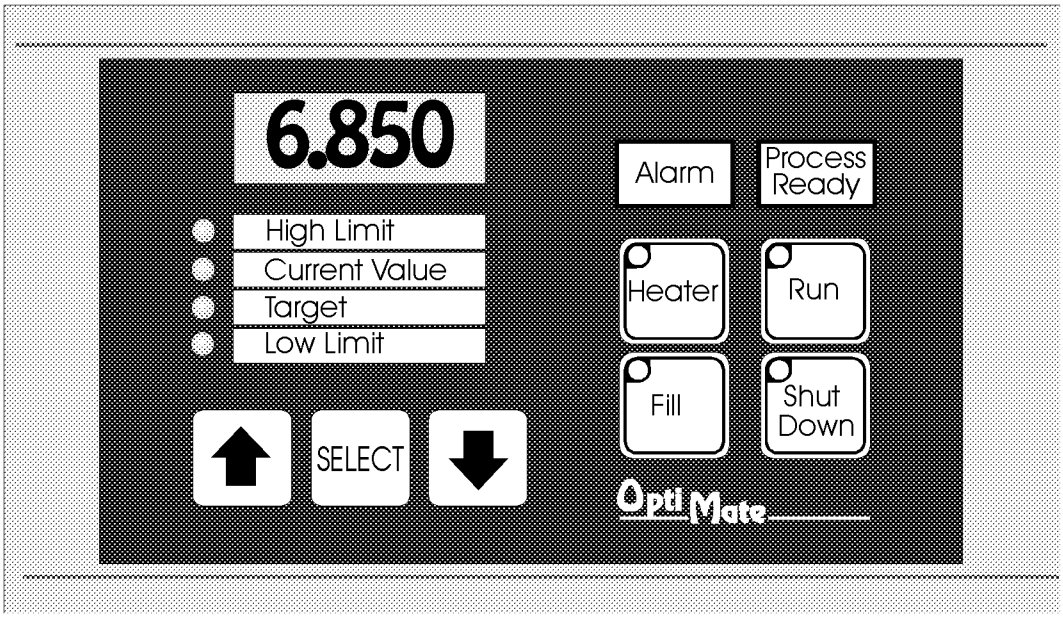


KM613 Operator Panel

The KM613 Operator Panel is a low cost/high performance man/machine interface with a broad range of operator-input and display capabilities. The panel includes four field points which can be used for either setpoint entry or data display, four pushbuttons and two large indicator lamps.

The four-digit numeric LED display is associated with four field points. The user can select which field point to project on the display by use of the SELECT button. The LEDs adjacent to the user-defined field point labels highlight which field point is active. Once selected, the display will either show the related data or project the current setpoint value.

Setpoint adjustment can be performed by use of the arrow keys to move the value up or down. Once set, the value is saved into non-volatile memory. It is permanently stored, whether power remains on or not, until the next time it is changed by the operator.

Lamps and buttons 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 KM613 Operator Terminal is part of Optimation's OptiMate® series. Each OptiMate module is designed to connect to a microprocessor or most PLC's 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 communications cable allows the microprocessor to directly control the lights and numeric display as well as to read numeric data entry and pushbutton status.

When used with a PLC, operation is transparent to the user. Panel functions tie directly into your PLC ladder logic program. The KM613 takes care of the rest.

Applications

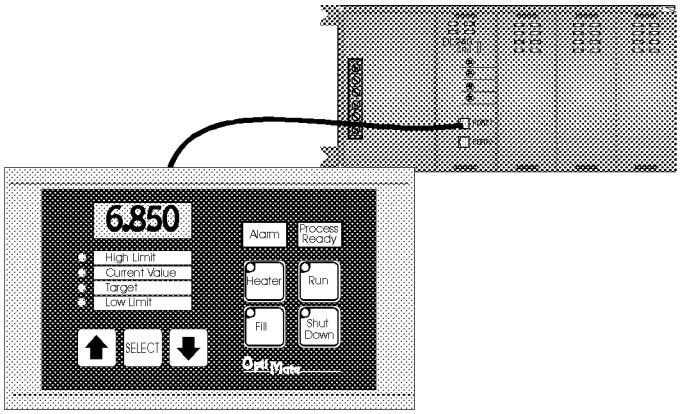
- Machine control
- Process control
- Security systems
- HVAC
- Plant monitoring/control
- PLC applications
- Microprocessor applications

