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User's Guide

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OM-LMPLC SERIES

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3. Repair instructions and/or specific problems relative to the product.	3. Repair instructions and/or specific problems relative to the product.

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All examples are included on the Procedure Writer install disks. Their names are indicated by (filename) in the following table.

Section I - General Information

Introduction

This section gives a general overview on the OM-LMPLC.

Description

The purpose of the OM-LMPLC is to function as a flexible I/O controller for test labs. In contrast with widely available controllers, the OM-LMPLC was specifically designed for on/off cycling tests such as pneumatic cycling, electronic power cycling, and other durability testing. Being tailored to the particular niche market brings features not available on current PLC's. Features usually required for testing such as cycle counters, ease of use, computer control, and solid state relay outputs.

Documentation

The User's Documentation is the comprehensive source for information concerning the OM-LMPLC. Use the Table of Contents, Table of Figures, and Table of Tables to quickly locate the information you require. Other sources of information include the Procedure Writer's on-line documentation, the Omega WWW (World Wide Web) site, and Omega's Application notes.

Safety Considerations

Although the OM-LMPLC is a low voltage device, the OM-LMPLC could control potentially dangerous test setups. The OM-LMPLC is not designed for controlling in situations where errors in the control logic could cause human injury. Please use common sense in your use of the OM-LMPLC and apply standard safety practices.

Qualified personnel should only perform wiring. Extreme care should be taken when working with dangerous voltage levels.

When output errors could cause problems, for example if a Solid State Relay fails "On", it is recommend that the user installs a output disable circuit on each of the commons of the output connector. OM-LMPLC's output enable button on its front panel disables the outputs from the control side only, so if the Solid State Relay fails "On" the output enable button will not have any affect.

Instrument Identification

On the rear of the OM-LMPLC is an identification number. This label clearly identifies the serial and model number of the OM-LMPLC.

Section II - Installation

Introduction

This section shows how to get started using the OM-LMPLC. This includes initial components inspection, mounting, installing the programming software, and configuring your PC's communications port.

Initial Inspection

When you receive your OM-LMPLC, you should have the following:

- Power supply (or) power jack connector
- Serial cable
- Setup disks (2) for the Procedure Writer Software (included in this manual)
- OM-LMPLC
- OM-LMPLC User's Documentation
- Panel mount slides (or) rubber feet and handle

If you do not have any of the above, please contact Omega's.

Power requirements

The OM-LMPLC comes with its own wall transformer DC power supply or a power jack connector compatible with the input power connector on the OM-LMPLC. The power jack connector allows you to use an alternative DC power source. Consult the Specifications in the appendices for information on power requirements.

Bench Operation

The OM-LMPLC is suitable for bench top operation. However, care should be taken when using the OM-LMPLC for controlling dangerous AC voltages. It is recommended that you enclose the OM-LMPLC in a protective case when working with AC voltages.

Panel Mounting

You can install the OM-LMPLC into a panel. In order to install the OM-LMPLC into a panel, you can use the panel mount installation kit. Contact Omega's for more information.

Software Installation

Use the two disks included with the OM-LMPLC to install the "Procedure Writer" software. The following steps describe the installation process.

1. Insert the program disk into a floppy disk drive.
2. Choose "Run" from the file menu of Program Manager if you are using Windows 3.x. If you are using Windows 95, press start and choose run.
3. Type the drive letter followed by a colon, slash (\ ) and then "setup". For example, if you placed the disk into the "a" drive it would be "a:\setup.exe"
4. Press enter.
5. Follow the instructions as shown in the setup program. The setup will check to see if there is enough space on your hard drive, install the software, and allow you to choose the directory for locating the software.

Setting up a free Comm port

Most PCs, both laptop and desktop type, have two Comm ports. Many devices use Comm ports to get data into and out of your PC. Two of the most prominent devices are mice and modems. Most desktop PCs have a mouse connected to one of their Comm ports. Most Laptops have a mouse built in which does not use the external Comm port connector. You must determine which Comm port is not in use. See Setting up a Comm port on page 32 for more information.

Section III - Operating Instructions

Introduction

This section describes how to operate the OM-LMPLC. It includes information about the hardware, software features, and the OM-LMPLC step commands.

Controls and Indicators

In order to simplify use and reduce cost, the OM-LMPLC's front panel user interface is extremely simple. The front panel of the OM-LMPLC has only two buttons, a key-switch, a connector, and a display (Figure 1). The rear panel has connections for the Inputs, Outputs, and the device power. All user interactions occur through the front panel.
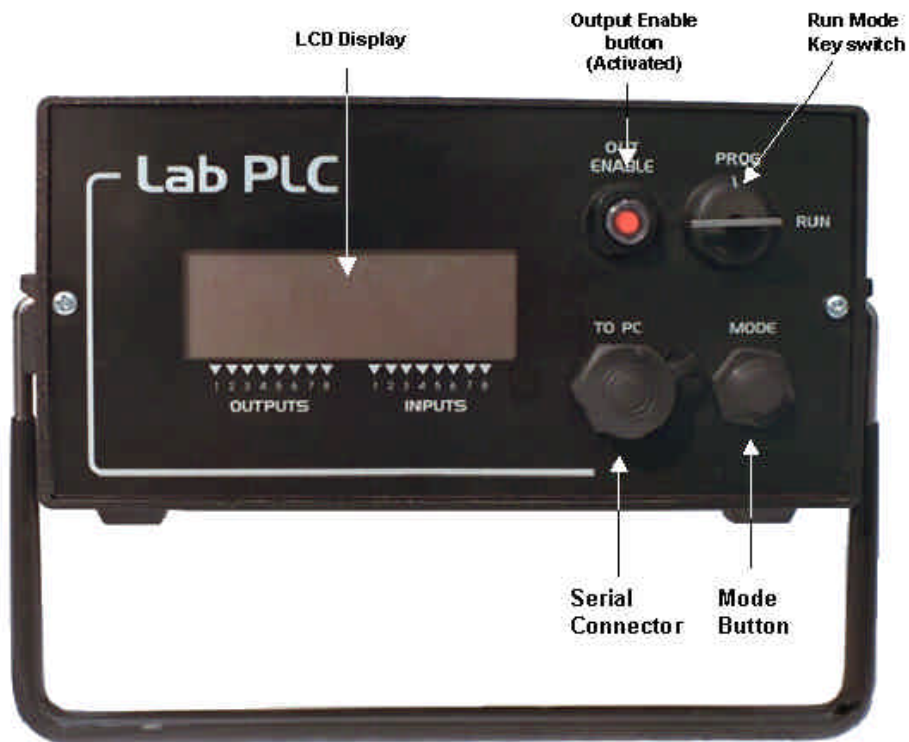
Figure 1 - OM-LMPLC front panel

The Mode push button is used to select the currently viewed display, to remove the OM-LMPLC from "Pause Mode", and to reset the procedure and internal counters. The operation of the "Mode" button is defined in the "Program, Run, and Pause Modes" sub-section later in this section.

The key-switch selects the operational mode of the OM-LMPLC. The OM-LMPLC has three modes: Pause, Run, and Programming Mode. The sub-section called "Program, Run, and Pause Modes" clearly defines the interaction of the key-switch and the different modes.

The output enable push button controls the signal to the OM-LMPLC's internal hardware output chip that enables its outputs. The purpose for this switch is so you can quickly disable the outputs. For increased safety, the output enable switch is independent of the Microprocessor control. When this switch is depressed, it will show an orange dot. In this state, it will enable the Microprocessor to control the outputs.

Note: The "output enable" safety feature only disables the outputs from the control side. For example, if the solid state relay failed on (Shorted) this switch would have no effect. For possible dangerous situations an external shut off relay should be added on the power side.

The serial connector is where you connect the serial cable with the PC. This is how the OM-LMPLC communicates with the PC.

The back panel of the OM-LMPLC has the connectors for the outputs, inputs, and power (Figure 2).
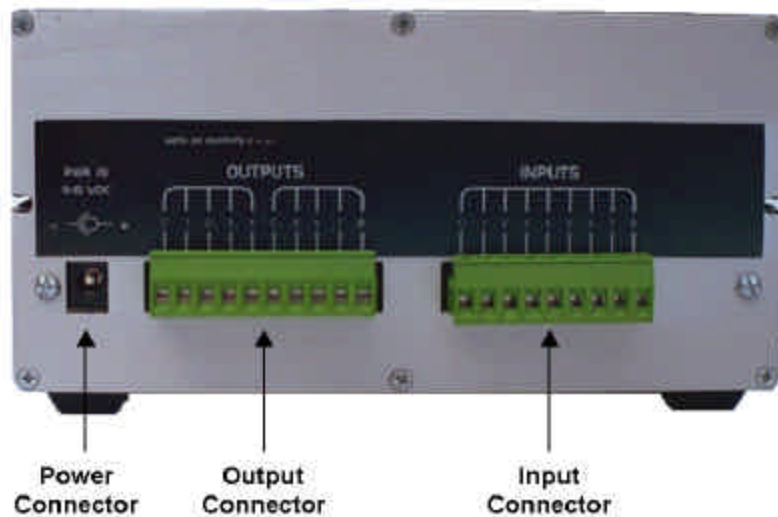
Figure 2 - Rear of OM-LMPLC

The power connector is where the proper power source should be connected. This connector has positive at its center and ground on the outside. Consult specifications for power requirements.

The OM-LMPLC output connector is a ten-position connector. It has two commons located at position 1 and 5. Outputs one through four share position 1 common and outputs four through eight share position 5. For example connection diagrams see the "Connecting Outputs" sub section later in this section.

The OM-LMPLC input connector is a nine-position connector. Position 1 of the connector is a common to all eight inputs. For more information on connecting inputs to the OM-LMPLC, see sub-section called "Connecting Inputs" later in this section.

