PLCMotion

VERSION 8.2.0

USER MANUAL

CATALOG #200016 REV. G

Table of Contents

1. Introduction

PLCMotion is an interactive graphic tool for teaching, designing, simulating and executing automatic control applications for the Allen Bradley^{TM} SLC 500^{TM}, MicroLogix^{TM} 1000, and MicroLogix^{TM} 1100 Programmable Logic Controller Systems. The program is suitable for use at the tech-ed and higher education levels, according to the Standard I.E.C. 1131-3 Instruction List of the International Electrical Committee. (Geneva, Switzerland).

PLCMotion allows you to use almost all the features of the following PLC input contacts:

One shot pulses, output coils, bit-flags, and 28 instructions/boxes (e.g., timers, counters, arithmetic or logic functions, move, shifts, sequencers, etc.).

The **PLCMotion** system contains:

- **PLC Editor** (to edit ladder diagrams):
  Compatible with the Allen Bradley SLC 500 / MicroLogix 1000 / MicroLogix 1100
- A Translator to I.E.C.1131-3 Instruction List for simulation
- An interactive Simulator, in a graphic display.
- **An Emulator** to run real applications.

2. Starting PLCMotion

2.1. SYSTEM REQUIREMENTS

PLCMotion minimum PC requirements are:

- Pentium 4 Dual Core @ 2.0 GHz processor
- 512 MB RAM
- DVD/CD ROM drive
- Windows 7 32 bit SP1
- Hard drive with at least 1 GB of free disk space
- Super VGA or better graphics display, minimum 256 colors
- Fully Windows compatible LAN interface card
- Separate RS232 port or USB port with RS232 – USB adapter on the PC

✎
Note

Supported Windows versions:

- *Windows 7 Home Premium/Enterprise/Professional/Ultimate 32/64 bit SP1*
- *Windows 8/8 Pro/8 Enterprise*
- *Windows 8.1/ 8.1 Pro/8.1 Enterprise*
- *Windows 10 Pro/Enterprise/Education*

PLCMotion maximum PC requirements are:

- Intel Core i7-4770 CPU @ 3.40GHz processor
- 8.00 GB RAM

Note: Your operating system might have additional hardware requirements.

2.2. INSTALLING THE SOFTWARE

PLCMotion software is supplied on a CD. The software is copy-protected.

To install the software:

1. If you are about to reinstall the software or install a newer version to an existing PLCMotion directory, it is recommended that you backup any existing user-created files before you begin the installation. It is also recommended that you remove the previous PLCMotion installation by means of the Uninstall utility included with the software.

2. Close any applications that are open before you begin the installation.

3. Insert the CD into the CD-ROM drive. The installation should begin automatically. If it does not, run **setup.exe** from the CD-ROM ****Install folder.

4. Follow the instructions that appear on the screen. Note the following:

▪ You will be asked to select a PLC Type. Select the type of controller you will be using. This selection cannot be changed after installation except by reinstalling PLCMotion.
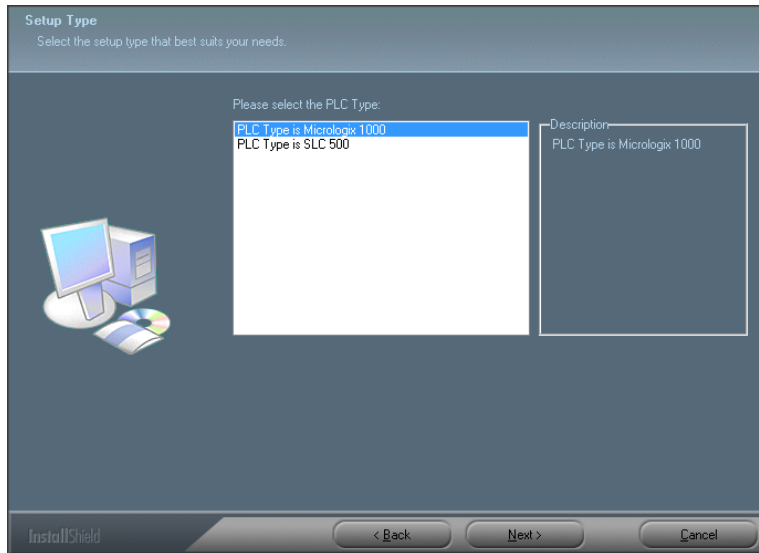
▪ By default, the software is installed to the folder C:\Intelitek\PLCMotion. During the installation process you have the option to change this. It is **not** recommended that you do so.
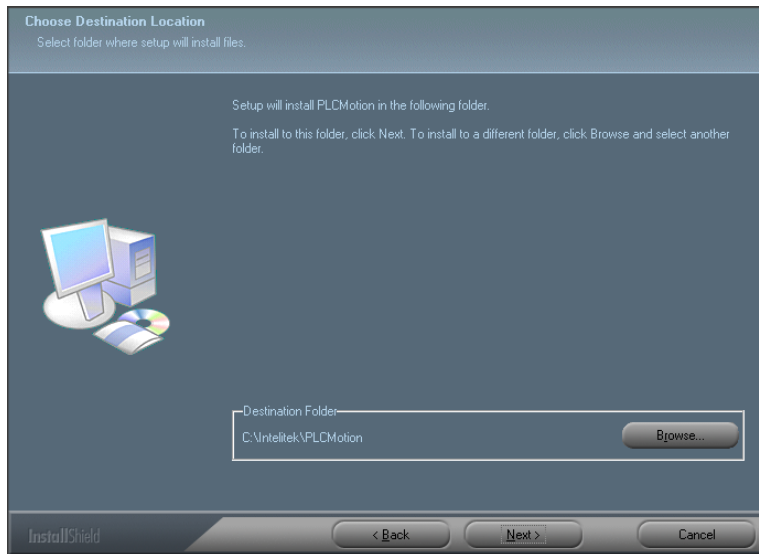
2.3. UNINSTALLING PLCMOTION

To uninstall PLCMotion:

1. Navigate to:

   - For Windows 10: Right-click the **Start** button, then select **Programs and Features**.
   - For Windows 8: Press **Windows Key+X** to display the Tools Menu, and then select **Programs and Features**.
   - For Windows 7: **Windows Start Menu | Control Panel | Programs | Uninstall a Program**.

2. Select **PLCMotion**.

3. Click **Uninstall**.

4. Follow the instructions that appear on the screen.

2.4. ACTIVATING THE SOFTWARE

From the PLCMotion program group in your Windows Start menu, select any of the following:

PLC Editor	PLC Editor	Activates the PLC Editor. For further information on how to create a ladder using the PLC Editor see Chapter 3.
PLC Online Control	PLC Online Control	Activates PLC Online Control. For more information see Chapter 4.
HMI PLC Line	HMI PLC Line	Activates the PLC Simulator with the HMI PLC Line interface. This configuration allows you to run a previously programmed ladder and observe it in the HMI PLC Line panel simulation. For more information see section 5.2.
HMI Gate	HMI Gate	Activates the PLC Simulator with the HMI Gate interface. This configuration allows you to run a previously programmed ladder and observe it with the simulation of a PLC-controlled Gate. For more information see section 5.3.
HMI IceCream	HMI IceCream	Activates the PLC Simulator with the HMI IceCream interface. This configuration allows you to run a previously programmed ladder and observe it with the simulation of a PLC-controlled ice cream filling line. For more information see section 5.4.

2.5. QUITTING THE SOFTWARE

To close the PLCMotion modules, refer to the specific chapter for the module you want to quit.

3. PLC Editor

3.1. OVERVIEW

3.1.1. Activating PLC Editor

To open PLC Editor, do one of the following:

- Double click the PLC Editor icon from the PLCMotion program group folder.
  OR

- From the Start menu, select **Programs | PLCMotion | PLC Editor**.
  The PLC Editor window opens:
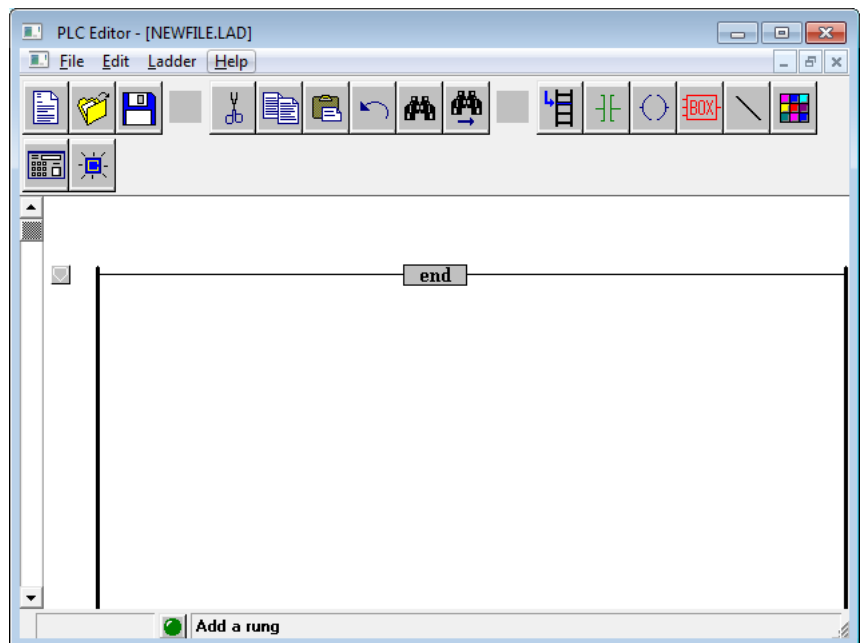
3.1.2. Quitting PLC Editor

