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OPTIMATE SERIES
MODEL 440 TERMINAL
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Opti Mate
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OM440 Display Panel

The OM440 Display Panel is a low cost/high performance man/machine interface with a broad range of display capabilities. The panel includes a 4 line by 20 character LCD display with the capability to display text messages, BCD, BCD Double, Binary and Floating Point numbers.

OM-WINEDIT configuration software allows you to predefine up to 160 messages. These messages can be later selected for display by your PLC program to display status and variable data.

The OM440 Display Panel is part of Optimation's **OptiMate**® series. Each OptiMate panel is designed to connect to most PLCs with a single cable connection.

When used with a PLC, operation is transparent to the user. Terminal functions tie directly into your PLC ladder logic program. The OM440 takes care of the rest.

Applications
- Machine control
- Process control
- Security systems
- HVAC
- Plant monitoring/control
- PLC applications
- Microprocessor applications

Features
- 4 line x 20 character LCD
- Text Message display
- Floating point, BCD, BCD Double and Binary data display
- PLC compatible
- RS232 communications
- Stand alone operation capable

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Configuration Options

PLC Stand Alone

OptiMate panels plug directly into most PLCs. A simple cable connection allows you to interface and control the OptiMate panel via PLC data registers and ladder logic.

The OM440 Display Terminal uses a bank of PLC registers. Complete operator interface is performed with 12 PLC registers for display message selection and data display. The OM440 continuously accesses these PLC registers and performs operations under ladder logic control on a real time basis.

PLCs are slave devices on their standard communications ports. This means that a panel attached to the standard port must control the transfer of information by reading and writing the PLC registers. OptiMate panels will perform this communications for most major PLC protocols. Configuration for particular PLC protocols and interconnect cabling is covered in the following pages.

Microprocessor Based Systems

OptiMate 400 Series modules can interface directly to most computers or microcontrollers. The modules communicate over RS232 serial communications. All that is required to interface OptiMate modules is an RS232 serial port and the ability to send and receive Hex numbers. The OptiMate Hex communications protocol, detailed in this document, allows the user to display messages and display data of various types.

Since the OptiMate 400 Series panels can only communicate on RS232, only 1 panel can be interfaced on each serial communications port.

In a microprocessor based system, the host microprocessor is the system master. The OptiMate modules are slave devices that respond to commands from the host. In the case of the OM440, these commands are requests that update messages numbers and display message data.

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Use with a PLC

Memory Mapping

Memory mapping is a technique that "maps" the memory of an OptiMate panel into the registers of the programmable controller. By knowing where the data of a specific OptiMate panel is mapped, this data can be moved, changed or monitored using ladder logic.

The term PLC register is used for describing the area of memory within the programmable controller that can be used for data storage. PLC registers are sometimes known as data registers or internal registers.

MSB   LSB

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
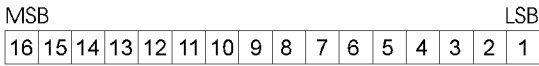
PLC Register

The OM440 Display Panel uses a bank of 12 contiguous PLC registers. The register set definition is shown in the table below.

OM440 Panel PLC Register Map

PLC Register	Register Function
M+0 (first register of bank)	Top line message selection
M+1	Second line message selection
M+2	Third line message selection
M+3	Bottom Line message selection
M+4	Top line data
M+5	Top line data 2 (for long BCD and floating point)
M+6	Second line data
M+7	Second line data 2 (for long BCD and floating point)
M+8	Third line data
M+9	Third line data 2 (for long BCD and floating point)
M+10	Bottom line data
M+11	Bottom line data 2 (for long BCD and floating point)

4 line X 20 char Backlit LCD Display Floating Point and BCD Double Capable
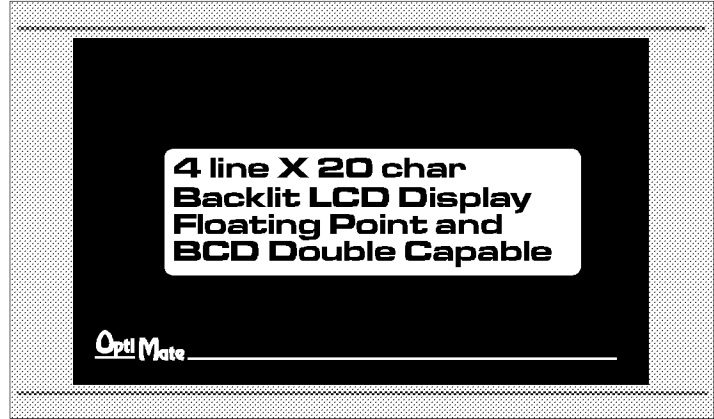
Register Definition

The following describes the function of the registers shown in the table.

- **Register M+0** - When a number from 1 - 160 is placed in this register, the predefined message associated with that number will be displayed on the top line of the LCD display.

- **Register M+1** - When a number from 1-160 is placed in this register, the predefined message associated with that number will be displayed on the second line of the LCD display.

- **Register M+2** - When a number from 1-160 is placed in this register, the predefined message associated with that number will be displayed on the third line of the LCD display.

- **Register M+3** - When a number from 1-160 is placed in this register, the predefined message associated with that number will be displayed on the bottom line of the LCD display.

- **Register M+4** - Numeric data associated with top line display (described in more detail in following paragraphs)

- **Register M+5** - Top line, for long BCD and floating point data only (described in more detail in following paragraphs).

- **Register M+6** - Numeric data associated with second line of display.

- **Register M+7** - Second line, for long BCD and floating point data only.

- **Register M+8** - Numeric data associated with the third line of display.

- **Register M+9** -Third line, for long BCD and floating point data only.

- **Register M+10** - Numeric data associated with bottom line of display.

- **Register M+11** - Bottom line, for long BCD and floating point data only.

Operational Overview

Displaying Messages on the LCD Display

Through the OM-WINEDIT configuration software, up to 160 predefined messages can be entered and stored in the OM440. These messages are 20 characters long and can include a field for the display of numeric data.

Any predefined message can be displayed on either the top, second, third, or bottom line. The messages entered via the configuration editor are numbered 1 through 160. To display a particular predefined message on the display, simply place that message's number in the message selection register.

For example, lets assume that we have defined message #16 as "Mary had a little .." , message #22 as "white fleeced lamb", message #25 as "Everywhere Mary went", and message #26 as "the lamb went also". If we wanted to put these four messages on the top, second, third and bottom lines of the display respectively, we would simply need to put the number 16 in register M, the number 22 in register M+1, the number 25 in register M+2 and the number 26 in register M+3.

If any number other than 1 to 160 is placed in a message selection register, the associated line will not change.

Placing Numeric Data in the Display

Certain predefined messages may incorporate a numeric data field. One numeric field per line is allowed. Messages that contain data are entered through the configuration editor with a caret symbol "^" as a place holder for each numeric digit.

An example of the use of numeric data is the message "#Widgets sold: ^^^^". Assume that this is message # 36 entered through the configuration editor. Also assume that a total of 465 widgets have been sold today. To display the current number of widgets sold on the second line of the display, you would place `36` in register M+1 and `465` in register M+6. The second line of the display would then read "#Widgets sold: 465".

Displaying Data with a Decimal Point

The OM440 panel allows you to display fixed point numbers. Fixed point numbers are numeric values that have a known decimal point placement and are simply handled as integer values within the PLC program. The only time you use an actual decimal point is for display to the operator. An example of a fixed point number is a program that uses temperature as a control variable. Within the program, all temperatures are scaled in tenths of a degree. The values are integer. A temperature of 73.5 degrees would be 735 in a data register. For the convenience of the operator, you would want the display to include the decimal.

Fixed point numbers are handled by simply placing a decimal point or period in the message field during configuration. In other words, the message " Temperature : ^^^.^" would be entered during configuration (say message 47). If 47 were placed in register M and the value 735 in register M+4, the display would read "Temperature : 73.5" on the top line.

Displaying BCD and Binary Numbers

Normally, numeric values to be displayed are values contained in one 16 bit register. One 16 bit register will handle values between 0 and 65535 (in binary format), or 0 to 9999 (in BCD format). For these type numbers, register M+4 is used for numeric value for the top line, register M+6 is used for the second line, register M+8 is used for the third line and register M+10 is used for the bottom line.