Connecting Inputs

The inputs on the OM-LMPLC are bi-directional LED opto-isolators (Figure 3). You can use any DC voltage source from 5 to 35 VDC to power the LED to complete the circuit. Wiring for dry contact switches and transistor output type devices (such as proximity sensors and photo detectors) are shown in Figure 4.
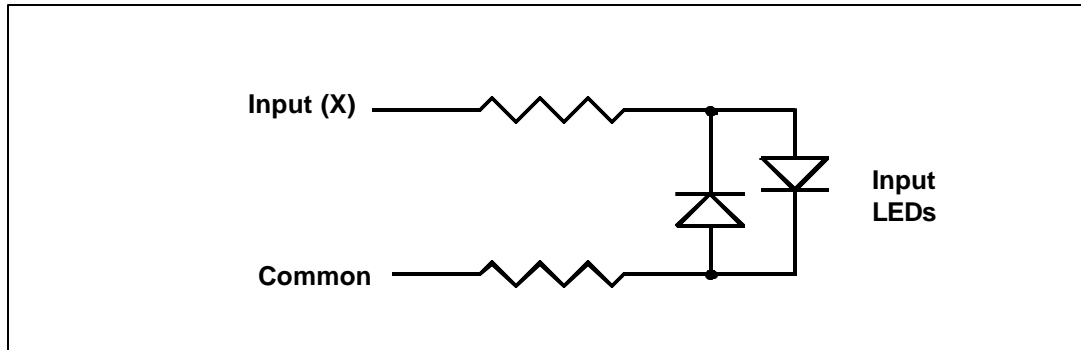
Figure 3 - OM-LMPLC Input Circuit
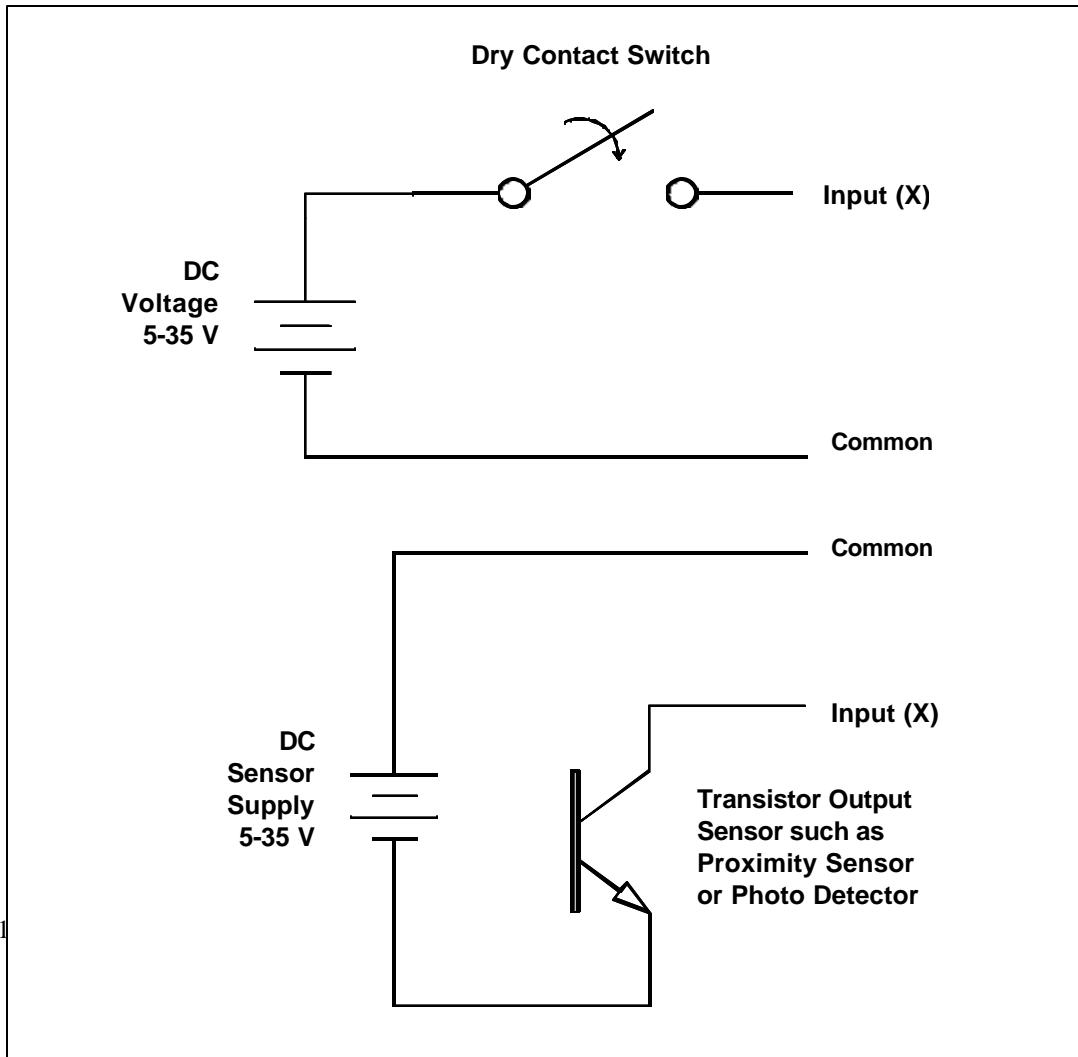
Figure 4 - Typical OM-LMPLC Input Wiring

Connecting Outputs

The OM-LMPLC has a 10-position connector for outputs. Outputs are available for DC and AC. Typical wiring for DC and AC connections is shown in
Figure 6 and Figure 7, respectively.

Output (X)

Crydom Solid
State Relay AC
Type (SCR or
TRIAC)

Common (X)
C1=OUT 1-4
C2=OUT 5-8

Output (X)

Crydom Solid
State Relay DC
Type (Bipolar
Transistor) Note
polarity

Common (X)
C1=OUT 1-4
C2=OUT 5-8
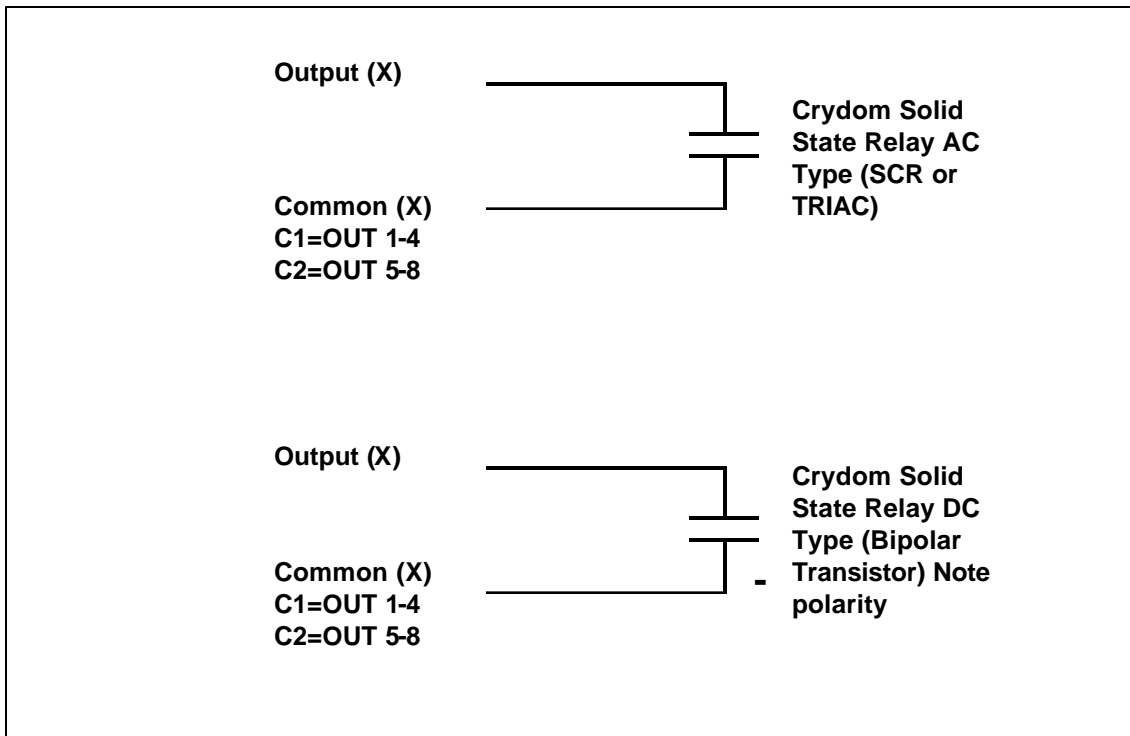
Figure 5 - OM-LMPLC output ciruit for AC and DC
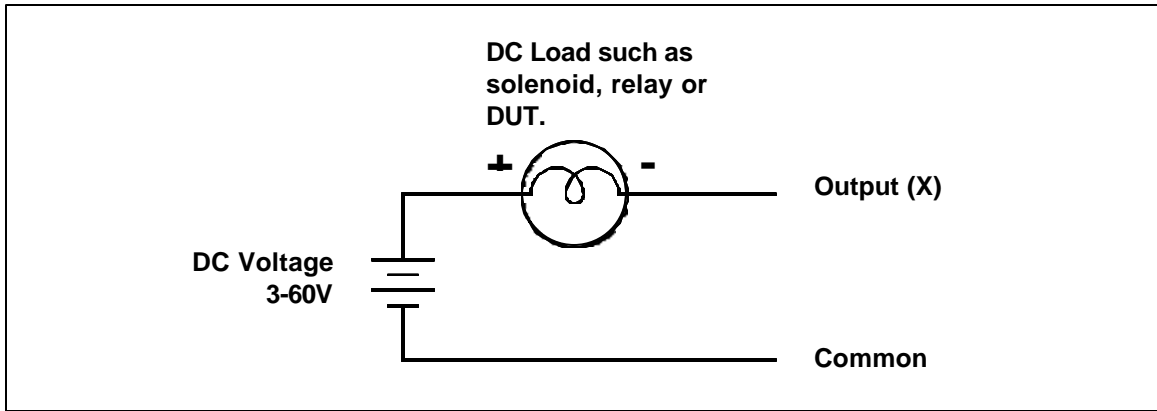
Figure 6 - Typical OM-LMPLC DC Output wiring
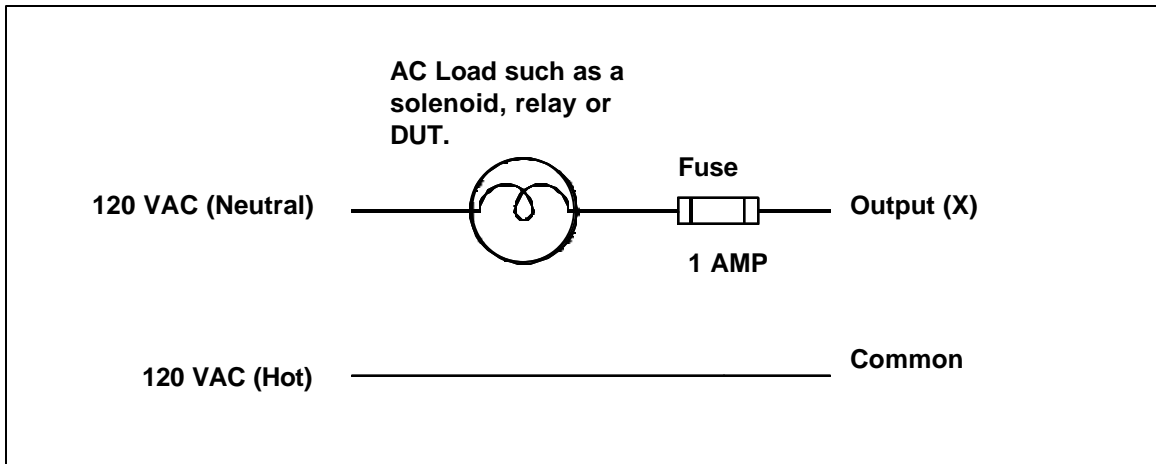
Figure 7 - Typical OM-LMPLC AC Output wiring

Program, Run, and Pause Modes

The OM-LMPLC operates in three different modes. The modes are the Run mode, Pause mode, and Program mode. For each mode, the OM-LMPLC behaves differently. The function of the "Mode" button also changes depending on what operational mode the OM-LMPLC is in. The key-switch is used to change the operational mode of the OM-LMPLC.