To exit PLC Editor:

1. Select **File | Exit**.

2. Click **Yes** in the Exit dialog box.
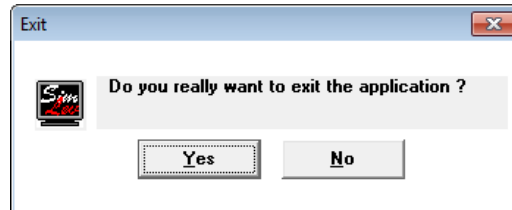
3.2. PLC EDITOR MENUS

3.2.1. File Menu
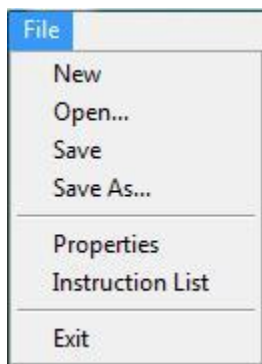
The file menu contains the usual Windows functions that allow you to load and save files, and exit the software. In addition, you may change the properties and view the instruction list through this menu.

New

Opens a new file called NEWFILE, for a new ladder diagram.

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| | Open | The Open dialog box opens. |
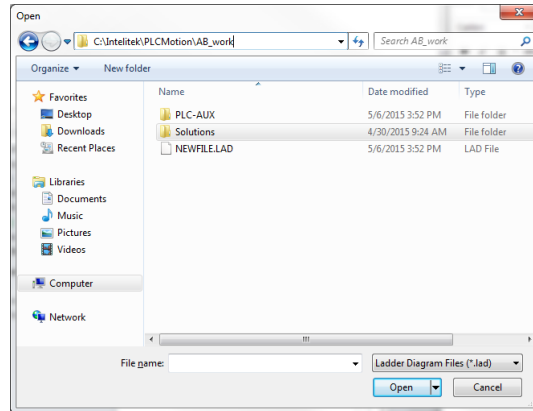
To open an existing ladder diagram from the dialog box:

1. Select the file you want to open.

2. Click **OK**.

| | Save | Saves the current ladder diagram. |

The first time you save a ladder diagram file, use the **Save As** command and assign a file name.

| | Save As | Saves the active ladder diagram under a new file name. |
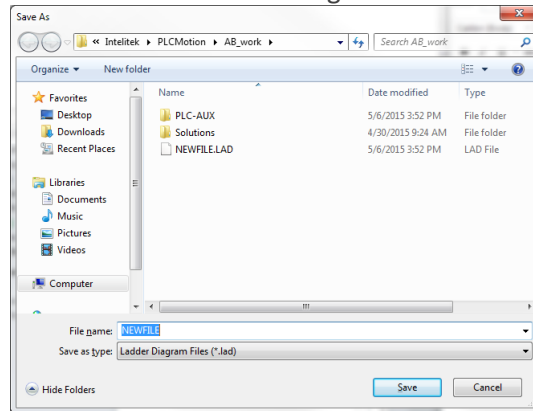
Properties

Opens the File Properties dialog box.
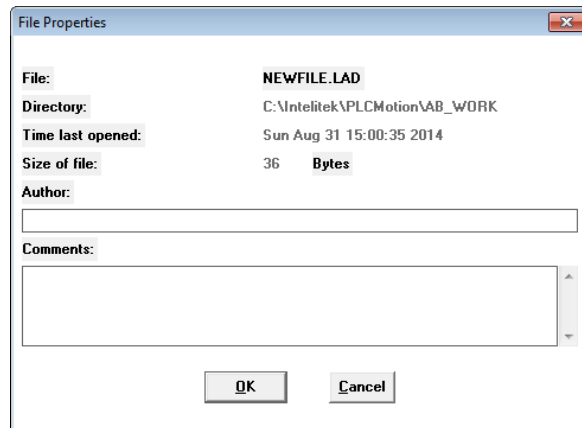
You may enter the author of the file, and make comments. You can also view the following information:

- File
- Directory (Path)
- Time last opened
- Size of file

| Instruction List | Opens the Text File dialog box. This displays the name and type of the active ladder diagram. Click on Display to see a list of all the instructions in the active ladder diagram. |
| Exit | Closes the PLC Editor. |

3.2.2. Edit Menu
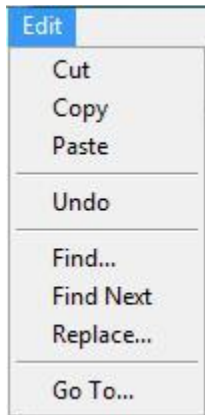
The Edit menu contains the commands that allow you to edit ladder diagram files.

Cut

Deletes selected texts or objects in the ladder diagram. To delete an object or rung:

1. Select **Edit | Cut**.

   OR

   Click the **Cut** button.

2. Click the activation button ■ of the rung with the object to be deleted.

3. Click on the object to be deleted.

   The object is deleted.

To delete an empty rung, follow steps 1 and 2 above. The rung is deleted.

Paste

Pastes the contents of the clipboard into the ladder diagram.

To paste rungs form the clipboard into a ladder diagram:

1. Click on the activation button of the rung above where you want to insert the clipboard selection.

2. Select **Edit | Paste**.

    The selection is inserted after the selected rung.

    The rungs are automatically renumbered.

	Undo	Undoes the last operation.

To undo an editing operation, do the following.

- Select **Edit |Undo**.
  OR

- Click the **Undo** button.
  The last operation is undone.

	Find	Opens the Find dialog box.

To find addresses and comments in a ladder diagram:

1. Select **Edit | Find**.

2. From the dialog box, select the desired text.

Find

I/O List

B3:00/0
I:0/0 - SW_UP
I:0/1 - SW_MID
I:0/2 - SW_LOW
O:0/4 - SOLENOID
T4:0/TT

OK

Cancel
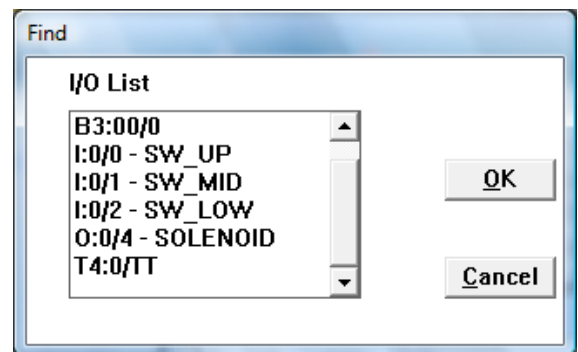
3. Click **OK**.

   The selected text will be highlighted. The rung with the text will be active.

	Find Next	Finds the next occurrence of the selected text.

Use this command after using the Find command. This will automatically locate the next occurrence of the text located with the Find command.

Replace	Opens the Replace Text dialog box:
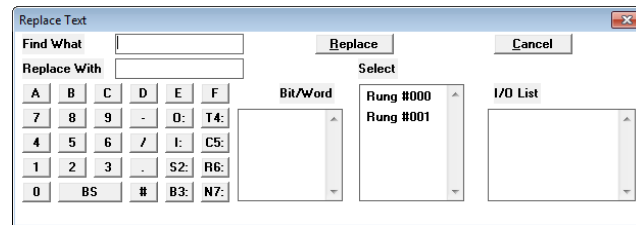
To replace addresses in a series of rungs:

1. Select **Edit | Replace**.

2. Type the address you want to replace in the Text to Find field.

3. Type the new address in the New Text field.

4. From the Select field in the dialog box, select the rung number where the address is to be replaced.

5. Click **Replace**.

Go To	Opens the Go To dialog box.

To choose a rung number directly:

1. Select **Edit | Go to Rung Number**.

   The Go To dialog box opens.
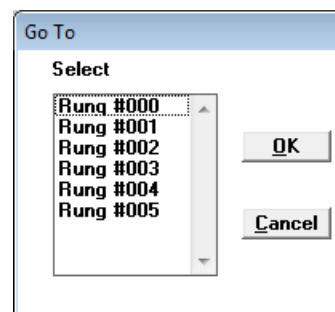
2. From the dialog box, select the desired rung number.

