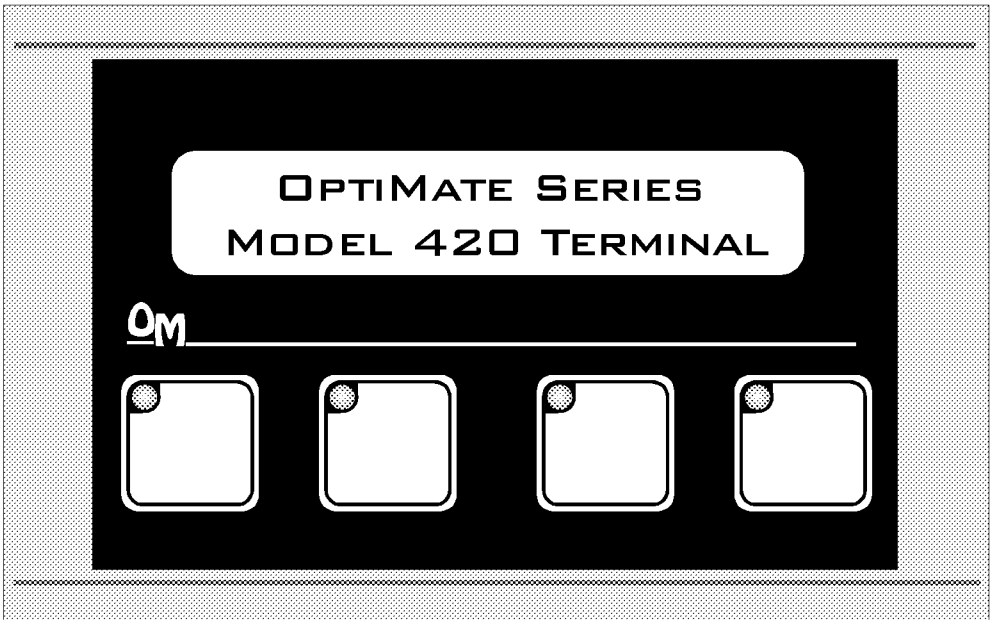


KM420 Operator Panel

The KM420 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, four function keys and the ability to display 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, text and data.

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 KM420 Operator 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 KM420 takes care of the rest.

Applications

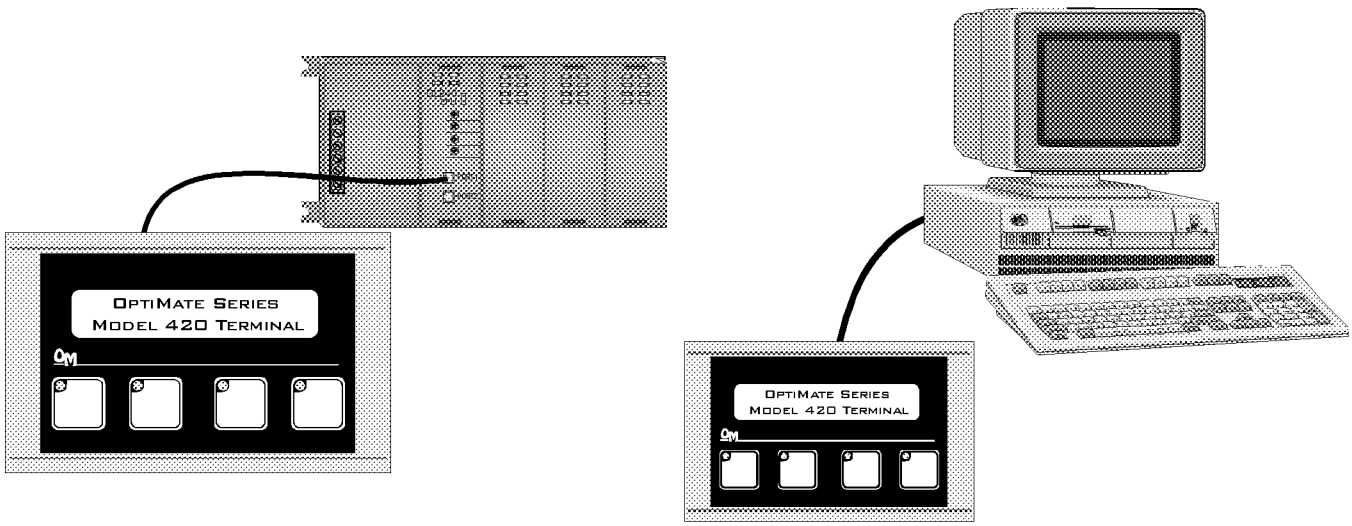
- Machine control
- Process control
- Security systems
- HVAC
- Plant monitoring/control
- PLC applications
- Microprocessor applications

Features

- 2 line x 20 character LCD
- Text message display
- Floating point, BCD, BCD Double and Binary data display
- 4 User-defined function keys
- PLC compatible
- RS232 communications
- Stand alone 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 KM420 Operator Terminal uses a bank of PLC registers. Complete operator interface is performed with 7 PLC registers for message selection, data display and function key interface. The KM420 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 these communications for most major PLC protocols. Configuration for particular PLC protocols and interconnect cabling is covered in the following pages.

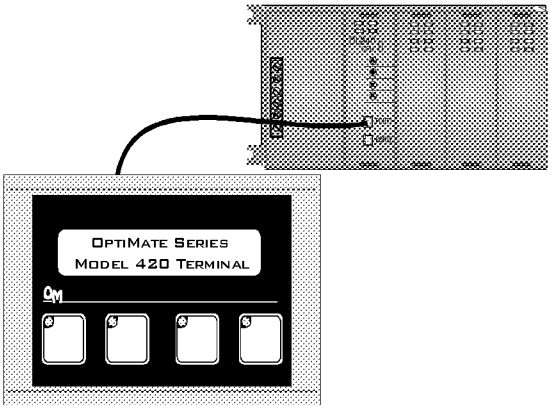
Microprocessor-Based Systems

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 a serial port. The OptiMate Hex communications protocol, detailed in this document, allows the user to display messages and data and to read the status of the five pushbuttons.

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 KM420, these commands are messages that request pushbutton status and update the LCD display.

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 KM420 Operator Panel uses a bank of 7 contiguous PLC registers. The register set definition is shown in the table below.

KM420 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 & floating point data)
M+4	Bottom line data
M+5	Bottom line data 2 (for long BCD & floating point data)
M+6	Status register

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 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 and floating point data only.
- Register M+4 - Numeric data associated with bottom line of display.
- Register M+5 - For long BCD and floating point data only.
- Register M+6 - Status register

MSB															LSB
													F4	F3	F2	F1

Status Register

> F1-F4 are status of the four function keys. Set to 1 when the button is active. Function keys can be independently configured as either alternate action (maintained) or momentary action.

Configuration

Configuration of the KM420 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 KM420, 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.

Configuration of the KM420 begins with selecting the proper PLC protocol information. The block of PLC registers to be used must be defined. 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 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.

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 KM420. 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, let's 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 will be a display data 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 KM420 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 this type of number, 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 KM420 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 KM420 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 KM420 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 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.