When the key-switch is placed in to the "Prog" position, the OM-LMPLC enters program mode. Moving the switch to the run position places the OM-LMPLC into pause mode. Run mode is then entered from pause mode by pressing the "Mode" button. In this case, the "Mode" effectively acts as a start button. The OM-LMPLC will power-up in pause mode if the key-switch is set to the "run" position. This avoids accidentally running a program on power up.

The program mode is where the OM-LMPLC is programmed and reset. In program mode, the "Mode" button serves two functions. First, pressing the mode button immediately switches to the next display. If the "Mode" button is held pressed, the OM-LMPLC will begin the reset countdown. See the next section for more information on resetting.

Pause mode serves as a temporary mode between the Program and Run mode. In the run mode, the "Mode" button serves as a Start button. When the mode button is pressed, the OM-LMPLC enters run mode. Pause mode can also be entered using the "Pause Test" step command.

When the OM-LMPLC enters the run mode, it immediately begins running the program at the current step. The current step is shown on the program information display. In the run mode, the mode button cycles through the six displays.

Resetting the Counters and Procedure

You can reset both the on-board counters and the procedure right from the OM-LMPLC's front panel when it is in program mode. You have the option to reset only the procedure or both the procedure and the counters. If you want to reset the counters and not the procedure, you can do this through the "Edit counters" dialog in the Procedure Writer software.

By holding the "Mode" button for longer than five (5) seconds, the "Reset" count down screen appears (Figure 8). The OM-LMPLC will begin to count down (this is indicated by the blocks shown). When all the blocks right of the "Procedure" label disappears, the procedure is reset (this will take approximately 5 seconds). When reset, the reset message appears (Figure 9). After resetting the procedure, the OM-LMPLC will be counting down to reset the counters in a similar fashion. To cancel resetting, release the mode button before the OM-LMPLC counts down to zero blocks.
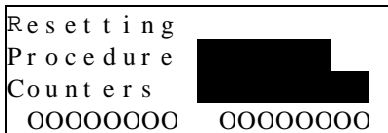
Figure 8 - Resetting Procedures "Count Down" warning on the LCD Display
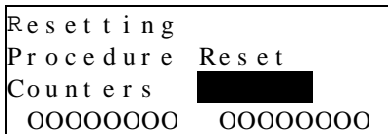
Figure 9 - Resetting procedures with "Procedure" reset message

OM-LMPLC Displays

The OM-LMPLC has six standard displays. They are the following: Counters 1-2, Counters 3-4, Counter 5-6, Counters 7-8, Test information, and Procedure information display. It also has a test complete display and special displays during programming and procedure resetting.

On each of the six displays, the lower line of the display reflects the Input and Output status of the OM-LMPLC (Figure 10). A filled in box indicates an input or output is activated while an empty box indicates that an output is deactivated. This display is very useful for debugging your test setup. Note, if the output enable button is not activated, the output reading will not reflect the actual output status.

```
Test Bannner Line
Counter 1       000000
Counter 2       000000
 O■OOOOOO    ■OOOOOO
```

Figure 10 - Output 2 Activated and Input 1 activated

The top line of all the displays, except for the procedure information display, show the test banner. This is a custom display setup in the "Procedure Writer" software. This is setup through the "Custom displays" selection in the "Edit" pull down menu.

Displays Counter 1-2, Counter 3-4, Counter 5-6, and Counter 7-8 show the counter's custom 13-character description and it's six digit count

```
Test Bannner Line  .
Counter 1       000000
Counter 2       000000
 OOOOOOOO   OOOOOOOO
```

Figure 11 - Counters 1-2 display

The test information display is a custom display that can be used for general test information. This is setup through the "Custom displays" selection in Procedure Writer.

The procedure information display shows the information about the current state of the procedure (Figure 12). It shows the current step the OM-LMPLC is operating, the name of the command of that step, and the value information for that step. For example, output type commands will show the time left to complete the current step. For wait for input type steps, the OM-LMPLC will display the Inputs the OM-LMPLC is waiting for. Use this screen and a procedure print to debug your tests.

```
OutputsOn/Off
Step03 000:00:00.25
 A:000005 B:000000
 OOOOOOOO   OOOOOOOO
```

Figure 12 - Procedure Information Display

Programming Overview

When you design a test, usually a *procedure* is developed which shows *step* by *step* on how to carry out the *actions* for that particular test. By following this procedure, you can carry out the test consistently over and over again. You start at *step number* one, then perform *step number* two, etc. until you arrive at the last step. Sometimes, you may have to repeat certain steps a number of times.

If you understand the above test procedure analogy you can understand programming the OM-LMPLC. You define a *procedure*, which has steps. Each *step* has a number, and on each step, an *action* is performed. The first step, step number one, is performed first. Then, following the logic of the procedure, each step is performed.

The OM-LMPLC has a small number of actions that can be performed. Each step has one action. A particular action may require parameters detailing how that action is to be performed. For Example, the action "Jump to another step" would require a parameter of which step to jump to. The command that turns outputs on/off needs to know what outputs to turn on/off and a time.

Examples of available actions are the following:

- Turn outputs on and off for a certain time period
- Wait until certain inputs are activated or deactivated
- Jump to different steps if inputs are activated or deactivated
- Increment on board counters
- Count inputs that are activated
- Perform a group of actions a specified number of times (Looping)
- Jump to a different step unconditionally
- Declare an END test to show a display or attract attention with an audible alarm
- Pause the test to wait for operator attention with a optional audible alarm

These commands are explained in detail in the sub-section called "Step Commands".

A simple example of a procedure to get a glass of water is the following:

1.   Turn on Faucet
2.   Wait until the glass is full
3.   Turn off Faucet
4.   End - Now you have a glass of water

First, the OM-LMPLC will turn on the output required to turn on the faucet. Then the OM-LMPLC will wait until the "glass full' input is activated. When this happens, it turns off the faucet and stops. You now have a glass of water.

Step Commands

OVERVIEW

The OM-LMPLC runs a procedure composed of steps. Logically, like any procedure, the OM-LMPLC starts at step 1 and then follows each step sequentially until its done. Each step has a command associated with it, which tells the OM-LMPLC to do something meaningful. These commands perform actions such as turn on outputs, increment counters, or check inputs. A command may have a value and connections to inputs,

outputs or counters. The meaning of the value depends on the particular command. Table 1 below summarizes the step commands.

Table 1 - Summary of Step Commands

Step command	Value	Associated with
Turn Outputs "On/Off"	Length of time of the step	Outputs
Turn Outputs "On"	Length of time of the step	Outputs
Turn Outputs "Off"	Length of time of the step	Outputs
Wait for Inputs to be "On"	Length of time out and step	Inputs
Wait for Inputs to be "Off"	Length of time out and step	Inputs
Wait	Time to wait	None
End Test	Beep on or off	None
Pause Test	Beep on of off	None
Jump if Inputs are "On"	Step to jump to	Inputs
Jump if Inputs are "Off"	Step to jump to	Inputs
Increment Counters	None	Counters
Count Inputs	None	Inputs
Begin Loop	Length of the Loop	None
End Loop	None	None
Jump	Step to jump to	None

TURN OUTPUTS "ON/OFF"

The turn outputs on/off command will activate and deactivate outputs. The Outputs selected will be turned "on" and the outputs not selected will be turned "off". The step value for this command indicates how long the OM-LMPLC will remain performing this step. The procedure information display will show the time remaining until the OM-LMPLC switches to the next step.

Example 1 demonstrates how this command can be used to cycle power to a device connected to output 1. On the first step, a "Turn outputs on/off" command is used to turn power on for 5 seconds. Then the "Turn outputs on/off" is used in step 2 to power off the device for five seconds. Finally, in step 3, the OM-LMPLC will immediately return to step 1 and repeat the process.

Example 1 - Turning outputs on and off with the "Outputs On/Off" command (ex_onoff.lm1)

Step no	Step Command	Value	1	2	3	4	5	6	7	8	Comments
1	Turn outputs on/off	00:00:05.00	Y	N	N	N	N	N	N	N	Turn power on for 5 seconds
2	Turn outputs on/off	00:00:05.00	N	N	N	N	N	N	N	N	Turn power off for 5 seconds
3	Jump to another step	Step 1	N	N	N	N	N	N	N	N	Keep cycling power

TURN OUTPUTS "ON"

This command is nearly the same as "Turn Outputs On/Off" command. The difference is that the selected inputs are turned "On" without affecting the non-selected outputs.

Example 2 shows how this command can be used. This example shows how, by adding two external switches, you can control if a part is cycled or not.

Step 1 checks to see if the first switch is not enabled with the" jump if inputs are off" command. If it is not it jumps to step 4, thereby not turning on output 1 or increasing count 1. At step 4, a similar operation is performed except that input 2 is examined. Then in step 7, the outputs that are turned on stay on for one second. Step 8 then turns them off. Finally, in step 9 a jump is made back to step one to repeat the process.

The value of this command is that step 5 will only affect output 2 and nothing else. Therefore, if output 1 was turned on it will still be turned on during step 7. Similarly, if output 2 was turned off output 1 will still be turned on during step 7.

Example 2 - Running parts when selected only using the Turn Outputs On command (exturnon.lm1)

	Outputs	Inputs	Counters
1	Door 1	Cycle Door 1	Door 1 count
2	Door 2	Cycle Door 2	Door 2 count

Step no	Step Command	Value	1	2	3	4	5	6	7	8	Comments
1	Jump if inputs are off	Step 3	Y	N	N	N	N	N	N	N	Should we cycle Door 1
2	Turn outputs On only	00:00:00.00	Y	N	N	N	N	N	N	N	Cycle door 1
3	Increase a counter(s)	N/A	Y	N	N	N	N	N	N	N	Keep track of door 1 cycles
4	Jump if inputs are off	Step 5	N	Y	N	N	N	N	N	N	Should we cycle door 2
5	Turn outputs On only	00:00:00.00	N	Y	N	N	N	N	N	N	Cycle door 2
6	Increase a counter(s)	N/A	N	Y	N	N	N	N	N	N	Keep track of door 2 cycles
7	Wait	00:00:01.00	N	N	N	N	N	N	N	N	Allow outputs to be on 1 second
8	Turn outputs Off only	00:00:01.00	Y	Y	N	N	N	N	N	N	Turn both outputs on
9	Jump to another step	Step 1	N	N	N	N	N	N	N	N	Keep cycling

TURN OUTPUTS "OFF"

This command is nearly the same as the "Turn Outputs On/Off" command. The difference is that the selected inputs are turned "Off" without affecting the non-selected outputs.

WAITING FOR INPUTS TO BE "ON"

When the OM-LMPLC encounters this command, it waits for the selected inputs to be activated. It waits only a specific length of time called a time out period. If the inputs are activated within this time out period, the OM-LMPLC continues to the next step immediately. If the inputs are not activated within a time out a jump is made to the step indicated in this steps value.

The OM-LMPLC checks once every 250 ms for the inputs to be activated. Therefore, inputs must be activated for 250 ms to guarantee the OM-LMPLC will react. On the procedure information display, it shows what inputs need to be activated to complete this step, the time remaining to wait for these inputs to be activated, and a step to jump to.