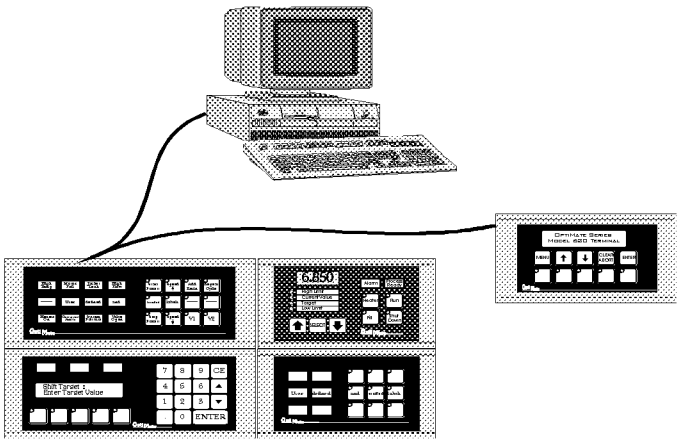
Features

- Setpoints or display points
- Four digit numeric display
- Two large LED light bars
- Four tactile-snap membrane function buttons
- Buttons independently configurable for momentary or alternate action operation
- PLC compatible
- RS232/RS422 communications
- Stand alone operation capable
- Multipanel operation capable

Contents

Configuration Options





PLC Stand Alone

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

The KM613 operator panel uses a bank of PLC registers. Complete operator interface is performed with 8 PLC registers for data entry and display, function key interface and indicator light control. The KM613 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 communicate with most major PLC protocols. Configuration for particular PLC protocols and interconnect cabling is covered in the following pages.

Microprocessor-Based Systems

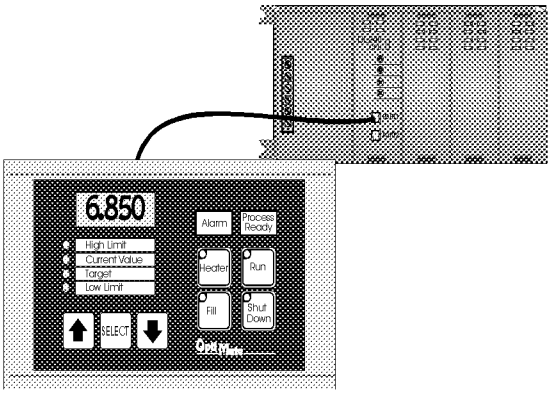
OptiMate panels can interface directly to most computers or microcontrollers. The panels communicate over either RS422 or RS232 serial communications. All that is required to interface OptiMate panels is a serial port. The OptiMate Hex protocol, detailed in this document, allows the user to directly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

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

In a microprocessor-based system, the host microprocessor is the system master. The OptiMate panels are slave devices that respond to commands from the host. In the case of the KM613, these commands are messages for data display, lamp control, setpoint retrieval and function button status.

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

Use with a PLC



Register	MSB															LSB	
X		L2F	L1F		B4F	B3F	B2F	B1F		L2	L1		B4	B3	B2	B1	Indicator Light/LED On/Off/Flash
X+1													B4	B3	B2	B1	Button On/Off Status
X+2	Field Point 1 data cell																
X+3	Field Point 2 data cell																
X+4	Field Point 3 data cell																
X+5	Field Point 4 data cell																
X+6	Field Point force data cell																
X+7	FSP		FP4	FP3	FP2	FP1				F1	F2	F3	B4	B3	B2	B1	Force Commands

Register Bit Association

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 the specific OptiMate panel is mapped, this data can be moved, changed or monitored using ladder logic.

The term PLC register is used for the area of memory within the programmable controller used for data exchange with the KM613. 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 KM613 Terminal Panel uses a bank of 8 contiguous PLC registers. The register set definition is shown in the table below.