Displaying "Double" Numbers

The OM440 will handle larger numeric numbers. If you select the option "BCD double" when the display message is being defined, your display will handle numbers between 0 and 99,999,999. The OM440 will use data in the register pair M+4 and M+5 for the top line. Likewise, M+6 and M+7 are used for the second line, M+8 and M+9 are used for the third line and M+10 and M+11 are used for the bottom line. The data must be in BCD format.

When placing a "BCD double" number in the display registers, the first register numerically in the sequence of two registers (M+4, M+6, M+8 or M+10) will contain the 4 least significant digits of the number. The second register in the sequence (M+5, M+7, M+9 or M+11) contains the data for the 4 most significant digits of the "BCD double" number.

If the data displayed on the third line of the panel is 46378345, the third line data

registers will contain the following: (shown in BCD/Hex format)

BCD Double Data	PLC Register
M+8	8345
M+9	4637

Displaying Floating Point Numbers

The OM440 has the capability to display Floating Point (or Real) numbers if you select the option "Floating Point" when the display message is being defined in the OM-WINEDIT software.

Floating point numbers can only be used with the PLC Direct DL250, DL350 and DL450 CPUs or a microcontroller based system using the OptiMate Hex Protocol since they are the only compatible devices that support the IEEE 32-bit floating point number format. The floating point numbers are stored in the IEEE 32-bit floating point format within the PLC. They always occupy 2 16-bit register locations regardless of the size of the number. Refer to the PLC manufacturer's programming documentation for more information on the IEEE 32-bit floating point number format.

An IEEE 32-bit floating point number has a range of -3.402823E+38 to +3.402823E+38. The OM440 will be able to display any number within that range. The panel always uses the format ±X.XXE±XX display the numbers.

The panel does not have the ability to display all the significant digits of a floating point number, it only displays the first 3 significant digits. The OM440 does not "round" the numbers up or down, instead it truncates the remaining digits so you always see the true number. The two examples in the table below show the data contained in the PLC registers and the value displayed on the panel in its format. Notice how the data is truncated, not rounded.

PLC Registers	OM440 Display
12301.789	+1.23E+04
123.96783	+1.23E+02

The configuration of a floating point number message is similar to any other message. First you select the message number, then you type in the text using 9 caret symbols "^" as a place holder for each of the 9 floating point number
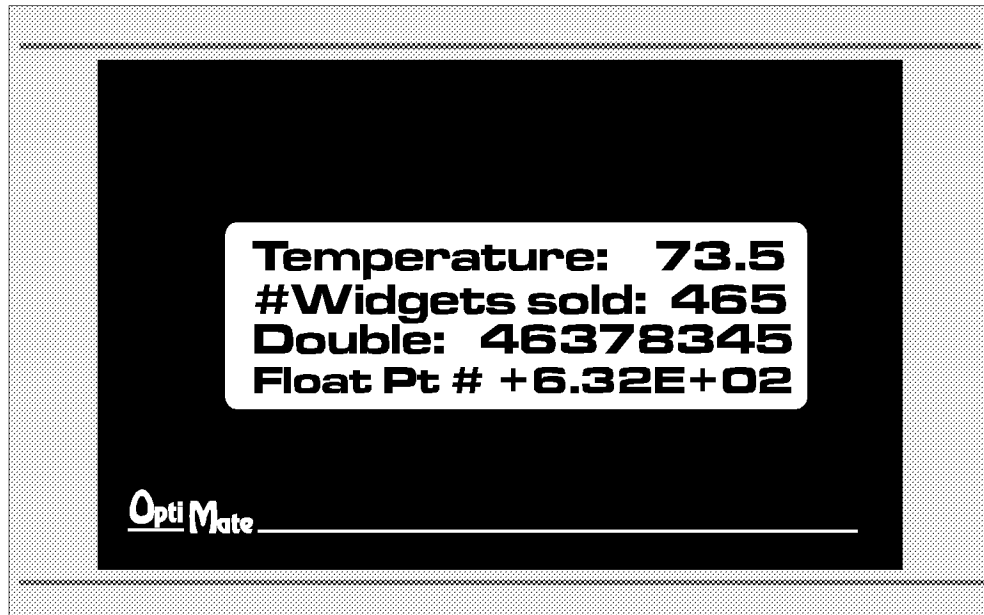
symbols. Next, select the "Floating Point" option for the data format.

Suppose you wanted to configure message #58 to display a floating point number. In the OM-WINEDIT software you would select OM440 as module type. Then to configure message #58 simply select it with the mouse and type in a message in the following manner "Float Pt # ^^^^^^^^^^" . Also, select floating point as the message format. To display a number, simply move it into either the top, second, third or bottom line data registers and load the appropriate message number into the corresponding top, second, third or bottom line message selection register. If the number 632.15 is to be displayed in message #58 on the bottom line, it will be displayed as the following: "Float Pt # +6.32E+02".

Configuration

Configuration of the OM440 Terminal is performed via an IBM PC compatible computer with the Windows operating system. Optimation supplies the OM-WINEDIT software that will allow you to select module configuration and PLC protocol definition.

> **Note : When configuring the OM440, always remember to use the programming cable that connects the panel to an IBM PC compatible computer. Always insert the programming cable into the panel to place it into configuration mode. When you are finished downloading, wait a few seconds before removing the programming cable. This will return the panel to PLC run mode.**

Configuration of the OM440 begins selecting the proper PLC protocol information. Next, the block of PLC registers to be used must be defined. Then each of the messages used by the PLC program must be defined.

Message definition is very straightforward and easily accomplished. All that is necessary is the following sequence.
- Select the message number to enter.
- Type the message. Up to 20 characters are allowed. Any unused characters will be filled with blanks. One numeric field per message may be defined with caret `^` characters. One decimal point or colon may be placed within the field.
- If the message contains a numeric data field, the data format must also be selected.

Examples of Use with a PLC Direct PLC

Register Usage

The OptiMate OM-WINEDIT software allows you to configure a module to use a block of registers at a starting value that you define. For a PLC Direct DL105, DL205, DL350 or DL405 PLC the recommended memory to use is the general purpose data words starting at V2000 and V4000. For the 305 family, except for the DL350, the recommended memory is the registers beginning at R400. Any block of registers within the data word range can be used.

The PLC registers in the block used by the OM440 panel are used for numeric information. As such they are ideally suited for the general purpose data registers (V2000 and V4000 area for the DL105/DL205/DL350/DL405 and R400 range for the 305).

Displaying Messages on the LCD Display

The examples on the following pages use an OM440 connected to a PLC Direct DL105/DL205/DL350/DL405 series PLC. The OM440 is configured for a base address of V2000.

Messages of various types can be configured via OM-WINEDIT and downloaded to the OM440. The message definitions shown in the figure below will be used in all of the examples that follow. Also, assume that message #140 consists of all blanks " ".

OM440 Configuration

Edit Help

Panel:

PLC Base Register Address: V2000

Close

Write to Panel

Configure Messages:

Delete Msg
Clear List

Msg Text	Action	Decimal	Format	Range
1: "Parts Left: ^^^^^ ":	Display	Fixed	BIN	
2: "Product Rate ^^^.^ ":	Display	Fixed	BCD	
3: "Tank Level ^^^^ ":	Display	Fixed	BCD	
4: "Good Parts: ^^^^ ":	Display	Fixed	BCD	
5: "Reject Parts ^^^^ ":	Display	Fixed	BCD	
6: "Double: ^^^^^^^^ ":	Display	Fixed	BCD Double	
7: "Part/Hr Avg ^^^^^^^^^^":	Display	Fixed	Floating Point	
8: "Process Step 1 ":				
9:				
10:				
11:				
12:				
13:				
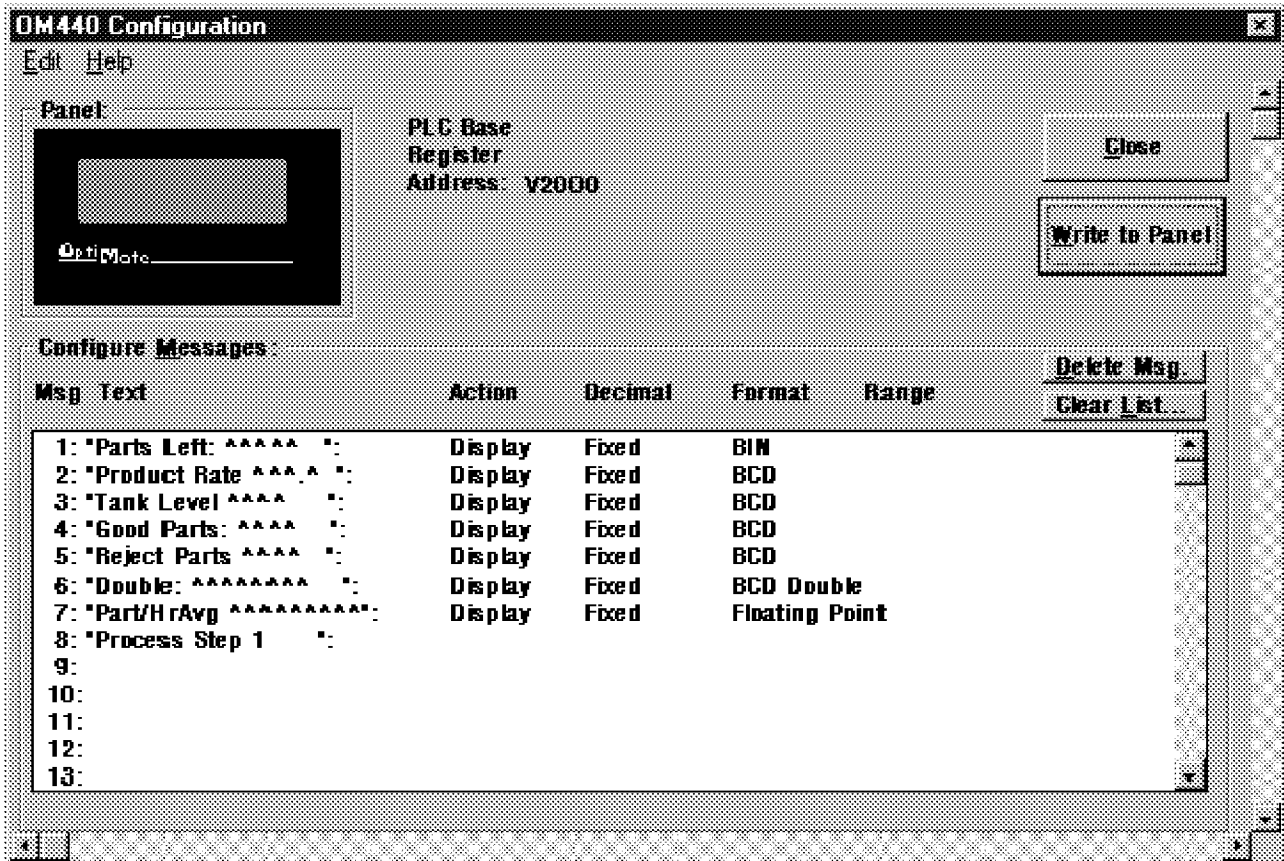
Displaying BCD Numbers on the LCD Display

The following example shows a couple of messages being displayed to the LCD display as long as C100 is active.   The second line uses BCD message #4. The data for the second line data field is coming from V3000. The bottom line is text message #8. The top and third lines use data display message #140, which has been configured as a blank text message.


```
C100        LD
─┤ ├─       K4

            OUT         Select
            V2001       message 4
                        to 2nd line

            LD
            K8          Select
                        message 8
            OUT         to bottom
            V2003       line

            LD
            V3000       Put data
                        from V3000
            OUT         into 2nd line
            V2006       data field

            LD
            K140        Select
                        message
            OUT         140
            V2000       to blank
                        Top  and
            OUT         Third lines.
            V2002
```

Good Parts: 235
Process Step 1

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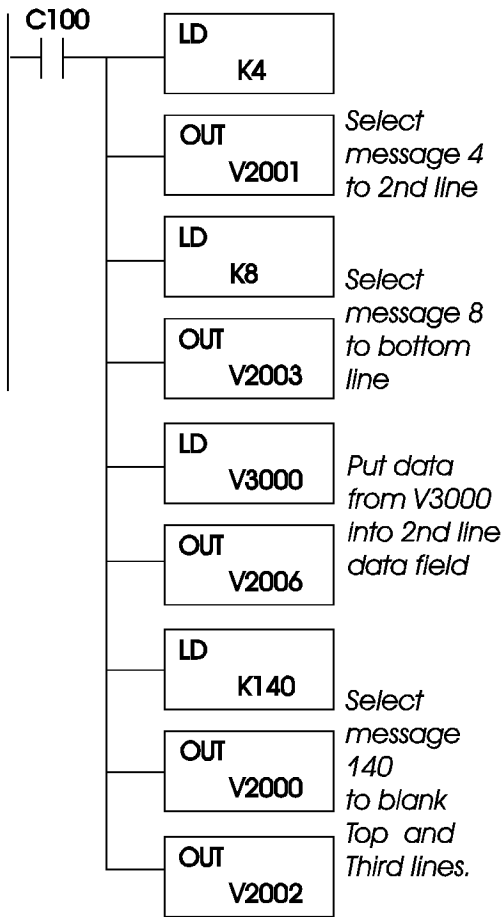
V2000	Top line message selection
V2001	Second line message selection
V2002	Third line message selection
V2003	Bottom line message selection
V2004	Top line data
V2005	Top line data 2 (for long BCD & floating point)
V2006	Second line data
V2007	Second line data 2 (for long BCD & floating point)
V2010	Third line data
V2011	Third line data 2 (for long BCD & floating point)
V2012	Bottom line data
V2013	Bottom line data 2 (for long BCD & floating point)

Displaying Binary Numbers

The example shown on the right is similar to the last example. The primary difference is that it uses a Binary number in the top line display. The top line uses data display message #1, which has been configured as a Binary display message. The data for the top line data field is coming from V2200. The third line is text message #8. The second and bottom lines use message #140 which has been configured as a blank text message.

```
Parts Left:    56432

Process Step 1
```

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C101		
⊣⊢	LD K1	Select message 1 to Top line
	OUT V2000	
	LD K140	Select message 140 to 2nd and bottom lines
	OUT V2001	
	OUT V2003	
	LD K8	Select message 8 to Third line.
	OUT V2002	
	LD V2200	Put data from V2200 into top line data field
	OUT V2004	
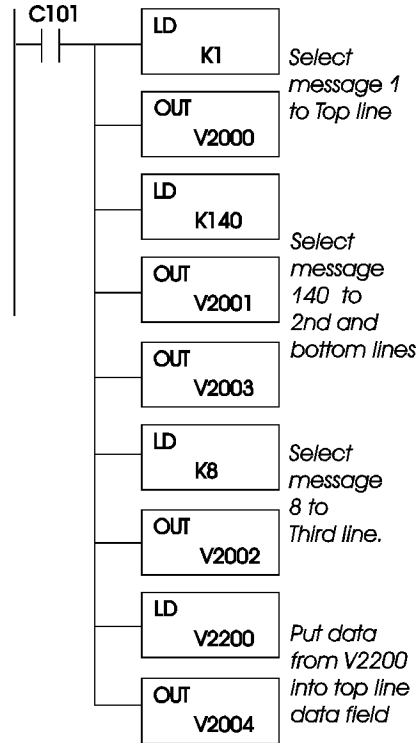
Displaying BCD Double Numbers

The example shown on the right shows a BCD double number in the bottom line display. The bottom line uses data display message #6, which has been configured as a BCD double display message. The data for the bottom line data field is coming from V3002 and V3003. The top line is text message #8. The second line displays message #3. The data for second line BCD message comes from register V2100. The third line uses message #140 which has been configured as a blank text message.

```
Process Step 1
Tank Level:  1935

Double:  64197324
```