In Example 3, the "Wait for inputs on" command is used to provide feedback during door cycling. In step 1, we turn on the outputs. Then, in step 2, we wait until input one is activated. As soon as it is activated, we move to step 3. If input 1 is not activated within 10 seconds, a jump to step 6 is made where an alarm is activated. In step 3 we close the door. Then, in step 4, we wait for it to close. Then, the entire process repeats by jumping back to step 1.

Example 3 - Using inputs to monitor test progress with the Wait Inputs command (exwaitin.lm1)

Wire List	Outputs	Inputs	Counters
1	Open Door	Door Open	Count 1
2	Close Door	Door Closed	Count 2
3	Alarm		Count 3

Step no	Step Command	Value	1	2	3	4	5	6	7	8	Comments
1	Turn outputs on/off	00:00:00.00	Y	N	N	N	N	N	N	N	Open the door
2	Wait until inputs are on	00:10.00 -> 6	Y	N	N	N	N	N	N	N	Wait until door is closed
3	Turn outputs on/off	00:00:00.25	N	Y	N	N	N	N	N	N	Close the door
4	Wait until inputs are on	00:10.00 -> 6	N	Y	N	N	N	N	N	N	Wait until door is closed
5	Jump to another step	Step 1	N	N	N	N	N	N	N	N	Keep Cycling
6	Turn outputs on/off	00:00:00.25	N	N	Y	N	N	N	N	N	Sound Alarm and wait for technician
7	Jump to another step	Step 6	N	N	N	N	N	N	N	N	Keep sounding alarm until reset

WAITING FOR INPUTS TO BE "OFF"

This command is very similar to the "Waiting for Inputs to be on" except that the selected inputs must be off or deactivated. On the procedure information display, it shows what inputs need to be off to complete this step, the time remaining to wait for these inputs to be activated, and a step to jump to.

WAIT

This command simply waits a specified time before going to the next step. This step's value is the length of time this step waits.

END TEST

This command suspends execution of the OM-LMPLC and shows the test complete display on to the LCD screen. You can select whether the OM-LMPLC sounds it's alarm or not for this step.

This step is useful when you need the OM-LMPLC to inform you or other lab personnel that the test is complete.

PAUSE TEST

This command makes the OM-LMPLC enter pause mode. Pause mode stops the OM-LMPLC procedure and shows "Press mode to start" message on the OM-LMPLC LCD display. The step value is whether the OM-

LMPLC should sound the OM-LMPLC's internal alarm when this command is activated. The states of the outputs are maintained when pause mode is entered.

This command is useful for cycling tests where you must perform a visual inspection of the parts on an interval. You can use the "Pause Test" command to stop the OM-LMPLC procedure every required number of cycles and alert you that the test needs service.

JUMP IF INPUTS ARE "ON"

This command will jump to another step instead of going to the following step if inputs are activated. If the inputs that are selected are all activated when this step is reached, the OM-LMPLC's next step will be changed to the step selected for this step command.

Example 4 shows how to use the Jump if command to run two different programs selected by an external switch. On step 1 a check is made on input 1. If activated, a jump is made to step 5. Otherwise, step 2 is then executed. Steps 2 and 3 run at a cycle rate of 2 seconds, while 5 and 6 run at a cycle rate of 4 seconds.

Example 4 - Running two different tests with one procedure using JumpIf command (exjumpin.lm1)

Step no	Step Command	Value	1	2	3	4	5	6	7	8	Comments
1	Jump if inputs are on	Step 5	Y	N	N	N	N	N	N	N	Run test 2 if selected
2	Turn outputs on/off	00:00:01.00	Y	N	N	N	N	N	N	N	Push for 1 second
3	Turn outputs on/off	00:00:01.00	N	N	N	N	N	N	N	N	Release for 1 second
4	Jump to another step	Step 1	N	N	N	N	N	N	N	N	Keep cycling
5	Turn outputs on/off	00:00:02.00	Y	N	N	N	N	N	N	N	Push for 2 seconds
6	Turn outputs on/off	00:00:02.00	N	N	N	N	N	N	N	N	Release for 2 seconds
7	Jump to another step	Step 1	N	N	N	N	N	N	N	N	Keep cycling

JUMP IF INPUTS ARE "OFF"

This is the same command as Jump if inputs are ON except the selected inputs should be off in order to qualify for a jump.

INCREASE COUNTERS

The increment counters command increments one of the OM-LMPLC's internal on-board counters. For this command, you must select the counter you wish the OM-LMPLC to increment. This step has no value.

Example 6 shows how the counters can be used to count cycles. On step 1, the device power is turned on. Then it is turned off in step 2. Finally, in step 3, a counter is incremented to keep track of cycles. This entire cycle repeats itself because step 4 jumps to step 1.

Example 5 - Using counters to track cycles (ex_cntr.lm1)

Step no	Step Command	Value	1	2	3	4	5	6	7	8	Comments
1	Turn outputs on/off	00:00:05.00	Y	N	N	N	N	N	N	N	Turn power on for 5 seconds
2	Turn outputs on/off	00:00:05.00	N	N	N	N	N	N	N	N	Turn power off for 5 seconds
3	Increase a counter(s)	N/A	Y	N	N	N	N	N	N	N	Increase counter
4	Jump to another step	Step 1	N	N	N	N	N	N	N	N	Keep cycling power

COUNT INPUTS

When the OM-LMPLC encounters this command it takes the current input reading and then compares it with the inputs you selected in the Procedure Writer for this command. If one of the inputs you have selected is activated, it increments a counter. The counter it increments is a direct correlation between the input number and the counter number. For example, if input 1 was on and selected in procedure writer, then Counter 1 would be incremented. This command has no value.

Example 6 shows how to use the count inputs command to cycle switches. On step one we actuate all the switches by turning all outputs on for one second. Then, we count each switch contact that was made (These are wired to each input). Next, we stop pressing the switch for 1 second. Finally, we repeat the process by returning to step one.

Example 6 - Counting inputs directly with the "Count Inputs" command (ex_cntin.lm1)

Wire list	Outputs	Inputs	Counters
1	Close Sw 1	sw 1 closed	sw 1 count
2	Close Sw 2	sw 2 closed	sw 2 count
3	Close Sw 3	sw 3 closed	sw 3 count
4	Close Sw 4	sw 4 closed	sw 4 count
5	Close Sw 5	sw 5 closed	sw 5 count
6	Close Sw 6	sw 6 closed	sw 6 count
7	Close Sw 7	sw 7 closed	sw 7 count
8	Close Sw 8	sw 8 closed	sw 8 count

Step no	Step Command	Value	1	2	3	4	5	6	7	8	Comments
1	Turn outputs on/off	00:00:01.00	Y	Y	Y	Y	Y	Y	Y	Y	Push all switches
2	Count the inputs	N/A	Y	Y	Y	Y	Y	Y	Y	Y	Count the switches which are closed
3	Turn outputs on/off	00:00:01.00	N	N	N	N	N	N	N	N	Release all switches
4	Jump to another step	Step 1	N	N	N	N	N	N	N	N	Keep cycling

This command is provided so you can easily setup for counting inputs. If you require increased flexibility, like incrementing any counter based on any combination of inputs, use Jump if commands combined with the Increase counter(s) command. Example 7 shows how to do this.

On step 1 we press switch 1. Switch 1 should close and activate input 1. On step 2, the OM-LMPLC checks to see if input 1 was not activated. If so, it jumps to step 4; therefore, skipping incrementing the count. If input 1 was activated no jump would occur and step 3 would increment the counter. On step 4, the switch is released and cycling continues.

Example 7 - Using "Jump If" commands for more advanced input counting (extcntin2.lm1)

Wire List	Outputs	Inputs	Counters
1	Close sw1	sw1 closed	sw 1 count

Step no	Step Command	Value	1	2	3	4	5	6	7	8	Comments
1	Turn outputs on/off	00:00:01.00	Y	N	N	N	N	N	N	N	Push sw 1
2	Jump if inputs are off	Step 4	Y	N	N	N	N	N	N	N	If not closed skip increment
3	Increase a counter(s)	N/A	Y	N	N	N	N	N	N	N	Increase sw1 count
4	Turn outputs on/off	00:00:01.00	N	N	N	N	N	N	N	N	Release sw1
5	Jump to another step	Step 1	N	N	N	N	N	N	N	N	Keep cycling

BEGIN LOOP

This command begins a loop. A loop is a series of steps that will be ran a certain number of times. The OM-LMPLC supports two concurrent loops. On the procedure information display, these are represented as A and B. The Procedure Writer checks your procedure's loops to ensure that you have no more than two concurrent loops. You must also have one end loop for every begin loop. The most external loop in your code will always be represented by A and most internal loops will be represented by b. The length of a Loop is limited to 999,999.

Example 8 shows how a loop can be used to execute a step a specific number of times. On step 1, the loop is started with a value of 100. Then, steps two and three cycle the DUT. Finally, the end loop command indicates the loop is complete. This cycle repeats 99 more times. After this, the RoboTechnician moves to step five and ends the test.

Example 8 - Using loops to cycle a specific number of times (exloop1.lm1)

Step no	Step Command	Value	1	2	3	4	5	6	7	8	Comments
1	Start a loop	000100	N	N	N	N	N	N	N	N	Run 100 cycles
2	Turn outputs on/off	00:00:00.25	Y	N	N	N	N	N	N	N	Stimulate DUT
3	Turn outputs on/off	00:00:00.25	N	N	N	N	N	N	N	N	Remove DUT stimulus
4	End the Loop	N/A	N	N	N	N	N	N	N	N	Keep looping
5	End the Test	Beep On	N	N	N	N	N	N	N	N	End the test
6	Jump to another step	Step 1	N	N	N	N	N	N	N	N	

Some times, you may want to perform a specific number of steps inside of a specific number of steps. Example 9 demonstrates this. On step 1 the outside loop is started. Then, step 2 starts the inner loop. The

inner loop (steps 3 and 4) cycle the DUT. After 200 iterations, step 7 is executed and RoboTechnician pauses for the operator to make a visual inspection. When the inspection is complete, the outside loop causes the inner loop to occur 9 more times. Finally, when the outer loop has exhausted, the test is ended on step 9. Note the DUT underwent 2000 cycles.

Example 9 - Using multiple loops for handling user inspections (exloop2.lm1)

Step no	Step Command	Value	1	2	3	4	5	6	7	8	Comments
1	Start a loop	000010	N	N	N	N	N	N	N	N	Run 2000 cycles with 10 inspections
2	Start a loop	000200	N	N	N	N	N	N	N	N	Perform an inspection every 200 cycles
3	Turn outputs on/off	00:00:01.00	Y	N	N	N	N	N	N	N	Stimulate DUT for 1 sec
4	Turn outputs on/off	00:00:01.00	N	N	N	N	N	N	N	N	Remove DUT stimulus for 1 sec
5	Increase a counter(s)	N/A	Y	N	N	N	N	N	N	N	Keep track of test cycles
6	End the Loop	N/A	N	N	N	N	N	N	N	N	Keep looping
7	Pause the Test	Beep On	N	N	N	N	N	N	N	N	Wait for technician inspection
8	End the Loop	N/A	N	N	N	N	N	N	N	N	keep looping
9	End the Test	Beep On	N	N	N	N	N	N	N	N	End the test

END LOOP

This command loops to the last begin loop and decreases its count by one. When the begin loops count is zero, it falls out of the loop and goes to the next step. This step has no value.