KM613 Panel PLC Register Map	
PLC Register	**Register Function**
X (first register of bank)	Lamp and inset LED control
X+1	Function button status
X+2	Field point 1 data cell
X+3	Field point 2 data cell
X+4	Field point 3 data cell
X+5	Field point 4 data cell
X+6	Field point force data cell
X+7	Force control

Register Definition

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

- Register X - Control outputs for the 2 indicator lamps and, if LED separation is selected, the inset LEDs in the momentary pushbuttons.
- Register X+1 - Button status for the four function buttons.
- Register X+2 - Field point 1 data (either setpoint input or display output, as configured)
- Register X+3 - Field point 2 data.
- Register X+4 - Field point 3 data.
- Register X+5 - Field point 4 data
- Register X+6 - Force data. Value to force setpoint equal to when force operation is initiated by the PLC program.
- Register X+7 - Force control. This register controls the forcing of setpoints or button state. The most significant bits of this register control setpoint force. The least significant control pushbutton force.
  - > FSP - When active, the Field point force data (X+6) will be forced into the field points set to be forced (FP1-FP4). Once the force operation takes place, the KM613 will automatically clear FSP.
  - > FP1-FP4 - Used to identify which setpoints must be forced.
  - > F1 - When set, all alternate action buttons B1-B4 will be forced to the state (on or off) selected in the low 4 bits (B1-B4) of this register. Once the force operation takes place, the KM613 will automatically clear F1.
  - > F2 - When set, all alternate action buttons matching the bits set in B1-B4 of this register will be forced on. Once the force operation takes place, the KM613 will automatically clear F2.
  - > F3 - When set, all alternate action buttons matching the bits set in B1-B4 of this register will be forced off. Once the force operation takes place, the KM613 will automatically clear F3.

Operational Overview

Reading a Setpoint

Setpoint data is continuously and transparently written to the associated PLC register. To access and use the setpoint data, simply reference the relevant PLC register (X+2 through X+5) in your PLC program.

Writing a Display Point

Writing a display value simply requires writing data into the associated PLC register. The KM613 will automatically retrieve and display the data.

Forcing a Setpoint

There are times when it is necessary for the PLC program to initialize or override a setpoint. The capability to do so is provided as the Force Setpoint function.

To force a setpoint to a given value, the value should be placed in register X+6. Next the bit(s) corresponding to the setpoint(s) to be forced and the FSP bit must be set. When the KM613 panel has forced the setpoint to the required value, it will clear register X+7.

Reading Pushbutton Status

Once the panel is configured and connected to the PLC, reading a button's status simply entails reading the appropriate register bit. In typical applications, a pushbutton appears in PLC ladder logic as a contact. The register bit association is shown in the table on the previous page. The OptiMate panel will automatically place status into this register. A 1 (or contact closed) indicates active or "on" condition.

Turning on a Lamp

When configured for PLC operation, turning on a lamp simply requires the writing of a 1 to the appropriate register bit. With most PLCs this is accomplished by activating a coil in the PLCs ladder logic. The OptiMate panel will automatically retrieve the register data and light any lamps whose bits are set.

A lamp must be turned on in order for the flash control bits to have any effect.

Flashing an Inset LED

As shown in the table, the second register will initiate lamp flash. To flash a lamp, the lamp must be on and lamp flash bit must be set.

Lamp flash is approximately .5 seconds on and .25 seconds off.

Turning on the Inset Indicator Light

In most cases, the LED inset in each button simply provides a visual indication of the status of the button. However, if a module is configured for LED separation mode, a momentary button's indicator light can be set directly from the PLC. In LED separation mode, turning on a lamp simply requires the writing of a 1 to the appropriate register bit. The register bit association is shown in the table on the previous page. The OptiMate panel will automatically retrieve the register data and light any lamps whose bits are set.

LED separation is available only for momentary pushbuttons.

Flashing an Inset LED

As shown in the table, the fourth register will initiate inset LED flash. To flash an LED, the LED must be on and LED flash bit must be set. In normal mode, LED "on" status simply reflects pushbutton status. In LED separation mode, LED "on" status is set directly via PLC register bits.

Lamp flash is approximately .5 seconds on and .25 seconds off.

Button Force Commands

If the KM613 panel is configured for force capability, the PLC can directly control button status when desired. This may be desirable for initialization purposes.

The force capability also may prove useful for functions initiated from the panel pushbuttons. For example, consider a situation where an operator initiates a control process by pressing an alternate-action panel button. The button status and indicator light would stay on and lighted to indicate that the function is still in process. At the end of the process, the PLC program could force the button status off.

There are three types of force functions available. These are described below.

Force function	Description
F1 (Force buttons status)	When the F1 bit is set, all buttons will be forced to the status set in the force register (X+7) bits B1-B4. Once these buttons are forced to the status set, the KM613 will automatically clear register X+7.
F2 (Force buttons on)	When the F2 bit is set, all buttons matching the bits set in the force register (X+7) will be forced on. Once these buttons are forced on, the KM613 will automatically clear register X+7.
F3 (Clear buttons)	When the F3 bit is set, all buttons matching the bits set in the force register (X+7) will be forced off. Once these buttons are forced off, the KM613 will automatically clear register X+7.

