

# GETTING STARTED

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# CHAPTER 1

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# Manual Overview

### Overview of this Publication

The WinPLC and Serial I/O manual describes the installation of the modules, port configuration, power budgeting, and basic operation of the WinPLC and Serial I/O modules. There is also a brief discussion of Ethernet cabling issues.

### Other Reference Materials

You may find other technical publications useful for your application. For technical information related to your PC-based control software or Windows® CE, please refer to the appropriate publication for those products. For more information about the *DirectLOGIC™* products, you may want to read the following:

- DL205 Installation and I/O manual (D2-INST-M)
- DL205 Analog manual (D2-ANLG-M)
- DL 205 Ethernet communications manual (HX-ECOM-M)
- DL205 ERM manual (H24-ERM-M)
- DL205 High speed counter manual (HX-CTRIO-M)

### Who Should Read This Manual

You will find the WinPLC manual helpful if you have chosen to use the following:

- WinPLC running PC-based Control software
- Our DL205 I/O

You will find that a familiarity with Ethernet communications and with the setup and installation of PLCs is helpful. An understanding of electrical codes and industrial control is essential.

### Technical Support

We strive to make our manuals the best in the industry. We rely on your feedback to let us know if we are reaching our goal. If you cannot find the solution to your particular application, or, if for any reason you need additional technical assistance, please call us at **770-844-4200**.

Our technical support group is glad to work with you in answering your questions. They are available weekdays from 9:00 a.m. to 6:00 p.m. Eastern Time. We also encourage you to visit our website where you can find technical and non-technical information about our products and our company. Visit us at [www.automationdirect.com](http://www.automationdirect.com).

### Special Symbols



When you see the “notepad” icon in the left-hand margin, the paragraph to its immediate right will be a **special note**.



When you see the “exclamation mark” icon in the left-hand margin, the paragraph to its immediate right will be a **warning**. This information could prevent injury, loss of property, or even death (in extreme cases).

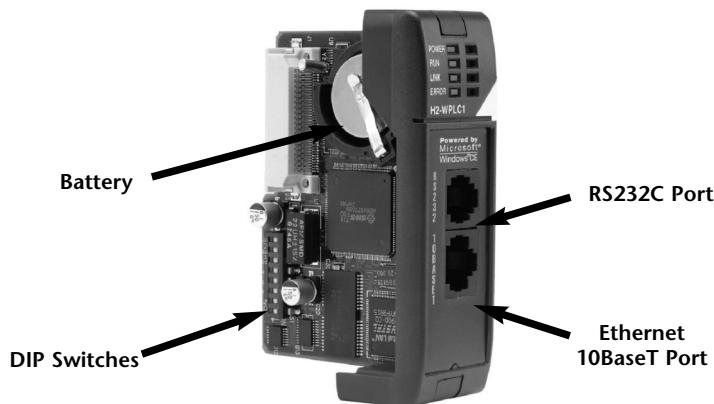
## WinPLC Overview

The WinPLC (part number H2-WPLC1-xx) is an open-platform CPU running the Windows→ CE operating system. It plugs into the CPU-slot of a *Direct*LOGIC DL205 base and “talks” across the backplane to standard digital and analog input and output modules.

The Windows→ CE operating system is a familiar favorite for embedded systems in a wide variety of applications. Using Windows→ CE in the WinPLC makes it a flexible control platform with the ability to run PC-based Control software from a number of sources, as well as Visual Basic and Visual C programs.

The operating system is resident in the module and does not require battery back-up. The user program is backed by a five-year lithium battery.

The WinPLC’s operating characteristics will largely be determined by the PC-based Control software running in it. The PC-based Control software provider chooses how to use the available features in their implementation of the product.



Only two of the DIP switch toggles are functional:  
 SW0: Turn on to force the WinPLC to power up in RUN mode.  
 SW7: Turn on to “Force booter mode” if necessary for IPX communications.

### Features Depend on Software Implementation

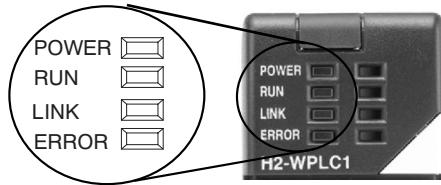
Support of the following features depends on your PC-based Control software implementation:

- the frequency of I/O updates
- the available support for RS232C serial communications
- the uses of the DIP switches
- the uses of the LEDs

If you are using the Visual Basic for CE or Visual C for CE version of the WinPLC, you will receive an SDK (software development kit), a utility called WinPLC Workbench, and a Viewer. The SDK will provide functions to access the features above, WinPLC Workbench will give you a means to set up the WinPLC, and the Viewer will make it possible to load your Visual Basic for CE or Visual C for CE programming the WinPLC.