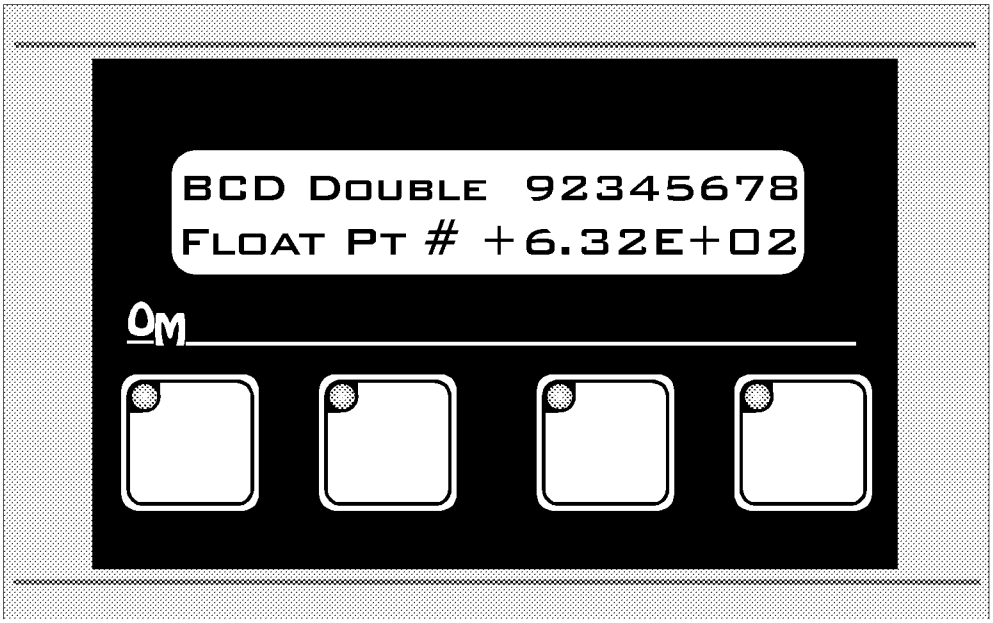
An IEEE 32-bit floating-point number has a range of -3.402823E+38 to +3.402823E+38. The KM420 will be able to display any number within that range. The panel always uses the format ±X.XXE±XX to display the numbers.

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 KM420 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	KM420 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 KM420 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".

Function Buttons

The KM420 contains four 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 four pushbuttons. In a typical PLC application, these pushbuttons would be mapped to control contacts for easy ladder logic interface.

Examples of Use with a Keyence 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. The memory block has to be in the Data Memory (DM) area of memory. For a Keyence PLC, the recommended memory starting register is address DM0000. Any block of registers within the data word range can be used as long as it does not conflict with any devices that may be using registers in the data memory area.

The first six PLC registers in the block used by the KM420 panel are used for numeric information. As such they are ideally suited for the general purpose data memory registers DM0000-DM0699. The last register uses individual bits for pushbutton status. This register is better suited for the control relay register range of memory. The solution to this minor conflict is to define the base register address in the data memory area and place a rung in your PLC program to copy the last register to an internal relay register. (see example below right).

The following table lists the internal relay register addresses for the various Keyence PLCs.

Keyence CPU	Internal Relay Register address assignment
KV10/16	1000-1915
KV24/40/80	1000-1915, 3000-6915
KV300	1000-1915, 3000-6915

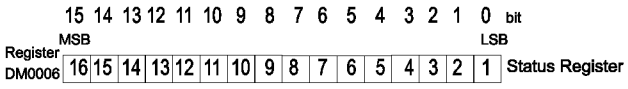
Memory Mapping

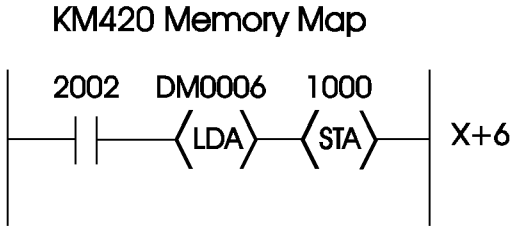
The program rung on the right should be placed in the program to copy the Pushbutton status register (X+2) from the data memory register to its corresponding internal relay memory register, 1000. The internal relay 2002 is ALWAYS ON, therefore it should be placed in the rung so that the memory map will occur in every scan.

The table below shows the internal relay correlation for a KM420 when the memory register X+6 is mapped to the internal relays beginning with 1000 (as shown in the program rung on the bottom right.)

Device	Button Status (X+6)
B1	1000
B2	1001
B3	1002
B4	1003

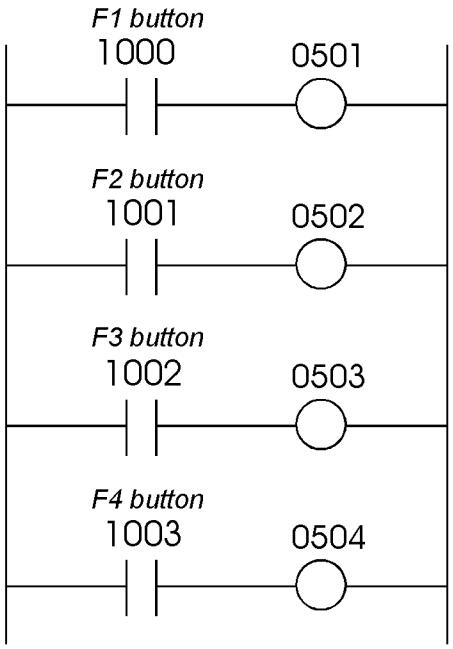
With this rung in the PLC program, the status bits will correspond to internal relays. The register association is shown in the figure below.