3. Click **OK**.

   The selected rung appears and is selected.

   You can also select a rung by scrolling through the ladder diagram, and selecting the ladder's activation button.

3.2.3. Ladder Menu
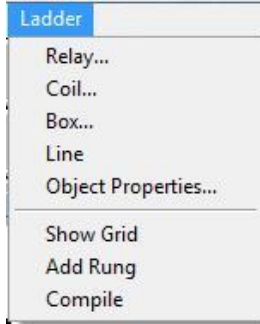
The ladder menu contains the commands needed to edit and create ladders.

   Relay

Activates the add relay function. To add a relay to a ladder diagram:

1. Select **Ladder | Relay**.

    OR

    Click on the **Add Relay** button.

    A submenu with a list of instructions opens.

2. Select the type of instruction you wish to use.

3. Click on the activation button of the rung to add the relay.

4. Click anywhere on the left side on the rung to add the relay.

    The Object Properties dialog box opens.
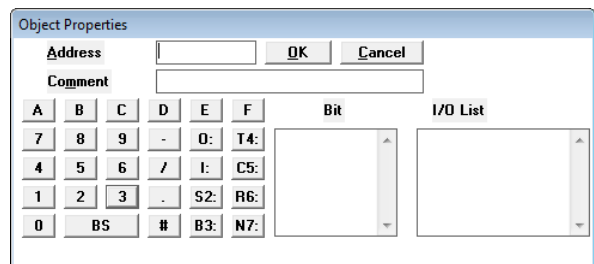
5. Enter the variable address in the Address field by using the on-screen keyboard.

6. Enter a comment or description in the comment field (optional).

7. Click **OK** to insert the relay on the rung.

| Coil | Activates the add coil function. To add a coil to a ladder diagram: |

- Select **Ladder | Coil**.
  OR

  Click on the **Add Coil** button.

  A submenu with a list of instructions opens.

1. Select the type of instruction to add to the ladder from the submenu.

2. Click on the activation button of the rung to add the coil.

3. Click on the appropriate section of the rung to add the box.

   The Object Properties dialog box opens.

4. Enter the variable address in the Address field by using the on-screen keyboard.

5. Enter a comment or description in the comment field (optional).

6. Click **OK** to insert the coil on the rung.

| Box | Activates the Add Box function. To add a box to a ladder diagram: |

1. Select **Ladder | Box**.

   OR

2. Click on the **Add Box** button.

   A submenu with a list of function boxes opens.

3. Select the type of function box to add to the ladder from the submenu.

4. Click on the Activation button of the rung to add the box.

5. Click on the appropriate section of the rung to add the box.

   A dialog box with the name of the selected function opens.

   Enter the information in the appropriate field using the on-screen keyboard. For more information on how to enter information in the function dialog boxes, see the

sectionCreating a Ladder with PLC Editor.

6. Click **OK** to insert the box on the rung.

	Line	Inserts vertical and horizontal lines to connect elements in the ladder.

To add a line to a ladder:

1. Select **Ladder | Line**.

   Or

2. Click on the **Line** button.

3. Click on the Activation button of the rung to connect the line.

4. Click on the appropriate part of the grid above or below the selected rung to connect the elements.

   You can select the Show Grid command (see below) to help in placing the lines.

	Object Properties	Opens the Object Properties dialog box or a function box dialog box of a selected object. This allows you to change any information entered for a selected object.

To edit information for an object:

1. Select **Ladder | Object Properties**.

   OR

   Click the **Object Properties** button.

2. Click the Activation button of the rung with the object to be edited.

3. Click on the object to be edited.

   The Object Properties dialog box, or a function box dialog box opens.

4. Edit the appropriate fields using the on-screen keyboard.

5. Click **OK**.

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	Show Grid	Shows the active grid area in a ladder diagram.

To view the active grid area in a ladder:

- Select **Ladder | Show Grid**.
  OR

- Click the **Show Grid** button.
  The grid appears in the ladder diagram.
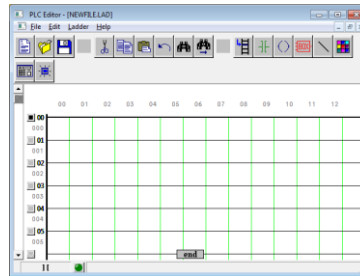
	Add Rung	Activates the add rung function. To add a rung do the following:

1. Select **Ladder | Add Rung**.

   OR

   Click on the **Add Rung** button.

2. Click on one of the Rung Activation buttons.

   A rung will be added above the rung you selected.

	Compile	Compiles and converts the ladder diagram into an Allen Bradley ASCII import file, or a simulation Instruction List.

To compile a completed ladder diagram:

1. Select **Ladder | Compile**.

   OR

   Click on the Compile button.

2. If you are prompted to save the ladder diagram, click yes.

   A check mark will appear on the button if the ladder was compiled successfully. If the ladder was not compiled successfully, an "X" will appear on the button, and a red dot will appear on the grid where the first error occurs.

For more information on compiling a ladder diagram, see the section Creating a Ladder with PLC Editor.

3.2.4. Help Menu

The Help menu contains commands for viewing the software version information as well as the software licensing options.

About	Opens the About PLC Editor dialog box containing the current software version information.
Registration	Opens the Registration dialog box enabling you to perform various registration options, such as obtain and retrieve your software license by Intelitek's web site, e-mail, or fax or phone.

3.3. CREATING A LADDER WITH PLC EDITOR

The Ladder menu and the button tool bar are used for ladder editing in PLCMotion.

To begin editing a ladder diagram, select **File | New** or **File | Open**.

3.3.1. Editing Tools

To edit a rung of the ladder:

1. Click the Activation button next to the rung to be edited.

2. Click on Relay (or other) button.

3. Click on the rung where the input or output is to be placed.

4. Enter information in the appropriate dialog box.

3.3.2. Using the Activation Button

	Activation Button	Activates the corresponding rung.
		Clicking the Activation button a second time will deactivate the corresponding rung.
		Editing a rung is possible only after it is activated. Click on the activation button for the rung to become active. An active rung is bold.

3.3.3. Using the Submenus

3.3.3.1. Relay Contact Submenu

The Relay submenu allows you to enter relays or inputs into a rung.
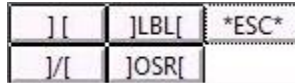
These relays are translated by the Allen Bradley controller as instructions.

In order to insert any input instruction, you must give it an address or other information.

To enter an address or other information, use the on-screen keyboard in the appropriate dialog box. See the section Using the PLC Editor Dialog Boxes.
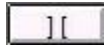
Symbol	Name	Description
] [	Normally Open contact	Inserts a normally open input into a rung. You must give the input an address. You may also enter a comment. This is also referred to as the Examine if Open (XIO) instruction.
]/[	Normally Closed contact	Inserts a normally closed input into a rung. You must give the input an address. You may also enter a comment. This is also referred to as the Examine if Closed (XIC) instruction.
]LBL[	Label	Inserts a label into a rung. A label marks a place a place in a rung as a reference for an output Jump. You must give the label an address. You may also enter a comment dialog box.
]OSR[	One Shot Rising	Inserts the One Shot Rising (OSR) instruction. This instruction generates a short pulse upon activation of the instruction. The OSR instruction is true only for one cycle. It is not true again until the conditions for the instructions preceding it change.
ESC	ESC	Cancels the Relay Contact submenu without adding and input.
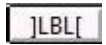
See Chapter 6 for more information on the above instructions.

3.3.3.2. Coil Contact Submenu

The Coil submenu allows you to enter coils or outputs into a rung.

( )	(L)	(JMP)	*ESC*
(RES)	(U)	(MCR)	
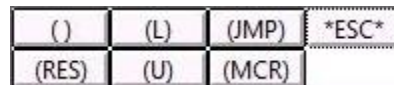
These coils are translated by the Allen Bradley controller as instructions.

See Chapter 6 for more information. In order to insert any output instruction, you must give it an address or other information.
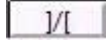
To enter an address or other information, use the on-screen keyboard in the appropriate dialog box. See the section Using the PLC Editor Dialog Boxes.
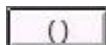
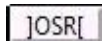| Symbol	Name	Description
( )	Coil Output contact	Inserts a Coil output contact into a rung. You must give the output an address. You may also enter a comment. This is also referred to as the Output Energize (OTE) instruction.

|		
(L)	Output Latch	Inserts an output latch into a rung. You must give the output an address. You may also enter a comment.
(JMP)	Jump to Label	Inserts a Jump to Label instruction into a rung. The Jump instruction causes the program to jump to the rung with the specified label.
(RES)	Reset a Timer/Counter	Inserts a reset timer or counter instruction into a rung. This instructs the program to restart a specified timer or counter to zero.
(U)	Output Unlatch	Inserts an output unlatch into a rung. You must give the output an address. You may also enter a comment.
(MCR)	Master Control	Inserts the master control instruction into a rung. This instruction instructs the program to skip a specified rung.
ESC	ESC	Cancels the Coil Contact submenu without adding an output.

