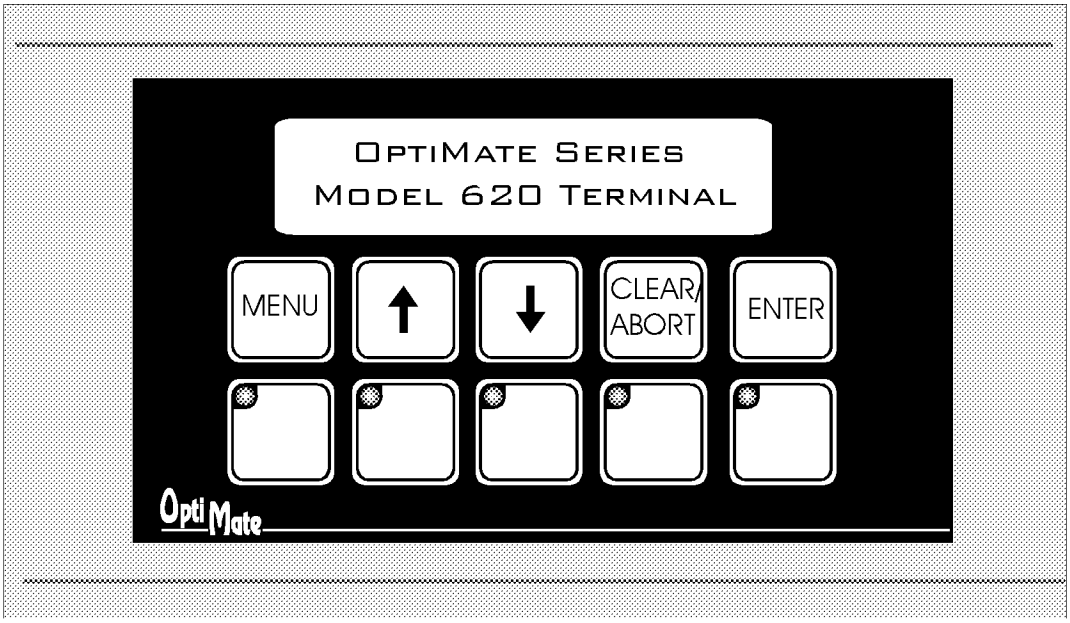


OM620 Operator Panel

The OM620 Operator Panel is a low cost/high performance man/machine interface with a broad range of operator input and display capabilities. The panel includes a 2 line by 20 character LCD display, arrow adjustment data entry, five function keys and menu tree capability.

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

Function keys can be custom labeled by the user with plastic inserts. The inserts can be custom legended with text and/or graphics, and slipped into a protective pocket behind the faceplate.

The OM620 Operator Panel is part of Optimation's **OptiMate**® series. Each OptiMate panel is designed to connect to a microprocessor or most PLCs with a single cable connection. OptiMate panels can be used individually, or together with any combination of other OptiMate panels.

When used with a microprocessor system, simple communications over either an RS232 or RS422 communication cable allows the microprocessor to directly control the LCD display as well as read numeric data entry and function key status.

When used with a PLC, operation is transparent to the user. Terminal functions tie directly into your PLC ladder logic program. The OM620 takes care of the rest.

Applications

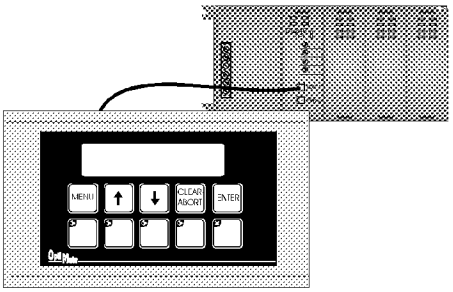
- Machine control
- Process control
- Security systems
- HVAC
- Plant monitoring/control
- PLC applications
- Microprocessor applications

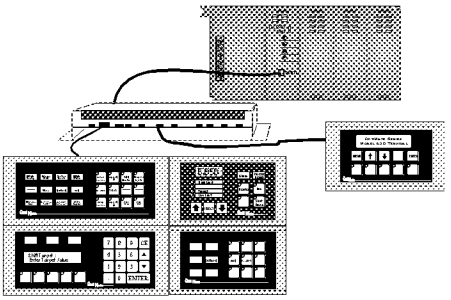
Features

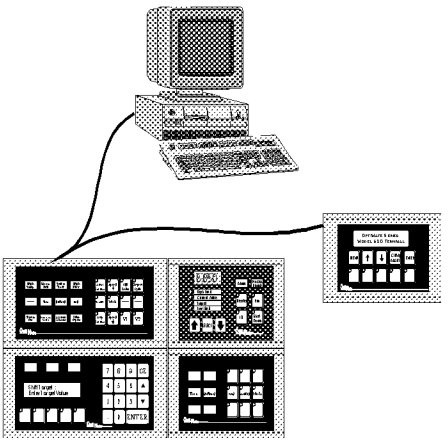
- 2 line x 20 character LCD
- Numeric arrow adjustment
- 5 User defined function keys
- Menu tree capability
- PLC compatible
- RS232/RS422 communications
- Stand alone operation capable
- Multimodule operation capable

Contents

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 OM620 operator terminal uses a bank of PLC registers. Complete Operator interface is performed with 9 PLC registers for display message selection, data entry and function key interface. The OM620 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.

PLC Multi Panels

Larger systems involving operator panels and I/O can be successfully addressed using OptiMate panels. These applications utilize the OM9001 Communications Master to transfer data between the PLC and the individual OptiMate modules. OptiMate panels can be located together to form custom panels or they can be distributed anywhere within 4000 feet.

The OM9001 Communications Master provides a transparent interface between the PLC and a group of OptiMate panels. The communication interface between modules requires only four wires.

System configuration is simple using OM-WINEDIT software that runs on any IBM PC compatible computer.

This modular approach to custom applications provides a nearly limitless number of possibilities.

Microprocessor Based Systems

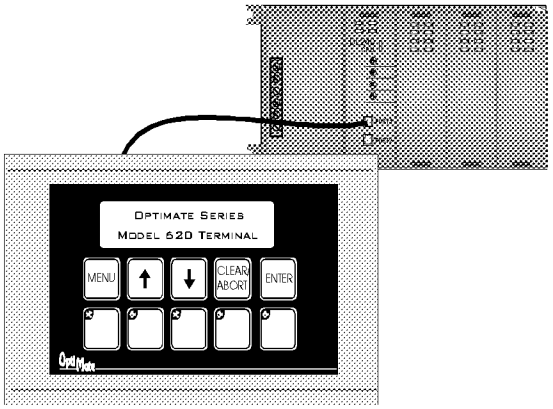
OptiMate panels can interface directly to most computers or microcontrollers. The modules communicate over either RS422 or RS232 serial communications. All that is required to interface OptiMate panels is a serial port and the ability to transmit and receive Hex numbers. The OptiMate Hex protocol, detailed in this document, allows the user to directly control panel operation and retrieve operator inputs.

Since each panel has its own unique address, up to 31 modules can be interfaced on one communications cable.

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 OM620, these commands are messages for display and data initialization as well as function button status and data entry retrieval.

Communications over RS422 allows placement of modules anywhere within a 4000 foot cable distance. Panels can be grouped together to form a larger panel. Panels can be grouped in several clusters all on the same communications cable.

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 OM620 Operator Panel uses a bank of 9 contiguous PLC registers. The register set definition is shown in the table below.

OM620 Panel PLC Register Map

PLC Register	Register Function
M+0 (first register of bank)	Top line message selection
M+1	Bottom Line message selection
M+2	Top line data
M+3	Top line data 2 (for long BCD)
M+4	Bottom line data
M+5	Bottom line data 2 (for long BCD)
M+6	Function selection
M+7	Status register
M+8	Control register

Register Definition

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

- Register M - 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 bottom line of the LCD display.
- Register M+2 - Numeric data associated with top line display (described in more detail in following paragraphs)
- Register M+3 - For long BCD data only. Numeric value is the four most significant BCD digits of data for the top line.
- Register M+4 - Numeric data associated with bottom line of display.
- Register M+5 - For long BCD data only. Value is the four most significant BCD digits of data for the bottom line.
- Register M+6 - The function number selected through the menu tree.
- Register M+7 - Status register

MSB																LSB
					↓	↑	ENT	MA	AB	FS	DA	F5	F4	F3	F2	F1

Status Register

> F1-F5 are status of the five function keys. Set to 1 when the button is active.

> DA - Data available. Associated with data entry. Set to 1 when new data has been entered.

> FS - Function Selected. Indicates that a function has been selected through use of the menu tree.

> ENT - ENTER button is active. (Not necessarily Data Entry - see DA bit).

> AB - Abort key active.

> MA - Menu operation is currently active.

> Up Arrow - Up arrow key is active.

> Down Arrow - Down arrow key is active.

- Register X+8 - Control bits

MSB																LSB
														BD	DAK	MR	ME

Control Register

> ME - Menu Enable. Must be set for menu operation to be enabled. (Normally, your control program would clear this bit when a function is in process).

> MR - Menu Return. Used at the end of a function. If set, will cause the menu to return to the same point in the menu tree as when the function started. If not set, function complete will not return directly into menu.

> DAK - Data acknowledge. This bit is used for repeat data entry into the same message. Setting to 1 acknowledges data entered from the keyboard as accepted by the PLC program. The 620 Terminal will clear the data on the screen message, clear the DA bit and allow new data entry. This bit must be cleared after DA (status register) is cleared.

> BD - Buzzer disable. When this bit is set to 1, the buzzer that beeps every time a button is pressed will be disabled (i.e. not beep).

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 OM620. These messages are 20 characters long and can include a field for the display and/or entry of numeric data.

Any predefined message can be displayed on either the top 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 .." and message #22 as "white fleeced lamb". If we wanted to put these two lines on the top and bottom lines of the display respectively, we would simply need to put the number 16 in register M and 22 in register M+1.

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. This field may be either a display data field or a data entry field. 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 bottom line of the display, you would place `36` in register M+1 and `465` in register M+4. The bottom line of the display would then read "# widgets sold: 465".

Displaying Data with a Decimal Point

The OM620 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+2, 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+2 is used for numeric value for the top line and register M+4 is used for the bottom line.

Displaying "Double" Numbers

The OM620 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 OM620 will use data in the register pair M+2 and M+3 for the top line. Likewise, M+4 and M+5 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+2 or M+4) will contain the 4 least significant digits of the number. The second register in the sequence (M+3 or M+5) contains the data for the 4 most significant digits of the "BCD double" number.

If the data displayed on the top line of the panel is 92345678, the top line data registers will contain the following: (shown in BCD/Hex format)

BCD Double Data	PLC Register
M+2	5678
M+3	9234

Displaying Floating Point Numbers

The OM620 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 the DL450 CPUs since they are the only compatible CPUs 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.