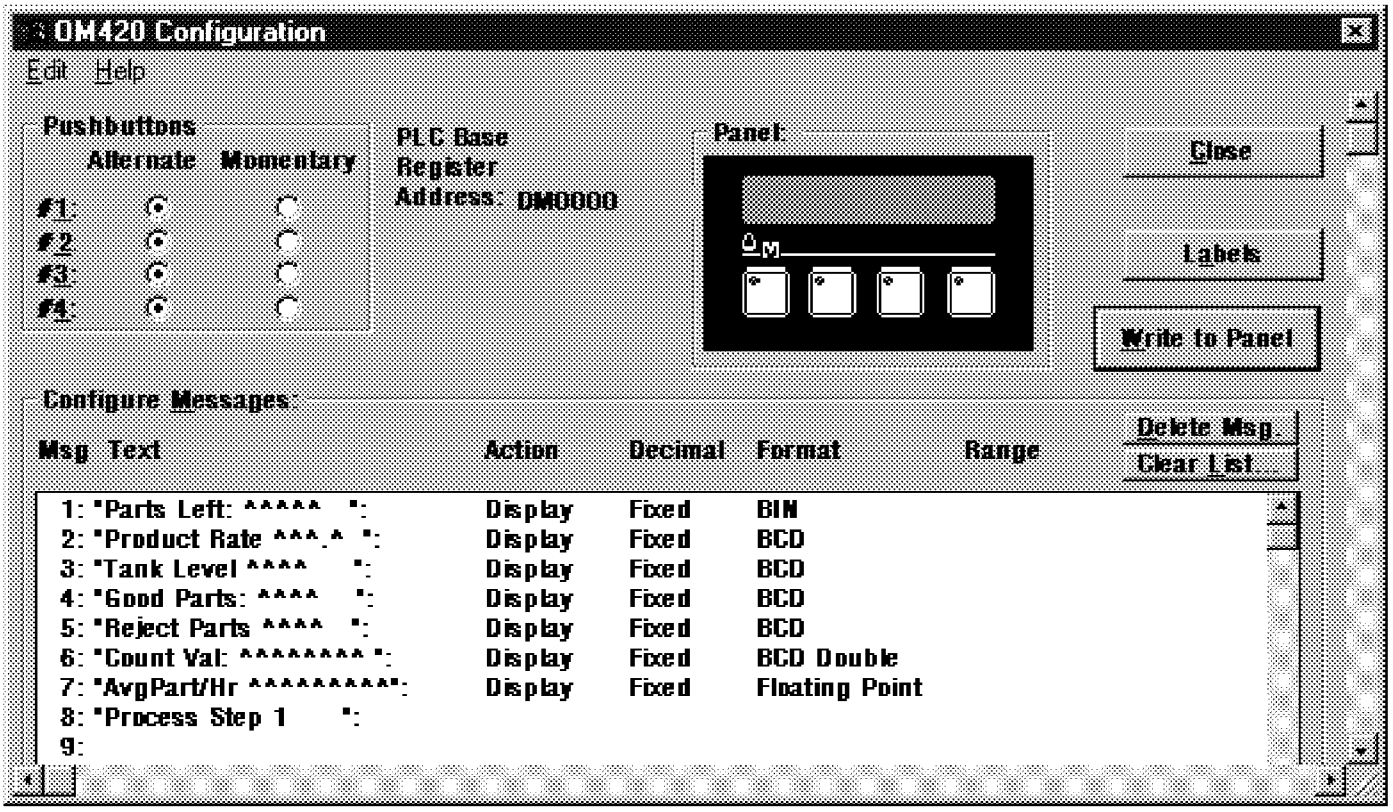


Using a Function Button

The four function buttons below the LCD display will appear as internal relay coils in your program (assuming the memory mapping rung described previously is in your program). The following example turns on output 0501 when button F1 is active, 0502 when button F2 is active, 0503 when button F3 is active and 0504 when button F4 is active.



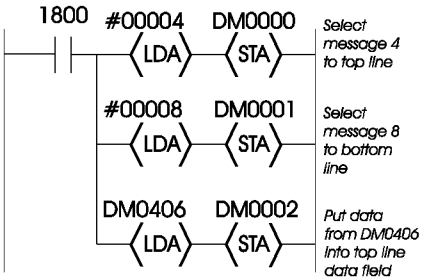
The examples on the following pages use a KM420 connected to a Keyence PLC. The KM420 is configured for a base register address of DM0000. The following examples correspond to the memory mapping program rung shown on the previous page. That rung should be placed into the top of the PLC program.

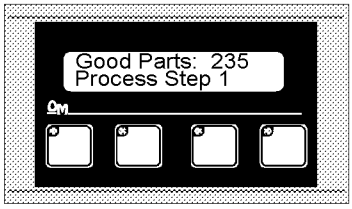


Displaying Messages on the LCD Display

Messages of various types can be configured via OM-WINEDIT and downloaded to the KM420. 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 DM0406. The bottom line is text message #8.

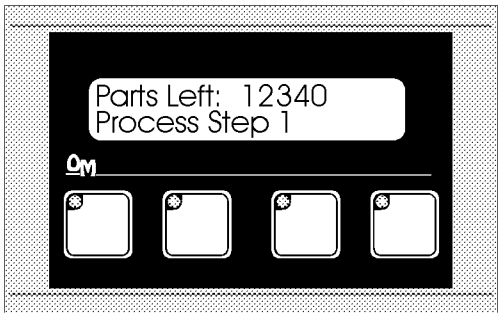


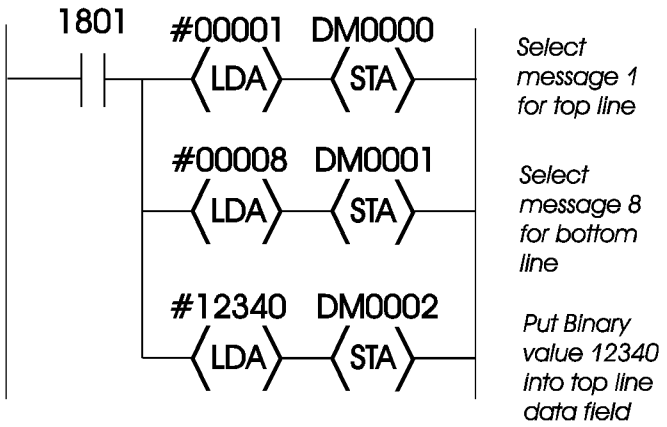


DM0000	Top line message selection
DM0001	Bottom line message selection
DM0002	Top line data
DM0003	Top line data 2 (for long BCD & floating point)
DM0004	Bottom line data
DM0005	Bottom line data 2 (for long BCD & floating point)
DM0006	Status register

Displaying Binary Numbers

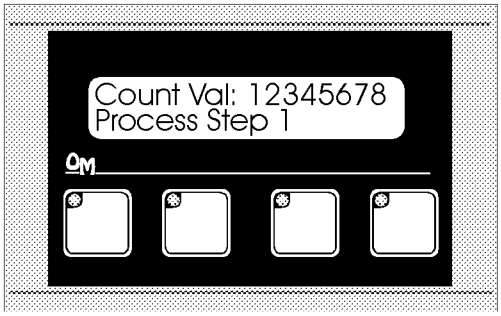
The example shown on the right is similar to the last example. The primary difference is that it uses a Binary number in the top line display. The top line uses data display message #1, which has been configured as a Binary display message. The data for the data field is a constant number 12340. The data can also be moved to the data register from another register. The bottom line is text message #8.

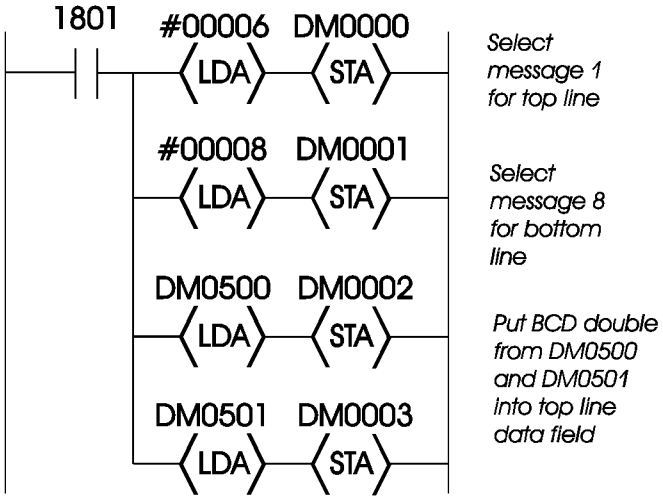




Displaying BCD Double Numbers

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 DM0500 and DM0501. DM0500 contains the four least significant digits while DM0501 contains the four most significant digits. The bottom line is text message #8.