Force obviously applies only to alternate-action pushbuttons.

Examples of Use with a Keyence PLC

Register Usage

The OptiMate Configuration Editor, OM-WINEDIT, allows you to configure the KM613 to use a block of 8 contiguous 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 address is DM0000.

Any address within the DM area of memory is valid for the panel. However, Keyence PLCs use some data memory registers for specific instructions. Also, your program may be using registers in the data memory. Refer to your Keyence 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 OptiMate panels communicate in two basic ways with a PLC. They either read data from a register or write data to a register.

The KM613 uses a block of 8 contiguous registers. It *reads* data to turn ON and flash lamps, display data, force setpoints and buttons. It *writes* data to the button status register to indicate the status of the pushbuttons and to the setpoint registers to indicate the value of the setpoints.

The middle 5 PLC registers (X+2 thru X+6) in the block used by the KM613 panel are used for numeric information. As such they are ideally suited for the general purpose data memory registers (DM0000-DM0699). Since individual bits are used to indicate control and status, registers X, and X+1 are better suited for the internal relay register range of memory. However, the KM613 only communicates with the DM memory area. The solution to this minor conflict is to define the base register address in data memory and place a rung in your PLC program to copy the registers to/from internal relay registers.

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

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

The examples on the following pages use a KM613 connected to a Keyence PLC. The KM613 is configured for a base address of DM0000. **The program rung on the right should be placed in the program to copy from 1000 to the Lamp Control register (X) and copy from the Pushbutton status register (X+1) to 1100.**

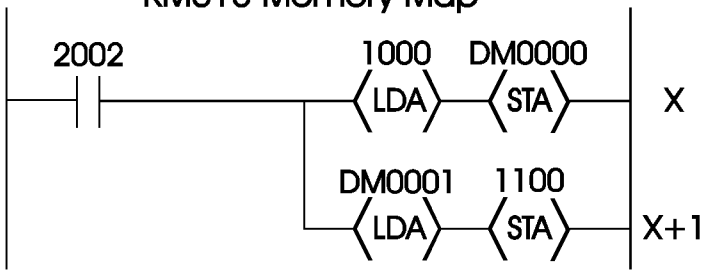
With the rung shown placed into the PLC program, the button status and lamp control bits will be internal relays. The register association is shown in the figure below.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	bit
Register	MSB															LSB	
1000	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Lamp Control
1100	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Button Status

The table below shows the internal relay correlation for a KM613 when the data memory registers X and X+1 are mapped to/from the internal relays beginning with 1000 (as shown in the program rung on the bottom).

Lamp Control Register (X)			Button Status Register (X+1)	
bit	relay		bit	relay
B1	1000		B1	1100
B2	1001		B2	1101
B3	1002		B3	1102
B4	1003		B4	1103
	1004			
L1	1005			
L2	1006			
	1007			
B1F	1008			
B2F	1009			
B3F	1010			
B4F	1011			
	1012			
L1F	1013			
L2F	1014			
	1015			

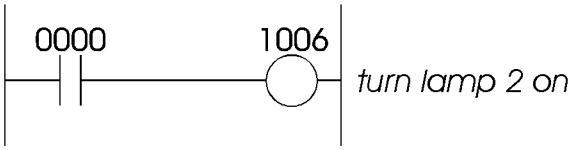
KM613 Memory Map



Operations with Lights & Buttons

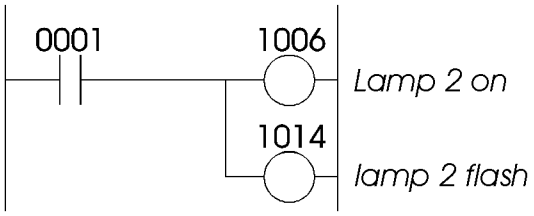
Turning on a Lamp

Turning on a lamp in the KM613 simply requires activating its associated internal relay coil. In the figure below, lamp 2 will be turned on whenever input 0000 is active (energizing 1006).