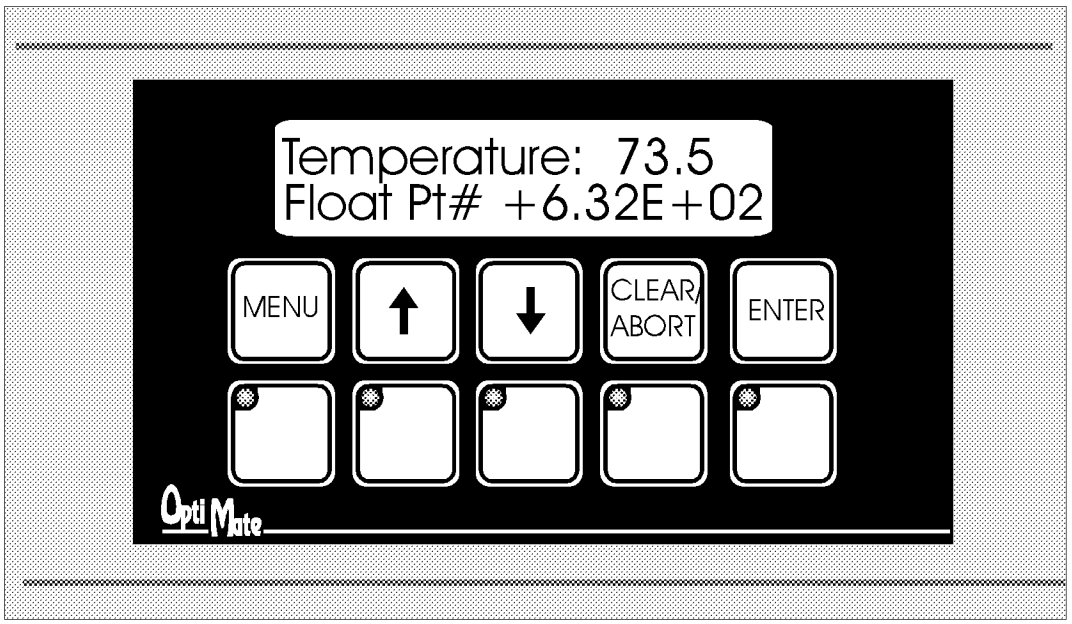
An IEEE 32-bit floating point number has a range of -3.402823E+38 to +3.402823E+38. The OM620 will be able to display any number within that range. The panel always uses the format ±X.XXE±XX to display the numbers.

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 OM620 does not "round" the numbers up or down, instead it truncates the remaining digits. 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	OM620 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 OM620 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



or bottom line data registers and load the appropriate message number into the corresponding top or bottom line message selection register. If the number 632.15 is to be displayed in message #58, it will be displayed as the following:
"Float Pt # +6.32E+02".

Numeric Data Entry

Numeric data can be entered through the adjustment arrow keys. To do so, the message must be marked for data entry via the configuration editor.

> ***Note : Only one data entry message may be active at a time. If data entry is selected simultaneously for both lines, unexpected operation may occur.***

All of the numeric features described for data display apply to numeric data entry. This includes the definition of the caret symbol "^" place holder within the message as well as "double" number types.

Data Entry/Adjustment with the Arrow Keys

A message can be set up for arrow adjustment through the OM-WINEDIT software. To do so, define the message with a numeric field. Select arrow adjustment. If there are limits, select and enter minimum and maximum values.

When the data screen is required in the program, place the number of the preconfigured message in the selection register and its current value in the associated data register. The digits marked by carets will initially display the current value.

As the operator presses the up or down arrow key, the numeric value will increment or decrement respectively. As it is adjusted, the value will be continuously updated in the PLC data register. When adjustment is complete, the operator will press the ENTER button. When this happens the data available (DA) status bit will be set. The DA bit will remain set until a new message number is placed in the message selection register (M or M+1) or the DAK bit is set.

Adjustment of data will be limited to within the limits defined through the configuration editor. Data also will be limited to the number of digits defined by carets in the message.

Example of Arrow Adjustment of Numeric Data

Suppose that your automatic banana peeler has a peel rate that can be adjusted between 1 and 50 bananas per second. With the configuration editor you define message 15 as "Set Peel Rate:^^.^". You would also select arrow adjustment and range limits of 10 to 500 (in tenths).

When this message is used, your PLC program would put 15 in register M (or M+1) and the current peel rate value in M+2 (or M+4). If the current peel rate was 5.7 bananas per second, the display would read "Set Peel Rate: 5.7". Pressing the arrow keys would adjust the value up or down while continuously writing the value to data register M+2 (or M+4). When the adjustment is complete, the operator would press ENTER. The OM620 will then set DA. DA will remain set until a new message is selected via M (or M+1) or the DAK bit is set.

Function Buttons

The OM620 contains five user definable pushbuttons. These pushbuttons can be custom labeled and used for any purpose.

The pushbuttons can be individually configured as either alternate action or momentary pushbuttons. Alternate action buttons alternate state each time they are pressed. Momentary buttons are active only while they are being pressed.

The status register holds the current state of each of the five pushbuttons. In a typical PLC application, these pushbuttons would be mapped to control contacts for easy ladder logic interface.

Menu Tree Operation

The OM620 terminal is designed to allow you to create a menu tree for function selection. The menu tree allows for interactive selection of a required function operation from a "menu" or list of options.

The OM620 allows up to four levels of menu. Each menu selection can be either a function or the next lower menu level. With this type of "tree" arrangement, you can construct an application menu that goes from general to specific. You can also place frequently used menu selections on the top layer and infrequent selections on lower layers.

The graphic below is an example of a typical menu tree.

Process Part type 1
Process Part type 2
Manual Control
    Turn Pump On
    Turn Pump Off
    Turn Heater On
    Turn Heater Off
    Turn Mixer On
    Turn Mixer Off
Setpoint Entry
    Tank Level Setpoints
        Set Minimum Level
        Set Maximum Level
        Set Low Alarm Level
        Set High Alarm Level
    Temperature Settings
        Temperature Setpoint
        Set Low Alarm Temp
        Set High Alarm Temp

Sample Menu Tree

The example shown has three menu layers. The top level has four selections. Selection "Process Part Type 1" and associated function number in X+6 and the set FS flag when selected. "Manual Control" will bring up the next menu. Each item under "Manual Control" will place a function number of X+6 and set FS if selected. The "Setpoint Entry" selection from the top level menu will bring up a second level menu of two items. Each second level item will in turn bring up another level. The items at the bottom level will perform actual function selections.

When a function is selected through the menu tree, the PLC program should start the function process. Once a function is selected, the menu selection is locked. When the PLC program clears the ME flag, the display will return to function control of your program. When the function is complete, you may return to the same point in the menu by setting ME and MR. To require the user to start the menu selection process from the beginning, don't set MR.

The menu enable is totally under PLC program control. If ME is set, the menu operation is enabled. If for any reason you need to take control of the display back from the menu, just clear the ME bit.

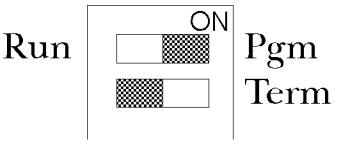
Each menu tree message takes up one of the 160 available total messages.

Configuration

Configuration of the OM620 Terminal or system of OptiMate modules is performed via an IBM PC compatible computer with the Windows operating system. Optimation supplies OM-WINEDIT software that will allow you to select module configuration, system configuration and PLC protocol definition.

If the OM620 is to be operated stand alone with a PLC, the configuration selection must be made to select the proper PLC protocol information. If it is part of a multi-panel system, each panel must be configured under the multi-panel selection in OM-WINEDIT.

Note : When configuring, always remember to set Run/Pgm to Pgm (towards the "ON"). Always wait for the module to reset (approximately 2 seconds) before downloading the module.



Specific configuration of the OM620 begins with defining the block of PLC registers to be used. Next, each of the function buttons must be configured for either momentary or alternate action operation. 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 has a field for numeric arrow adjustment, select arrow adjustment. Select and enter minimum and maximum values if they apply.
- If applicable, select the data type for the message.

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, the recommended memory is the registers beginning at R400. Any block of registers within the data word range can be used.

The first seven PLC registers in the block used by the OM620 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). The last two registers use individual bits for control and status. These registers are better suited for the control relay register range of memory. The solution to this minor conflict is to define the base register address in general purpose data register memory and place a rung in your PLC program to copy the last two registers to/from control relay registers. See the example at the bottom of the page.

The following table lists the control relay register addresses for the various PLC Direct PLCs.

PLC Direct CPU	Control Relay Register address assignment
DL130	V40500-V40617
DL230	V40600-V40617
DL240	V40600-V40617
DL250	V40600-V40617
DL330	R016-R037
DL330P	R016-R017 and R020-R027
DL340	R016-R037 and R100-R106
DL350	V40600-V40617
DL430	V40600-V40635
DL440	V40600-V40677
DL450	V40600-V40777

The examples on the following pages use an OM620 connected to a PLC Direct DL105/DL205/DL350/DL405 series PLC. The OM620 is configured for a base address of V2000. The program rung on the right should be placed in the program to copy the status register to V40600 and copy from V40601 to the control register.

With this rung placed in the PLC program, the status and control bits will be control relays. The register association is shown in the figure below.

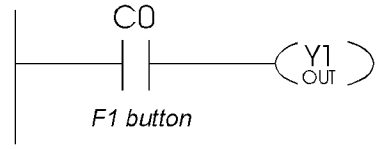
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0 bit	
Register	MSB															LSB	
V40600	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Status Register
V40601	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Control Register

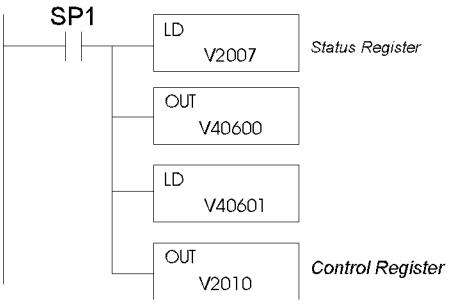
This will result in the following control relay association for the status and control registers.