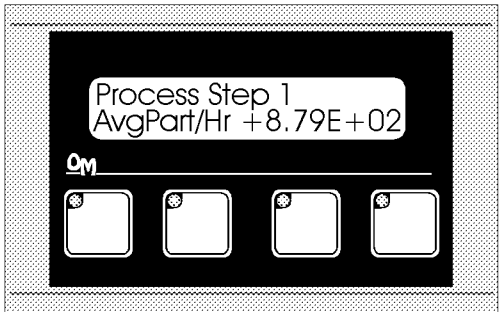


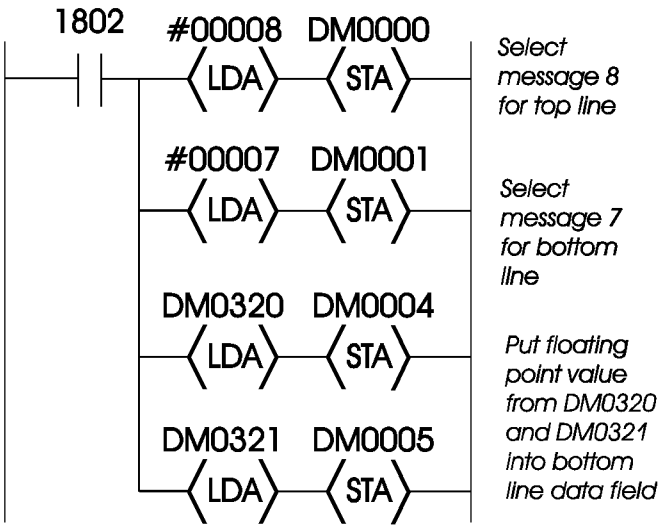


Note: Keyence PLCs do not have a means of easily handling BCD long numbers. If the PLC program can be written to manipulate BCD long numbers, the KM420 can handle them. The KM420 has the capability to display them.

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 bottom line display. 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 DM0320 and DM0321 to the bottom line display registers DM0004 and DM0005. The top line is text message #8.





Note: Keyence PLCs do not have a means of easily handling BCD long numbers. If the PLC program can be written to manipulate BCD long numbers, the KM420 can handle them. The KM420 has the capability to display them.

Examples of Use with a Modicon PLC

Register Usage

The OptiMate Configuration Editor, OM-WINEDIT, allows you to configure the KM420 to use a block of 7 contiguous registers at a starting value that you define. The memory block has to be in the **4x** area of memory between 40001 and 40617. For a Modicon PLC, the recommended memory starting register is address 40001.

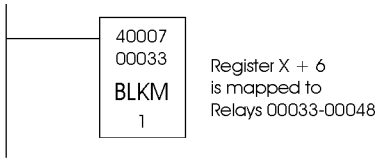
Any address between 40001 and 40617 area of memory is valid for the panel. However, Modicon PLCs use some data memory registers for specific instructions. Also, your program may be using registers in the 4x memory area. Refer to your Modicon PLC User's Manual to ensure that the registers you define for the panel do not conflict with registers that are already in use.

Memory Mapping

The KM420 uses a block of 4 contiguous registers. It writes data to the button status register to indicate the status of the pushbuttons. Since individual bits are used to indicate status, these registers are better suited for the relay register range of memory. However, the KM420 only communicates with the 4x memory area. The solution to this minor conflict is to define the base register address in 4x area of memory and place a rung in your PLC program to copy the registers to the 0x relay registers.

Note: Modicon's bit-numbering convention is backwards from the standard (i.e. The least significant register bit is bit 16, while the most significant is bit 1). By carefully documenting bit association, you can avoid confusion.

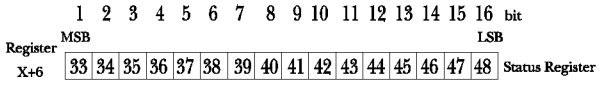
With the following memory-mapping rung placed in the PLC program, the status bits will correspond to relays in the 0x memory area.



The following is a table relating status register bits to their locations.

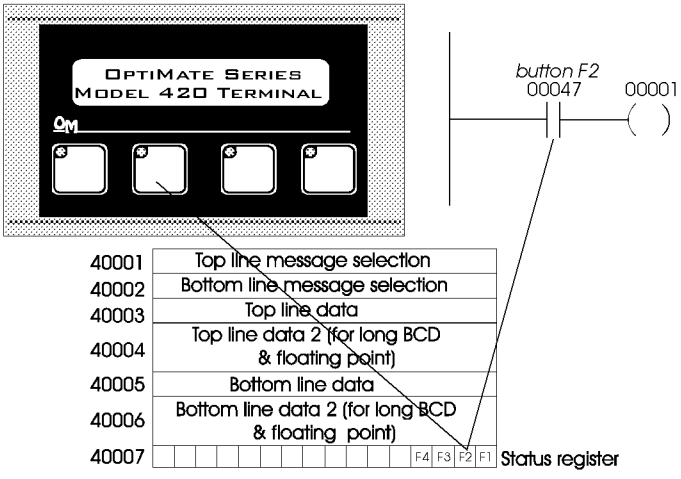
Status Register	M+6
bit	location
F1	00048
F2	00047
F3	00046
F4	00045