### The WinPLC LEDs

The WinPLC module has four LED indicator lights. The green POWER and RUN LEDs are individually addressable. Their exact meaning will depend on the PC-based Control software you are using. The green LINK LED has a double function. It indicates that the unit is connected successfully to an Ethernet network, and it indicates that there is activity on the network. The LINK LED will come on intermittently to indicate that it sees Ethernet traffic. The LINK LED will blink faster to indicate an increase in network activity. The red ERROR LED comes on steady to indicate that a hardware error has occurred internal to the WinPLC.



### Inserting the H2-WPLC<sub>x</sub> into the DL205 Base

The H2-WPLC1 plugs into the “CPU” slot of any DL205 base.

- Locate the grooves on the inside top and bottom of the DL205 base.
- Align the module with the grooves and slide the module into the slot until the face of the module is flush with the power supply.
- Push in the retaining clips to secure the module.



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**WARNING:** To minimize the risk of electrical shock, personal injury, or equipment damage, always disconnect the system power before installing or removing any system component.

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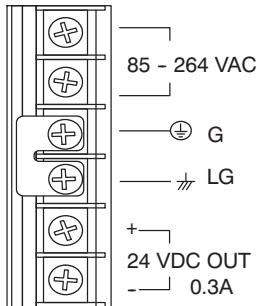
## DL205 Power Wiring and Grounding

The DL205 power supply is an integral part of the base. The DL205 also has three power options: 12/24VDC, 125VDC, and 120/240VAC.

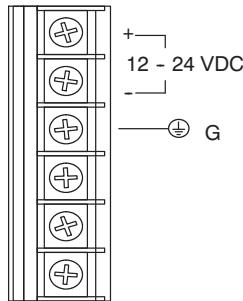


The diagram shows the terminal connections located on the power supply of the DL205 bases. The base terminals can accept up to 16 AWG. You may be able to use larger wiring depending on the type of wire used, but 16 AWG is the recommended size.

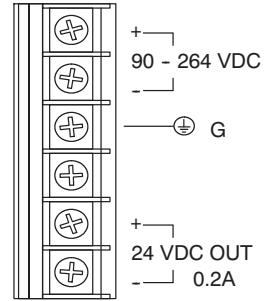
**110/220 VAC Base Terminal Strip**



**12/24 VDC Base Terminal Strip**



**125 VDC Base Terminal Strip**



**NOTE:** You can connect either a 120 VAC or 240 VAC supply to the AC terminals. Special wiring or jumpers are not required as with some of the other DirectLOGIC™ products.



**WARNING:** Once the power wiring is connected, install the plastic protective cover. When the cover is removed there is a risk of electrical shock if you accidentally touch the wiring or wiring terminals.

# 10BaseT Network Cabling

The H2-WPLC1-xx supports the Ethernet 10BaseT standard. The 10BaseT standard uses twisted pairs of copper wire conductors.

## 10BaseT Connections

The H2-WPLC1-xx has an eight-pin modular jack that accepts RJ45 connector plugs. UTP (Unshielded Twisted-Pair) cable is rated according to its data-carrying ability (bandwidth) and is given a “category” number. We strongly recommend using a category 5 cable for all Ethernet 10BaseT connections. For convenient and reliable networking, we recommend that you purchase commercially manufactured cables (cables with connectors already attached).

H2-WPLC-xx



## 10BaseT

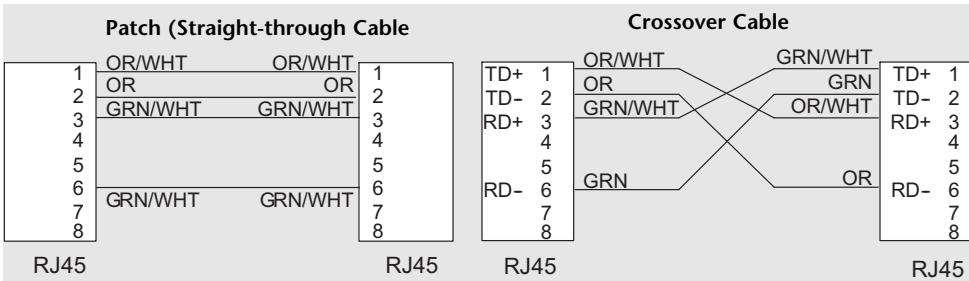
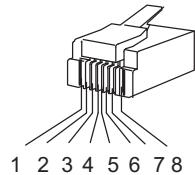
To connect an H2-WPLC1-xx (or PC) to a hub or repeater, use a patch cable (sometimes called a straight-through cable). The cable used to connect a PC directly to a WinPLC or to connect two hubs is called a crossover cable.