JUMP

This command jumps to another step. The step value for this step is the number of the step to jump to.

Procedure Writer programming software

The Procedure Writer software is where you build your OM-LMPLC procedure. The Procedure writer software allows you to easily build procedures to control outputs with complex logic. We have attempted to make "Procedure Writer" very similar to other popular Windows applications so that you will already be familiar with how it works.

STARTING PROCEDURE WRITER

If you are using Windows 95, select Procedure Writer from the appropriate group in the start menu. For Windows 3.1 users, double click on the Procedure Writer Icon. This will start the Procedure Writer. After starting, you have the options to open a existing procedure, start a new procedure, or start a new procedure using the procedure wizard.

CREATING A NEW PROCEDURE

A new procedure can be created by selecting "New" from the file pull down. This will create a new procedure with cleared custom displays and steps initialized to the default jump command.

DIFFERENT VIEWS OF YOUR PROCEDURE

The procedure writer lets you look at your procedure in three different ways. Each is called a "view". The three views are the following: step, sheet, and output.

THE STEP VIEW

Step view shows the procedure one step at a time (Figure 13). From this view, the OM-LMPLC procedure can be completely built. Here you can navigate through the steps, insert steps, delete steps, change the step action, and add comments.

This view shows all the information about the current step. The current step is indicated by the box under the "Step Number" label. This view shows the step command, step value, comments and Input/Output/Counter association.

You can navigate the steps by clicking on the up-down arrows under the "step number" caption. Clicking on the up arrow decreases the step number while clicking the down arrow increases the step number.

You can change the current step command by clicking the down arrow to the right of the current step command. This will drop down a list of step commands. After selection, "Procedure Writer" will change the currently displayed value to the selected command's default.

If the step has a value, the "Procedure Writer" will allow you to adjust it by clicking on the "Enter" button. When you click this button, a dialog box will appear allowing you to manipulate that step's value.

To insert a step before the current step, click on the "Insert" button. Procedure Writer will then ask if it is okay to delete step 96. Deleting the last step is required because the OM-LMPLC can only execute 96 steps.

To delete the current step, click the "Delete" button. "Procedure Writer" will then verify your delete action. If you respond with yes, the current step will be deleted.

Note It is important to re-adjust jump steps after insert and delete commands if they are affected.

When a command that requires an output, an input, or a counter the associated buttons will become enabled. To select the input/output/counter just click the button corresponding to input/output/counter which you wish to select. A button that is pressed is selected and a button that is not pressed is not selected.

Add comments to the current step by entering text into box below "Step comments".
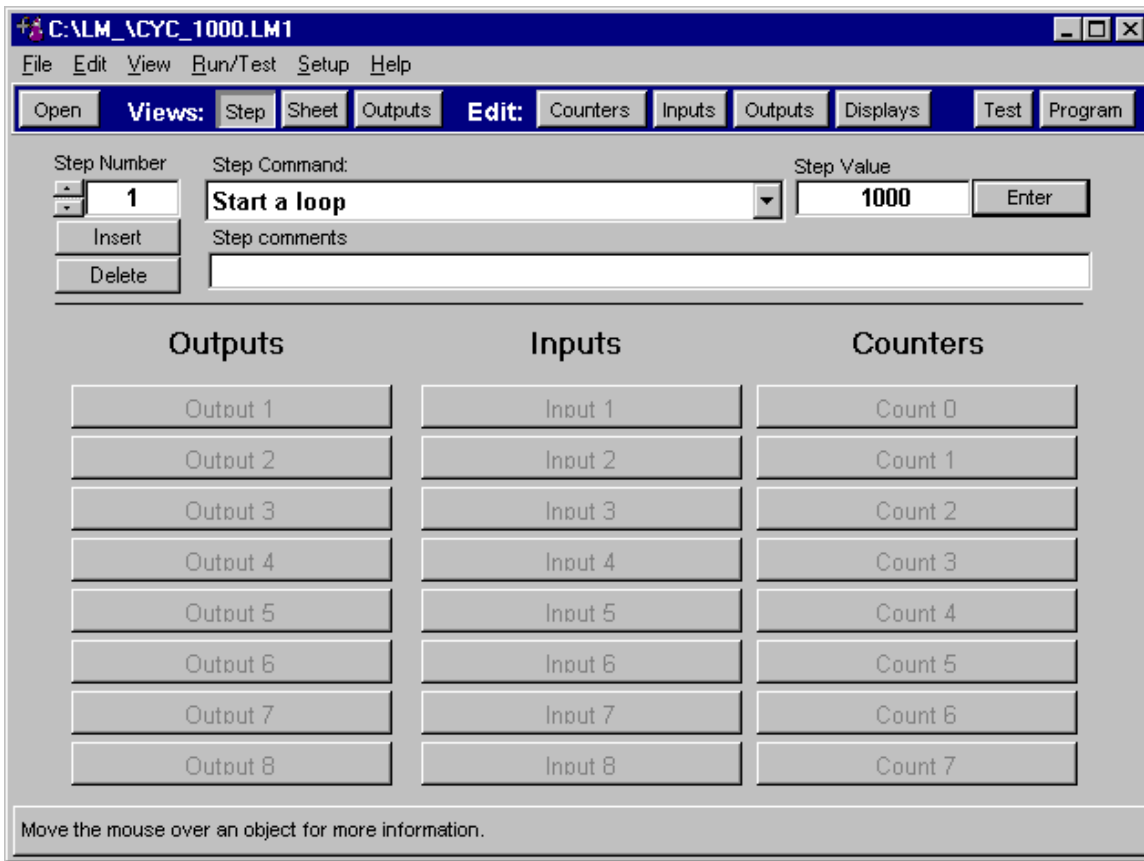
Figure 13 - Procedure Writer Step View

THE SHEET VIEW

The sheet view gives a spreadsheet type view of the procedure (Figure 14). It shows all the steps from 1 to 96. From this view, you can adjust step values and output/input/counter connections. This view is especially useful for setting up the jump values, since you can immediately see the step you wish to jump to.

To adjust a step's value, double click on its value. Procedure Writer will then bring up a dialog allowing you to manipulate this steps value.

To manipulate its outputs/inputs/counters value double click on the column 1-8 to change the value. A "Y" corresponds to being selected and a "N" corresponds to not being selected.

If you double click on the sheet for anything besides values or output/inputs/counters, Procedure Writer will switch to step view. The step view's current step will be the step that was double clicked on in the sheet view. This provides a quick way to switch to any step in the procedure.
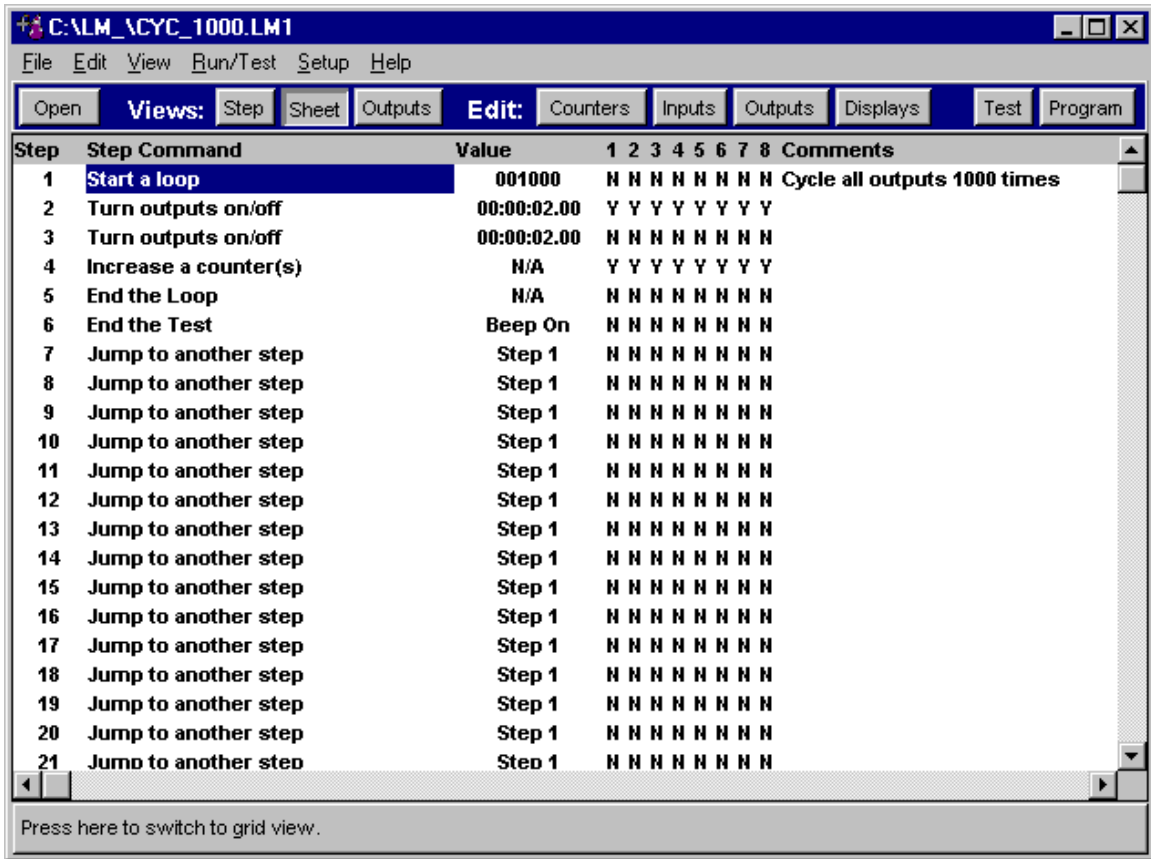
Figure 14 - Sheet View

THE OUTPUT VIEW

This view gives graphical view of the outputs by step (Figure 15). This view helps you see relationships between turning different outputs on and off. Since this representation is by step, this view is not based on timing.