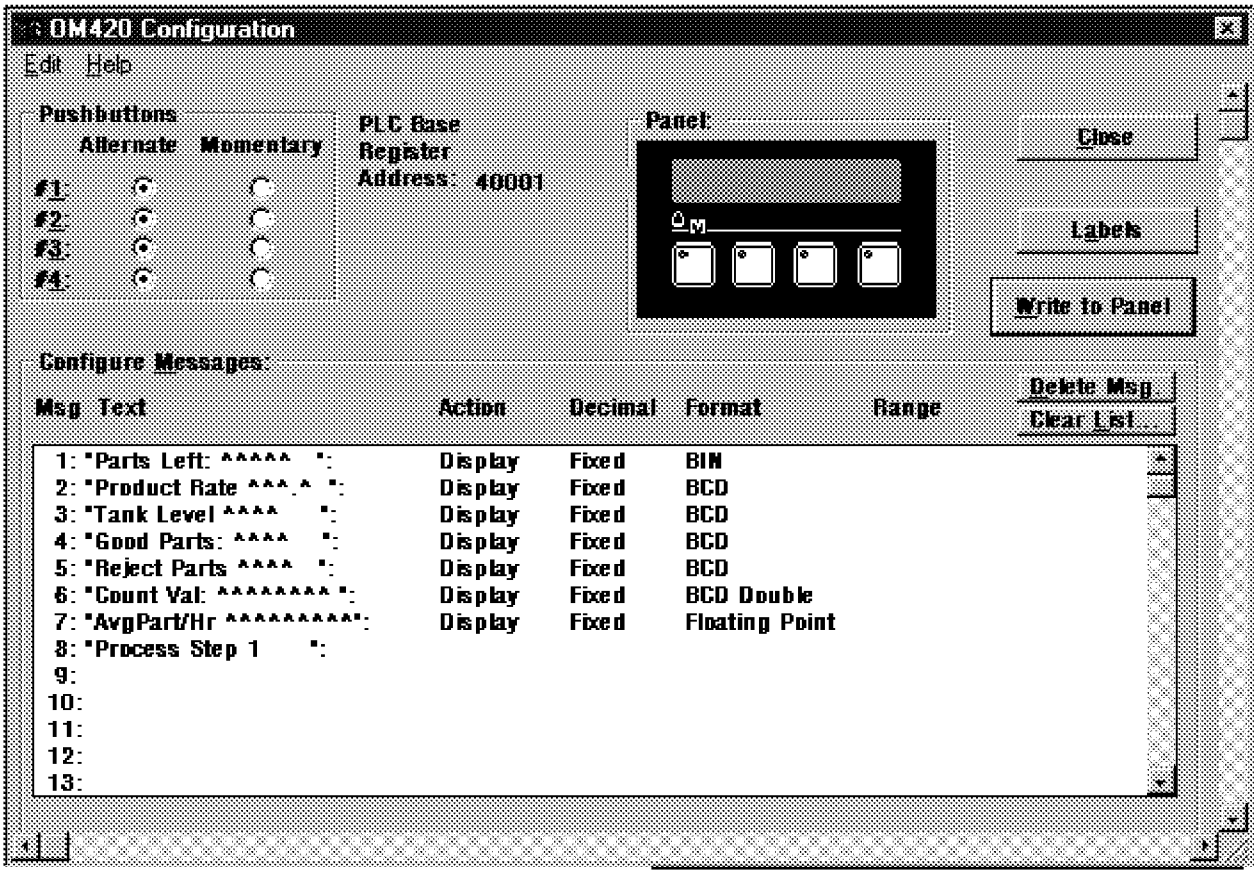
The register association is shown in the figure below.



Using a Function Button

The four function buttons below the LCD display will appear as relay coils in your program (assuming the register copy rung described previously is in your program). The following example turns on output 00001 when button F2 is active.

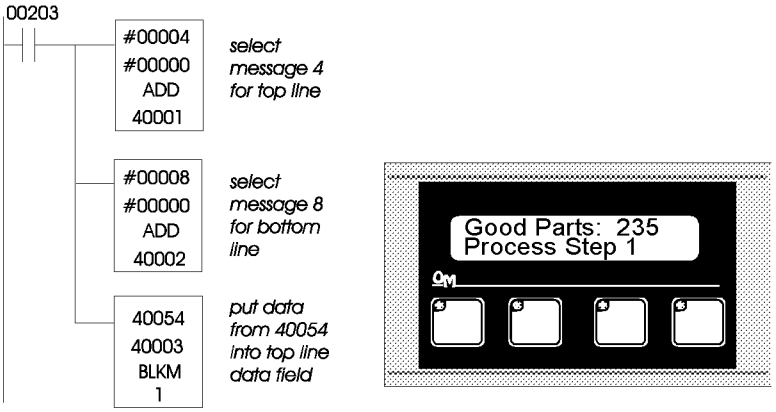




Displaying Messages on the LCD Display

Messages of various types can be configured via OM-WINEDIT and downloaded to the KM420. 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 40054. The bottom line is text message #8.

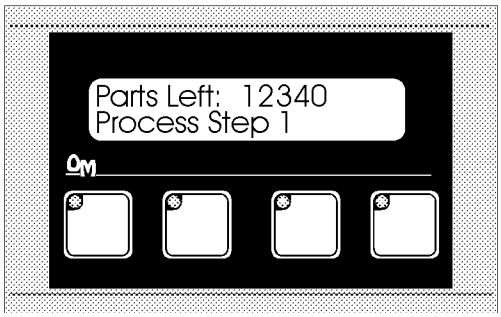


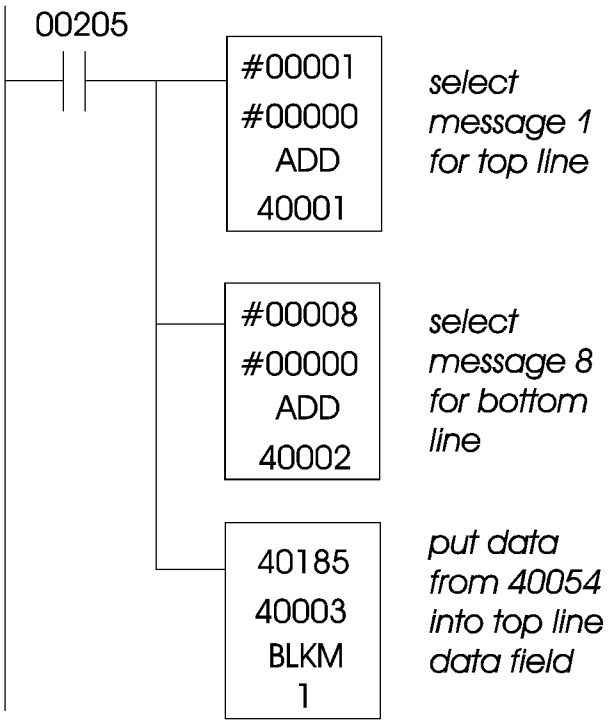
40001	Top line message selection
40002	Bottom line message selection
40003	Top line data
40004	Top line data 2 (for long BCD & floating point)
40005	Bottom line data
40006	Bottom line data 2 (for long BCD & floating point)
40007	F4 F3 F2 F1 Status register

Displaying Binary Numbers

Binary numbers can be displayed by the KM420. The example on the right illustrates the method for displaying binary numbers.

Binary numbers are displayed by moving data from a PLC register to either the top line and/or bottom line data register(s) depending on which line(s) the binary formatted message is displayed on. In this example, the bottom line is text message #8.