The diagram below illustrates the standard wire positions in the RJ45 connector. We recommend all WinPLC 10BaseT cables to be Category 5, UTP cable.



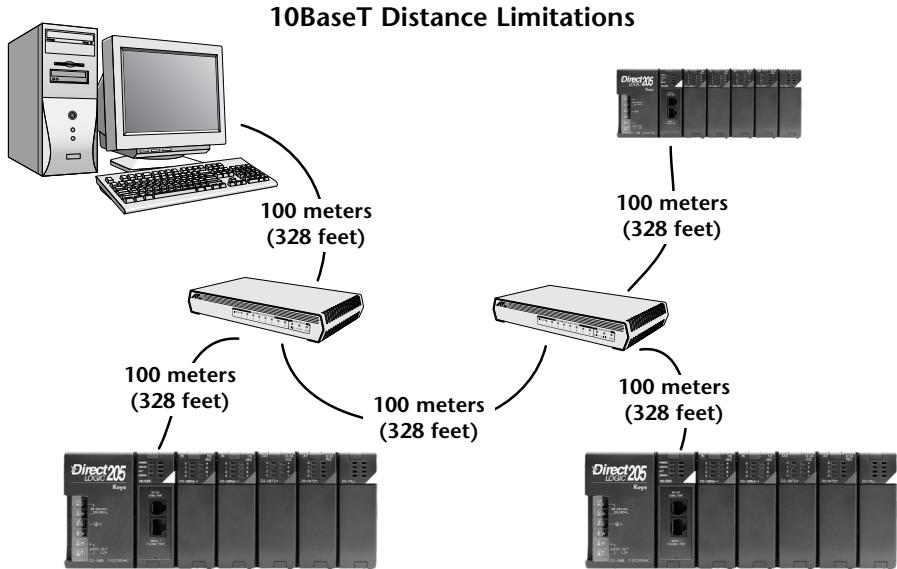
*NOTE: See page 1-7 for 10BaseT distance limitations.*

8-pin RJ45 Connector (8P8C)



## Maximum Ethernet Cable Length

The maximum distance per 10BaseT cable segment is 100 meters or 328 feet. Repeaters extend the distance. Each cable segment attached to a repeater can be up to 100 meters. Two repeaters connected together extend the total range to 300 meters.



## H2-WPLC-xx Serial Port Pinouts

Pin Assignments for: H2-WPLC-xx serial port		RJ12 (6P6C) Female Modular Connector
1	0V Power (-) Connection (GND)	
2	5V Power (+) Connection	
3	RXD Receive Data (RS232C)	
4	TXD Transmit Data (RS232C)	
5	RTS Request to Send	
6	0V Signal Ground (GND)	

# Power Budget for the DL205 with H2-WPLC1-xx

### Managing your Power Resource

When determining which I/O modules you will be using in the DL205 WinPLC system, it is important to remember that there is a limited amount of power available from the power supply. We have provided a table showing the power available from the various DL205 base power supplies and a table showing the maximum power consumed by the WinPLC and each of the I/O modules supported by the WinPLC. Following these two tables is an example of a completed power budgeting worksheet and then a blank worksheet you can use for your own calculations.

If the I/O modules you choose exceed the maximum power available from the smaller DL205 base power supplies, you will need to use a D2-09B9-slot base. This base supplies more power than the other bases, as you can see in the table below.



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**WARNING:** It is extremely important to calculate the power budget. If you exceed the power budget, the system may operate in an unpredictable manner which may result in a risk of personal injury or equipment damage.

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### WinPLC Power Specifications

The following table shows the amount of electrical current available at the two voltages supplied from the DL205 base. Use these values when calculating the power budget for your system.

The Auxiliary 24V power source mentioned in the table is available at the base terminal strip. You can connect to external devices or DL205 I/O modules that require 24VDC, but be sure not to exceed the maximum current supplied.