See Chapter 6 for more information on the above instructions.

3.3.3.3. Box Submenu

The Box submenu allows you to enter special instructions into a rung.

TON	RTO	CTD	NEQ	GEQ	GRT	ADD	MUL	AND	XOR	NEG	MOV	BSR	*ESC*
TOF	CTU	EQU	MEQ	LEQ	LES	SUB	DIV	OR	NOT	CLR	MVM	BSL	

These instructions are inserted inside of a function box.

To program an instruction, use the on-screen keyboard in the appropriate dialog box. See the section Using the PLC Editor Dialog Boxes for more information.

TON	TON	Inserts the [Timer On Delay] instruction into the function box.
TOF	TOF	Inserts the [Turn Off Delay] instruction into the function box.
RTO	RTO	Inserts the [Retentive Timer On Delay] instruction into the function box.
CTU	CTU	Inserts the [Count Up] instruction into the function box.
CTD	CTD	Inserts the [Count Down] instruction into the function box.
EQU	EQU	Inserts the [Equal] instruction into the function box.
NEQ	NEQ	Inserts the [Not Equal] instruction into the function box.

MEQ	MEQ	Inserts the [Masked Comparison for Equal] instruction into the function box.
GEQ	GEQ	Inserts the [Greater Than or Equal To] instruction into the function box.
LEQ	LEQ	Inserts the [Less Than or Equal To] instruction into the function box.
GRT	GRT	Inserts the [Greater Than] instruction into the function box.
LES	LES	Inserts the [Less Than] instruction into the function box.
ADD	ADD	Inserts the [Addition] instruction into the function box.
SUB	SUB	Inserts the [Subtraction] instruction into the function box.
MUL	MUL	Inserts the [Multiply] instruction into the function box.
DIV	DIV	Inserts the [Divide] instruction into the function box.
AND	AND	Inserts the [Logical AND Operation] into the function box.
OR	OR	Inserts the [Inclusive OR operation] into the function box.
XOR	XOR	Inserts the [Exclusive OR Operation] into the function box.
NOT	NOT	Inserts the [Logical NOT Operation] into the function box.
NEG	NEG	Inserts the [Negate] instruction into the function box.
CLR	CLR	Inserts the [Clear] instruction into the function box.
MOV	MOV	Inserts the [Move] instruction into the function box.
MVM	MVM	Inserts the [Masked Move] instruction into the function box.
BSR	BSR	Inserts the [Bit Shift Right] instruction into the function box.
BSL	BSL	Inserts the [Bit Shift Left] instruction into the function box.

See Chapter 6 for more information on the above instructions.

3.3.4. Using the PLC Editor Dialog Boxes

Instructions in PLCMotion must have addresses or other information. A dialog box appears each time an instruction is inserted into a rung. Each dialog box includes fields to enter information. Data is entered into the fields using an on-screen keyboard found in the dialog box.

3.3.4.1. Assigning Addresses
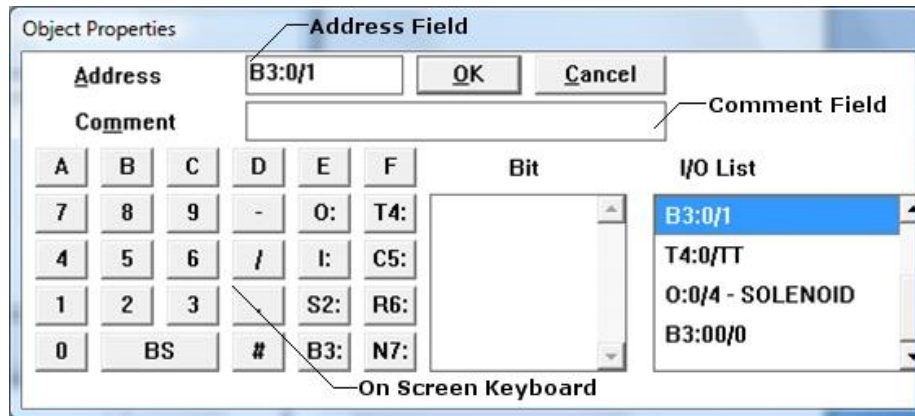
The Object Properties, or an instruction specific dialog box opens when you insert an instruction into a ladder diagram.

To assign an address or other information:

1. Click in the Address field.

2. Enter an address using the on-screen keyboard, or your computer keyboard.

   - Enter the input or output word number.
   - Enter a slash (/).
   - Enter the bit number.

3. Click on the comment field.

4. Use the on-screen keyboard, or your computer keyboard to enter a comment. (Optional).

Each word begins with a file type and number separated by a colon. The following table describes the file types used in PLCMotion.

File # or File Type	File Description
O:	Output. This file stores the state of an output.
I:	Input. This file stores the state of an input.
S2:	Status. This file stores information useful for troubleshooting.
B3:	Bit. This file contains internal relay logic. It is used for bit instructions other than inputs or outputs. For example, the One Shot Rising (OSR) instruction.
T4:	Timer. This file contains timer accumulators and preset values.
C5:	Counter. This file contains the counter accumulators and preset values.
R6:	Control. This file contains the length, pointer position and status for specific instructions.
N7:	Integer. This file is used to store numeric values.

Each of these file types is available by clicking a button found in the on-screen keyboard.

When selecting the file types, T4, C5 or R6, an internal bit must be selected. Select an internal bit from the Bit box found in the middle of the dialog box.

The following are the internal bit instructions found in PLCMotion:

Internal Bit	Description	Use With File Type:
CD	Count down	C5
CU	Count up	C5
DN	Done	T4, C5, R6
EN	Enable	T4, R6
ER	Error	R6
FD	Found	R6
OV	Overflow	C5
TT	Timer Active	T4
UL	Unloaded unit	R6
UN	Underflow	C5

3.3.4.2. Entering Information for Instructions in Function Boxes

Instructions in function boxes also have addresses. See the section, Assigning Addresses for more information.

Depending on the specific instruction, additional information is also entered into specific fields (See dialog box examples below). This information varies. Therefore, each instruction has a different dialog box. The following are examples of some of the dialog boxes used to enter this information.

See Chapter 6 for further information on specific instructions.

4. PLC Simulator and PLC Online Control

4.1. OVERVIEW

Both PLC Online Control and PLC Simulator allow you to view PLC ladder diagrams created with PLC Editor.

PLC Online Control is used to run a PLC ladder diagram on a PLC logic controller connected to the PLCLine panel.

PLC Simulator is used to run a PLC ladder diagram on a simulated HMI (Human-machine interface) panel displayed on your screen, without the need for a PLC logic controller or the PLCLine panel.

Both programs work almost identically, and are explained in the sections below.

4.1.1. Activating PLC Online Control

To open the PLC Online Control window:

- From the Start menu, select **Programs | PLCMotion | PLC Online Control**.
  The PLC Online Control window opens at the top of the screen. The PLC logic controller you selected during installation is indicated in the window title bar.
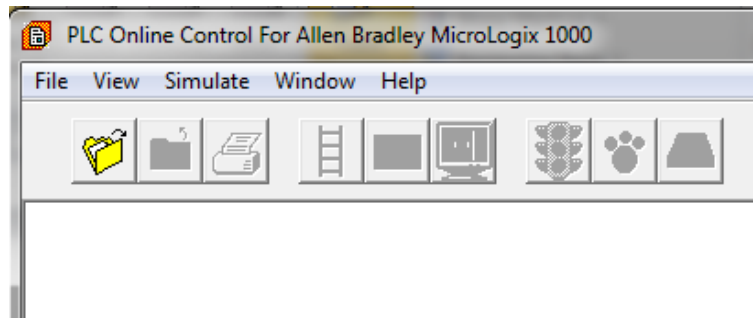
4.1.2. Activating PLC Simulator

PLC Simulator is opened automatically when you launch any of the three HMI simulators from the PLCMotion program group in your Start menu.

 HMI Gate
 HMI IceCream
 HMI PLC Line

PLC Simulator is also launched from within LearnMate content courses.

4.1.3. Quitting PLC Online Control / PLC Simulator

To exit PLC Online Control or PLC Simulator:

- Select **File | Exit**.
  OR

- Press **[Alt] F4**.

4.2. RUNNING A LADDER DIAGRAM

All menu options and toolbar buttons are described in section 4.3. This section provides instructions on how to open a ladder diagram and run it. The instructions are identical for PLC Online Control and PLC Simulator.

To open a ladder diagram and run it:

1. Open PLC Online Control or PLC Simulator.

2. Click **File | Open**.

3. Select the ladder diagram to open, and click **Open**.

   The ladder diagram is displayed.