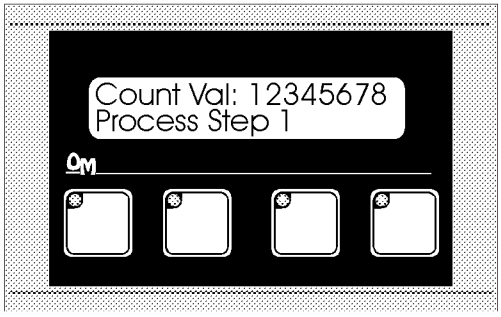


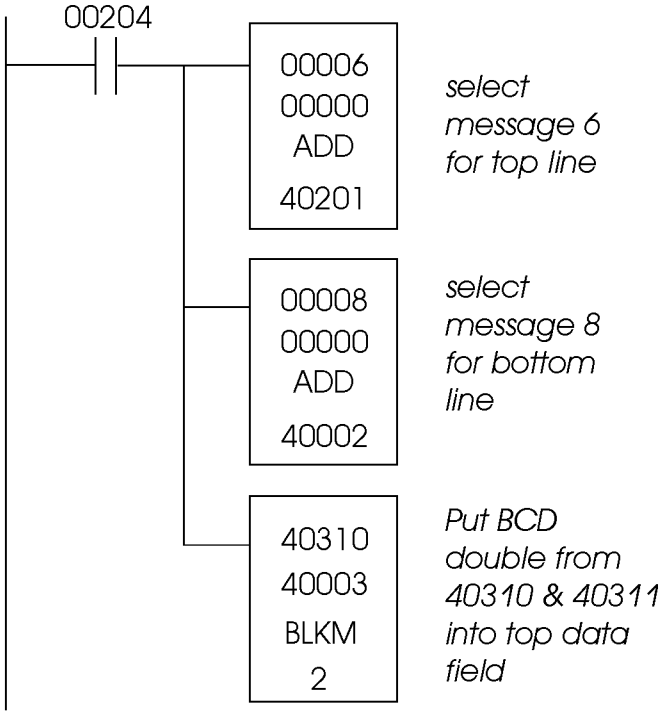


Displaying BCD Double Numbers

Long (up to 8 digit) BCD numbers can be displayed by the KM420. However, the Modicon PLCs do not have an easy means of handling long BCD numbers. Due to the limitations of the Modicon, this capability will not be commonly implemented, but if a valid BCD double number is placed in the data registers for a BCD double message, the panel will display it.

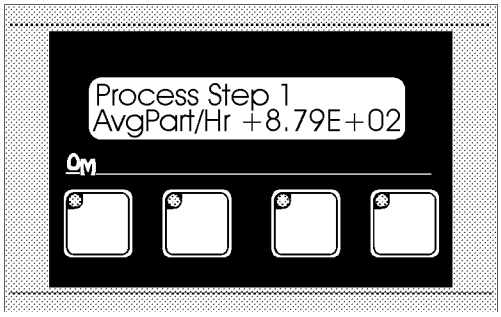
The example in the next column illustrates the method for displaying large numbers. Registers 40310 and 40311contain an 8 digit BCD number, with the most significant 4 digits in 40311. BCD long data can also be displayed on the bottom line by simply moving the data to the bottom line data registers. In this example, the bottom line is text message #8.

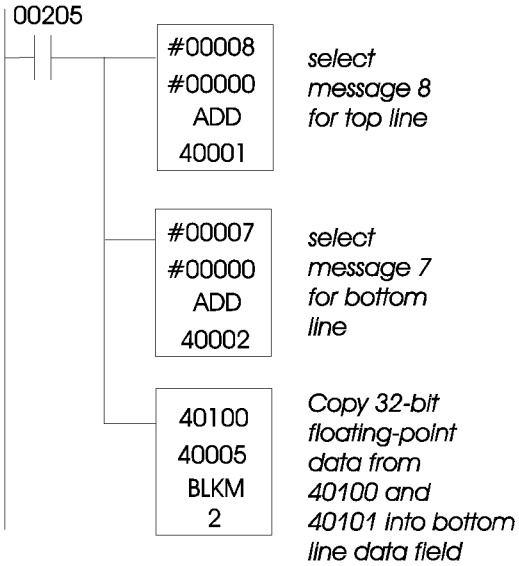




Displaying Floating-Point Numbers

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 copied from 40100 and 40101 to the bottom line display registers 40005 and 40006. The top line is text message #8.





Use in a Microprocessor-Based System

OptiMate modules can interface a microprocessor-based controller over a serial link. For the OptiMate 400 Series line of panels, this link can only be RS232 (for point to point) with the microprocessor acting as the master. It can write data to the panel or read data from the panel.

The KM420 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 KM420 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 KM420 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 KM420 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 message must be transmitted in hex.

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 hex equivalent. The other commands and data must be sent in hex.

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. 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 hex format.

Function Buttons

The KM420 contains four 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 General Status/Control message (0xA0) will return the current state of each of the four buttons. The message must be transmitted in hex and the response will also be in hex.

KM420 OptiMate Hex Protocol

General format

STX Module function ftn_data checksum
address

Where STX = 0x02
Module address = 0 to 30
function = 0xA0 ; General status/control
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.

General status/control

STX Module 0xA0 checksum
address

response

STX status checksum *if message received and processed OK*
where status = terminal status
bits 0-3 = Button status for function buttons 1-4 respectively (1 = active, 0 = inactive)
bit 4 : Top line display data
bit 5 : Bottom line display data

or

NAK if any errors
Where NAK = 0x15

Select Predefined Message

STX Module 0xA1 line mesg_no data checksum
Address

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.
> 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*
Where ACK = 0x06
or
NAK *if any errors in message*

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
Bottom line= 0x01
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 0x21 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*

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.
> 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*

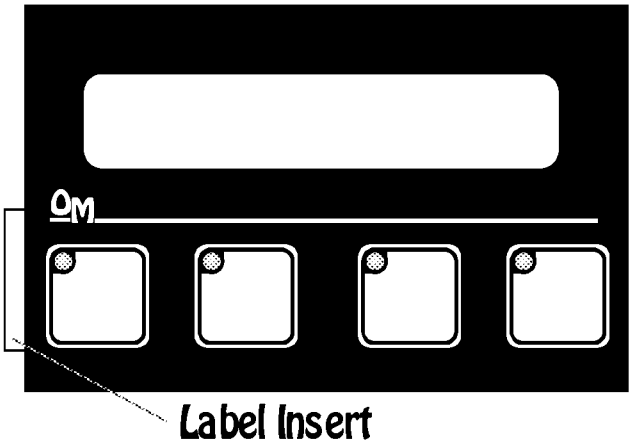
Display status request
STX Module 0xA9 checksum
Address

response
STX top_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

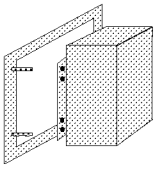
or
NAK *if any errors in message*

Set Up and Interconnect

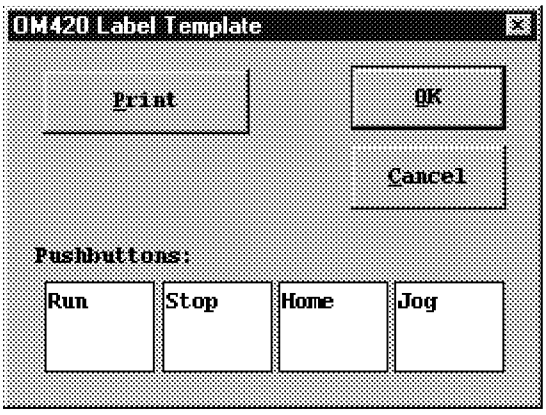
Legending the Function Keys



Legending the KM420 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:

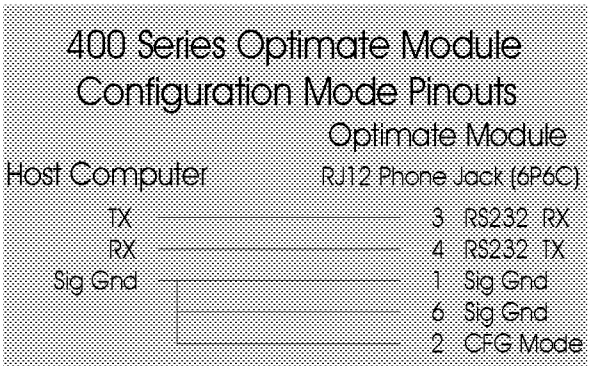
  - > Use a computer graphics program and a laser printer to create the transparency directly. Alternately print onto paper and photocopy to a transparency
  - > Use press-on letters onto a transparency sheet.
  - > Use a typewriter, lettering machine or press-on letters to letter onto paper, then photocopy.
- Cut along outline. Slide into overlay pocket. Pushbutton legends slide in from the left side.
- Re-attach bezel. Push bezel onto box until all four snaps snap together. Ensure that the bezel covers all the housing snaps before installing the panel.