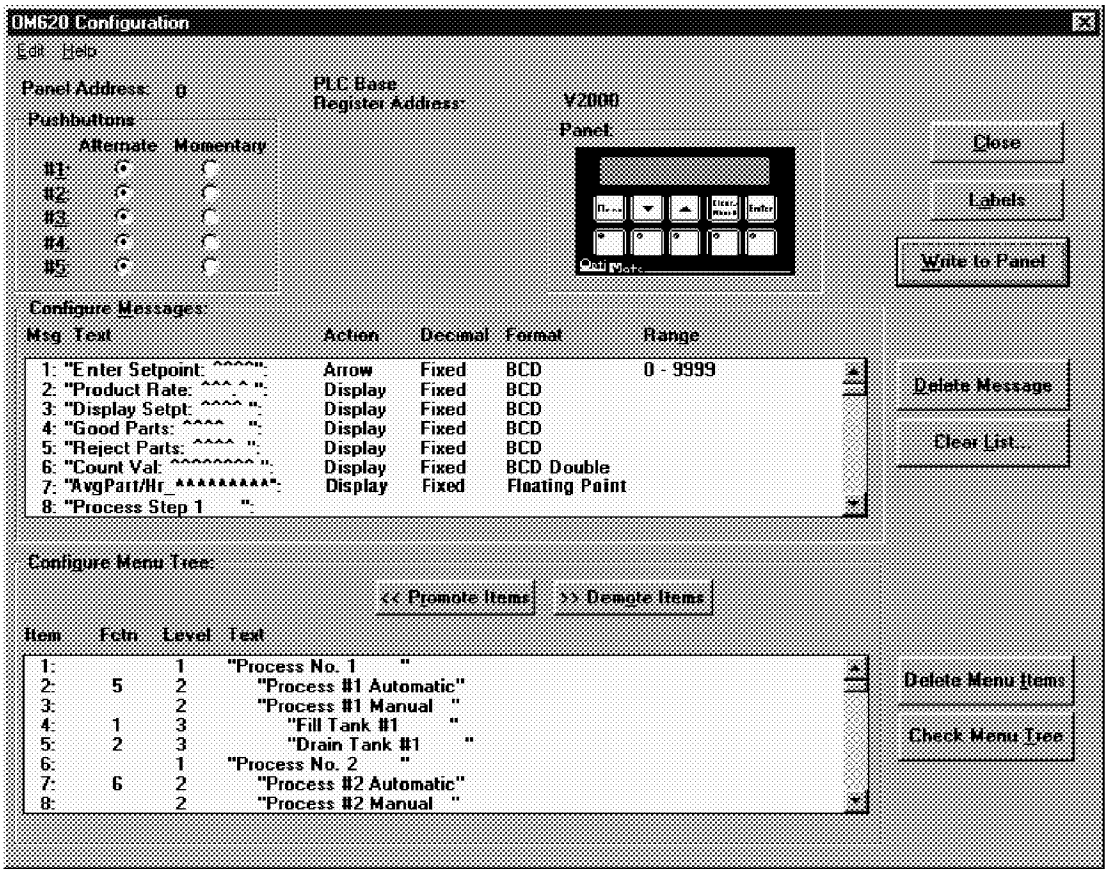
Status Register			Control Register	
bit	relay		bit	relay
F1	C0		ME	C20
F2	C1		MR	C21
F3	C2		DAK	C22
F4	C3		BD	C23
F5	C4			
DA	C5			
FS	C6			
AB	C7			
MA	C10			
ENTER	C11			
Up arrow	C12			
Down arrow	C13			

Using a Function Button

The five function buttons below the LCD display will appear as control relay coils in your program (assuming the register copy rung described previously is in your program). The following example turns on output Y1 when button F1 is active.



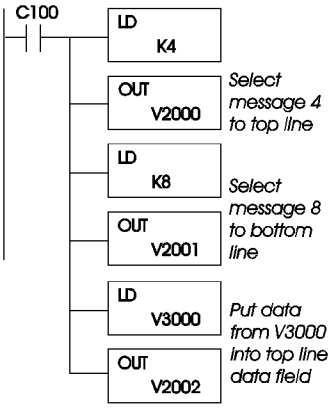


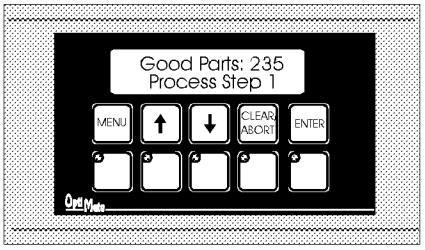


Displaying Messages on the LCD Display

Messages of various types can be configured via OM-WINEDIT and downloaded to the OM620. The message definitions shown in the figure above will be used in all of the examples that follow.

The following example shows a couple of messages being displayed to the LCD display. The top line uses data display message 4. The data for the data field is coming from V3000. The bottom line is text message 8

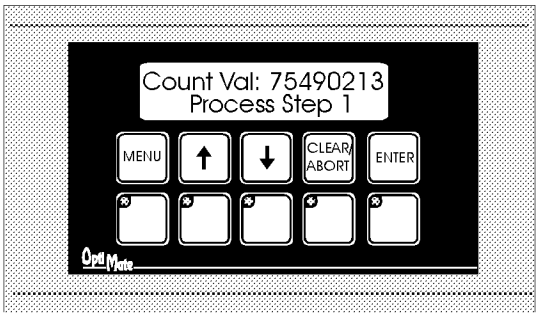


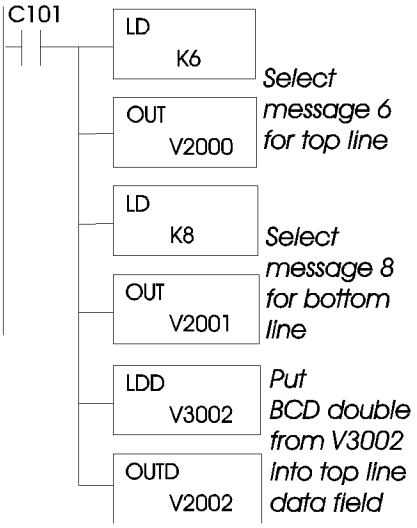


V2000	Top line message selection
V2001	Bottom line message selection
V2002	Top line data
V2003	Top line data 2 (for long BCD)
V2004	Bottom line data
V2005	Bottom line data 2 (for long BCD)
V2006	Function Selection
V2007	Status register
V2010	Control register

Displaying long BCD Numbers

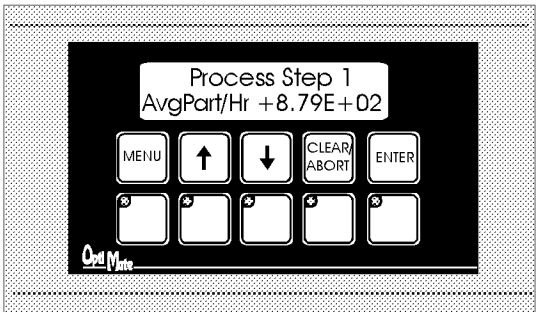
The example shown on the right is similar to the last example. The primary difference is that it uses a BCD double number in the top line display. The top line uses data display message 6, which has been configured as a BCD double display. The data for the data field is coming from V3002 (&V3003). The bottom line is text message 8.

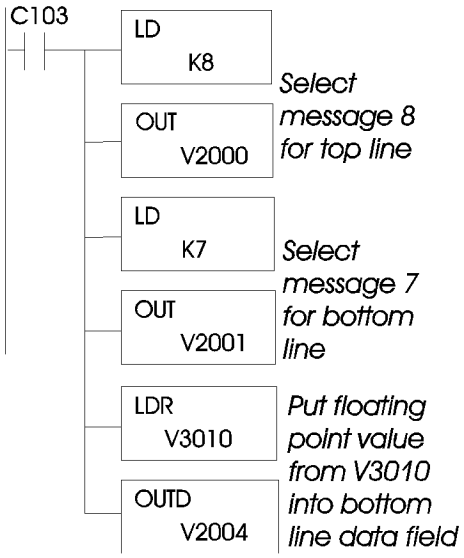




Displaying Floating Point Numbers

The example shown on the right is similar to the previous example. The primary difference is that it displays a floating point number The bottom 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 bottom line display registers V2004 and V2005. The top line is text message 8.



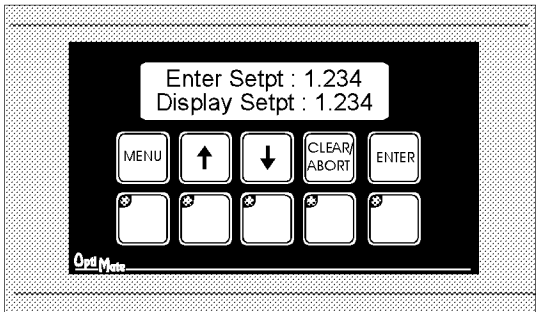


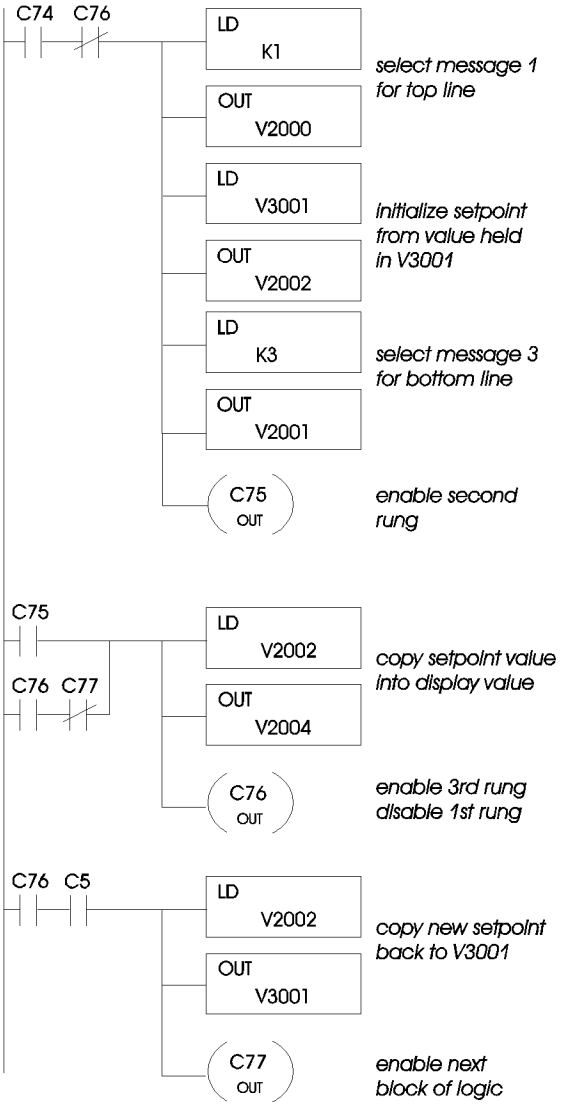
Arrow Adjustment of Setpoint Data

The figure to the right illustrates arrow adjustment of setpoint data (and a whole lot more). The process is enabled when C74 is energized. The first program rung places the "Enter Setpoint" and "Display Setpt" messages in the top and bottom lines, initializes the setpoint value from the value in V3001 and enables the second rung.

The second rung continually copies the setpoint value to the display value so long as it is enabled. It latches itself until unlatched by the next rung while disabling the first rung.

The third rung waits until the data available flag is set (C5), then copies the setpoint back to V3001. It also unlatches the second rung and, by activating C77, enables the next block of logic (whatever that might be) in the program.