4. Click Simulation and then On-Line .

   The HMI simulation or PLCLine panel should now operate according to the ladder diagram loaded.

   For information on how to configure online operation if not functional, see Chapter 7.

4.3. PLC ONLINE CONTROL / PLC SIMULATOR MENUS

4.3.1. File Menu
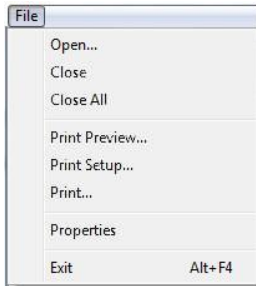
The file menu contains the Windows functions used to open close and print files. New files must be created first using PLC Editor.

Open

Opens a saved ladder diagram.

Close

Closes the active window without exiting the program.

Close All

Closes all open windows.

Print Preview

Shows how a file will look when printed.

Print Setup

Opens the Page Setup dialog box. Sets margins, paper size, page orientation, paper source, and other layout options for the active file.
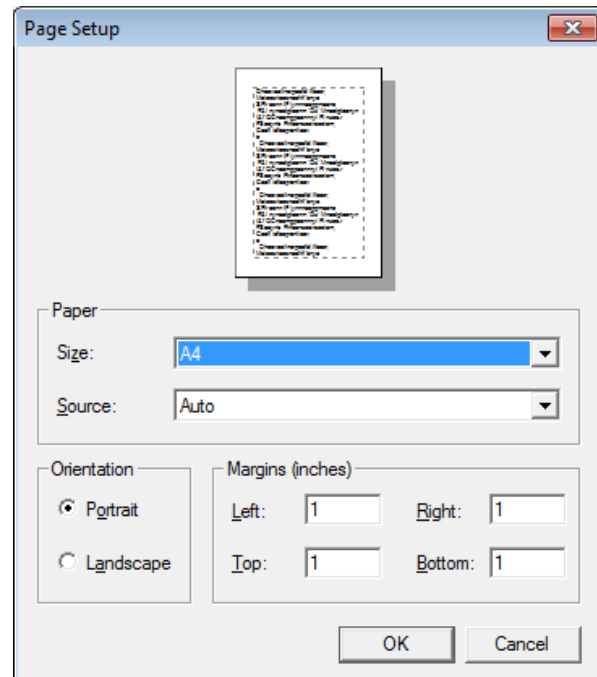
Print

Opens the Print dialog box. Allows you to print the active file.

Properties

Opens the Properties window.
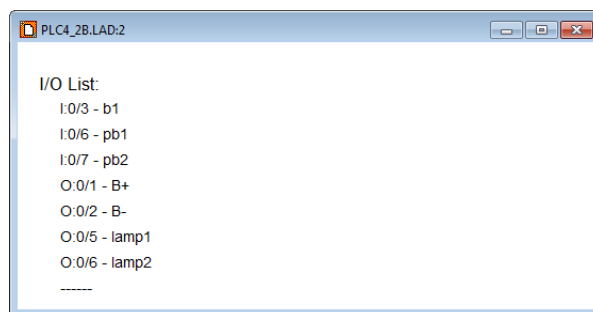
The properties window has the name of the active ladder diagram. It contains the following information:

- Author
- Comments
- I/O list

Exit

Closes the software, while prompting you to save files.

4.3.2. View Menu
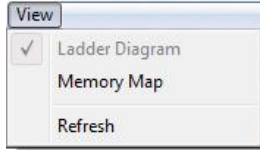
The View menu contains the commands for the viewing modes available in PLC Online Control / PLC Simulator.

	Memory Map	Opens a memory map. The memory map shows the status of the memory addresses used in the ladder diagram. For information on using the Memory Map, see Map Menu below.
	Ladder Diagram	Opens the active ladder diagram when the Memory Map is active.
	Refresh	(In PLC Simulator only) Updates the HMI file when the simulator ladder is changed.

The active ladder diagram must correspond to the active HMI module. For more information on using the simulator with an HMI module, see Chapter 5.

4.3.3. Simulate Menu
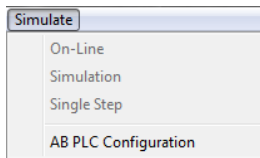
The Simulate menu allows you to choose how to operate the software. You can work online with a PLC panel and controller, offline, or in simulation mode.

	On-Line	Activates PLCMotion communication with a PLC logic controller or simulated HMI.
		Select this option again to go off-line.
	Simulation	Activates PLCMotion simulation mode for the PLC logic controller or simulated HMI.
	Single Step	Activates the active PLC ladder instructions one at a time.
	AB PLC Configuration	Opens a utility for establishing communication between the PC and the PLCLine panel. For more information, see section 7.3.1.

4.3.4. Window Menu

The Window menu allows you to define how the windows containing circuit diagrams are displayed on the screen.

Cascade	The usual Windows control for resizing and layering open windows so that each title bar is visible.
Tile Horizontal	Arranges open windows one above the other.
Tile Vertical	Arranges open windows side by side.

4.3.5. Map Menu

The Map menu contains the commands used for viewing a Memory Map. The Memory Map shows the status of the memory addresses. The Map menu is available only when a Memory Map is open.

Red, Green	Displays the status for each bit by color. The box is red when the status is false, and green when the status is true.
0,1	Displays the status for each bit by number. The box displays the number 0 when the status is false, and displays 1 when the status is true.
Hexidecimal	Displays the value of the word in hexidecimal numeric form.
Decimal	Displays the value of the word in decimal numeric form.
Octal	Displays the value of the word in octal numeric form.

4.3.6. Help Menu

The Help menu contains commands for viewing the software version information as well as the software licensing options.

About	Opens the About PLC Online Control / PLC Simulator dialog box containing the current software version information.
Registration	• Opens the Registration dialog box enabling you to perform various registration options, such as obtain and retrieve your software license by Intelitek's web site, e-mail, or fax or phone.

4.3.7. Working with the Memory Map

The Memory Map displays the status of memory addresses for an active PLC ladder. Each row has 16 boxes. Each box displays one bit, and each row represents one word. See the above Figure for a description of the Memory Map. Placing the mouse on a box displays the address at the bottom of the screen. The address values can be manually edited or automatically monitored with the Memory Map.

4.3.7.1. Manually Changing the Status of Addresses in the Memory Map

To change the status of a bit:

- Click on the bit.

To change the value of a word:

1. Click on the word value in the second column.

   The Memory Value dialog box will open.

2. Enter the new memory value in the field.

3. Click **OK**.

4.3.7.2. Automatically Monitoring the Status of Addresses in the Memory Map

To monitor the status of a PLC program:

1. Open the Memory Map.

2. Click the Simulation button or Select **Simulate | Simulation**.

   The status of the bits will change in coordination with the active PLC ladder.

5. Working with HMIs

5.1. OVERVIEW

PLC Simulator is used to run a PLC ladder diagram on a simulated HMI (Human-machine interface) panel displayed on your screen, without the need for a PLC logic controller or the PLCLine panel.

For information on how to launch and use PLC Simulator, see Chapter 4.

This chapter describes the HMIs listed in the PLCMotion program group in your Start menu. HMIs that are only available through LearnMate courses and not directly through the Windows Start menu are described within the courses.

The input and output addresses used vary depending on which controller is being used.

5.2. PLC LINE HMI

The HMI PLC Line, shown in the figure below, is a graphic display of the PLCLine hardware panel.