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.

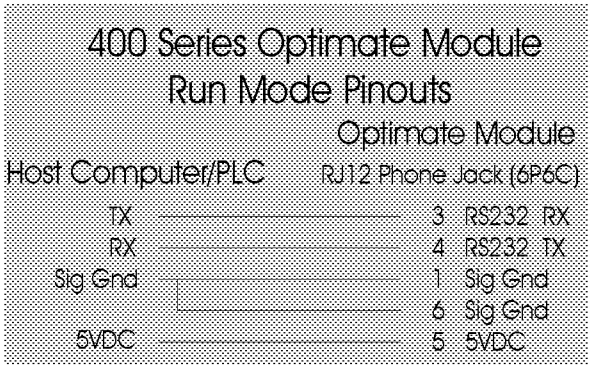


Refer to manufacturer's documentation for computer serial link connector pinouts.

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

Run Mode Connection to a Computer or PLC

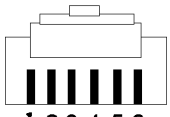
Connection of a 400 Series OptiMate module to a computer or PLC can be accomplished over an RS232 link. RS232 is limited to one OptiMate module to one computer serial port. Since PLCs are slave devices, the RS232 link for a PLC is limited to one OptiMate module. See the figure below for 400 Series OptiMate 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 below shows the RJ12 connector pinouts for connection to an OptiMate 400 series module.



RJ12 Connector
Optimate End

Power

The KM420 Setpoint/Display Panel will operate only on a DC voltage of *5VDC*. Steady state current is listed on the specification page.

The KM420 panel can draw power from its communications cable if the host device has a 5VDC connection on its comm port.

The KM420 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. 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 center negative DC power jack.**

There is a very brief (0.1 - 1 millisecond) power on surge up to 0.44 amps. This is typical of nearly any type of electronic equipment and is due to the initial charging of power capacitors. This surge is not normally a problem for a commercial power supply.

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 KM420 module, the following are important configuration parameters. Further configuration details are covered in the OM-WINEDIT help screens.

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 KM420.
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 OM-9001Communications 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 KM420, 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.

Configuration using a Keyence PLC

The KM420 requires that certain parameters be set in order for it to communicate with a Keyence PLC. The parameters are PLC type, protocol, baud rate, parity, stop bits and base register address.

If you are using the KV10, KV16, KV24, KV40 or the KV80 PLCs the KM420 should always be set to the following:

KM420 Communication Parameters KV10, KV16, KV24, KV4, KV80, KV300, KV-L2	
Baud rate	9600
Parity	even
Stop Bits	1
Data Bits	8

Communications with a KV300 CPU can be accomplished by two means:

(1) direct connection to the communications port on the CPU
(2) connecting the panel to a KV-L2 Serial Interface Module

Note: If a KV-L2 Serial Interface Module is connected in the PLC system, you must use it to connect to the KM420. If you try to connect the panel to the KV300 CPU's communcations port, the panel will not communicate because the CPU will not recognize the protocol.

Direct Connection to the CPU

If you are connected to the KV300 through the CPU communications port, configure the KM420 with the parameters shown in the table above.

The KM420 uses the KV mode protocol to communicate with the PLC, therefore, the port that the panel is communicating with should be set for KV mode also.

Communications through the KV-L2

If you are using a KV-L2, the following dip switch paramenters apply:

Port 1		Port 2	
A1	A2	A3	A3
OFF	OFF	OFF	OFF

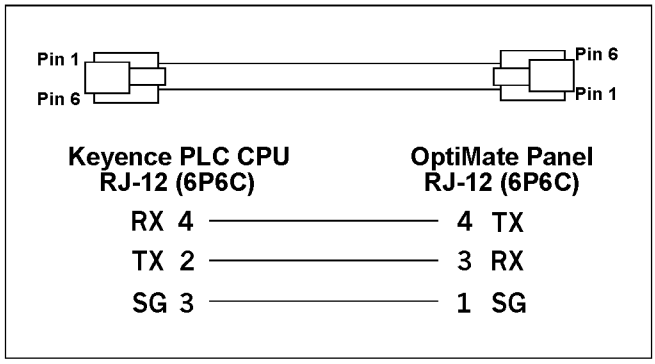
The dip switch settings shown above are dependent on the port that the KM420 is connected to. If the panel is connected to Port 1, then switches A1 and A2 should be OFF. If you have another device on Port 2, then the switches for Port 2 should be set to the proper protocol for that device.

The KM420 uses the KV Mode protocol to communicate with Keyence PLCs. Regardless of the "B" dip switch settings, the port that the panel is connected to will automatically default to the communication parameters shown in the table above.

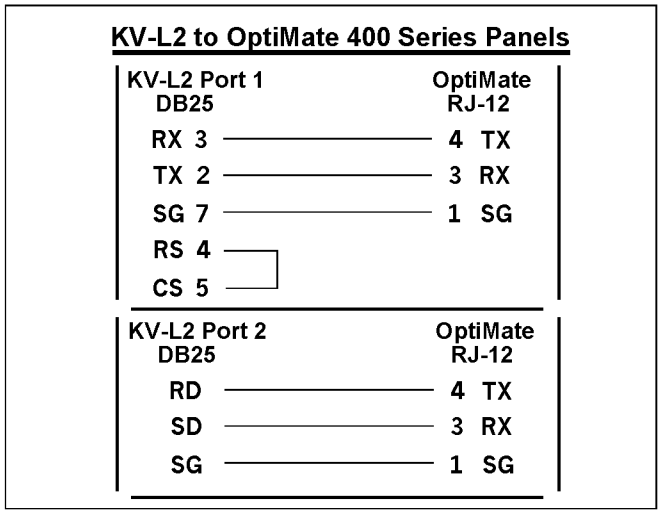
Note: If using Port 2, ensure that the port switch is set for RS232.

Refer to the chapter on the KV-L2 Serial Interface Module in the Keyence User's Manual for more details.

The figure below shows the pinouts to connect a KM420 to a Keyence PLC CPU. This cable is available from Optimation.



The figure below shows the pinouts to connect a KM420 to a KV-L2 Serial Interface Module. The pinouts shown are for RS232.