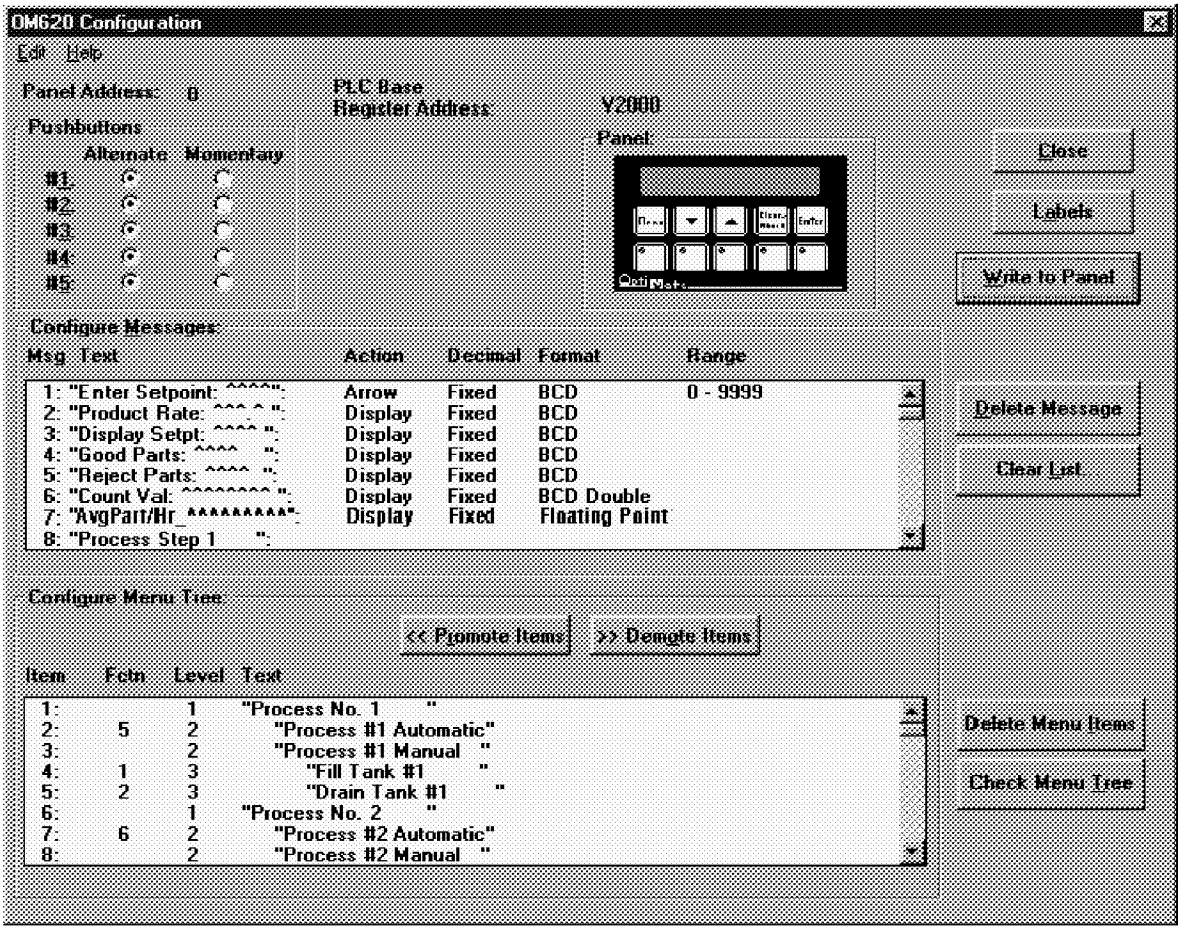
Using a Menu Tree

The OM620 allows you to predefine and use a layered menu tree for function selection. The operation of this menu tree is taken care of entirely by the OM620 panel. The only requirement that the user has is to enable or disable the menu operation, and branch to the appropriate function logic when a function selection is made.

We will use the menu tree definition shown below for our example.

The OM-WINEDIT Editor screen shown below displays the menu structure,including function associations, on the lower section of the display. For example, if the operator selects "Process #1 Automatic" from the menu tree, function number 5 would be placed in the function select register. If "Process No.2" is selected, no function number is selected; the terminal display will go to the next lower layer of the menu - "Process #2 Automatic".

Any menu item that has lower level menu items below it will, when selected, branch to the next level. If the "MENU" button is pressed, the terminal will back the menu tree up to the next higher level (towards the trunk) Arrow keys will step the panel through selection items on the same level of the same branch. The lowest level items on any branch will be function selections.

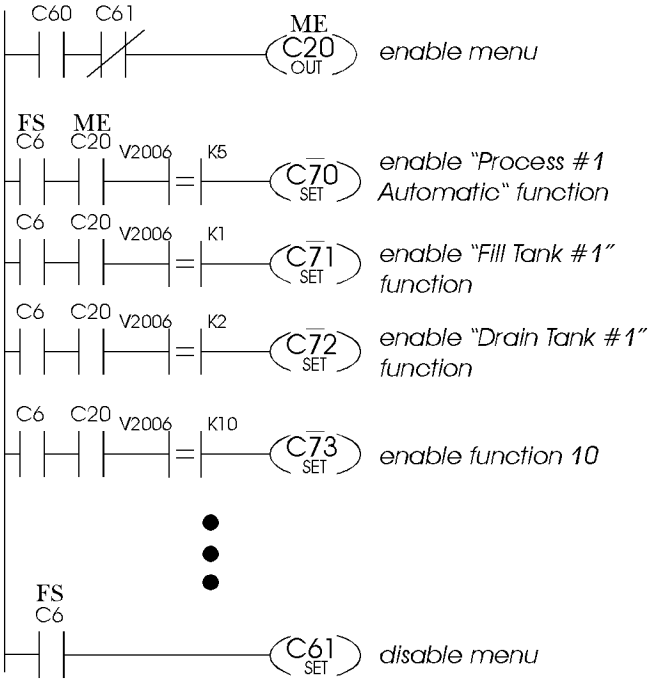


A Menu Tree Example

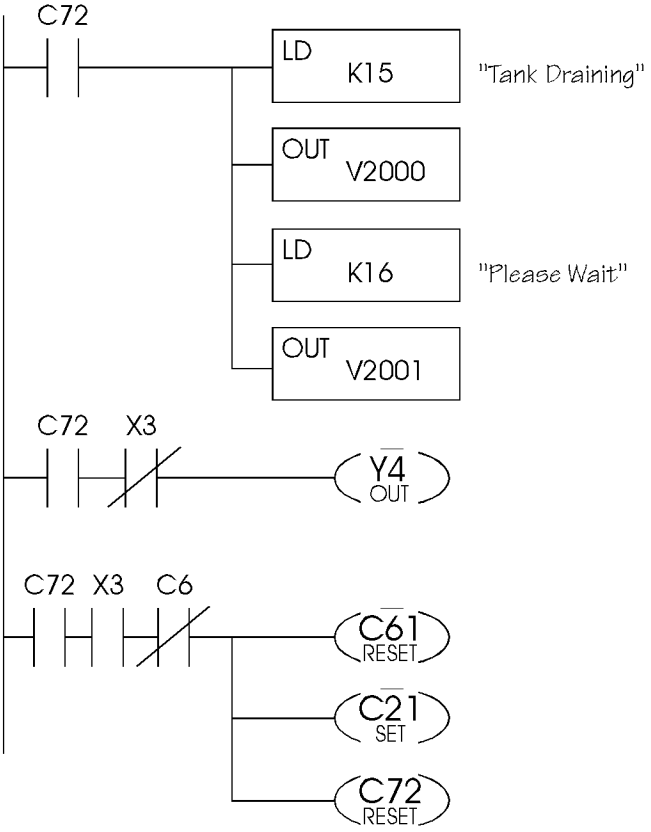
The program shown below illustrates menu tree function selection using the menu tree shown on the previous page. The first rung enables the menu tree when C60 is active.

> **Note : Enabling the menu tree does not automatically put the terminal into the menu. Once enabled, the terminal will bring up the menu tree when the operator presses "MENU". Until then, the display is under PLC program control.**

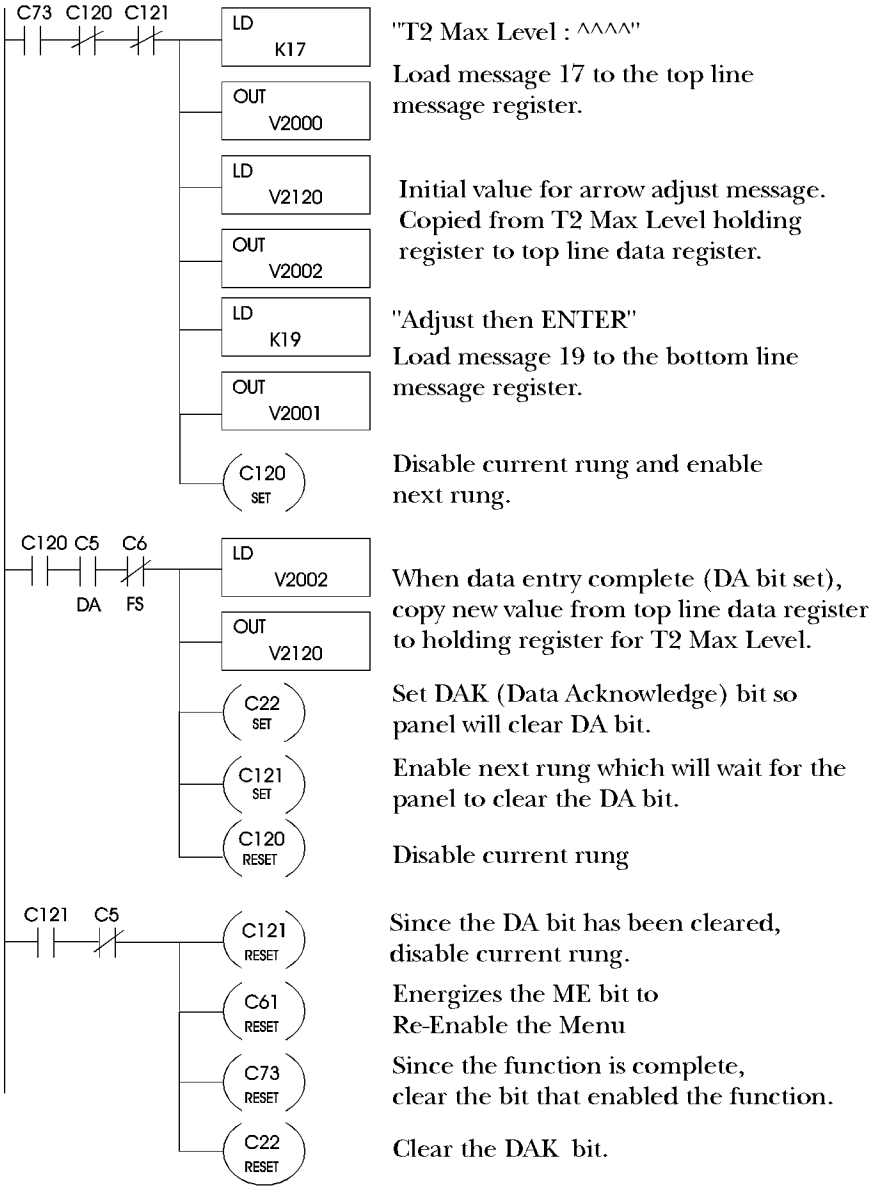
The second rung sets the appropriate function enable bit when a selection is selected from the OM620. Function selection will activate the FS flag (which, based on our register copy shown earlier, will be C6). The value comparison to the value held in the function register will set the appropriate enable relay (C70,C71, etc.). The last rung shown will also disable the Menu Enable (ME) bit by setting C61. Note that the logic shown interlocks the function selects (setting C70, C71, etc.) with the function select and menu enable flags to ensure that only one function is enabled each time a function is selected.