5.2.1. Panel Buttons

The bottom of the HMI PLC Line contains buttons that activate commands used when working with the HMI PLC Line simulation.
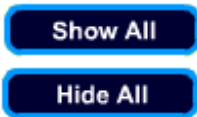
	Show All Hide All	Turns the labels on the HMI PLC Line on or off. The labels show the addresses of the Panel components. This functionality is not available when using the SLC 500 controller.
	Reset	• Resets the nut on the motor to the initial (left) position.
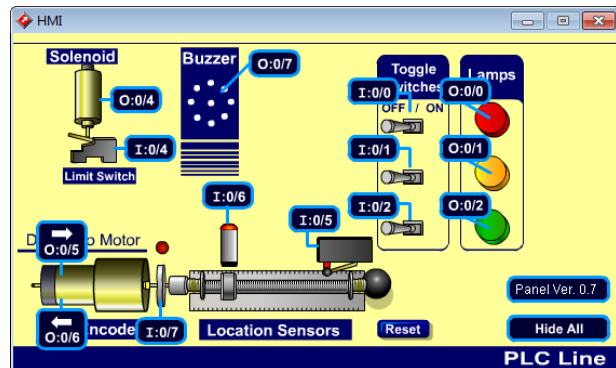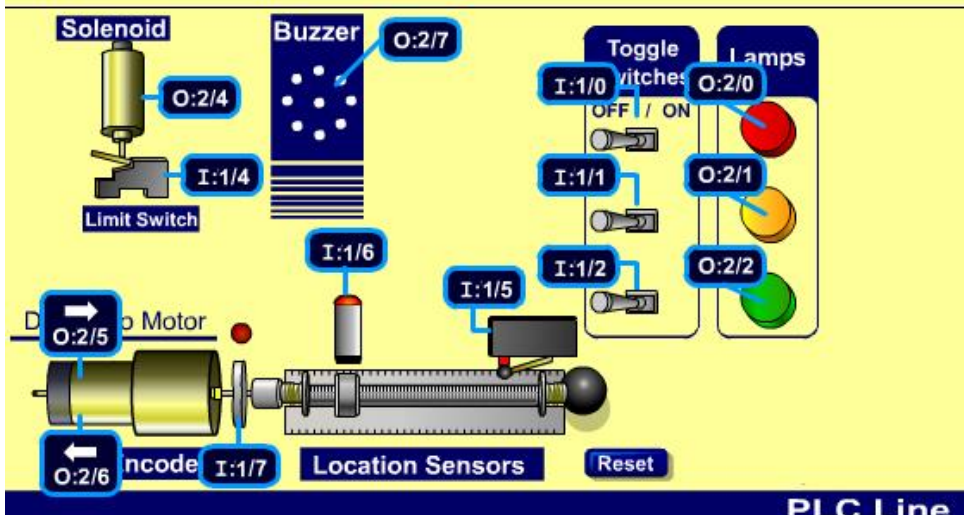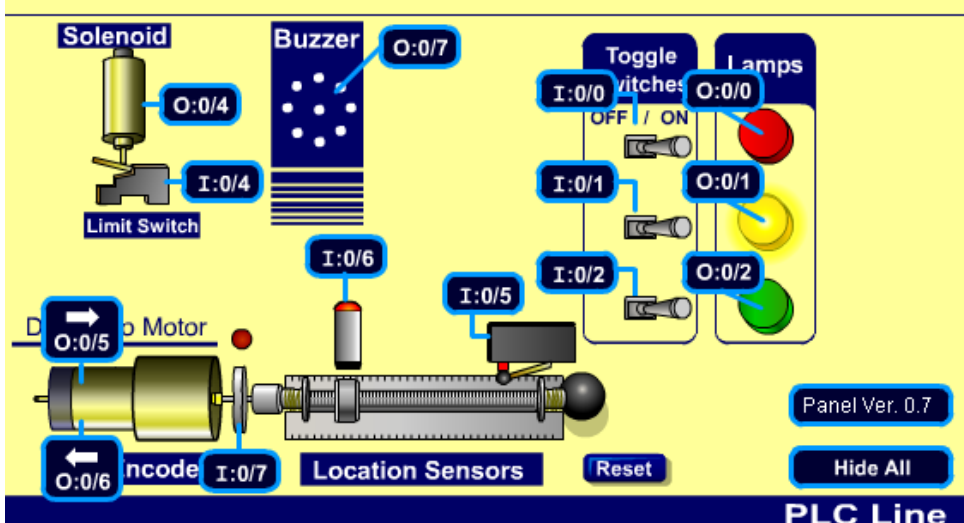
5.2.2. I/O Addresses

Controller	Addresses
SLC 500	
MicroLogix 1000 / 1100	

5.3. GATE HMI

The Gate HMI enables users to simulate ladder diagrams that control an entrance gate, which is opened and closed by an electric motor that drives one of the gate's wheels. The electric motor is controlled by two push button (PB) switches installed in the gatekeeper's booth: **OPEN PB** and **CLOSE PB.**

Assuming the gate is initially closed, the gate is opened as follows:

- Pressing the OPEN PB starts the motor, and the gate opens.
- The gate continues to open, even if the OPEN PB is released.
- Once the gate is fully open, a sensor is activated and the motor stops.

The gate-closing procedure is as follows:

- Pressing the CLOSE PB starts the motor in the opposite direction and the gate begins to close.
- The gate continues to close, even if the CLOSE PB is released.
- The motor stops once the sensor detects that the gate is fully closed.

5.3.1. I/O Addresses

Controller	Addresses
SLC 500	
MicroLogix 1000 / 1100	

5.4. ICE CREAM FILLING STATION HMI

The Ice Cream Filling Station HMI simulates the control of an ice cream filling process.
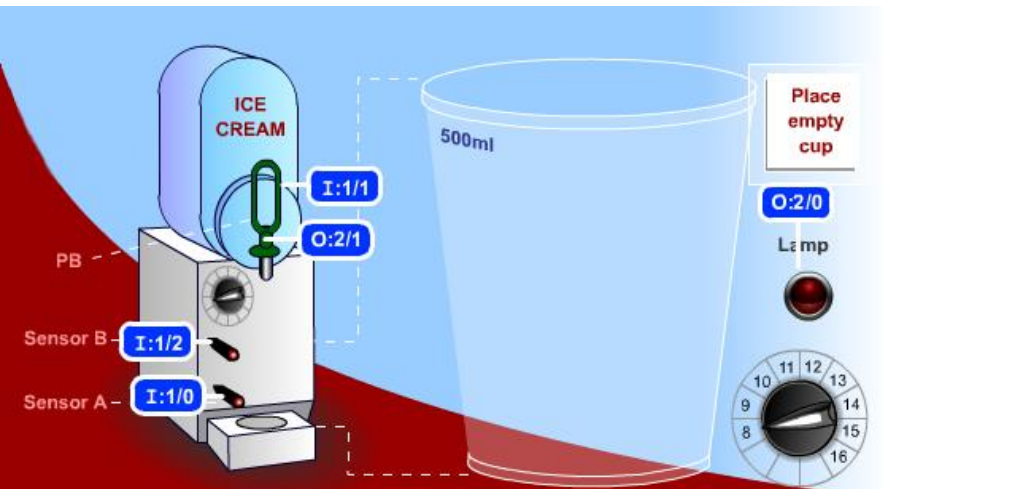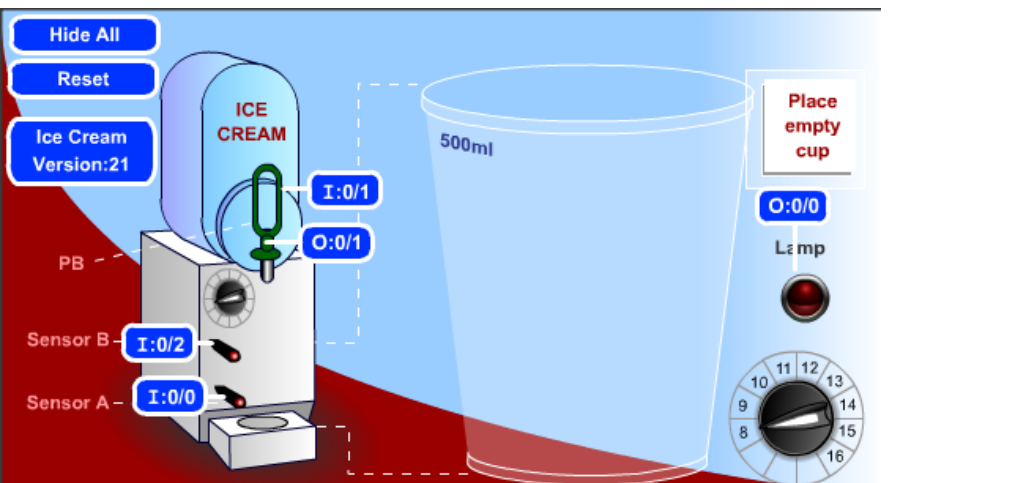
The station includes the following components:

- A filling valve.
- A cup (to be filled with ice cream).
- A PB switch that activates the system.
- Two sensors:
  - Sensor A indicates when a cup is under the valve outlet.
  - Sensor B indicates when the cup is full.

The simulated control system works as follows:

1. When an empty cup is placed under the valve outlet (indicated by Sensor A) AND the PB is pressed, the ice cream valve is opened.

2. When the cup is full (indicated by Sensor B), the filling valve closes.

3. When the ice cream flow is too slow (for example, if the ice cream viscosity is too high), a red warning lamp is activated to warn the system operator.

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5.4.1. I/O Addresses

Controller	Addresses
SLC 500	
MicroLogix 1000 / 1100	

6. Allen Bradley (AB™) Controllers Instruction List

6.1. OVERVIEW

This chapter describes the instructions used for an Allen Bradley controller. For information on how to insert instructions into your PLC ladder, see Chapter 3.

6.1.1. Address Organization

Allen Bradley PLC instruction addresses are made of words. Each word is made up of 16 bits, numbered from 0 to 15. Each group of addresses is located in a memory file. Each file contains 256 words, numbered from 0 to 255.

For an explanation of which file types to use with which type of instruction, see Chapter 3.