OptiMate

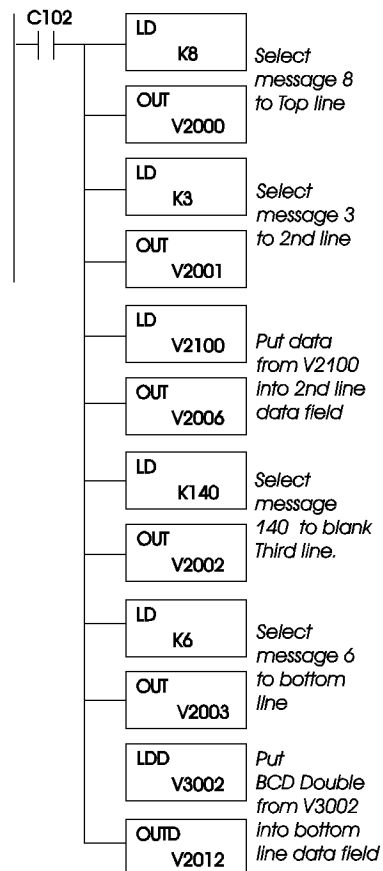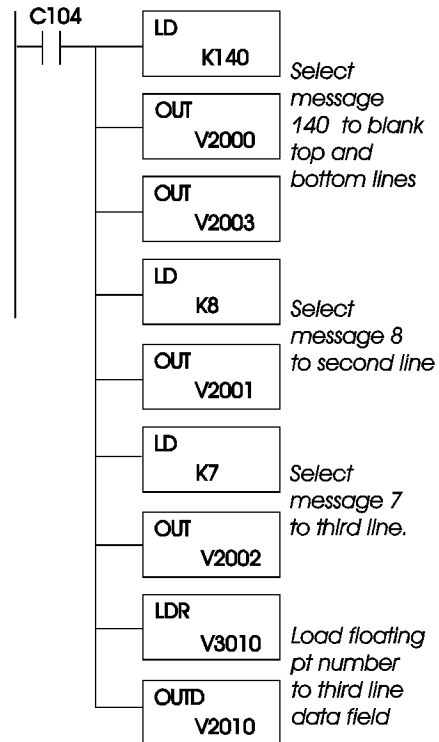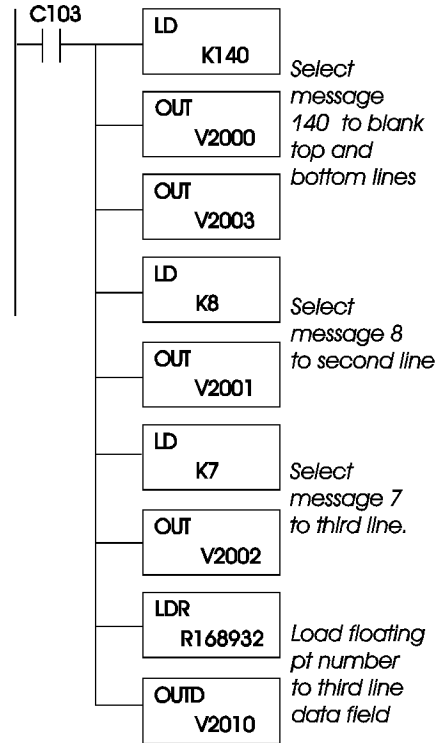| C102		
⊣⊢	LD K8	Select message 8 to Top line
	OUT V2000	
	LD K3	Select message 3 to 2nd line
	OUT V2001	
	LD V2100	Put data from V2100 into 2nd line data field
	OUT V2006	
	LD K140	Select message 140 to blank Third line.
	OUT V2002	
	LD K6	Select message 6 to bottom line
	OUT V2003	
	LDD V3002	Put BCD Double from V3002 into bottom line data field
	OUTD V2012	

Displaying Floating Point Numbers

The example shown on the right is similar to the previous example. The primary difference is that it uses a floating point number in the third line display message. The third line uses data display message #7, which has been configured as a floating point display message. Since the data is a floating point number, it uses two 16-bit registers. The two registers have to be looked at together, not individually, for you to be able to make any sense of the data. In this example, the data, a constant number (168932), is loaded into the third line data display registers V2010 and V2011 using the LDR (load real number) instruction. The top and bottom lines use message #140 which has been configured as a blank text message. The second line uses message #8, a text message.

```
C103
 ┤├──┬── LD
     │    K140        Select
     │              message
     ├── OUT         140 to blank
     │    V2000      top and
     │              bottom lines
     ├── OUT
     │    V2003
     │
     ├── LD
     │    K8          Select
     │              message 8
     ├── OUT         to second line
     │    V2001
     │
     ├── LD
     │    K7          Select
     │              message 7
     ├── OUT         to third line.
     │    V2002
     │
     ├── LDR
     │    R168932    Load floating
     │              pt number
     └── OUTD        to third line
          V2010      data field
```

The example shown on the right is similar to the previous example. The primary difference is that it gets its value from two PLC registers instead of a constant value as the previous example did. The third line uses data display message #7, which has been configured as a floating point display message. Since the data is a floating point number, it uses two 16-bit registers. The two registers have to be looked at together, not individually, for you to be able to make any sense of the data. In this example, the data is loaded from V3010 and V3011 using the LDR (load real number) instruction to the third line display registers V2010 and V2011. The top and bottom lines use message #140 which has been configured as a blank text message. The second line uses message #8, a text message.

```
C104
 ┤├──┬── LD
     │    K140        Select
     │              message
     ├── OUT         140 to blank
     │    V2000      top and
     │              bottom lines
     ├── OUT
     │    V2003
     │
     ├── LD
     │    K8          Select
     │              message 8
     ├── OUT         to second line
     │    V2001
     │
     ├── LD
     │    K7          Select
     │              message 7
     ├── OUT         to third line.
     │    V2002
     │
     ├── LDR
     │    V3010      Load floating
     │              pt number
     └── OUTD        to third line
          V2010      data field
```

Process Step 1
Part/HrAvg +1.68E+05

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Examples of Use with an Allen-Bradley PLC

Interfacing to A-B Memory

OptiMate panels interface to Allen-Bradley SLC 5/03, SLC 5/04 and Micrologix PLCs via integer file type N. The 5/03 and 5/04 have file type N7 as standard. Other "N" type files can be created. The Micrologix has a fixed file type N7. Please refer to Allen-Bradley documentation for information on setting up and using "N" type files.

Note: When using an OM440 with an A-B PLC, always ensure that at least 12 words of memory are allocated to ensure proper communications.

All of the examples that follow assume that the OM440 module has been configured, through the OM-WINEDIT Editor, for a file type N7 and base register address 0.

Displaying Messages on the LCD Display

Messages of various types can be configured via OM-WINEDIT and downloaded to the OM440. The message definitions shown in the figure below will be used in all of the examples that follow. Also, assume that message #140 consists of all blanks " ".