The program logic shown below illustrates how a typical function might be implemented. Suppose the selection was made by the operator to "Drain Tank #1". According to the logic just shown, this would result in control relay C72 being set. The first rung of the "Drain Tank #1" function, shown below, will put messages into the top and bottom lines of the display. The second rung energizes output Y4 to open the drain until level sensor input X3 senses that it is empty. The third rung re-enables the menu and sets it to return back to the "Drain Tank #1" selection when the tank is empty. The third rung also disables the function. By putting the function select relay (C6) in series, we force the program to wait until the function select has been cleared before re-enabling the menu.



The logic shown below is another typical example of how a setpoint function might be implemented. Suppose the selection for "Tank 2 Maximum Level" was made. From the logic on the previous page, this will result in C73 being set. Accordingly, the first rung shown below selects the appropriate setpoint message for the top line and a prompt message for the bottom line. It also initializes the setpoint value for arrow adjustment. The first rung disables itself and enables the second rung. When the setpoint data is entered (after the FS flag is cleared), the second rung will copy the setpoint value back and pass control to the third rung. The third rung waits until DA is clear, then clears the DAK and re-enables the menu. If the menu return flag is also set, the OM620 will return to the same point in the menu.



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.

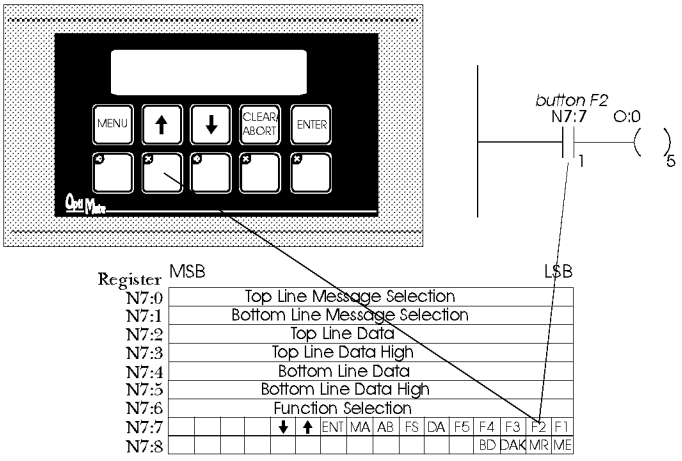
Note: When using an OM620 with an A-B PLC, always ensure that at least 8 words of memory are allocated to ensure proper communications.

All of the examples that follow assume that the OM620 module has been configured, through the OM-WINEDIT Editor, for a file type 7 and base register address 0. With this configuration, the status and control registers will be at N7:7 and N7:8 respectively. The following is a table relating status and control register bits to their N7 locations.

Status Register			Control Register	
bit	location		bit	location
F1	N7:7/0		ME	N7:8/0
F2	N7:7/1		MR	N7:8/1
F3	N7:7/2		DAK	N7:8/2
F4	N7:7/3		BD	N7:8/3
F5	N7:7/4			
DA	N7:7/5			
FS	N7:7/6			
AB	N7:7/7			
MA	N7:7/8			
ENTER	N7:7/9			
Up arrow	N7:7/10			
Down arrow	N7:7/11			

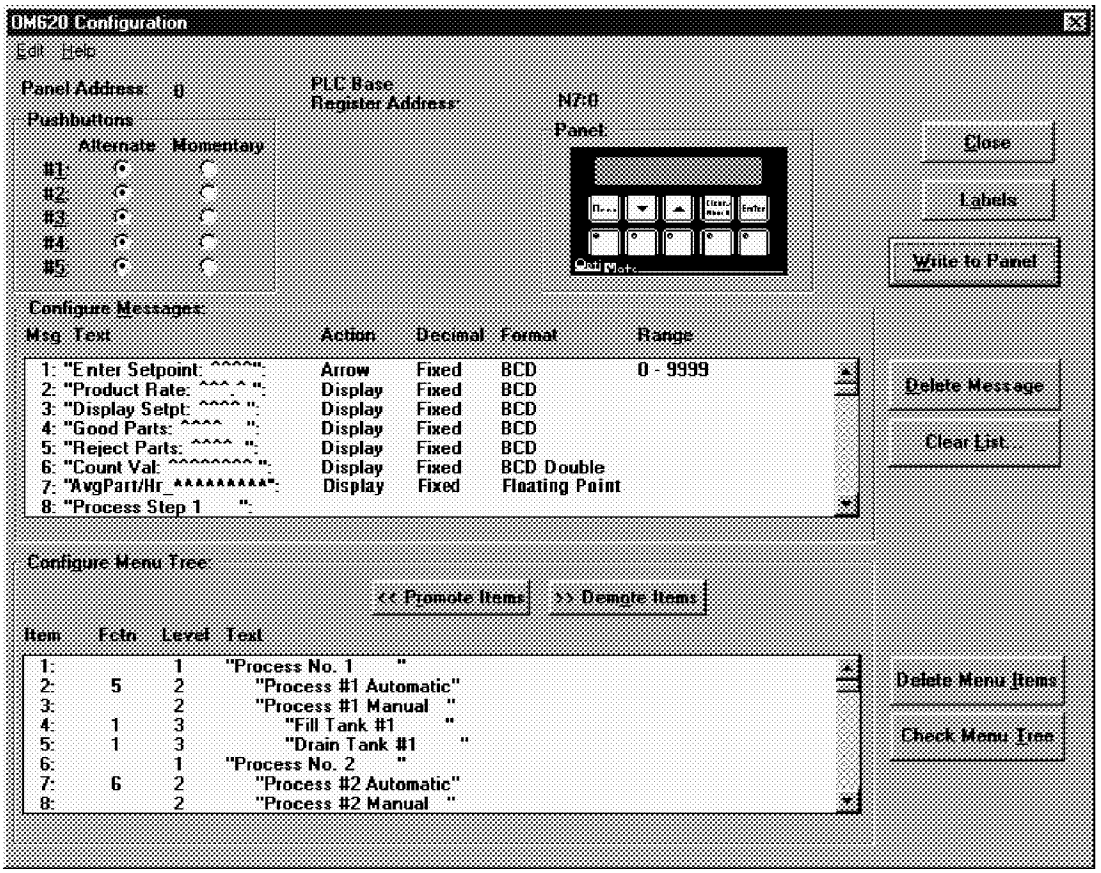
Using a Function Button

The five function buttons below the LCD display will appear as control relay coils in your program (assuming the register copy rung described previously is in your program). The following example turns on output O:0/5 when button F2 is active.



Displaying Floating Point Numbers

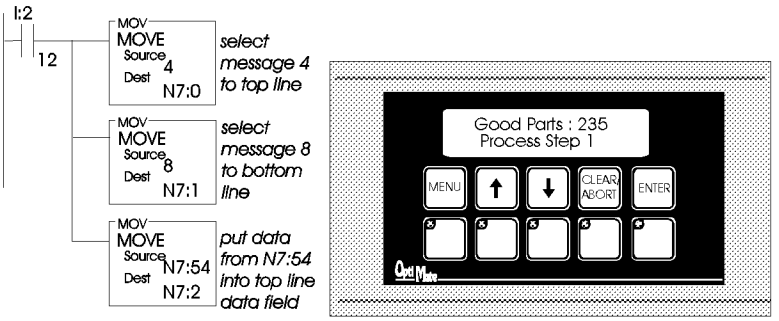
Floating point numbers can be displayed by the OM620. This number format is a standard capability for PLC Direct DL250, DL350 and DL450 PLCs. However, the A-B SLC PLCs do not have a means of handling floating point numbers. Due to the limitations of the SLC, this capability will not be commonly implemented with A-B PLCs.



Displaying Messages on the LCD Display

Messages of various types can be configured via OM-WINEDIT and downloaded to the OM620. The message definitions shown in the figure above will be used in all of the examples that follow.

The example on the right shows a couple of messages being displayed to the LCD display. The top line uses data display message 4. The data for the data field is coming from N7:54. The bottom line is text message 8.

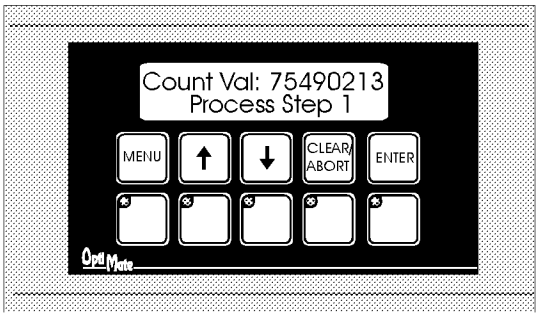


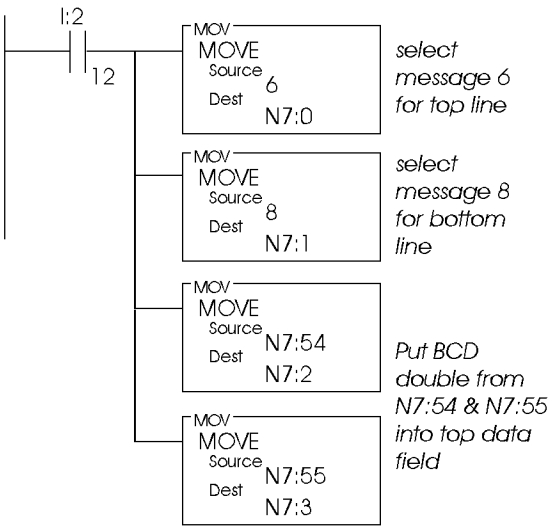
Register	MSB															LSB
N7:0	Top Line Message Selection															
N7:1	Bottom Line Message Selection															
N7:2	Top Line Data															
N7:3	Top Line Data High															
N7:4	Bottom Line Data															
N7:5	Bottom Line Data High															
N7:6	Function Selection															
N7:7					↓	↑	ENT	MA	AB	FS	DA	F5	F4	F3	F2	F1
N7:8													BD	DAK	MR	ME

Displaying long BCD Numbers

Long (up to 8 digit) BCD numbers can be displayed by the OM620. 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 in the next column illustrates the method for displaying large numbers. Registers N7:54 and N7:55 contain an 8 digit BCD number, with the most significant 4 digits in N7:55.



