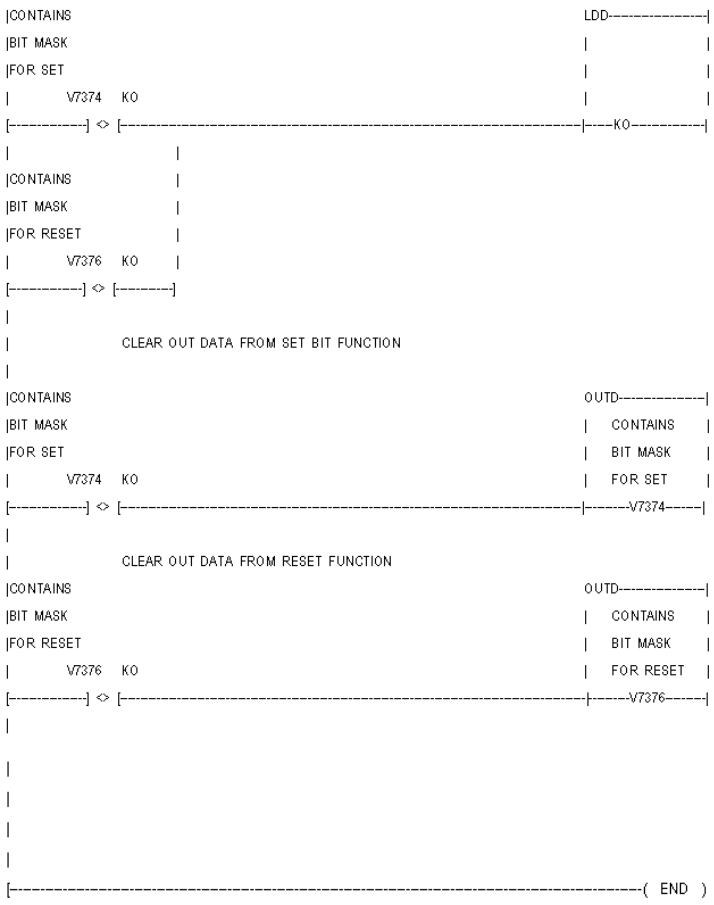
XX-VYYYYY or XX-YYYYY or XX

Where

XX	PLC ID in range 1 - 90
-	PLC ID/memory address separator
V	Optional memory type specifier
YYYYY	Optional starting with V memory address in range 1400 -7374

If a memory address is not entered, the Bit Write register will default to V7374. The following ladder logic rungs may be added to a PLC Direct 405 Series program for the purpose of setting and clearing individual bits.


IF SET MASK IS PRESENT, LOAD ACCUMULATOR WITH TARGET WORD
VALUE, PERFORM LOGICAL OR WITH MASK IN V7374 AND RETURN
TARGET WORD VALUE.
CONTAINS
BIT MASK
FOR SET
V7374 K0
LD
CONTAINS
V ADDRESS
TO CHANGE
P7375
OR
CONTAINS
BIT MASK
FOR SET
V7374
OUT
CONTAINS
V ADDRESS
TO CHANGE
P7375
IF RESET MASK IS PRESENT, LOAD ACCUMULATOR WITH TARGET WORD
VALUE, PERFORM LOGICAL AND WITH VALUE IN V7376 AND RETURN
TARGET WORD VALUE.
CONTAINS
BIT MASK
FOR RESET
V7376 K0
LD
CONTAINS
V ADDRESS
TO CHANGE
P7377
AND
CONTAINS
BIT MASK
FOR RESET
V7376
OUT
CONTAINS
V ADDRESS
TO CHANGE
P7377


|CONTAINS
|BIT MASK
|FOR SET
| V7374 K0
LDD
|FOR RESET
| V7376 K0
CLEAR OUT DATA FROM SET BIT FUNCTION
OUTD
CONTAINS
BIT MASK
FOR SET
V7374
CLEAR OUT DATA FROM RESET FUNCTION
FOR RESET
V7376
END

Word and Bit References

5

In this chapter, you will learn:

- *How to configure word and bit references*

Word Referencing Method

The general word referencing method is:

[plcname,word#format]

The "plcname" is the name of the designated PLC as listed in the PLC Name and Port Table. The "word" is the reference number (address) of the word or register to be read or written. The "#format" is a code which specifies the format of the data being read or written. The "plcname" and "#format" are optional.