OM440 Configuration

PLC Base Register Address: N7:0

Msg Text	Action	Decimal	Format	Range
1: "Parts Left: ^^^^^ ":	Display	Fixed	BIN	
2: "Product Rate ^^^.^ ":	Display	Fixed	BCD	
3: "Tank Level ^^^^ ":	Display	Fixed	BCD	
4: "Good Parts: ^^^^ ":	Display	Fixed	BCD	
5: "Reject Parts ^^^^ ":	Display	Fixed	BCD	
6: "Double: ^^^^^^^^ ":	Display	Fixed	BCD Double	
7: "Part/HrAvg ^^^^^^^^^^":	Display	Fixed	Floating Point	
8: "Process Step 1 ":				
9:				
10:				
11:				
12:				
13:				
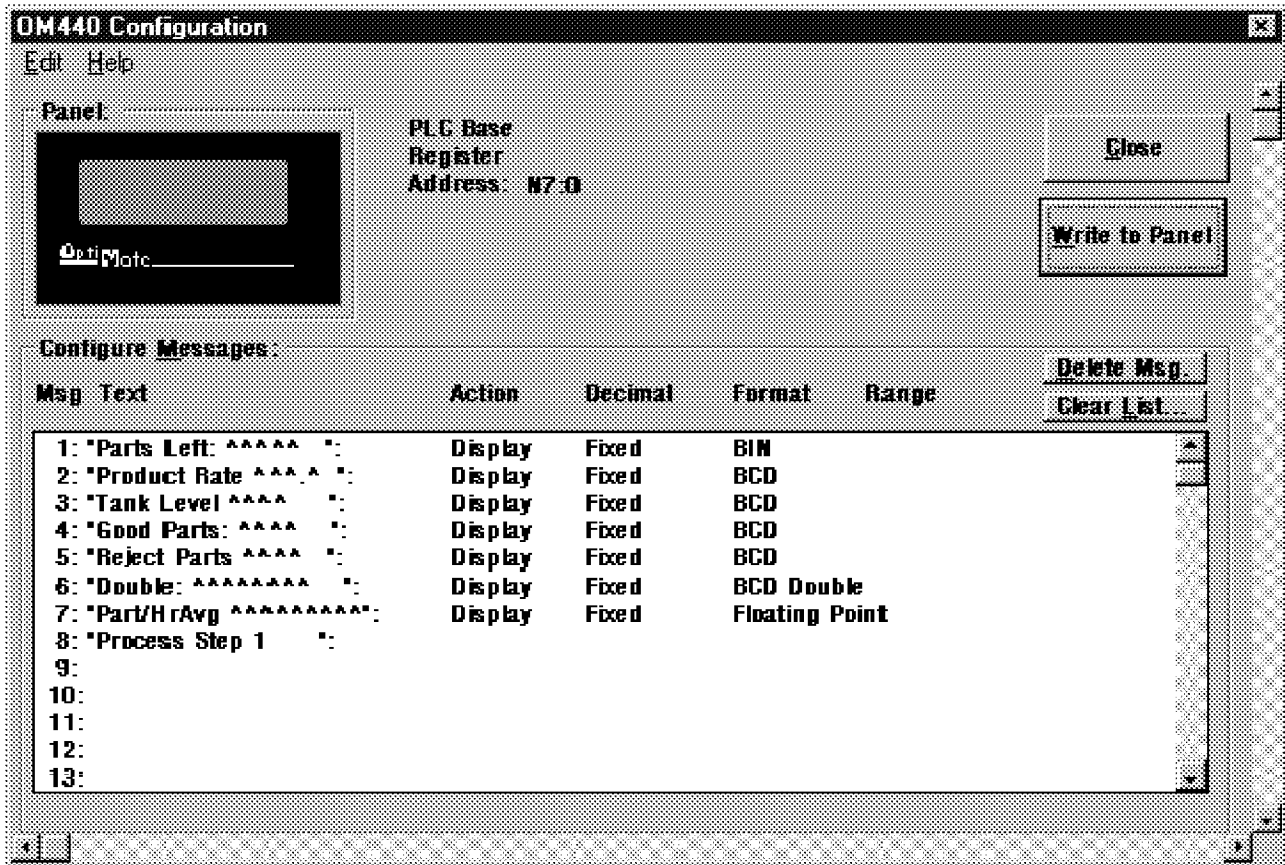
Displaying Floating Point Numbers

Floating point numbers can be displayed by the OM440. This number format is a standard capability for PLC Direct DL250, DL350 and D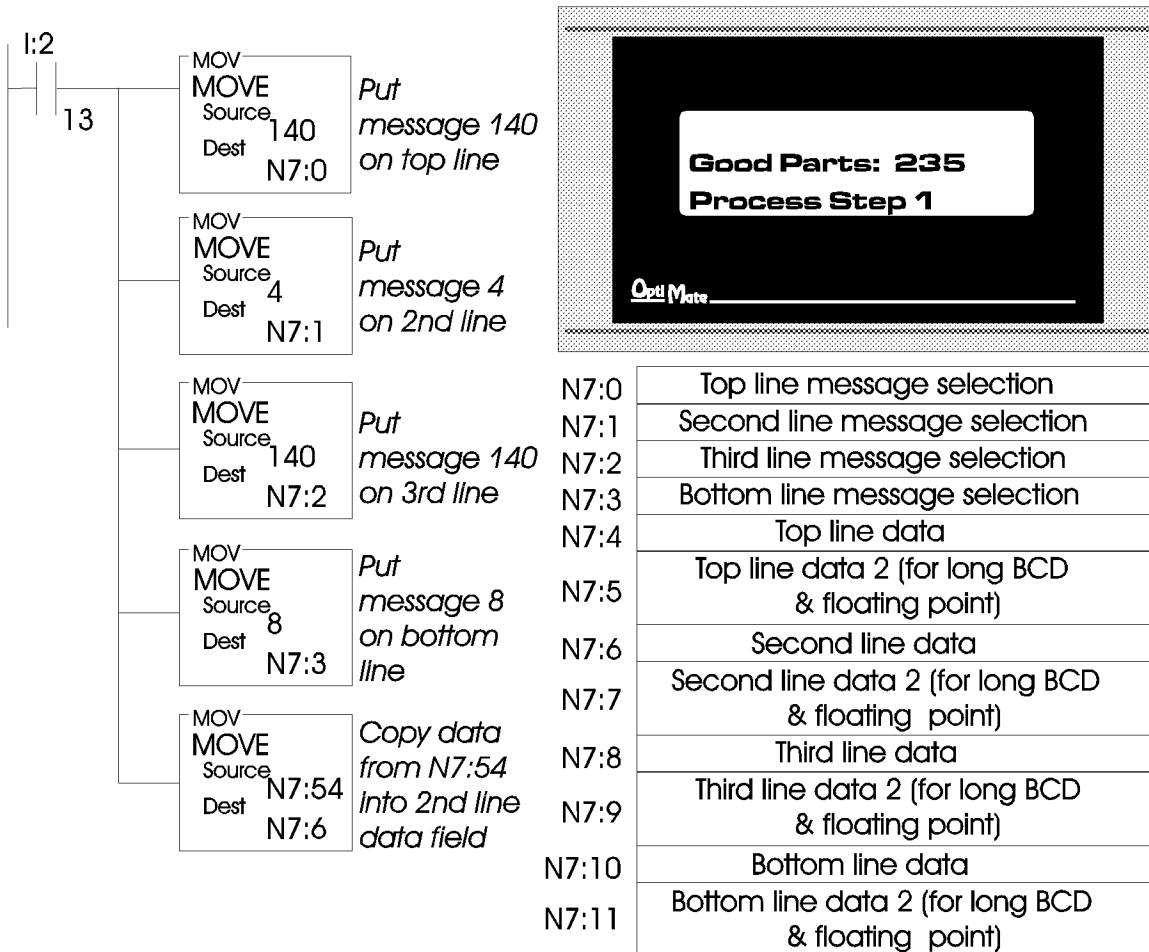L450 PLCs. However, the A-B SLC PLCs do not have a means of handling floating point numbers. Due to the limitations of the SLC, this capability will not be commonly implemented with A-B PLCs.

Displaying BCD Numbers on the LCD Display

The example below shows a couple of messages being displayed to the LCD display as long as I:2/13 is active. The second line uses BCD message #4. The data for the second line data field is coming from N7:54. The bottom line is text message #8. The top and third lines use data display message #140, which has been configured as a blank text message.

I:2
┤ ├ 13

	MOV MOVE Source 140 Dest N7:0	Put message 140 on top line
	MOV MOVE Source 4 Dest N7:1	Put message 4 on 2nd line
	MOV MOVE Source 140 Dest N7:2	Put message 140 on 3rd line
	MOV MOVE Source 8 Dest N7:3	Put message 8 on bottom line
	MOV MOVE Source N7:54 Dest N7:6	Copy data from N7:54 into 2nd line data field

Good Parts: 235
Process Step 1

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N7:0	Top line message selection
N7:1	Second line message selection
N7:2	Third line message selection
N7:3	Bottom line message selection
N7:4	Top line data
N7:5	Top line data 2 (for long BCD & floating point)
N7:6	Second line data
N7:7	Second line data 2 (for long BCD & floating point)
N7:8	Third line data
N7:9	Third line data 2 (for long BCD & floating point)
N7:10	Bottom line data
N7:11	Bottom line data 2 (for long BCD & floating point)

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Displaying Binary Numbers

The example shown on the right is similar to the last example. The primary difference is that it uses a Binary number in the top line display. The top line uses data display message #1, which has been configured as a Binary display message. The data for the top line data field is a constant number, 56432 (DC70 Hex) . The third line is text message #8. The second and bottom lines use message #140 which has been configured as a blank text message.

```
Parts Left:    56432

Process Step 1
```

I:2
14

MOV MOVE Source 1 Dest N7:0	Put message 1 on top line
MOV MOVE Source 140 Dest N7:1	Put message 140 on 2nd line
MOV MOVE Source 8 Dest N7:2	Put message 8 on 3rd line
MOV MOVE Source 140 Dest N7:3	Put message 140 on bottom line
MOV MOVE Source &HDC70 Dest N7:4	Move constant 56432 into top line data field