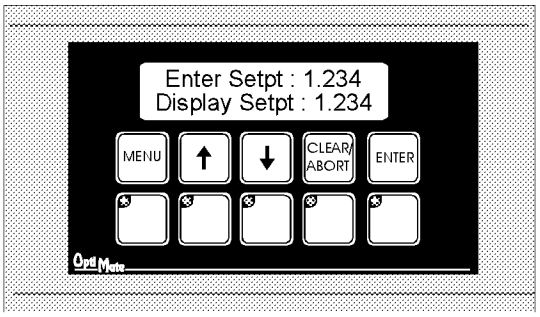


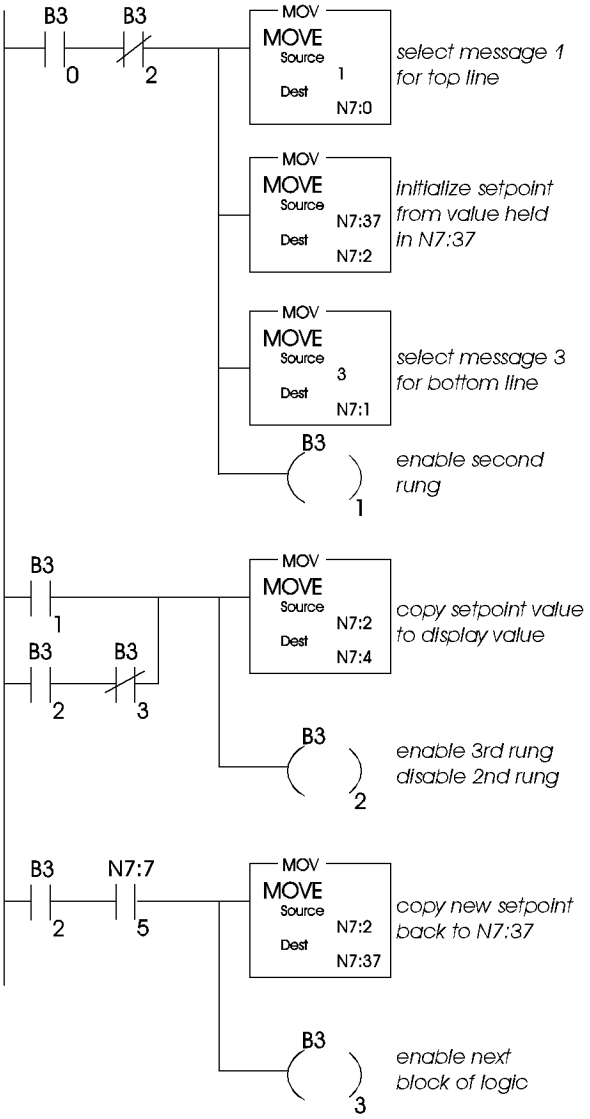
Arrow Adjustment of Setpoint Data

The figure to the right illustrates arrow adjustment of setpoint data (and a whole lot more). The process is enabled when B3/0 is energized. The first program rung places the "Enter Setpoint" and "Display Setpt" messages in the top and bottom lines, initializes the setpoint value from the value in N7:37 and enables the second rung.

The second rung continually copies the setpoint value to the display value so long as it is enabled. It latches itself until unlatched by the next rung while disabling the first rung.

The third rung waits until the data available flag is set (N7:7/5), then copies the setpoint back to N7:37. It also unlatches the second rung and, by activating B3/3, enables the next block of logic (whatever that might be) in the program.





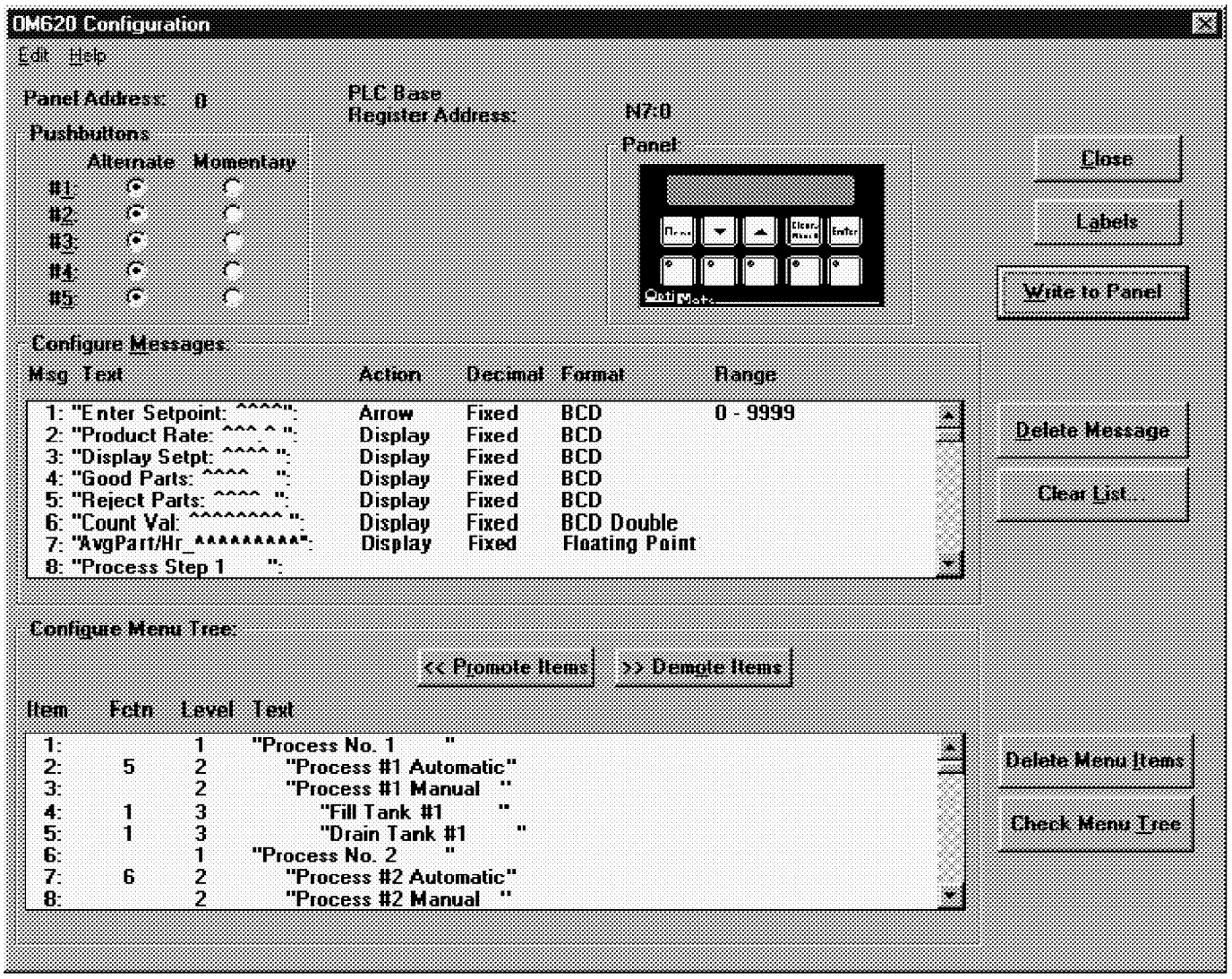
Using a Menu Tree

The OM620 allows you to predefine and use a layered menu tree for function selection. The operation of this menu tree is taken care of entirely by the OM620 terminal. The only requirement that the user has is to enable or disable the menu operation, and branch to the appropriate function logic when a function selection is made.

We will use the menu tree definition shown below for our example.

The OM-WINEDIT Configuration Editor screen shown below displays the menu structure, including function associations, in the lower section of the display. For example, if the operator selects "Process #1 Automatic" from the menu tree, function number 5 would be placed in the function select register. If "Manual" is selected, no function number is selected; the terminal display will go to the next lower layer of the menu - "Fill Tank #1".

Any menu item that has lower level menu items below it will, when selected, branch to the next level. If the "MENU" button is pressed, the terminal will back the menu tree up to the next higher level (towards the trunk) Arrow keys will step the panelthrough selection items on the same level of the same branch. The lowest level items on any branch will be function selections.

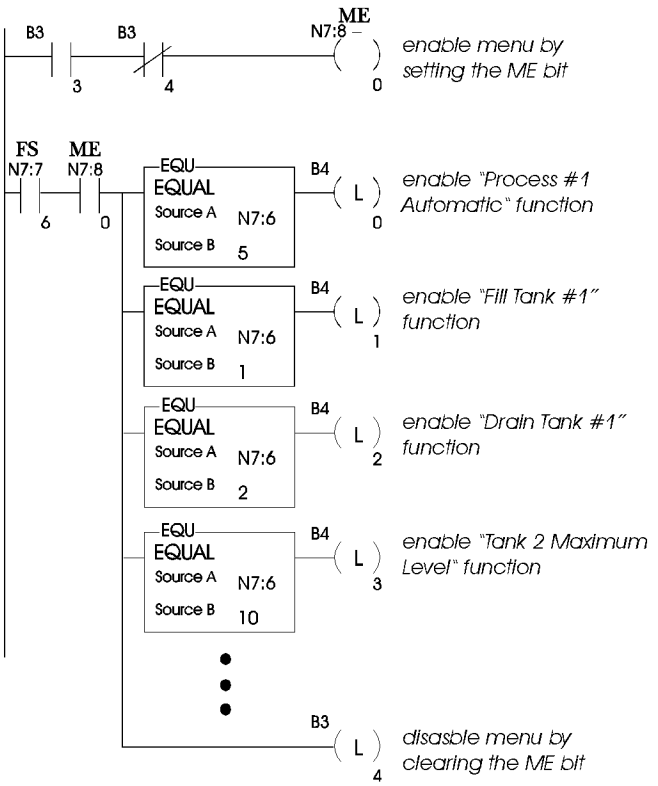


A Menu Tree Example

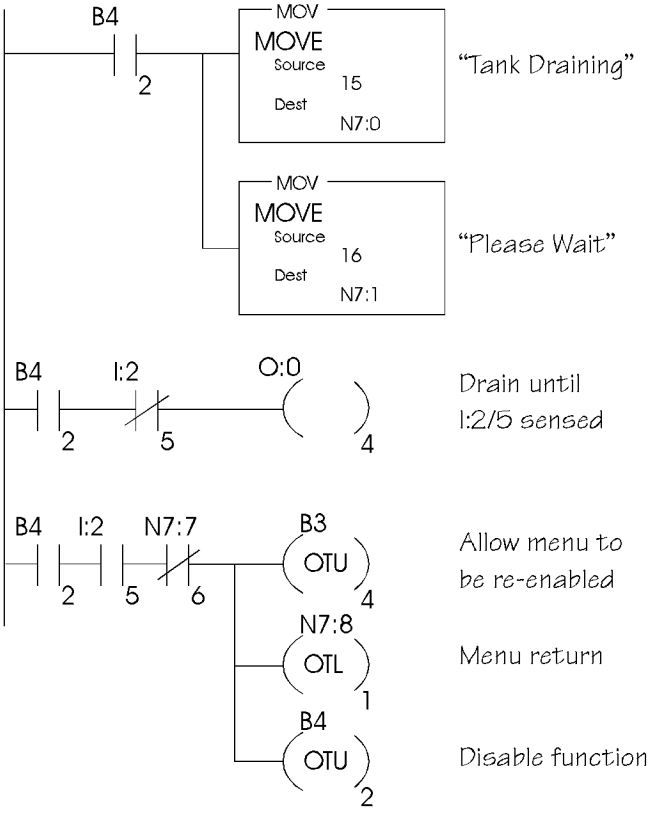
The program below illustrates menu tree function selection using the menu tree shown on the previous page. The first rung enables the menu tree when B3/3 is active.