6.2. INSTRUCTION DESCRIPTIONS

6.2.1. Relay Type Instructions

6.2.1.1. OSR: One Shot Rising

The OSR is a conditional input instruction that triggers a one time. Use the OSR when an event must start as soon as the state of the rung changes from false to true, as triggered by a push button. An example would be to use the OSR to freeze rapidly displayed LED values.

Place the OSR on the rung immediately before the output instruction. Then reference the output as the one-shot in your program. The address that you give to the OSR input instruction is where the previous state of the rung is retained.

Use the bit address B3 for the OSR instruction. This address is not used for any other instruction in PLCMotion.

6.2.1.2. OTE: Output Energize

When this is true, the output will be energized.

6.2.1.3. XIO: Examine if Open

This instruction functions as an input or storage bit.

If the corresponding memory bit is a "1" (on), this instruction will not allow rung continuity and any outputs on its rung will be de-energized.

6.2.1.4. XIC: Examine if Closed

This instruction functions as an input or storage bit.

If the corresponding memory bit is a "1" (on), this instruction will allow rung continuity and outputs will be energized.

6.2.2. Computational Instructions

6.2.2.1. ADD: Addition

When rung conditions are true, this output instruction adds Source A to Source B and stores the result at the destination address. Source A and Source B can be either values or addresses that contain values; however, Source A and Source B cannot both be constants.

6.2.2.2. CLR: Clear

This output instruction sets all the bits in a word to (0) when rung conditions are true. The destination must be a word address.

6.2.2.3. DIV: Divide

When rung conditions are true, this output instruction divides Source A by Source B and stores the result in the destination and the math register. The value stored in the destination is rounded. The value stored in the math register consists of the non-rounded quotient (placed in the most significant word) and the remainder (placed in the least significant word).

Source A and Source B can be either constant values or addresses that contain values; however, Source A and Source B cannot both be constants.

6.2.2.4. MUL: Multiply

Use the MUL instruction to multiply one value (source A) by another (source B) and place the result in the destination. Source A and Source B can be either constant values or addresses that contain values; however, Source A and Source B cannot both be constants.

6.2.2.5. NEG: Negate

The NEG instruction changes the sign of the source and places it in the destination when rung conditions are true. The source and destination parameters must be word addresses.

6.2.2.6. SUB: Subtraction

The SUB output instruction subtracts Source B from Source A and stores the result in the destination when rung conditions are true. Source A and Source B can be either values or addresses that contain values; however, Source A and Source B cannot both be constants.

6.2.3. Program Control Instructions

6.2.3.1. JMP: Jump

When the rung condition is true, the processor jumps in the program to the rung with the specified label. Jumping forward to a label saves program scan time by omitting a program segment until needed. Jumping backward lets the controller execute program segments repeatedly.

6.2.3.2. LBL: Label

A label marks a place in a rung as a reference for a Jump instruction. This instruction has no control bits. It is always evaluated as true or logic 1.

6.2.4. Timer and Counter Instructions

6.2.4.1. CTD: Count Down

This output instruction counts down for each false-to-true transition of conditions preceding it in the rung and produces an output when the accumulated value reaches the preset value. Rung transitions might be activated by a limit switch or by parts traveling past a sensor.

6.2.4.2. CTU: Count Up

This output instruction counts up for each false-to-true transition of conditions preceding it in the rung and produces an output when the accumulated value reaches the preset value. Rung transitions might be activated by a limit switch or by parts traveling past a sensor.

6.2.4.3. RTO: Retentive Timer on Delay

An RTO function is the same as a TON except that once it has begun timing, it holds its count of time even if the rung goes false or a fault occurs. By retaining its accumulated value, retentive timers measure the cumulative period during which rung conditions are true.

6.2.4.4. TOF: Turn Off Delay

Use the TOF instruction to turn an output on or off after its rung has been off for a preset time interval. This output instruction begins timing (at either one second or one hundredth of a second intervals) when its rung goes false. It waits the specified amount of time (as set in the PRESET), keeps track of the accumulated intervals which have occurred (ACCUM), and resets the DN (done) bit when the ACCUM (accumulated) time equals the PRESET time.

The Accumulated value is reset when rung conditions go true regardless of whether the timer has timed out.

6.2.4.5. TON: Timer on Delay

Use the TON instruction to turn an output on or off after the timer has been on for a preset time interval. This output instruction begins timing (at either one second or one hundredth of a second intervals) when its rung goes true. It waits the specified amount of time (as set in the PRESET), keeps track of the accumulated intervals which have occurred (ACCUM), and sets the DN (done) bit when the ACCUM (accumulated) time equals the PRESET time.

As long as rung conditions remain true, the timer adjusts its accumulated value (ACC) each evaluation until it reaches the preset value (PRE). The accumulated value is reset when rung conditions go false, regardless of whether the timer has timed out.

6.2.5. Compare Instructions

6.2.5.1. EQU: Equal

This input instruction compares two sources. If Source A equals Source B the output will be true. It allows rung continuity if the two values are equal.

6.2.5.2. GEQ: Greater Than or Equal To

This input instruction compares two sources. If Source A equals or is greater than Source B it allows rung continuity. The rung will go true and the output will be energized.

6.2.5.3. GRT: Greater Than

This input instruction compares two sources. If Source A is greater than Source B it allows rung continuity. The rung will go true and the output will be energized.

6.2.5.4. LEQ: Less Than or Equal To

This input instruction compares two sources. If Source A equals or is less than Source B it allows rung continuity. The rung will go true and the output will be energized.

6.2.5.5. LES: Less Than

This input instruction compares two sources. If Source A is less than Source B it allows rung continuity. The rung will go true and the output will be energized.

6.2.5.6. MEQ: Masked Comparison for Equal

This conditional instruction compares 16-bit data of a source address to 16-bit data at a reference address through a mask. If the values match, the instruction is true. This instruction allows portions of the data to be masked by a separate word.

6.2.5.7. NEQ: Not Equal

This instruction tests whether two values are not equal. Source A and Source B can be values or addresses.

6.2.6. Logical Instructions

6.2.6.1. AND

When rung conditions are true, sources A and B of this output instruction are stored in a specified destination.

Sources A and B can be either word addresses or constants; however, both sources cannot be a constant. The destination must be a word address.

AND Truth Table		
SOURCE A	SOURCE B	DEST
0	0	0
0	1	0
1	0	0
1	1	1

6.2.6.2. NOT

When rung conditions are true, the source of the NOT instruction is stored in the specified destination.

The source and destination must be word addresses.

NOT Truth Table	
SOURCE	DEST
0	1
0	1
1	0

6.2.6.3. OR

When rung conditions are true, Sources A and B of the OR instruction are stored in the specified destination. Sources A and B can be either word addresses or constants; however, both sources cannot be a constant. You can enter a constant or a word address for either source parameter. The destination must be a word address.

OR Truth Table		
SOURCE A	SOURCE B	DEST
0	0	0
0	1	1
1	0	1
1	1	1

6.2.6.4. XOR

When rung conditions are true, Sources A and B of the XOR instruction are Exclusive stored in the specified destination. Sources A and B can be either word addresses or constants; however, both sources cannot be a constant.

XOR Truth Table		
SOURCE A	SOURCE B	DEST
0	0	0
0	1	1
1	0	1
1	1	0

6.2.7. Move Instructions

6.2.7.1. MOV: Move

When rung conditions preceding this instruction are true, the MOV instruction moves a copy of the source to the destination each scan. The original value remains intact and unchanged in its source location.

6.2.7.2. MVM: Masked Move

When rung conditions are true, the MVM instruction moves data from a source location to a destination, and allows portions of the destination data to be masked by a separate word. Data at the source address passes through the mask to the destination address. As long as the rung remains true, the instruction moves the same data each scan.

6.2.8. Shift Register Instructions

6.2.8.1. BSL: Bit Shift Left

On each false-to-true transition, this output instruction loads a bit of data into a bit array, shifts the pattern of data through the array to the left, and unloads the end bit of data.

An example of the use of this instruction might be for tracking bottles through a bottling line where each bit represents a bottle.

6.2.8.2. BSR: Bit Shift Right

On each false-to-true transition, this output instruction loads a bit of data into a bit array, shifts the pattern of data through the array to the right, and unloads the end bit of data.

7. Online Operation

7.1. OVERVIEW

The PLCMotion software is configured to work online with a PLC controller. To connect the controller to the PLC components, consult the manual provided with your controller.

7.2. CONNECTING A CONTROLLER TO A PC

7.2.1. Allen Bradley (AB) SLC 500, MicroLogix 1000 or MicroLogix 1100 PLC

To connect the controller to the computer:

- Connect an RS232 cable from the RS232 port on the controller to an open COM port on the computer, or
- Connect an RS232 cable from the RS232 port on the controller to an RS232 – USB adapter and connect the adapter to an open USB port on the computer.