Displaying BCD Double Numbers

Long BCD numbers (up to 8 digit) can be displayed by the OM440. This number format is a standard capability for PLC Direct PLCs. However, the A-B SLC PLCs do not have an easy means of handling long BCD numbers. Due to the limitations of the SLC, this capability will not be commonly implemented.
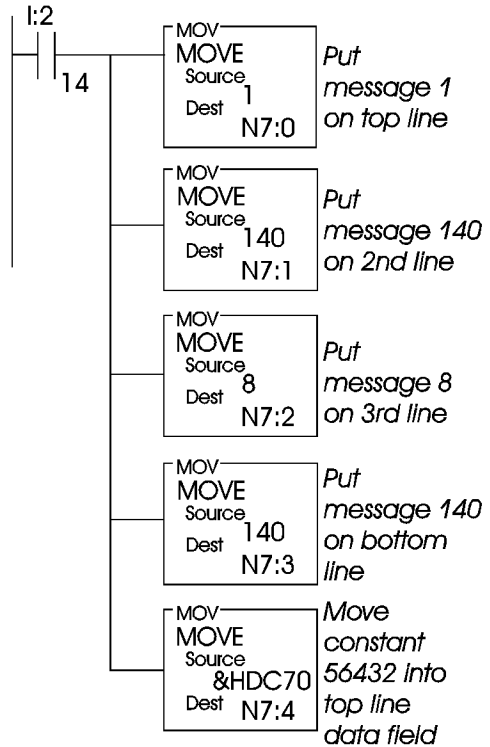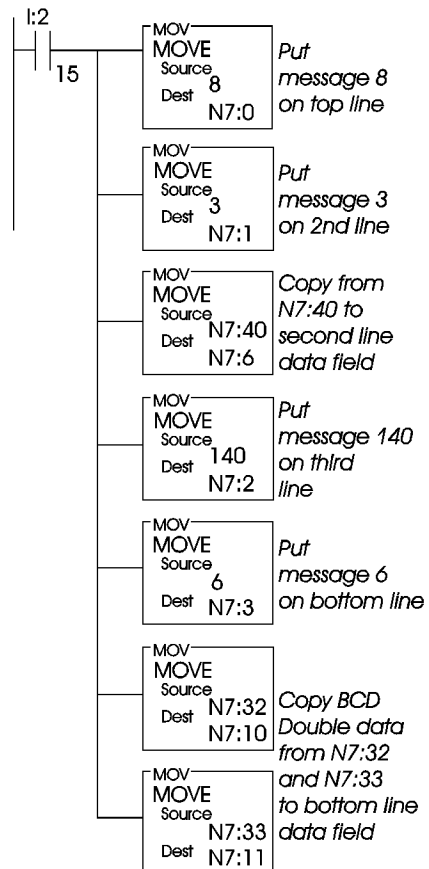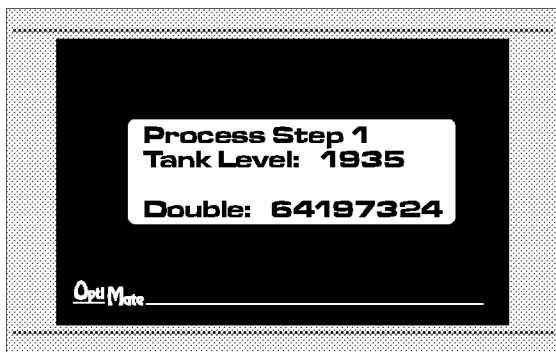
The example shown on the right shows a BCD double number in the bottom line display. The bottom line uses data display message #6, which has been configured as a BCD double display message. The data for the bottom line data field is coming from N7:32 and N7:33. The top line is text message #8. The second line displays message #3. The data for second line BCD message comes from register N7:40. The third line uses message #140 which has been configured as a blank text message.

```
Process Step 1
Tank Level:  1935

Double:  64197324
```

I:2
15

MOV MOVE Source 8 Dest N7:0	Put message 8 on top line
MOV MOVE Source 3 Dest N7:1	Put message 3 on 2nd line
MOV MOVE Source N7:40 Dest N7:6	Copy from N7:40 to second line data field
MOV MOVE Source 140 Dest N7:2	Put message 140 on third line
MOV MOVE Source 6 Dest N7:3	Put message 6 on bottom line
MOV MOVE Source N7:32 Dest N7:10	Copy BCD Double data from N7:32
MOV MOVE Source N7:33 Dest N7:11	and N7:33 to bottom line data field

Use in a Microprocessor Based System

OptiMate 400 Series modules can interface a microprocessor based controller over a serial link. This link will be RS232. The microprocessor acts as the master. It can write data to the panel or read data from the panel.

The OM440 uses the OptiMate Hex protocol for fast and easy communications. The OptiMate Hex protocol is defined in subsequent pages.

Module Address

In a microprocessor system, each panel must have its own unique address. You define this address (between 0 and 30) using the configuration editor. For the OptiMate 400 Series line of modules, the module address is normally 0. The panel will respond to the host only if it is properly addressed.

Communications Protocol

To use an OptiMate panel as a slave device in a microprocessor based system, the panel must be configured for the OptiMate Hex protocol. The other options that must be set are module address, baud rate, parity and number of stop bits. If parity is set to even or odd, only one stop bit is allowed. Once selected, it must be downloaded to the panel.

Computer Based Operation

The OM440 protocol for computer based operations is OptiMate Hex protocol.

All of the basic functionality described for PLC operation is also available to computer or microprocessor based applications.

The following is a synopsis of the OM440 operation as it relates to computer based applications. In certain cases, more detail is provided under the same topic for PLC operation. The details of messages involved are covered in the protocol documentation which follows.

Displaying Messages on the LCD Display

Under computer based operation, the OM440 can be instructed to display predefined messages. Selection of a predefined message simply requires transmitting the proper command (0xA1), the message number, the appropriate line, and initial display data. The data must be in hexadecimal.

To send the "Send data display message", the message text and data must be sent along with the command to send the message (0xA6), the line number, displayed data type and initial display data. The message text should be sent in the ASCII hexadecimal equivalent. The other commands and the data must be sent in hexadecimal.

Placing Numeric Data in the Display

Any message containing caret `^` place holders will allow either the display of numeric data.

Numeric data for the numeric data field can be transmitted by the host computer. This is done by transmitting the proper command (0xA7), the line number, and the data in a message field. For this message type, all data is transmitted in the hexadecimal format.

OM440 OptiMate Hex Protocol

General format
    STX   Module   function   ftn_data   checksum
           address

	Where	STX	= 0x02
		Module address	= 0 to 30
		function	= 0xA1 ; Select predefined message display
			0xA6 ; Send display message
			0xA7 ; Send data for data display message
			0xA9 ; Display status request
		ftn_data	= data specific to the function
		checksum	= 8 bit sum of all characters after address until checksum

Note : Spaces are shown for readability only. There are no spaces between message fields.
0xXX denotes a hex number.

Select Predefined Message
    STX   Module   0xA1   line   mesg_no   data   checksum
           Address

	where line	= top (0x00), second (0x01), third (0x02) or bottom (0x03) line
	mesg_no	= number of the predefined (through the configuration editor) message
		(1 - 160, hex integer, i.e. 33 = 0x21)
	data	= 4 bytes. The format depends on the message type selected

                > For an integer type data message, the first two bytes are not used (send as 0's). The
                     Third byte is the high 8 bits of the 16 bit integer data. The fourth byte is the low 8 bits.
                > For BCD data type message, the data is sent MSByte through LSByte. For a long BCD
                     Data type message, all 4 bytes (8 digits) are used. For a regular BCD message, only
                     the last two bytes are used.
                > For floating point data format, data sent in IEEE 32-bit floating point format, MSB first.
                - Used as display data for numeric data display message.
                - Ignored for all other message types.

response
ACK   *if message received and processed OK*
 or
NAK   *if any errors in message*

where	ACK	= 0x06
	NAK	= 0x15

Send data display message
    STX   Module   0xA6   line_type   text   data   checksum
           Address
             where line_type = line number and data type
                     bits 0,1 = line number

		Top line	= 0x00
		Second line	= 0x01
		Third line	= 0x02
		Bottom line	= 0x03

                 bits 2,3 =unused
                 bits 4,5 = data type

		Binary (integer)	= 0x00
		BCD	= 0x01
		BCD Double	= 0x02
		Floating Point	= 0x03

                 bits 6,7 =unused

	text	= 20 characters of ASCII text: message including caret characters for numeric display
		Data placeholders.