Note : Enabling the menu tree does not automatically put the terminal into the menu. Once enabled, the terminal will bring up the menu tree when the operator presses "MENU". Until then, the display is under PLC program control.

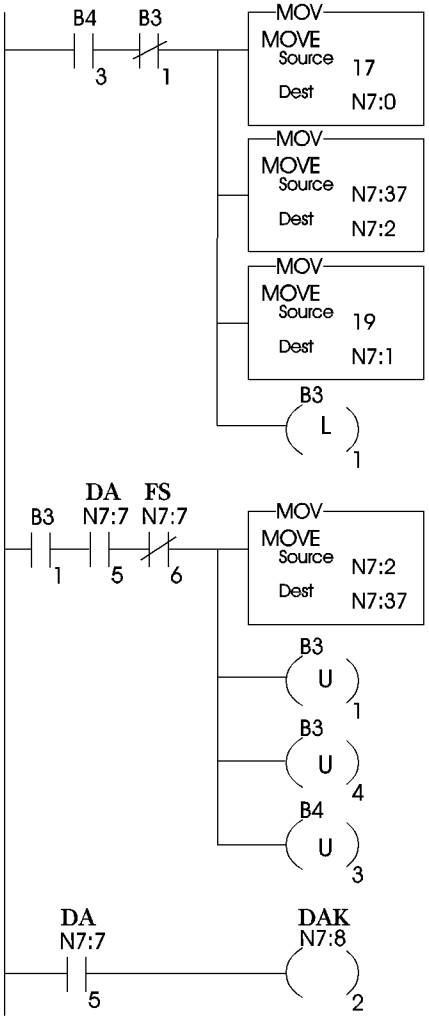
The second rung sets the appropriate function enable bit when a selection is selected from the OM620. Function selection will activate the FS flag (N7:7/6). The value comparison to the value held in the function register will set the appropriate enable relay (B4/0, B4/1, etc.). The last rung shown will also disable the Menu Enable (ME) bit by setting B3/4. Note that the logic shown interlocks the function selects (setting B4/0, B4/1, etc.) with the function select and menu enable flags to ensure that only one function is enabled each time a function is selected.



The program logic shown below illustrates how a typical function might be implemented. Suppose the selection was made by the operator to "Drain Tank #1". According to the logic just shown, this would result in control relay B4/2 being set. The first rung of the "Drain Tank #1" function, shown below, will put messages into the top and bottom lines of the display. The second rung energizes output O:0/4 to open the drain until level sensor input I:2/5 senses that it is empty. The third rung re-enables the menu and sets it to return back to the "Drain Tank #1" selection when the tank is empty. The third rung also disables the function. By putting the function select relay (N7:7/6) in series, we force the program to wait until the function select has been cleared before re-enabling the menu.



The logic shown below is another typical example of how a setpoint function might be implemented. Suppose the selection for "Tank 2 Maximum Level" was made. From the logic on the previous page, this will result in B4:3 being set. Accordingly, the first rung shown below selects the appropriate setpoint message for the top line and a prompt message for the bottom line. It also initializes the setpoint value for arrow adjustment. The first rung disables itself and enables the second rung. When the setpoint data is entered (after the FS flag is cleared), the second rung will copy the setpoint value back, clear B3:1 to disable the function and clear B3:4 to re-enable the menu. If the menu return flag is also set, the OM620 will return to the same point in the menu.



"T2 Max Level : ^^^^"
Load message 15 to the top line message register.

Initial value for arrow adjust message. Copied from T2 Max Level holding register to top line data register.

"Adjust then ENTER"
Load message 16 to the bottom line message register.

Disable current rung and enable next rung.

When data entry complete (DA bit set), copy new value from top line data register to holding register for T2 Max Level.

Disable current rung

Energize the ME bit to Re-Enable the Menu

Since function is complete, clear the bit that enabled the function.

Set Data Acknowledge (DAK)

Use in a Microprocessor Based System

OptiMate modules can interface a microprocessor based controller over a serial link. This link can be either RS232 (for point to point) or RS422 (for multidrop or point to point). In either case the microprocessor acts as the master. It can write data to the panel or read data from the panel.

The OM620 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. 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 (note; 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 OM620 protocol for computer based operation is the 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 OM620 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 OM620 can be instructed to display predefined messages. Selection of a predefined message simply requires transmitting a command which selects the particular message.

Placing Numeric Data in the Display

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

Numeric data for the numeric data field can be transmitted by the host computer. If it is a display data field, it may be continuously updated. If it is a data adjustment message (arrow key adjustment), only the first value transmission will be accepted.

Data Entry/Adjustment with the Arrow Keys

Data entry in the OM620 can be performed via the arrow adjustment keys. This type of data entry is most applicable to cases where you want to have a number adjusted slightly, rather than entered from scratch. This happens many times with setpoints. It is also common when adjusting speeds and rates. When this is done in an operation, it is commonly referred to as a "jog" operation.

A message can be set up for arrow adjustment through the OM-WINEDIT Editor. When the data screen is required in the program, transmit a command for the preconfigured message and its current value. The digits marked by carets will initially display the current value.

As the operator presses the up or down arrow key, the numeric value will increment or decrement respectively. As it is adjusted, the value is continuously available to be read by the host computer. When adjustment is complete, the operator will press the ENTER button. When this happens the data available status bit will be set. When the computer host sends a DAK or changes the message, the data available will clear.

Adjustment of data will be limited to within the limits defined through the configuration editor. Data also will be limited to the number of digits defined by the carets in the message.

Function Buttons

The OM620 contains five user definable function buttons. These buttons can be custom labeled and used for any purpose.

The buttons can be individually configured as either alternate action or momentary pushbuttons. Alternate action buttons alternate state each time they are pressed. Momentary buttons are active only while they are being pressed.

The status request message will return the current state of each of the five buttons along with other status.

Note: All OptiMate Hex protocol messages are transmitted in hexadecimal number format. The message responses will be transmitted back to the host in the same number format.

OM620 OptiMate Hex Protocol

General Format

STX Module address function ftn_data checksum

Where STX = 0x02
Module address = 0 to 30
function = 0xA0 ; General status/control
0xA1 ; Select predefined message display
0xA5 ; Read operator entered data
0xA7 ; Send data for data display message
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 hexadecimal number.

General status/control

STX Module address 0xA0 control checksum

where control bit 0 ; Menu enable
bit 1 ; Menu return
bit 2 ; buzzer disable
bit 3 ; Data acknowledge

response

STX term_stat disp_stat ftn_select checksum *if message received and processed OK*

where term_stat = terminal status
bits 0-4 = Button status for function buttons 1-5 respectively (1 = active, 0 = inactive)
bit 5 : operator entered data available
bit 6 : function selected
bit 7 : abort key pressed
disp_stat = display status (1=TRUE)
bit 0 : Top line display data
bit 1 : Top line arrow adjust
bit 2 : Bottom line display data
bit 3 : Bottom line arrow adjust
bit 4 : Enter button
bit 5 : Up arrow
bit 6 : Down arrow
bit 7 : Menu active

or

NAK if any errors

Where NAK = 0x15

Select Predefined Message

STX Module Address 0xA1 line mesg_no data checksum

where line = top (0x00) or bottom (0x01) 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.
- Used as display data for numeric data display message.
- Used as initial value for arrow adjustment type message (integer portion only).
- Ignored for all other message types.

response

ACK *if message received and processed OK*
Where ACK = 0x06

or

NAK *if any errors in message*

Read Operator Entered Data

STX Module 0xA5 checksum
Address
response
STX status data checksum *if message receive and processed OK*
where status = 0x00 if ENTER key has not been pressed
= 0x01 if ENTER key has been pressed
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.
Note : This message can be used to read of an arrow adjusted value while it is being adjusted.

or
NAK *if any errors in message*

Send data for data display message

STX Module 0xA7 line data checksum
Address
where line = top (0x00) or bottom (0x01) 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.
response
ACK *if message received and processed OK*
or
NAK *if any errors in message*

Display status request

STX Module 0xA9 checksum
Address

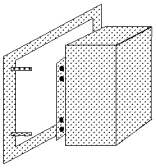
response
STX top_msg bot_msg checksum *if message received and processed OK*
where top_msg = last predefined message selected for top line
bot_msg = last predefined message selected for bottom line

or
NAK *if any errors in message*

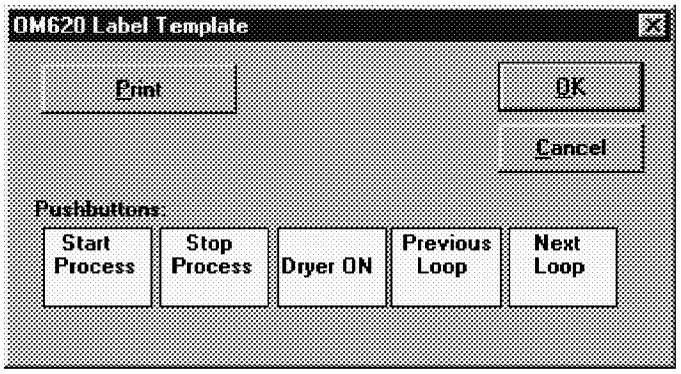
Set Up and Interconnect

Legending the Function Keys

Legending the OM620 panel is a relatively simple process that basically involves sliding a label transparency into a pocket in the panel overlay. Use the following procedure.

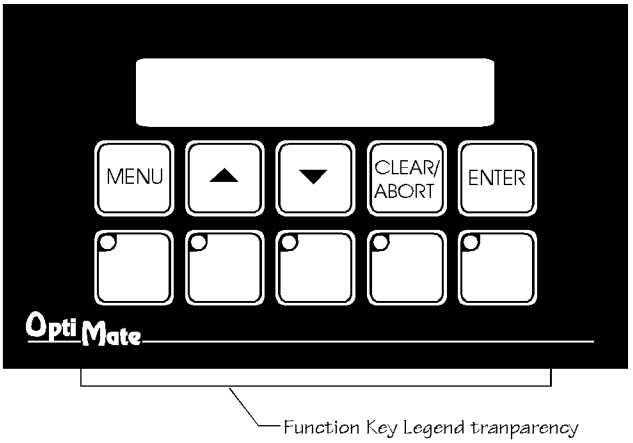


- Remove the bezel from the panel. The bezel snaps to the panel box along the top and bottom edges. Pull the bezel out and over the snaps to remove.
- Create legend transparencies. There are a number of available options for doing so. Patterns are provided on the next to last sheet of this document.
  - > Use the built in label making capability of the OM-WINEDIT software to create labels. Either print on the transparency directly or print on paper and photocopy onto the transparency. The figure below is a screen from OM-WINEDIT which illustrates the process.



Other options include the following

- > Uses a computer graphics program and a laser printer to create the transparency directly. Alternately print on paper and photocopy to a transparency
- > Use press on letters onto a transparency sheet.
- > Use a typewriter, lettering machine or press on letters to letter onto paper, then photocopy.
- Cut along outline. Slide into overlay pocket. Pushbutton legends slide in from the bottom.
- Re-attach bezel. Push bezel onto box until it snaps together.