In complex procedures where a lot of jumping is done, this display may not be meaningful. Only on intervals where the "Turn Outputs on/off" commands are used will this display accurately reflect the output relationships.
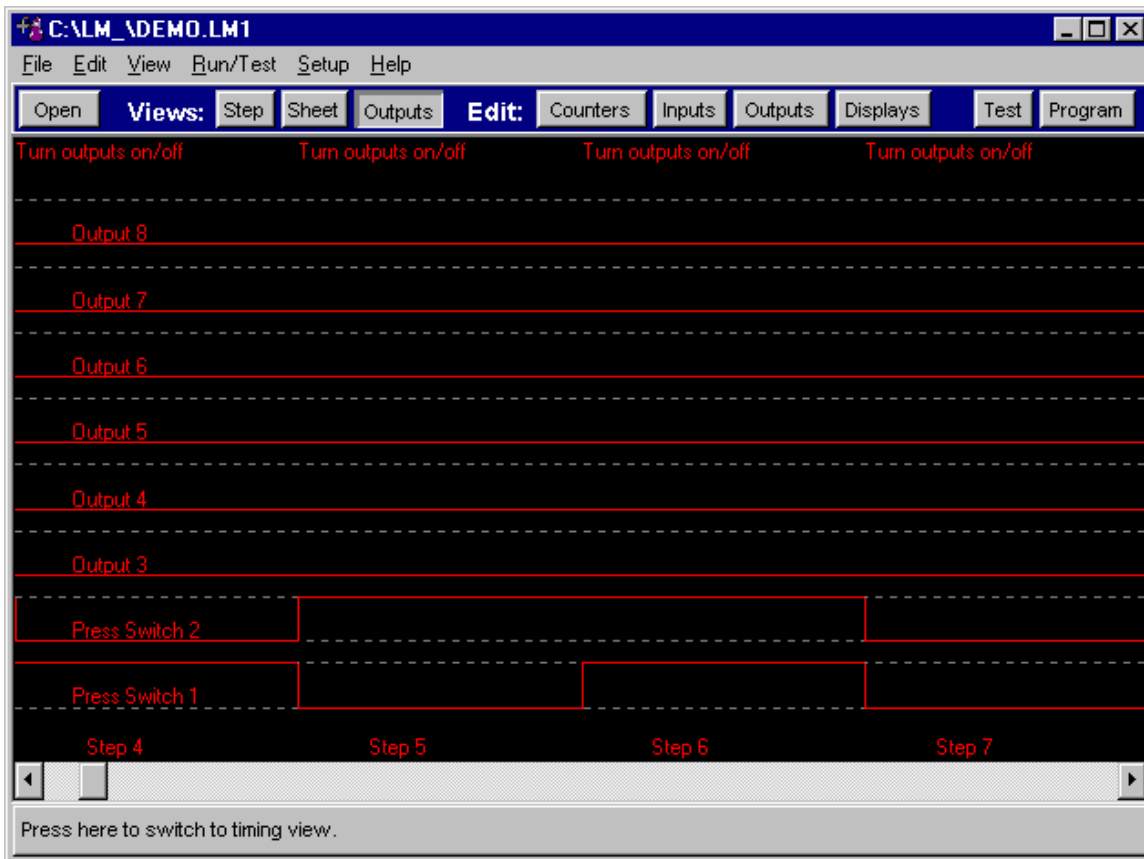
Figure 15 - Output View

EDITING THE CUSTOM DISPLAYS

To enter the custom test information and test complete displays, choose the "Custom Displays…" from the "Edit" pull down menu. This will show a screen where you can edit the OM-LMPLC's custom displays (Figure 16).

The box labeled "Test Banner" is the text that is shown on the top line of most of the OM-LMPLC's screens. Usually, you will enter a descriptive name for the test you are performing. The test information display's line two and three are described here. A simulation of what the test information display would look like is shown in the yellow box on the right.

The test complete screen is also entered on this screen. Fill in the boxes labeled "Test complete line 2" and "Test complete line 2" with the information you want shown on the LCD display. This display will be shown when the OM-LMPLC encounters an "End Test" command. A simulation of what the test complete display would look like is shown in the yellow box on the right.
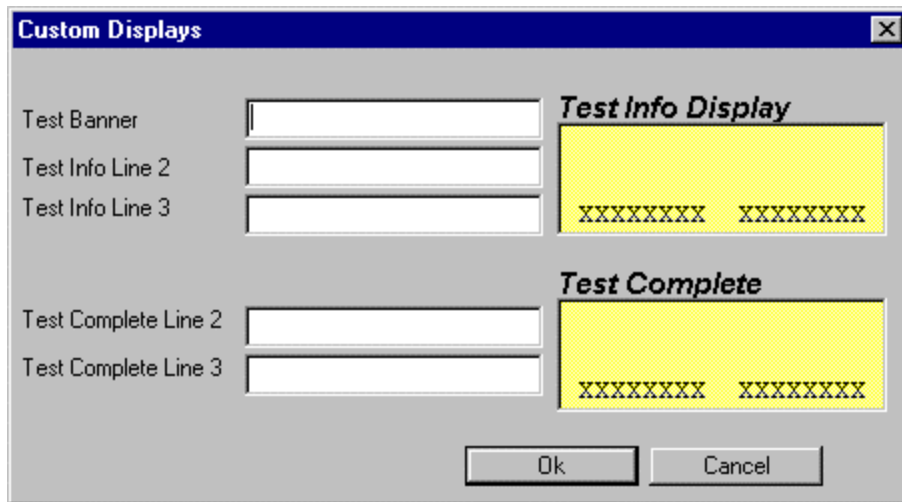
Figure 16 - Entering Custom Displays

CUSTOM INPUT, OUTPUT, AND COUNTER NAMES

The Procedure Writer allows you to give your outputs, inputs, and counters custom names. This is helpful while you are building your procedure because you can refer to your outputs, inputs, and counters by name instead of number. This also is needed for descriptive wire lists and printing. The custom counter names are displayed on the OM-LMPLC's LCD display.

You can name them by making the appropriate selection from the edit menu. When you select the inputs, for example, you will see a screen that allows you to edit the names (Figure 17).
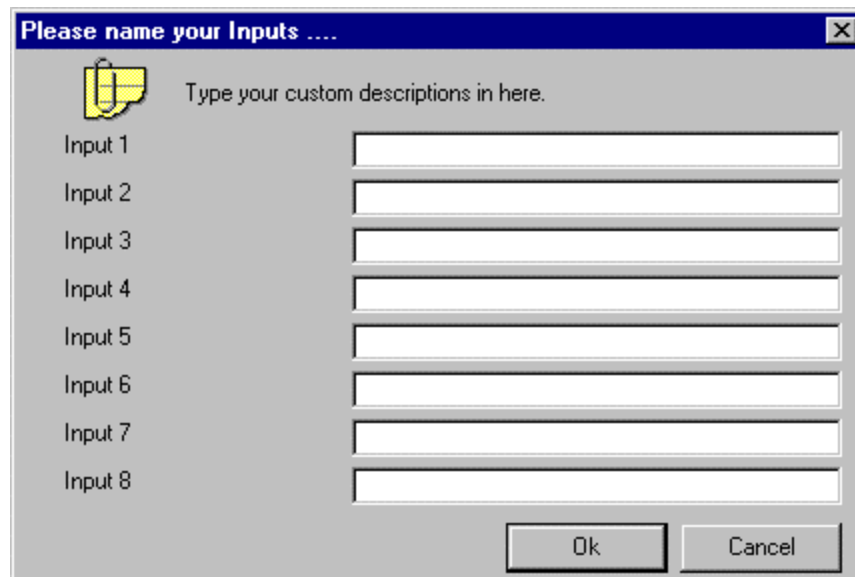
Figure 17 - Naming Inputs, Outputs, and Counters

MODIFYING ONBOARD COUNTS

Procedure Writer allows you to preset the OM-LMPLC's on board counters to any value within their counting range. This is useful for test samples that may have been pre-cycled and already have cycle counts. You can also use this feature to reset the counters without resetting the current procedure.

To access this feature, choose "On board counts" from the edit pull down menu. Making this selection shows the "Edit current counts" dialog (Figure 18 - Edit current counts dialog). Obviously, you need to have the serial cable attached to read the on-board counts from the OM-LMPLC. To save your changes to the OM-LMPLC, choose "Ok". If you wish to keep the current counts, choose "Cancel".
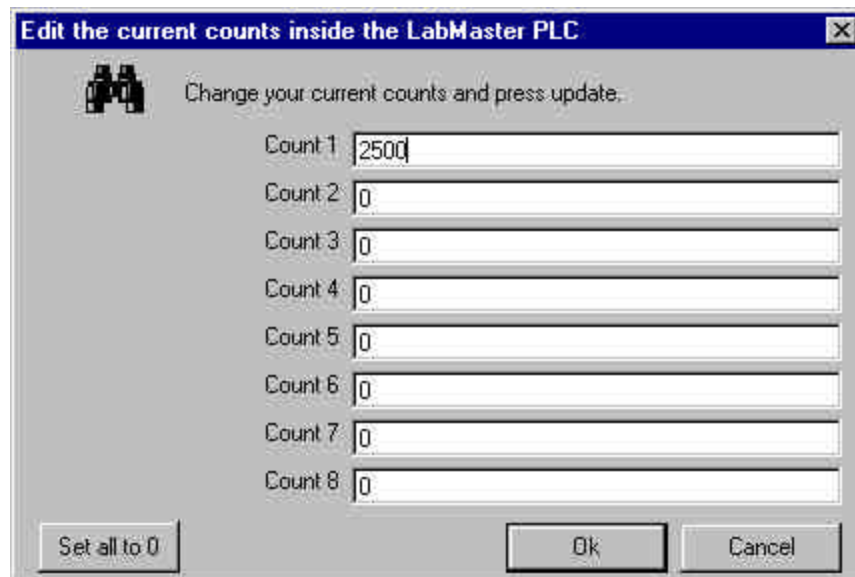
Figure 18 - Edit current counts dialog

PROCEDURE WRITER OPTIONS

To serve the needs of different users of the OM-LMPLC and Procedure Writer, Procedure Writer has application options. You can setup the options of the Procedure Writer through the options selection from the setup pull down. Selecting this pull down will show the options dialog (Figure 19).

Setting up a Comm port

You have to tell the Procedure Writer which Comm port you are using to communicate with the OM-LMPLC. This is done by selecting "Options" from the "Setup" pull down menu. This selection will show a screen allowing you to select the Comm port (Figure 19). Select the Comm port from the drop down box and click ok.

Automatically Reset Counts when programmed

The Procedure Writer can automatically reset the OM-LMPLC's counters when it is programmed. To enable this feature select the "Automatically reset counters when programmed" in the options dialog. To manually reset the counters you can use the mode button of the OM-LMPLC or via the "Edit Current Counts" dialog.

Show Adjustment button in the test dialog

You have the option of showing adjustment buttons in the test dialog. These adjustment buttons allow the user to adjust timing and manipulate the current step shown on the OM-LMPLC. These are provided as an option because the manipulations are not recorded into the procedure that is on the PC. Therefore, you may create an inconsistency between the saved procedure on the PC and the procedure in the OM-LMPLC. This may be unacceptable for organizations that need the documentation features for quality standards.
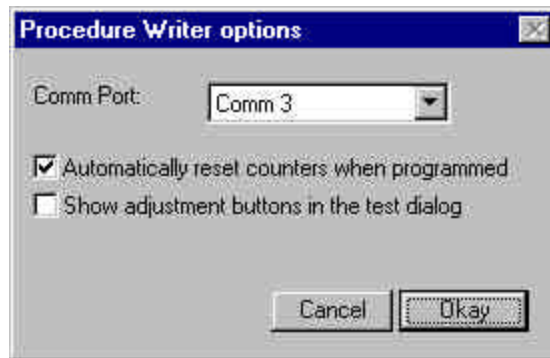
Figure 19 - Selecting a Comm Port and other Procedure Writer options

TESTING YOUR INPUT AND OUTPUT WIRING

Procedure Writer allows you to test your input and output wiring by manually exercising your outputs. This is done from the "Test Outputs" screen (Figure 20). You can exercise outputs individually by clicking on the output buttons. The Inputs are read from the OM-LMPLC a few times a second and are refreshed on the display.