             Example: STX   0x02   0xA6   0x23   BCD Double ＾＾＾＾＾＾   0x43   0x62   0x78   0x59
                   0x??(checksum)
             will display "BCD Double 43627859 " on the bottom line of the display.

	data	= 4 bytes. The format depends on the message type selected

                > For an integer type data message, the first two bytes are not used (send as 0's). The
                     Third byte is the high 8 bits of the 16 bit integer data. The fourth byte is the low 8 bits.
                > For BCD data type message, the data is sent MSByte through LSByte. For a long BCD
                     Data type message, all 4 bytes (8 digits) are used. For a regular BCD message, only
                     the last two bytes are used, the first two bytes are not used (send as 0's).
                > For floating point data format, data sent in IEEE 32-bit floating point format, MSB first.

response
ACK   *if message received and processed OK*
 or

NAK   *if any errors in message*

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Send data for data display message
        STX   Module   0xA7   line data   checksum
               Address
                      where line   = top (0x00), second (0x01), third (0x02) or bottom (0x03) line
                            data   = 4 bytes. The format depends on the message type selected
                                    > For an integer type data message, the first two bytes are not used (send as 0's). The
                                      Third byte is the high 8 bits of the 16 bit integer data. The fourth byte is the low 8 bits.
                                    > For BCD data type message, the data is sent MSByte through LSByte. For a long BCD
                                      Data type message, all 4 bytes (8 digits) are used. For a regular BCD message, only
                                      the last two bytes are used.
                                    > For floating point data format, data sent in IEEE 32-bit floating point format, MSB first.
        response
        ACK   *if message received and processed OK*
         or
        NAK   *if any errors in message*

Display status request
        STX   Module   0xA9   checksum
               Address

        response
        STX top_line_msg line2_msg line3_msg bot_line_msg   checksum   *if message received and processed OK*
                   where top_line_msg = last predefined message selected for top line
                         line2_msg   = last predefined message selected for second line
                         line3_msg   = last predefined message selected for third line
                         bot_line_msg = last predefined message selected for bottom line

         or
        NAK   *if any errors in message*

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                                                   home page: optimate.com
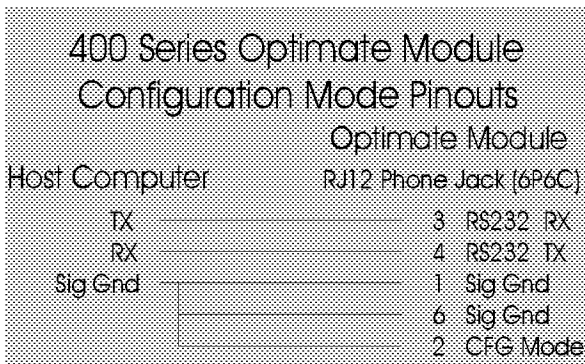
Set Up and Interconnect

Connection to the System

OptiMate modules are designed for communications connection to system devices. The module can be connected to a computer or PLC over the serial port (RS232).

Connection to a Computer for Configuration

Connection of a 400 Series OptiMate module to a computer for configuration can be accomplished over an RS232 link. RS232 is limited to one OptiMate module to a computer serial port. See the figure below for 400 Series OptiMate module configuration mode pinouts.

```
400 Series Optimate Module
   Configuration Mode Pinouts
                          Optimate Module
Host Computer      RJ12 Phone Jack (6P6C)
        TX                    3   RS232 RX
        RX                    4   RS232 TX
     Sig Gnd                  1   Sig Gnd
                              6   Sig Gnd
                              2   CFG Mode
```

Refer to manufacturer's documentation for computer serial link connector pinouts.

Configuration cables are available for connection to IBM PC-AT compatible ports.

Run Mode Connection to a Computer or PLC

Connection of a 400 Series OptiMate module to a computer or PLC can be accomplished over an RS232 link. RS232 is limited to one OptiMate module to one computer serial port. Since PLCs are slave devices, the RS232 link for a PLC is limited to one OptiMate module. See the figure on the right for 400 Series OptiMate Module run mode pinouts.

Refer to manufacturer's documentation for PLC or computer serial link connector pinouts.

Standard cables are available for connection to several different PLCs as well as to IBM PC-AT compatible ports.

The figure on the right shows the RJ12 connector pinouts for connection to an OptiMate 400 series module.
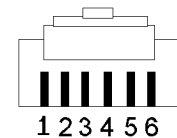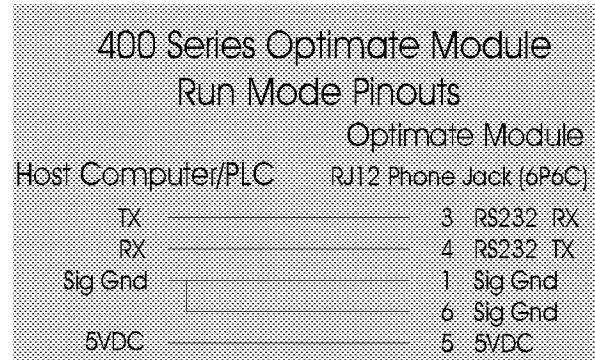
Power

The OM440 Setpoint/Display Panel will operate only on a DC voltage of _5VDC_. Steady state current is listed on the specification page.

The OM440 panel can draw power from its communications cable making a single 6 wire phone type cable the only cable necessary for installation. PLC Direct DL105, DL205, DL350, or DL405 CPUs are the only PLC CPUs that can connect to the OM440 in this manner. Microprocessor based devices can also be used in this way if they have a 5VDC connection in their comm ports.

The OM440 panel can be powered from a 5VDC adapter for panel configuration or connection to PLCs or microprocessor based devices that do not have a 5VDC connection in their communication ports. Examples are the PLC Direct DL340 and the Allen-Bradley 5/03, 5/04 and Micrologix CPUs. A description of the DC power connector is listed on the specification page.

> **Note:** Only use an Optimation approved 5VDC power supply or equivalent that contains a <u>center negative DC power jack.</u>

There is a very brief (0.1 - 1 millisecond) power on surge up to 0.44amps. This is typical of nearly any type of electronic equipment and is due to the initial charging of power capacitors.

```
400 Series Optimate Module
      Run Mode Pinouts
                           Optimate Module
Host Computer/PLC     RJ12 Phone Jack (6P6C)
        TX                    3   RS232 RX
        RX                    4   RS232 TX
     Sig Gnd                  1   Sig Gnd
                              6   Sig Gnd
       5VDC                   5   5VDC
```

```
|‾‾‾‾|
||||||
1 2 3 4 5 6
```
RJ12 Connector
Optimate End

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Configuration

Configuration Selections

OptiMate panels can be configured for the specific application by using the OM-WINEDIT Configuration Editor. The OM-WINEDIT Editor runs on any IBM PC compatible computer with Windows. It allows the user to select the exact functionality to meet application requirements.

For the OM440 module, the following are important configuration parameters.