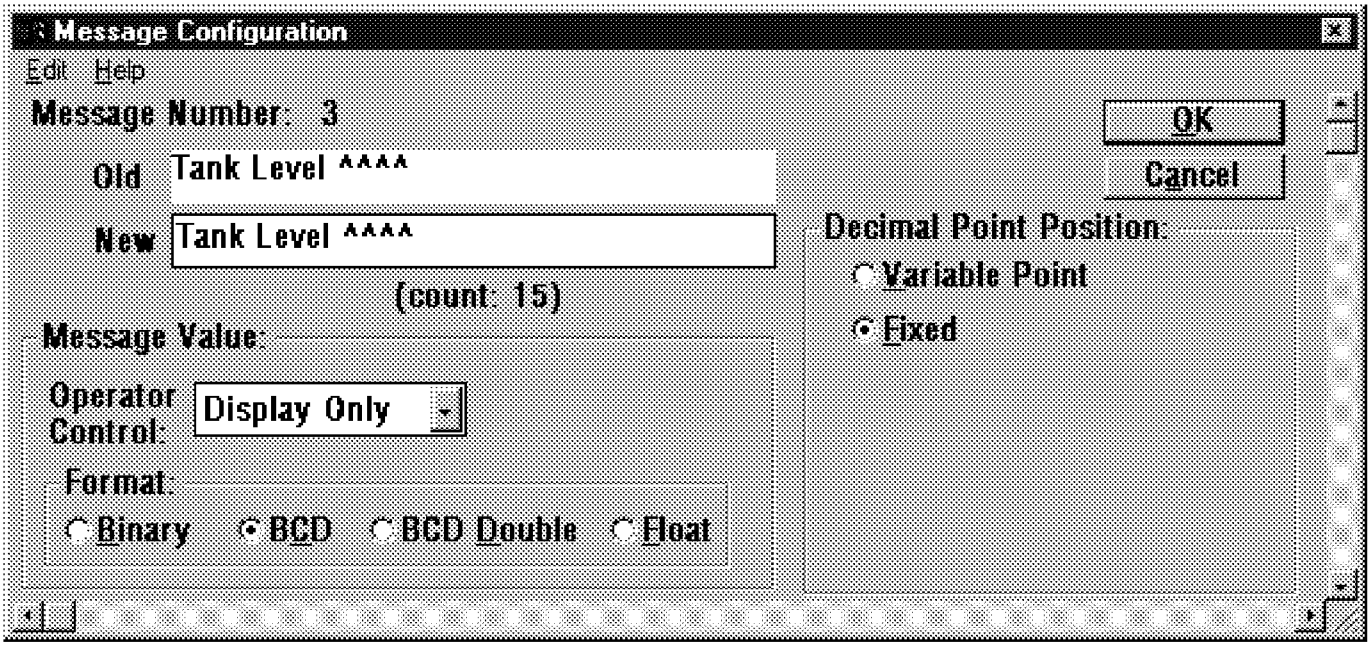
Creating Messages

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, etc. as shown below.

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

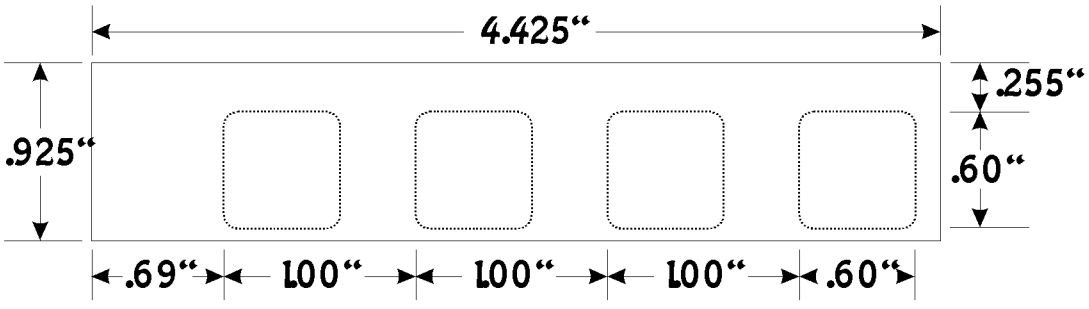
Example Message Definitions



Label and Message Definition Templates

Message #	Text (20Characters Max.)

Message Definition Template

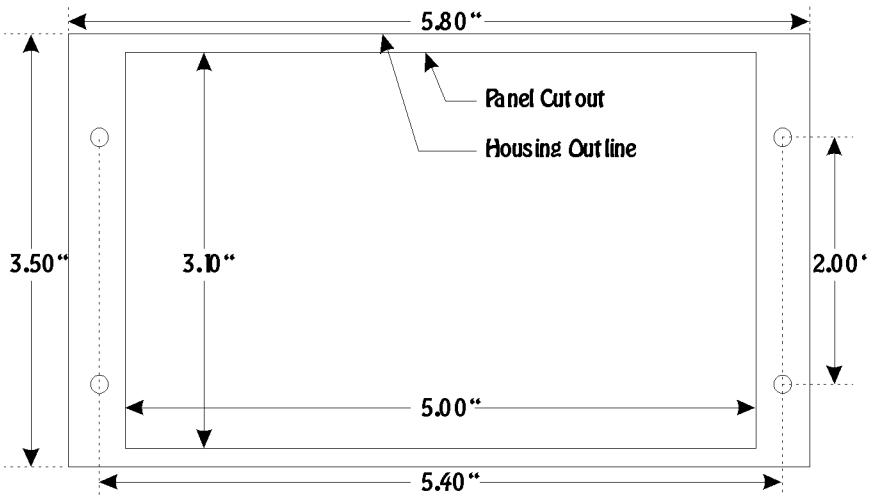


Pushbutton Label Strip Pattern

Specifications

Physical

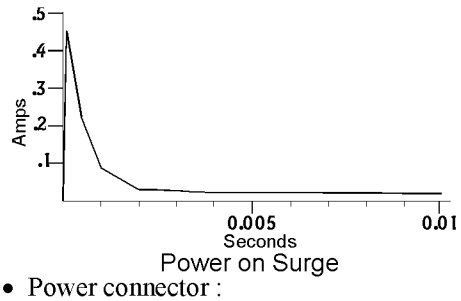
- Recessed Mount Housing: 6.00"L x 3.50"H x 1.25"D
- Cutout size: 3.20"H x 5.10"L
- Panel Fasteners:Four, 6x32 threaded studs, shown at right (on ends, symmetrical about center line)
- Weight : 8 ounces
- Colors : Dark gray housing with dark gray panel. Keypad keys: white
- LCD Display: 2 line X 20 character STN with LED backlight
  character size: 5.5mm high X 3.2mm wide
- Pushbutton life : 1,000,000 switch cycles



Panel Mounting Dimensions

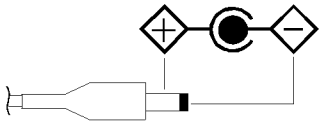
Electrical

- Power: 5VDC @ 0.58Watts
  115mA @ 5VDC
- Power On Surge (see figure below)
  0.44A for 1 millisecond max



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 LEDs on the panel front will flash rapidly.

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)