The general bit referencing method is:

[plcname,bit]

The "plcname" is the designated PLC as listed in the PLC Name and Port Table. The "bit" is the reference number (address) of the bit, coil, or input to be written or read.

See the "Word and Bit References" topic in the Configuration Software Online Help for a more detailed explanation of word and bit references, including format descriptions.

Word, Byte, and Bit References

PLC Direct 405 Series PLCs use octal word addresses. The Operator Station format default is U16.

The following is the format for a register reference.

[XY]

X	Memory type (TMR, CNT, and V)
Y	Word address (leading zeroes not required)

To reference a byte value, the memory address must be on an 8-bit boundary. The following is the format for an 8-bit (byte) reference.

[B:XY]

B	Designating byte reference
:	Byte designator/byte address separator
X	Memory type (GX, X, Y, C, S, T, CT, and SP)
Y	Byte Address

The following is the format for a bit reference within a word.

[XY/B]

X	Memory type [TMR, CNT, and V]
Y	Word address (leading zeroes not required)
B	Bit number in the range (0 – 17 in octal)

The following is the format for a single bit reference (device).

[XY]

X	memory type (GX, X, Y, C, S, T, CT, and SP)
Y	Bit address (leading zeroes not required)

Examples

The following are examples of valid PLC references that may be assigned in the Operator Station expression fields.

Word References	
Reference	**Description**
[TMR11]	Timer register 12
[CNT30]	Counter register 30
[V24]	User Data register 22

Byte References	
Reference	**Description**
[B:GX10]	Remote I/O register 10
[B:X20]	Input register 20
[B:Y100]	Output register 100
[B:C30]	Control relay register 30
[B:S40]	Stage register 40
[B:T50]	Timer relay register 50
[B:CT170]	Counter relay register 170
[B:SP0]	Special relay register 0

Bit References	
Reference	**Description**
[GX12]	Bit 12 of remote I/O memory
[X315]	Bit 315 of input memory
[CNT.50/10]	Bit 10 of counter word 150

Maintenance Access

6

In this chapter, you will learn:

- *How to use the Maintenance Template*

Maintenance Access

The Maintenance Template will access all memory locations supported by the PLC driver as defined in this manual. When running online, you may change the PLC reference. The Maintenance Template is designed to assist you in specifying the PLC reference by scrolling through a list of mnemonics that are used to enter the PLC word reference. When online in the PLC reference change mode, the following list is available.

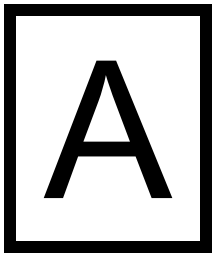
"TMR", "CNT", "V", "GX", "X", "Y", "C", "S", "T", "CT","SP", "B:", and "/"

You must enter the correct mnemonics and numeric values and create a legal reference to change a PLC reference.

Note: When a new reference is entered on an Operator Station, the Maintenance Template will remain in a paused state until the **Start Monitor** control button or the **Chng** soft function key is pressed. When the **Start Monitor** control button or the **Chng** soft function key is pressed, the Operator Station will parse the reference. (Parsing means checking the syntax and range of the reference to ensure that it is supported by the driver.) If correct, the template begins updating.

Note: A Maintenance Template cannot be used to monitor unsolicited references.

PLC Cabling Cross-Reference List



In this chapter, you will learn:

- *The catalog numbers for PLC cables*

PLC Cabling Cross-Reference List

If you have a PanelMate Power Series 1500 and you wish to order PLC cables from Cutler-Hammer, use the following catalog numbers:

TI32	PLC direct and TI 405 Series cable (RS232C)
TI34	PLC Direct and TI 435 Series cable (RS422)

For all other PanelMate Power Series models, use the following catalog numbers:

TI22	PLC direct and TI 405 Series cable (RS232C)
TI24A	PLC direct and TI 435 Series cable (RS422)

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