You also have the option to manipulate the current step's timing and change the current step of the OM-LMPLC. This is done by clicking the buttons in the lower left-hand corner of the test dialog. These buttons may not appear because they were disabled in the options dialog discussed in the last section.
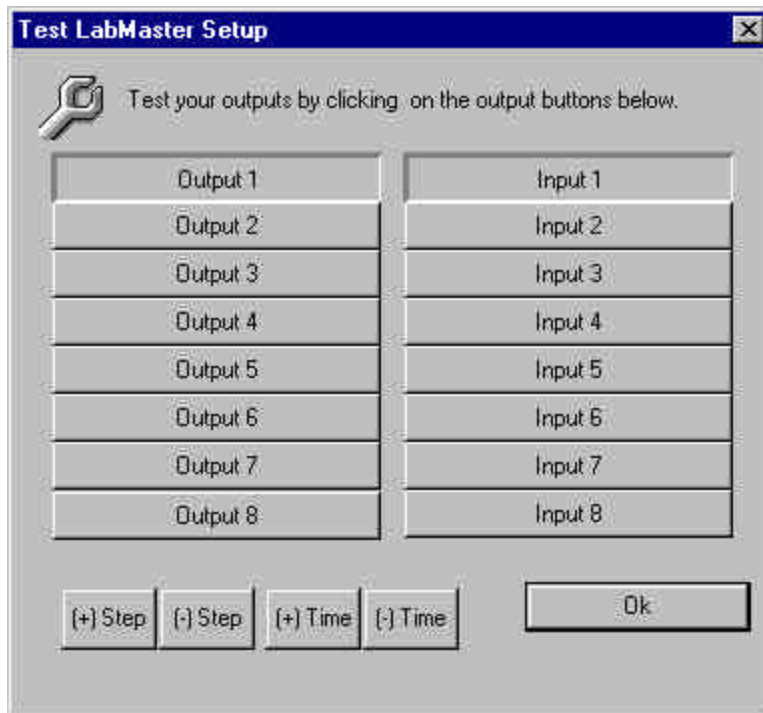
Figure 20 - Testing Input and Output wiring screen

DEBUGGING YOUR PROCEDURE

Follow these steps when you have problems with your procedure. These are the source for the most common errors in building a OM-LMPLC procedure.

1. Verify output and input wiring using the Test Inputs and Outputs Screen
2. Inspect your procedures Jump type steps and make sure they have correct values

PRINTING YOUR PROCEDURE

The Procedure Writer software allows you to print your procedure. Select "Print…" from the file pull down menu. A dialog box will be shown allowing you to select the default printer and paper orientation.

DOCUMENTING YOUR PROCEDURE

The Procedure writer can help you document your procedure. From the edit menu, you have three selections that will transfer procedure information to the Windows clipboard in a tab-separated format. Then, the information can then be pasted in to your favorite word processor or spreadsheet. For example, in MS-Word you can paste the procedure, select it, and then convert text to table to turn it into a formatted table. The selections under the edit menu are the following: Copy Current Counts to the clipboard, copy the procedure to the clipboard, and copy the wire list to the clipboard.

The "Copy current counts to the clipboard" reads the OM-LMPLC's current counts through the serial cable, attaches them to the custom names and places them on the Clipboard in a tab-separated format. This feature

is very useful if you have counts that exceed the six-digit view on the OM-LMPLC's PLC display. This method of reading the counts can read counters up to the internal limit of 16,777,216.

SAVING YOUR PROCEDURE

You can save the current procedure by choosing "Save" from the file pull down menu. If you wish to save the current procedure to a different name "Choose Save As."

OPENING YOUR PROCEDURE

You have a few options to opening a previous procedure. The most convenient is to use the Most recent procedure menu. These are the file names located at the lowest part of the file pull down menu. Other options are the "Open" selection and the "Open" button on the tool bar.

READING A PROCEDURE FROM THE OM-LMPLC

You can read a procedure from the OM-LMPLC into the PC. To do this, select "Read Program from OM-LMPLC" from the Run/Test menu. This will bring up the "Read program from OM-LMPLC" dialog (Figure 21). From this dialog, you can read the program by clicking the get program button. Note that you must have the OM-LMPLC connected to get the program.

You have the options to read the counter descriptions and the custom displays. You can also have procedure Writer erase the existing comments in your procedure.

You can use this feature to update your procedure with the field updates done with the field programmer. To do this, you can load the original procedure and read the program out of the OM-LMPLC. Since you do not erase existing comments, your changes will be updated and your comments will remain.

Note: Your custom names for inputs and outputs are not stored in the OM-LMPLC. Therefore, when you read the program from the OM-LMPLC your custom names for inputs and outputs will not be there. If you wish to preserve this information you must load the original procedure and then read the program out of the OM-LMPLC.

Figure 21 - Read the procedure out of the PLC to print it out.
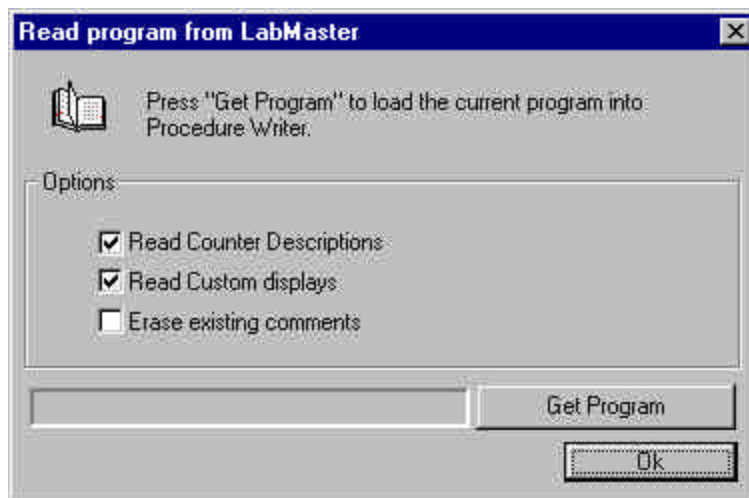
USING THE PROCEDURE WIZARD

The Procedure Wizard creates a new procedure and then steps you through all of the custom naming screens. This is useful when you are beginning a procedure or you are new to writing a procedure.

OM-LMPLC Field Programmer

The OM-LMPLC field programmer allows complete programmability of the PLC without a PC. This is accomplished through simple menus (Figure 23).

Pressing the custom menu key brings up the main menu display (Figure 22). From this display, you can select what command you want to perform. The following subsections describe what each menu does.

STEP	TIME	CMD	OUT	CNT

Figure 22 - The Main Toolbar for the field programmer is accessed through the CST button

STEP
Selecting step will allow you to change the currently displayed step of the OM-LMPLC. You may select a step from 1 to 96.

TIME
This selection allows you to adjust the time of a time type step.

CMD
Selecting this will let you change the current command for that particular step.

OUT
This command allows you to change the state of each individual output.

CNT
This command lets you adjust the value of any of the counters.

Figure 23 - The OM-LMPLC field programmer allows programming without the PC

DOWNLOADING THE OM-LMPLC FIELD PROGRAMMER SOFTWARE INTO THE CALCULATOR

Overview

If you purchased the field programmer from the Omega the software should be already installed. This software will remain in the calculator forever as long as the batteries are replaced when required. However, in the case of battery failure or the case where the calculator resets its memory (very rare) you may need to download the software yourself.

This tutorial shows step-by-step how to move the software from the PC to your calculator. If you have difficulty or are uncomfortable with this procedure, you may send your calculator to Omega for reprogramming. This is available for a small fee to cover shipping and handling. Please contact Omega to obtain an RMA (return material authorization) number prior to shipment.

Steps

1. Locate the file that contains the field programmer software. This file is called: "LMSTUF.txt". You can find this file on the disk that came with the calculator.
2. Connect the serial cable that came with the field programmer to the serial port on your PC. Connect the other end to the HP-48G calculator. The cable is multi-sectioned. The first section is the one that you normally connect to the PLC. The second section is an adapter from the OM-LMPLC's connector and the PC's connector.
3. Power on the calculator.
4. Select the I/O menu by hitting the green right arrow on the calculator and then hitting the One key.
5. Select "Transfer" from the menu.
6. From the "Transfer" setup select all of the following options: 1) Port: Wire, 2) Type: Kermit, 3) Name: blank, 4)fmt: ASCII, 5)XLAT: New1, 6)chk: 3, 7)Baud: 9600, 8) Parity: None 9) ovrw: checked.

7. Now, start the Hyper-terminal program that comes with Windows95/NT.
8. Select the option to connect directly to the Comm port the calculator is connected to.
9. Then, select all of the following communications options: 1) Bits per second: 9600, 2) Data bits: 8, 3) Parity: None, 4) Stop bits: 1, and 5) Flow control: none.
10. From the transfer pull down menu select "send file"
11. In the "send file" dialog press browse to select the file you located in step 1. Set the protocol to "Kermit". Click the send button and immediately hit the receive button on the HP calculator.
12. The file should be transferring. The progress should show up in the monitor.
13. After completion, change the baud rate of the calculator to 1200.
14. Now you must go to the directory with the OM-LMPLC code. Do this by pressing the var button. In the graphic display, you should see "LMST". Move to that directory by pressing its button. Now select the OM-LMPLC custom menu by pressing "CST"
15. You are complete.

Advanced programming techniques

The OM-LMPLC command set, although simple, can be used to write very powerful logic. The command set is logically complete meaning that any logic function can be assembled from its commands.

Say we wish to salt spray when switch 1 is on or if switch 2 is off. This could be represented by the Boolean expression A or not B. Basically; we use jump steps to perform different logical combinations. Our proceeding wire list should help you in understanding the following examples.

The first example, Example 10, implements our desired procedure. First, it determines if switch 1 is on. If so, it jumps to the step which performs the salt spray. Otherwise, the OM-LMPLC proceeds to step 2. In step 2 it determines if switch 2 is off. If so, it jumps to the step which performs the salt spray. If the switch is not off, it proceeds to the next step. This procedure effectively achieves our goal of having salt sprayed when switch 1 is on <u>or</u> if switch 2 is off.

Example 10 - Creating Or logic with multiple jump steps

Wire List

	Outputs	**Inputs**		**Counters**
1	Spray Salt	Sw1 ON		Count 1
2		Sw2 ON		Count 2

Procedure

Step no	Step Command	Value	1	2	3	4	5	6	7	8	Comments
1	Jump if inputs are on	Step 4	Y	N	N	N	N	N	N	N	Is SW1 On? Yes, spray salt
2	Jump if inputs are off	Step 4	N	Y	N	N	N	N	N	N	Is SW2 Off? Yes, spray salt
3	Jump to another step	Step 1	N	N	N	N	N	N	N	N	Keep checking
4	Turn outputs on/off	00:00:05.00	Y	N	N	N	N	N	N	N	Spray Salt for 5 seconds
5	Jump to another step	Step 1	N	N	N	N	N	N	N	N	

Suppose we only wanted salt spray when both sw1 was on and sw2 was off. This could be represented by the Boolean expression A and not B. To achieve this, we only run step 2 when sw1 is on. So, if we change step 1 to a "Jump if inputs Off" and change its step number to skip step 2 if there is a condition of sw1 off (as shown in Example 11).