Microprocessor Based Systems

Decision	Selection
Single/Multi Module	Choose Single module even if the system will contain several modules. The Multi module selection applies only to systems using a communications master. In computer based systems, each module is configured independently.
Configuration starting point	First time configuration, start with defaults for module. Subsequent configurations can utilize disk files you create.
PLC Type	Select OptiMate Hex
Address	Each module must have a unique address. Normally 0 for the OM440.
Protocol	Select appropriate baud rate, 8 data bits, #stop bits & parity. Note that if even or odd parity selected, only 1 stop bit is available.
Messages	Define messages as required for application

Single Module PLC Based Systems

Decision	Selection
Single/ Multi Module	Choose single panel configuration
Configuration starting point	First time configuration start with defaults for the panel. Subsequent configurations can utilize disk files you create
PLC Type	Select appropriate PLC type
Protocol	Select appropriate baud rate, # data bits, # stop bits & parity. Note that if 8 data bits and even or odd parity selected, only 1 stop bit is available
Messages	Define messages as required for application

Multi Module PLC Applications (Uses OM-9001 Communications Master)

Not Applicable with the 400 Series Panels

Note: Configuration must be downloaded from an IBM PC compatible computer to each module. This is done over the serial link. When configuring the OM440, always remember to use the programming cable that connects the panel to an IBM PC compatible computer. Also, always insert the programming cable into the panel to place it into configuration mode. When you are finished downloading, wait a few seconds before removing the programming cable. This will return the panel to PLC run mode. Communication cables are available from Optimation.
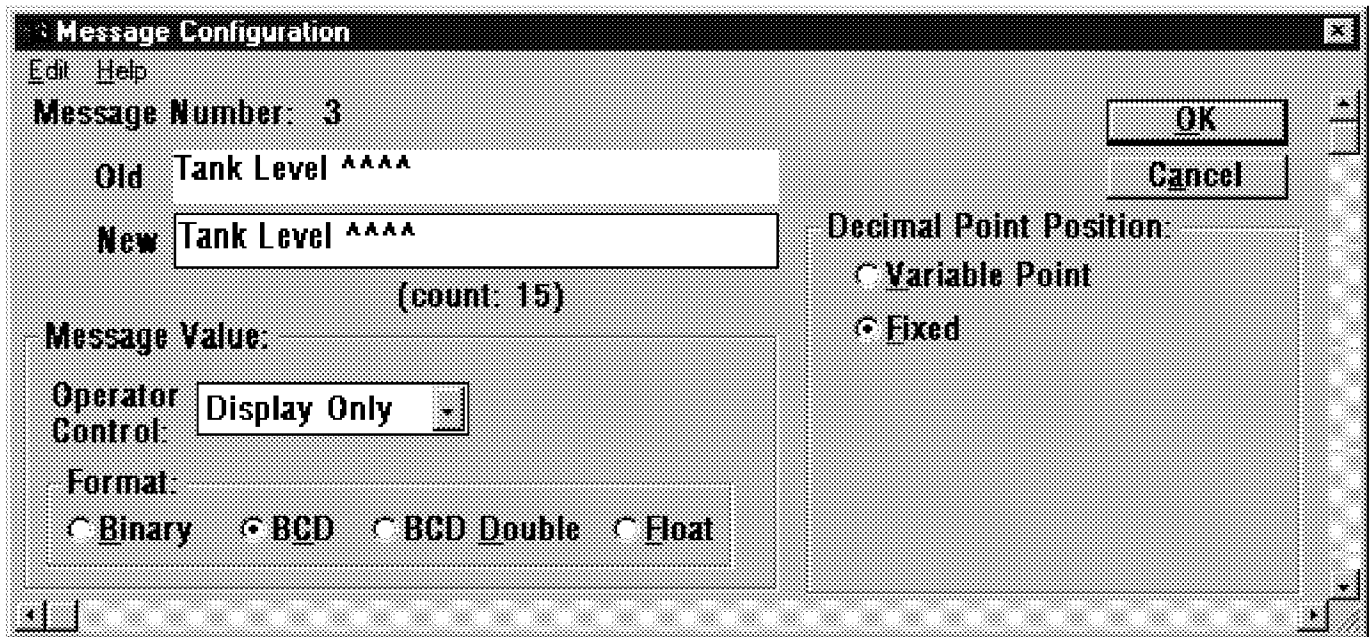
Creating Messages

The figure on right the illustrates the process of creating messages for your program to use. The first step involves simply using a message template to define, on paper, each of the messages. We suggest copying the template page and using it to define all of your messages.

The next step is to use the OM-WINEDIT configuration editor to enter the messages as defined. Remember to use carets wherever variable data is to be used. The OM-WINEDIT editor will guide you through other definable parameters, including data type, message type, etcetera, as shown below.

Message #	Text (20Characters Max.)																			
1	E	n	t	e	r		S	e	t	p	o	i	n	t	:		^	^	^	^
2	P	r	o	d	u	c	t		R	a	t	e	:		^	^	^	.	^	
3	S	h	i	f	t		T	a	r	g	e	t	:		^	^	^	.	^	

Example Message Definitions

Message Configuration

Edit   Help

Message Number: 3

Old Tank Level ^^^^

New Tank Level ^^^^

(count: 15)

Message Value:

Operator Control: Display Only

Format:
○ Binary   ● BCD   ○ BCD Double   ○ Float

Decimal Point Position:
○ Variable Point
● Fixed

OK

Cancel

Message Definition Template

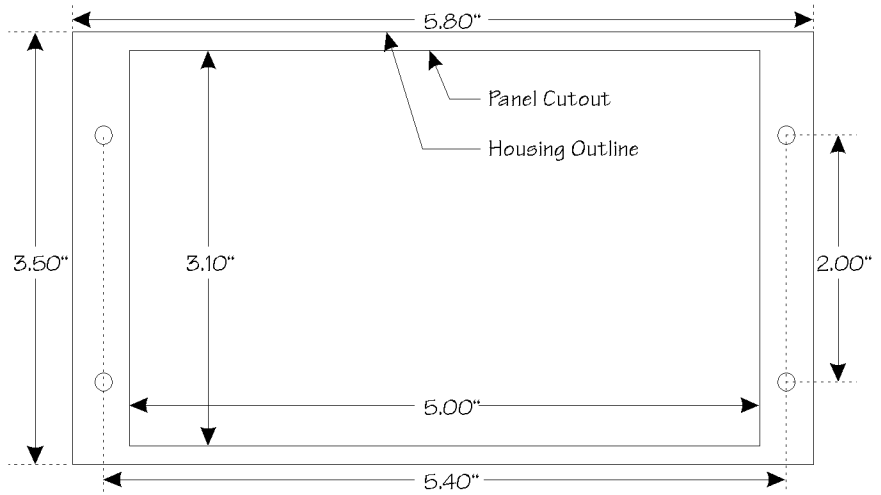| Message #	Text (20Characters Max.)																			

Message Definition Template

Specifications

Physical
- Recessed Mount Housing: 6.00"L x 3.50"H x 1.25"D
- Cutout size: 3.20"H x 5.10"L
- Panel Fasteners: Four, 6x32 threaded studs, shown at right (on ends, symmetrical about center line)
- Weight : 10 ounces
- Colors : Dark gray housing with dark gray panel.
- LCD Display: 4 line X 20 character STN with LED backlight
 character size: 4.75mm high X 2.95mm wide

Electrical
- Power: 5VDC @ 0.75 Watts
  150mA @ 5VDC
- Power On Surge (see figure below)
  0.44A for 1 millisecond max

Panel Cutout

Housing Outline

5.80"

3.50"   3.10"   2.00"

5.00"

5.40"

Panel Mounting Dimensions

Power on Surge
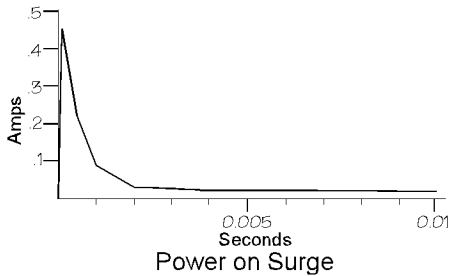
- Power connector :
  DC power plug, center negative (see figure below) DC power plug is necessary for panel configuration and for connection to PLCs that do not have a 5VDC connection in their communication ports.

  + ⊙ −
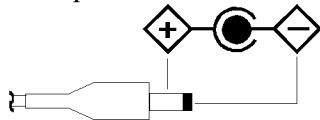
  Always use an Optimation approved 5VDC power supply with a *center negative plug.*

Communications
- RS232
- 4800 to 19200 baud
- Compatible with major PLC protocols
- Microprocessor compatible OptiMate Hex protocol
- 6 pin RJ12 phone jack type connector

Communications Failure Operation
Should the panel (when not selected for configuration) ever fail to communicate successfully for a period of 12 seconds, the LCD display will flash "Host Comm Fail !" on the second line.

Environmental
- Enclosure   - NEMA 4 (when properly installed)
- Temperature   - 0 to 50 C
- Humidity   - 95% Non-condensing

Message Types (160 user defined messages available)
- General Text message
- Data display message (one data value per line)

Numeric Types & Values
- Integer
- Fixed Point
- BCD (Values between 0 & 9999; with appropriate decimal placement)
- BCD Double (Values between 0 & 99999999 with appropriate decimal placement)
- Binary (Values between 0 & 65535 with appropriate decimal placement)
- Floating Point (Values between -3.402823E+38 to +3.402823E+38 in the format of ±X.XXE±XX)