Bases	5V Current Supplied	Auxiliary 24VDC Current Supplied
D2-03B-1	2600 mA	300 mA
D2-04B-1	2600 mA	300 mA
D2-06B-1	2600 mA	300 mA
D2-09B-1	2600 mA	300 mA
D2-03BDC1-1	2600 mA	None
D2-04BDC1-1	2600 mA	None
D2-06BDC1-1	2600 mA	None
D2-09BDC1-1	2600 mA	None
D2-06BDC2-1	2600 mA	300 mA
D2-09BDC2-1	2600 mA	300 mA

## DL205 Module Power Requirements

The chart below shows the maximum amount of electrical current required to power each of the DL205 WinPLC or I/O modules. Use these values when calculating the power budget for your system. The Power Budget for the DL205 with H2--WPLC1--xx

Power Consumed			Power Consumed		
Device	5V (mA)	24V Auxilliary (mA)	Device	5V (mA)	24V Auxilliary (mA)
<b>CPUs</b>			<b>Combination Modules</b>		
D2-230	120	0	D2-08CDR	200	0
D2-240	120	0	<b>Analog Modules</b>		
D2-250-1	330	0	F2-04AD-1	50	80
D2-260	330	0	F2-04AD-1L	100	5mA @ 10-30V
<b>DC Input Modules</b>			F2-04AD-2	110	5mA @ 10-30V
D2-08ND3	50	0	F2-04AD-2L	60	90mA @ 12V*
D2-16ND3-2	100	0	F2-08AD-1	100	5mA @ 10-30V
D2-32ND3(-2)	25	0	F2-08AD-2	100	5mA @ 10-30V
<b>AC Input Modules</b>			F2-02DA-1	40	60**
D2-08NA-1	50	0	F2-02DA-1L	40	70mA @ 12V*
D2-08NA-2	100	0	F2-02DA-2	40	60
D2-16NA	100	0	F2-02DA-2L	40	70mA @ 12V*
<b>DC Output Modules</b>			F2-08DA-1	30	50mA*
D2-04TD1	60	20	F2-08DA-2	60	140
D2-08TD1(-2)	100	0	F2-02DAS-1	100	50mA per channel
D2-16TD1-2	200	80	F2-02DAS-2	100	60mA per channel
D2-16TD2-2	200	0	F2-4AD2DA	90	80mA*
D2-32TD1(-2)	350	0	F2-8AD4DA-1	35	100
<b>AC Output Modules</b>			F2-8AD4DA-2	35	80
D2-08TA	250	0	F2-04RTD	90	0
F2-08TA	250	0	F2-04THM	110	60
D2-12TA	350	0			
<b>Relay Output Modules</b>			<b>Misc. Modules</b>		
D2-04TRS	250	0	D2-08SIM	50	0
D2-08TR	250	0	H2-CTRIO	400	0
F2-08TRS	670	0			
F2-08TR	670	0			
D2-12TR	450	0			
*add an additional 20mA per loop					

## Power Budget Calculation Example

The following example shows how to calculate the power budget for the DL205 system.

Base # 0	Module Type	5 VDC (mA)	Auxiliary Power Source 24 VDC Output (mA)
<b>Available Base Power</b>	<b>D2-09B-1</b>	<b>2600</b>	<b>300</b>
CPU Slot	H2-WPLCxx	+ 480	0
Slot 0	D2-16ND3-2	+ 100	+ 0
Slot 1	D2-16NA	+ 100	+ 0
Slot 2	D2-16NA	+ 100	+ 0
Slot 3	F2-04AD-1	+ 50	+ 80
Slot 4	F2-02DA-1	+ 40	+ 60
Slot 5	D2-08TA	+ 250	+ 0
Slot 6	D2-08TD1	+ 100	+ 0
Slot 7	D2-08TR	+ 250	+ 0
Other			
Handheld Programmer	D2-HPP	+ 200	+ 0
<b>Total Power Required</b>		<b>1670</b>	<b>140</b>
<b>Remaining Power Available</b>		$2600 - 1670 = 930$	$300 - 140 = 160$

1. Using the table on the previous page, fill in the information for the base power supply, the WinPLC1-xx, I/O modules, and any other devices that will use system power including devices that use the 24 VDC output. Pay special attention to the current supplied by the base power supply. The 9-slot base has a larger current capacity than the smaller bases.
2. Add the current columns starting with the row for the CPU slot and work your way down to the "Other" category. Put the total in the row labeled "Maximum power required".
3. Subtract the row labeled "Maximum power required" from the row labeled "Available Base Power". Place the difference in the row labeled "Remaining Power Available".
4. If "Maximum Power Required" is greater than "Available Base Power" in either of the two columns, the power budget will be exceeded. It will be unsafe to use this configuration, and you will need to restructure your I/O.