Now, when step 1 is encountered it will only check if switch 2 is off (step 2) if switch 1 is on. Otherwise it will skip checking switch 2 and proceed to step 3. If switch 1 happened to be on, the OM-LMPLC would not jump and would proceed to step 2. Then, if switch 2 was off the OM-LMPLC would perform a salt spray. This new procedure effectively achieves our goal of having salt sprayed when switch 1 is on and if switch 2 is off.

Example 11 - Implementing AND logic with multiple jump steps

New Procedure

Step no	Step Command	Value	1	2	3	4	5	6	7	8	Comments
1	Jump if inputs are off	Step 3	Y	N	N	N	N	N	N	N	Is SW1 Off? No, check sw2
2	Jump if inputs are off	Step 4	N	Y	N	N	N	N	N	N	Is SW2 Off? Yes, spray salt
3	Jump to another step	Step 1	N	N	N	N	N	N	N	N	Keep checking
4	Turn outputs on/off	00:00:05.00	Y	N	N	N	N	N	N	N	Spray Salt for 5 seconds
5	Jump to another step	Step 1	N	N	N	N	N	N	N		

To further our discussion, say we wished to have sw1 and sw3 on and sw2 off we could be achieve this by selecting sw3 in step number 1. This would achieve the Boolean formula (A and C) and (not B).

See Omega's application notes for other useful programming techniques.

Integrating the OM-LMPLC in a Data Acquisition System

The OM-LMPLC's communications port is designed so that the OM-LMPLC can be used in a data acquisition as a dedicated I/O controller. Through the communications port you can change outputs, read counters, read inputs, pause a test, un-pause a test, load a procedure, and read the device status.

The OM-LMPLC is useful in this capacity because it can perform cycling independent of the PC. This would free the PC to perform other tasks. Such as collect data, monitor error levels, real-time display, or user interface. Contact Omega's for the latest utilities for using the OM-LMPLC in this fashion.

Section IV - Principles of Operation

Introduction

Understanding how the OM-LMPLC works internally will help you better determine its strengths and weaknesses.

Step cycles

The OM-LMPLC performs a sequence of steps. Some require a fixed amount of time or no time. There are also cases when a procedure logic error occurs where a step would take an infinite amount of time. For example, step 1: jump to step 1 would take an infinite amount of time. Each step cycle lasts 250 ms.

Output steps last a finite amount of time if not set to zero. Wait type steps last either as long as the time out or no time if input are activated when the step is encountered. Each output step will last exactly as long as you tell it to in the procedure writer. The remaining steps do not require any time.

It is important to understand what "No time required" means. This means that the OM-LMPLC will immediately perform this command when it is encountered and move to the next step without ending a step cycle. The OM-LMPLC can perform ten "non-time" steps per step cycle without affecting your output timing. This is best explained in the following examples.

Procedure Example A

Step 1: Turn Outputs On/Off 00:00:00.50
Step 2: Turn Outputs On/Off 00:00:00.50
Step 3: Increase Counter(s)
Step 4: Jump to step 1

The previous code will increment the counter once a second with perfect timing. This is because steps 3 and 4 do not require any time and they are implemented immediately when encountered. So, after the time for step 2 has exhausted, the OM-LMPLC implements the next two steps immediately and proceeds to step one. The OM-LMPLC implements these steps very quickly with respect to the 250 ms cycle time. So, steps 3 and 4 actually occur early in the time used by step 1.

Procedure Example B

Step 1: Jump if Inputs ON step 3
Step 2: Jump to step 1
Step 3: do something

The previous code example still works but it simply runs ten iterations of this loop every 250 mS. This is because of the ten non-time step limit per step cycle.

Solid State Relays

Solid state relays were chosen because of their superior lifetime characteristOmega. In durability testing, solid-state relays are superior because of their non-mechanical nature. Please see our references section for information on where you can learn more about solid state relays.

Please keep in mind that the relays in the OM-LMPLC can easily drive the coils of electromechanical AC or DC relays, if these are more appropriate for your application.

Section V - Maintenance

Introduction

The OM-LMPLC was designed to be Maintenance free. Internally, the OM-LMPLC has a self-resetting fuse protecting its internal circuitry. So, besides output failure, there is no need to open the OM-LMPLC's case.

Output failure

If you experience output failure, the OM-LMPLC's Solid State relays are easily replaced. Each relay is individually socketed for easy replacement. See the "Replaceable parts section in the appendices for more information on the solid-state relays.

To replace a Solid State Relay:

1. Remove power from the OM-LMPLC
2. Remove Input and output connectors
3. Remove the eight retainer screws on the back panel
4. Remove the affected relay from its socket. The relays start from the left side at one and continue to the right.
5. Insert the new relay.
6. Follow steps 1 through 3 in reverse order to reassemble the OM-LMPLC.

Troubleshooting

Use the follow table to assist you in your trouble shooting.

Table 2 - OM-LMPLC Trouble shooting

Problem	Possible Solutions
OM-LMPLC Outputs will not turn on	1. Check the state of the output enable button. It should be "pressed in" in order for the outputs to function
OM-LMPLC will not communicate with the Procedure Writer software	1. Comm port is not configured properly. Try a different Comm port. Make sure no other devices, such as modems or mice are conflicting with the Procedure Writer Comm port setting. 2. Cable is not connected.
OM-LMPLC outputs will turn on but not off	1. Make sure your are not using AC SSR relays with a DC load.
When I return to program mode, the outputs that were on remain on.	1. This is the normal operation of the PLC. To disconnect outputs, use the output enable button.

Section VI - Support

Introduction

Omega's prides itself in the ability to provide outstanding support of its products. This section tells you how to contact Omega's when you have problems with the OM-LMPLC that you cannot solve yourself.

Internet Web Site

You can get programming examples, application notes, and software upgrades from our Web Site.

http://dasieee.com

Appendices

Specifications

Typical for 25 C, unless noted.

Power Requirements	9-15 VDC @ 170mA maximum
Operating temperature	0 C - 50 C (32 - 122 F)
Relative Humidity	5% to 90% Non-condensing
Time base accuracy	+/- 3.0 sec /day
Number of Outputs	8
Number of Inputs	8
Input type	Opto-isolated parallel LED
Input voltage range	4v - 36V (DC)
Minimum Input Turn Current	Contact Omega's
Minimum Input Pulse Width	250 mS
Step time resolution	0.25 Seconds
Maximum Number of steps per 250ms Step Time	10
Maximum number of steps	96
Max step time (change outputs)	41.6 Days
Internal Circuit protection	Auto-reset fuse
Counter Maximums	999,999 Visible, 16,777,216 kept internally
Loop count Maximums	999,999
Concurrent Loop Counts	2
Approximate Dimensions (LxWxDepth)	7.2x3.6x6.5 inches
Panel Cutout Dimensions (LxW)	7.25x3.625 inches
Output Connector	10 Positions - 1 common per 4 outputs
Input Connector	9 Positions - 1 Common per 8 inputs

Output Specifications

AC Outputs - Crydom part number AO241 SPST-NO miniature SIP Solid State Relays

Line Voltage Range (VAC)	Load Current Range A RMS	Surge Current 1-Cycle (A peak)
24-120	0.2-1.0	40

DC Outputs - Crydom part number DO0061A SPST-NO miniature SIP solid state relay with bipolar transistor output

Line Voltage Range (Vdc)	Load Current Range (Adc)	Surge Current, 1 sec (A peak)
3-60	0.02-1.0	5.0

Serial Cable wiring

The following is the wiring diagram for the serial connector on the OM-LMPLC. For the part number of this connector, see the replacement parts section in the appendices.
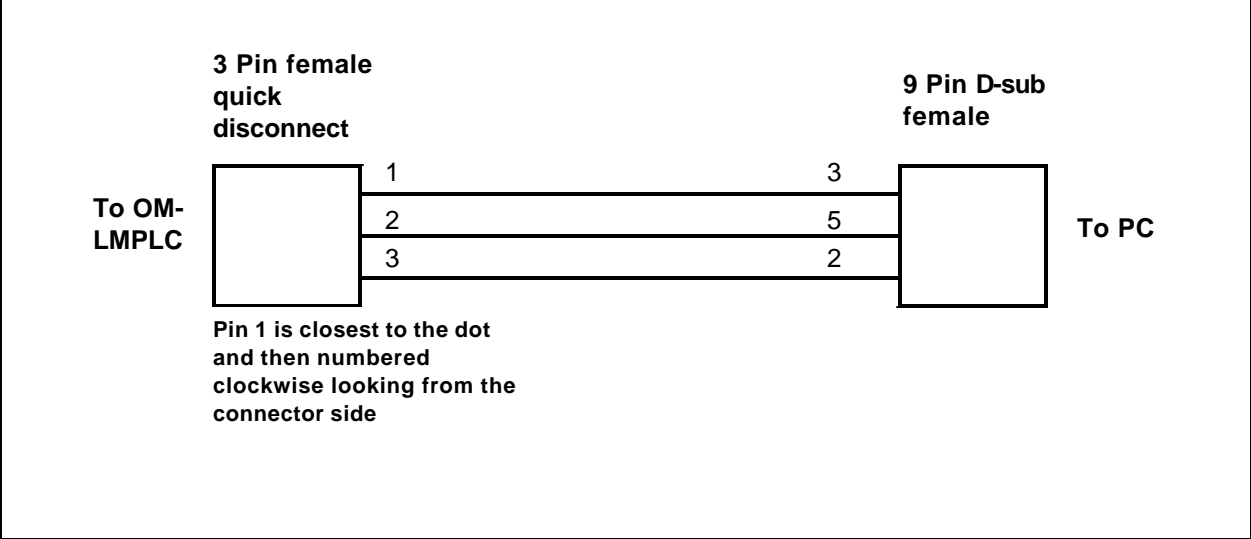
3 Pin female quick disconnect

9 Pin D-sub female

To OM-LMPLC

1	3
2	5
3	2

To PC

Pin 1 is closest to the dot and then numbered clockwise looking from the connector side

Figure 24 - Serial cable wiring

RS232 protocol summary

Please contact Omega's for the latest information on RS232 programming and the OM-LMPLC.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 13 months from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal one (1) year product warranty to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

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The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:	FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:
1. Purchase Order number under which the product was PURCHASED,	1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product under warranty, and	2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.	3. Repair instructions and/or specific problems relative to the product.

Procedure Writer - License Agreement

You must agree to the following agreement before using the Procedure Writer programming software.

If you find an exception with the terms of this agreement, you must return the diskette package unopened promptly to the dealer from which it was purchased for a refund.

Omega's Program License Agreement

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