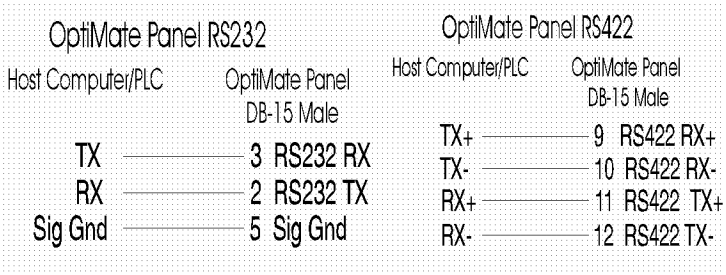
Connection to the System

OptiMate panels are designed for communication connection to system devices. The panel can be connected to a computer , PLC or communication master over the serial port (RS232 or RS422).

Connection to a Computer or PLC

Connection of an OptiMate panel to a computer or PLC can be accomplished over either an RS 232 or RS422 link. RS232 is limited to one OptiMate module to one computer serial port. RS422 allows up to 31 modules to be connected to one computer port. Since PLCs are slave devices, the RS422 link for a PLC is limited to one OptiMate module.

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



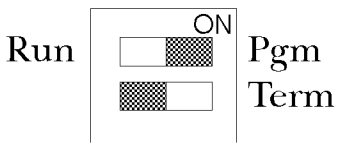
Interface cables for connection to several different PLCs as well as to IBM PCAT compatible ports are available.

Serial Connection to OM9001 Communications Master

Connection to an OM9001 Communications Master over a serial link is via RS422. The Communication Master port connections are reversed from the panel ports to enable direct pin to pin connection. For distances under 50 feet (in a low electrical noise environment), a ribbon cable connection works quite well. For longer distances or in noisy environments, a two pair shielded RS422 cable is recommended. We recommend Belden 9729 or equivalent cable.

Termination

The termination DIP switch on the back of the panel switches in a terminating resistor. This terminating resistor does not apply to an RS232 connection (and should be in the OFF position for RS232). In an RS422 connected system, such as with the OP-9001 Communication Master, the termination should be on in the last, and only the last, panel on the cable.



Power

OptiMate modules can operate on any voltage between 8 and 30 VDC. Power must be connected to the terminal plug located on the back of the module.

There is a brief (0.5 to 2 millisecond) power on surge to 1.5 amps. This is typical of nearly any type of electronic equipment and is due to the initial charging of power capacitors. This surge is normally easily handled by commercial power supplies.

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 OM620 module, the following are important configuration parameters.

Computer Based Systems

Decision	Selection
Single/Multi Module	Choose single panel even if the system will contain several panels. The Multi panel selection applies only to systems using an OM9001. In computer based systems, each panel is configured independently. After configuration, multiple panels can be connected together to form a system.
Configuration starting point	First time configuration, start with defaults for panel. Subsequent configurations can utilize disk files you create.
PLC Type	Select OptiMate Hex
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.
Buttons	Select momentary or alternate action as required for your application
Messages	Define messages as required for application

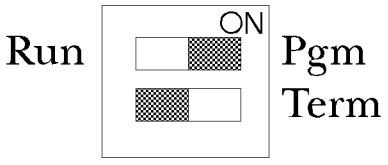
Single Module PLC Based Systems

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
Buttons	Select momentary or alternate action as required for your application
Messages	Define messages as required for application

Multi Module PLC Applications (Uses Communications Master)

Decision	Selection
Single/Multi Module	Chose Multi module
PLC Type	This applies to the Communications master. Choose appropriate type
Protocol	This applies to the OM9001 Communications master. Choose appropriate baud rate, # bits, # stop bits & parity. Note that if 8 data bits and even or odd parity are selected, only 1 stop bit is available.
Address	Each panel must have a unique address
Panel Protocol	The OM-WINEDIT software will automatically select the OptiMate Hex protocol for communications between the OP-9001 and the panel. (This is all transparent to the user)
Buttons	Select momentary or alternate action as required for your application
Messages	Define messages as required for your application.

Configuration must be downloaded from the IBM PC compatible to each panel. This is done over the serial link. Panel must be selected for "Pgm" (DIP switch in back of the module) for module to accept configuration data. After the download to the panel is complete, wait a few seconds before switching the DIP switch from "Pgm" to "Run." The DIP switch must be in the "Run" position for the module to operate with the selected host.



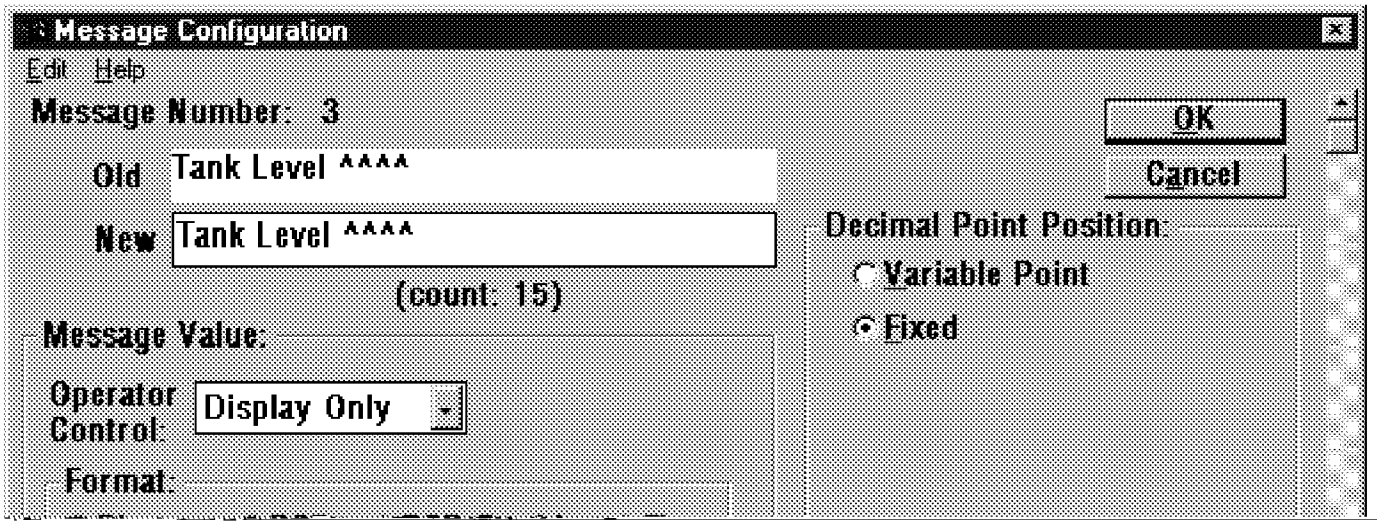
Creating Messages

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 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 parameter, including data type, message type, etcetera, as shown below.

Message #	Text (20Characters Max.)
1	Enter Setpoint: ^^^^
2	Product Rate: ^^^.^
3	Shift Target: ^^^.^

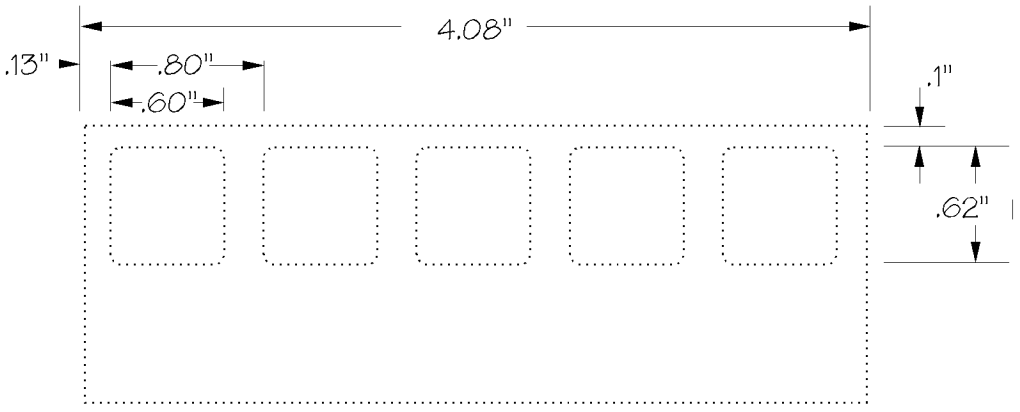
Example Message Definitions



Label and Message Definition Templates

Message #	Text (20Characters Max.)

Message Definition Template

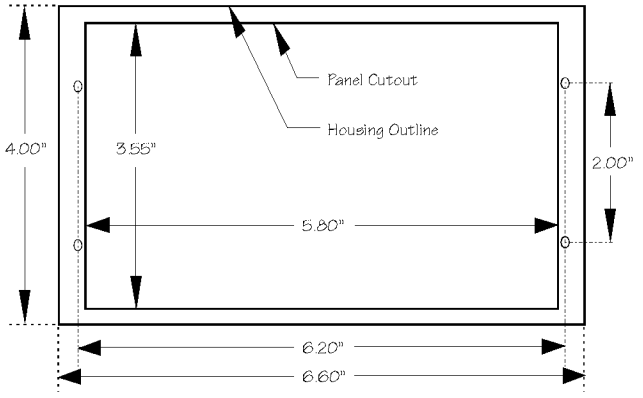


Pushbutton Label Strip Pattern

Specifications

Physical

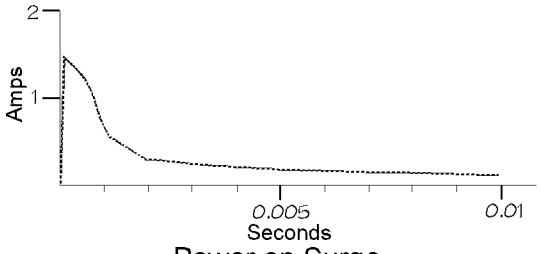
- Recessed Mount Housing 6.6"Lx4.0"H x 1.25"D
- Cutout size for above 3.55"Hx5.80"L
- Panel Fasteners : Four, 6x32 threaded studs, shown above (on ends, symmetrical about center line)
- Weight : 10 ounces
- Colors : Dark gray housing with dark gray panel. Key-pad keys; white with dark gray letters. White with user supplied label.
- LCD Display : 2 line x 20 character STN with LED backlight character size : 5.5mm high x 3.2mm wide



Panel Mounting Dimensions

Electrical

- Power : 8 - 30VDC @ 1.8Watts
  150mA @ 12VDC 75mA @ 24VDC
- Power on surge (see figure below)
  1.5A for 2 milliseconds maximum



Power on Surge

- Power connector : Pluggable terminal block, 2 position

Communications

- RS232 and RS422
- 4800 to 19200 baud
- Compatible with most major PLC protocols
- OptiMate Hex protocol for computer based systems
- 15 pin female 'D' shell connector

Communications Failure Operation

Should the module (when not selected for configuration) ever fail to communicate successfully for a period of 12 seconds, the LEDs inset in the corner of the 5 buttons will all simultaneously flash at a rapid rate.

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)
- Arrow adjustment data message (integer or fixed point)

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)