## Power Budget Calculation Worksheet

This blank chart is provided for you to copy and use in your power budget calculations.

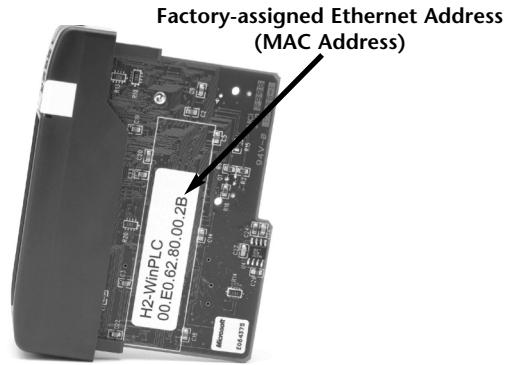
Base # 0	Module Type	5 VDC (mA)	Auxiliary Power Source 24 VDC Output (mA)
<b>Available Base Power</b>			
CPU Slot			
Slot 0			
Slot 1			
Slot 2			
Slot 3			
Slot 4			
Slot 5			
Slot 6			
Slot 7			
Other			
<b>Total Power Required</b>			
<b>Remaining Power Available</b>			

- Using the table on the previous page, fill in the information for the base power supply, the WinPLC-xx, I/O modules, and any other devices that will use system power including devices that use the 24 VDC output. Pay special attention to the current supplied by the base power supply. The 9-slot base has a larger current capacity than the smaller bases.
- Add the current columns starting with the row for the CPU slot and work your way down to the "Other" category. Put the total in the row labeled "Maximum power required".
- Subtract the row labeled "Maximum power required" from the row labeled "Available Base Power". Place the difference in the row labeled "Remaining Power Available".
- If "Maximum Power Required" is greater than "Available Base Power" in either of the two columns, the power budget will be exceeded. It will be unsafe to use this configuration, and you will need to restructure your I/O.

# Locating the Ethernet Address Label

### Ethernet Address

A unique Ethernet Address is assigned to each module at the factory and cannot be changed. It is a twelve digit number (six pairs of hexadecimal numbers) and is printed on a label permanently attached to the WinPLC module.



# Setting Up the WinPLC

If you are using Think & Do Studio, Version 6.1 or later, use Chapter 2, Workbench Utility Operation, to help you set up the WinPLC.

If you are using Think & Do, Version 5.2 or 5.3, use Appendix A, Using The ESP Utility To Set Up The WinPLC When Using Think & Do vers. 5.2 or 5.3, to help you set up the WinPLC.

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## Diagnosing Network Cable Problems

If you are experiencing communication problems, swapping cables is one of the simplest diagnostic procedures you can perform. If the network operates correctly with a different cable, you have isolated and cured the problem. If possible, use a short run of cable to test the network because problems with longer cable runs can be more difficult to diagnose and are more often intermittent.

If you are unable to swap cables, verify the proper operation of all other network components. You probably have a cable problem if you have verified that your:

- WinPLC module is working correctly.
- WinPLC module configuration is correct.
- PC-based Control program is correct.
- any hubs are working correctly.
- Windows configuration is correct.
- network adapter card is the correct type, and it is working correctly.

It is a good maintenance practice to test network cables periodically and maintain a permanent record of cable characteristics. A number of cable test instruments are available to test 10BaseT networks. These instruments will check the electrical characteristics of your cabling, including:

- Continuity — This is a check to make sure the communication pairs are wired correctly, and that the wires are continuous from end to end.
- Attenuation — This refers to the amount of signal loss over the cable segment at the signal frequency of interest. The 10BaseT specification allows for a maximum signal loss of 11.5 decibels (dB) for the entire link at the signal frequency used by 10Mbps Ethernet.
- Crosstalk — Crosstalk occurs when a signal in one pair of wires is electromagnetically coupled to an adjacent pair.



*NOTE: Any significant difference between the cable characteristics of the transmitter and receiver can cause communication errors.*

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Ethernet devices continually monitor the “receive data” path for activity as a means of verifying their link is working correctly. When the network is idle, each network device (including the WinPLC module) sends a periodic link test signal to verify that the network is working. If the link test signal or other network activity is not received periodically, the LINK LED on the WinPLC module is turned off.

## Notes