7.3. PC-CONTROLLER COMMUNICATION

7.3.1. Configuring Communication Settings

If there is no communication between the PC and the controller, the communication settings must be configured. Ensure that the TESTPLC.exe application is closed before continuing.

To configure the communication settings:

1. Run SERVCFG.exe from the C:\Intelitek\PLCMotion\ folder, or from within PLC Online Control, select **Simulate| AB PLC Configuration**.
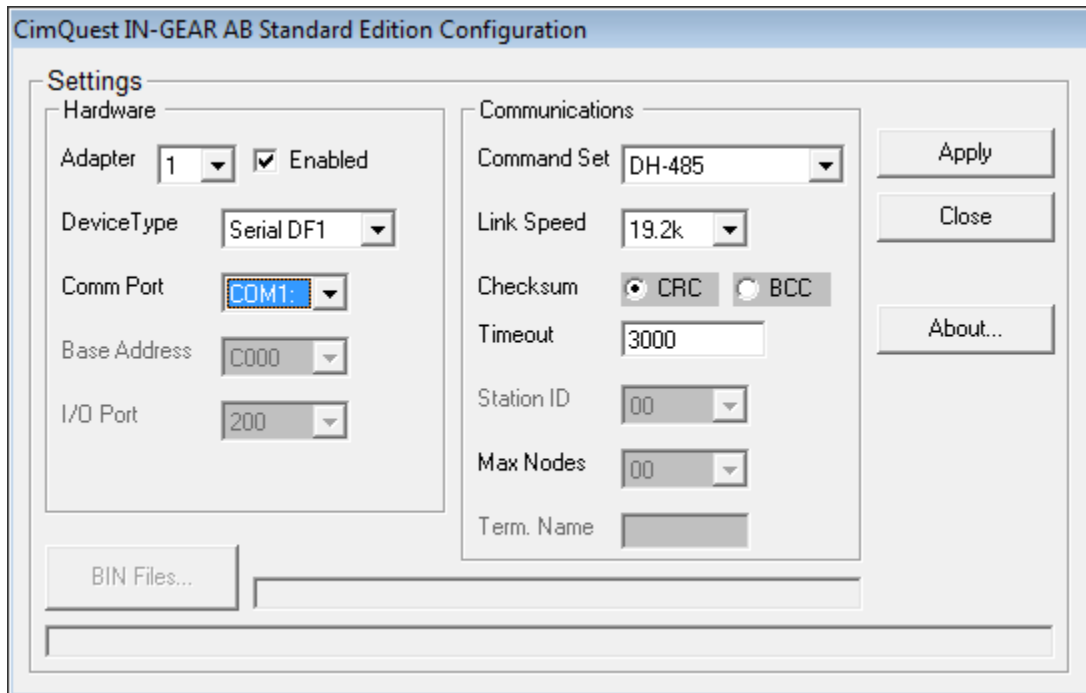
2. Ensure that the correct Com Port is selected.

    If you are using a RS232 – USB adapter, identify the Com Port number from Windows Device Manager.

3. Configure the Communications settings as required.

4. Click **Apply**, and then **Close**.

Run TESTPLC.exe as described in the steps in the Testing Communication section below to test if communication has been enabled between the PC and the controller.
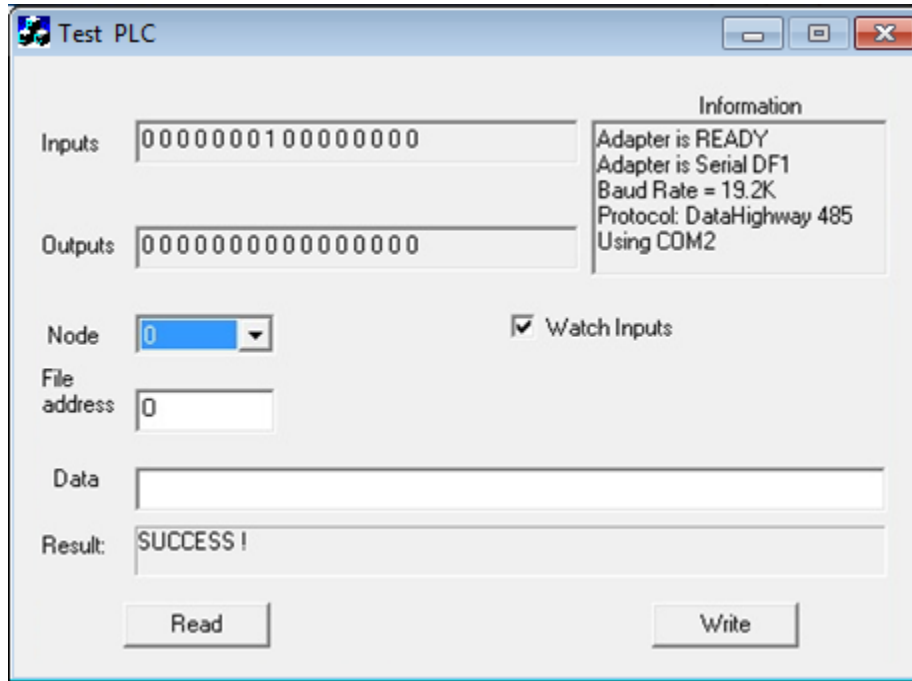
7.3.2. Testing Communication

For most PCs configuration is not required in order to facilitate communication with the controller.

To test whether the PC communicates with the PLC:

1. Run **TESTPLC.exe** from the C:\Intelitek\PLCMotion\ folder.

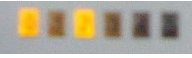1. In the Data field, insert a number between 1 and 63.

2. Click Write.

The number will appear in binary form in the Outputs field.

If communication is successful:

- The word "SUCCESS!" will appear in the Result field.
- The corresponding output LEDs on the controller for the binary number will light-up.

For example: If you insert the number 5 in the Default field, since 5 is equal to 101 in binary, the first and third LEDs will light-up.

101000 =

If communication is unsuccessful, an error will appear in the result field (see the example error message in the image below). If this occurs, the PLC communication settings must be configured.
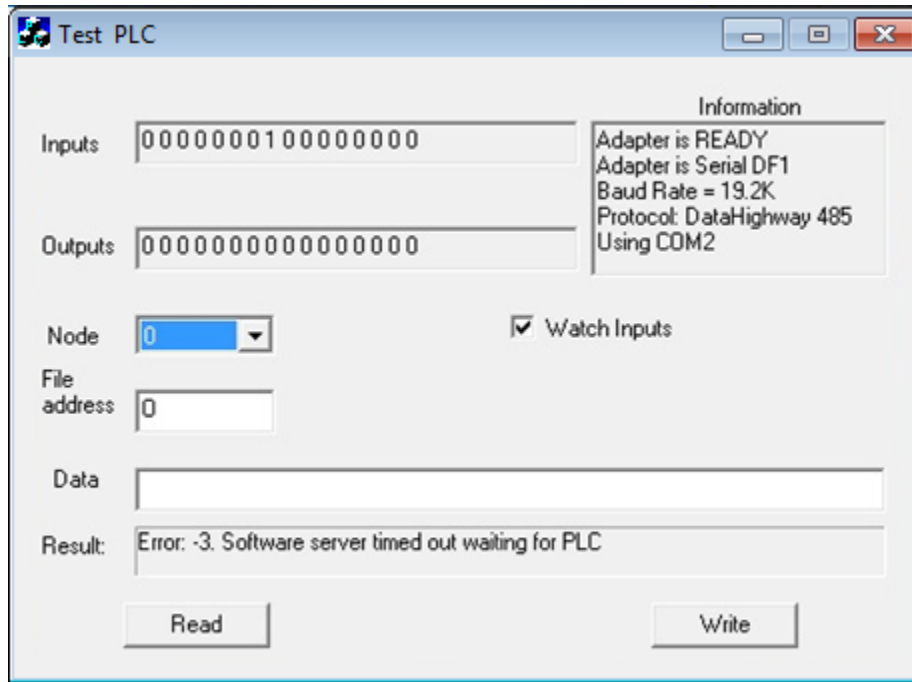
IMPORTANT: If communication is successful, the controller must be returned to its default state after performing the test. To do so, insert the number "0" and click **Write**. Then close the program.

To confirm that there is communication between the PC and the PLC:

1. From the Start menu, select **Programs | PLCMotion | PLC Simulator**.

2. Open the PLCLINE4.LAD ladder diagram (if using an AB SLC 500 controller), or PLCMLINE4.LAD (if using an AB MicroLogix 1000 or 1100 controller) located in the C:\Intelitek\PLCMotion\AB_work\Solutions\ folder.

3. Click the On-Line ![On-Line icon] icon followed by the Simulation ![Simulation icon] icon.

PLC Line activity should be reflected in the ladder diagram. If there is still no communication, contact technical support.

8. Software Licensing

For information regarding software licensing, refer to the Intelitek Software Licensing Guide in the Books folder on the installation CD.