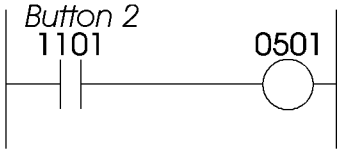
Flashing a Lamp

To flash a lamp, you simply need to turn it on and also set the associated flash bit. The example below shows a Keyence program used to flash lamp 2 whenever 0001 is energized.



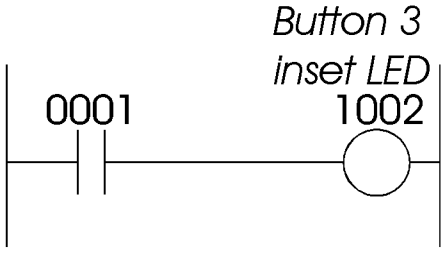
Using a Function Button

The four function buttons will appear as internal relay coils in your program (assuming the register copy rung described previously is in your program). The following example turns on output 0501 when button B2 is active.



Lighting an Inset LED

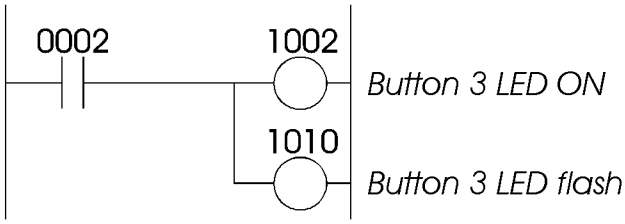
In LED separation mode, the LEDs in the corner of each momentary pushbutton may be directly controlled by the PLC program. The following example shows a segment of a Keyence program that will light button 3's inset LED whenever input 0001 is energized. *In order for this to work, the panel must be configured for LED separation and button 3 must be a momentary pushbutton.*



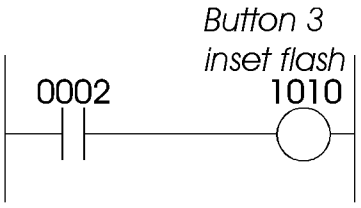
Flashing an Inset LED

To flash an inset LED, you simply need to turn it on and also set the associated flash bit. If the panel is not set up for LED separation, LED status is the button state. For momentary buttons with LED separation enabled, the on/off state is controlled by the PLC as shown in the previous example. For alternate action buttons, on/off state is always the button state.

The example below shows a Keyence program used to set the LED inset in momentary button 3 to flash whenever 0002 is energized.



If the panel has been configured with button 3 being an alternate-action button, the LED will operate as shown in the example and table below.



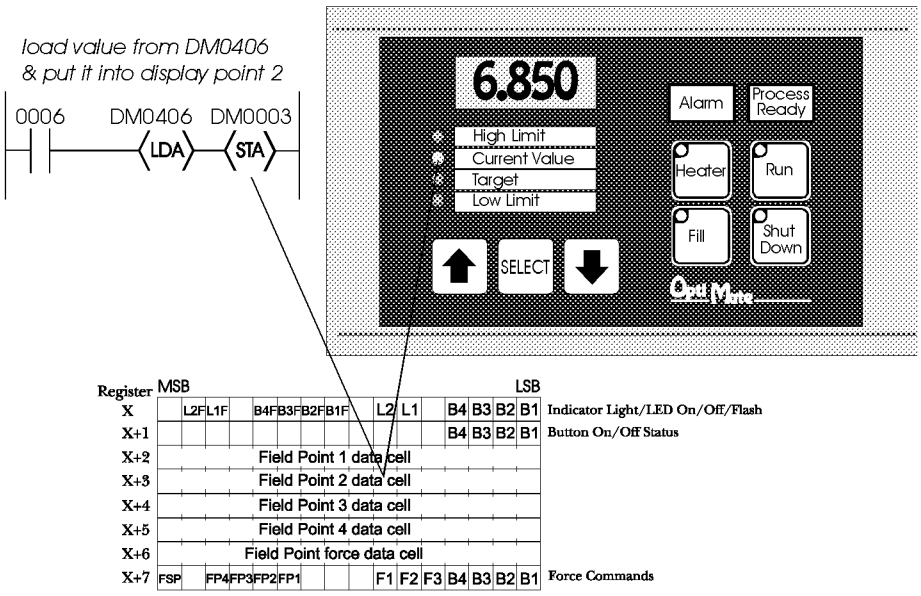
Button State	0002 State	LED operation
Inactive	de-energized	Off
Inactive	energized	Off
Active	de-energized	On solid
Active	energized	Flashing

Setpoint & Display Operations

Displaying Numeric Data

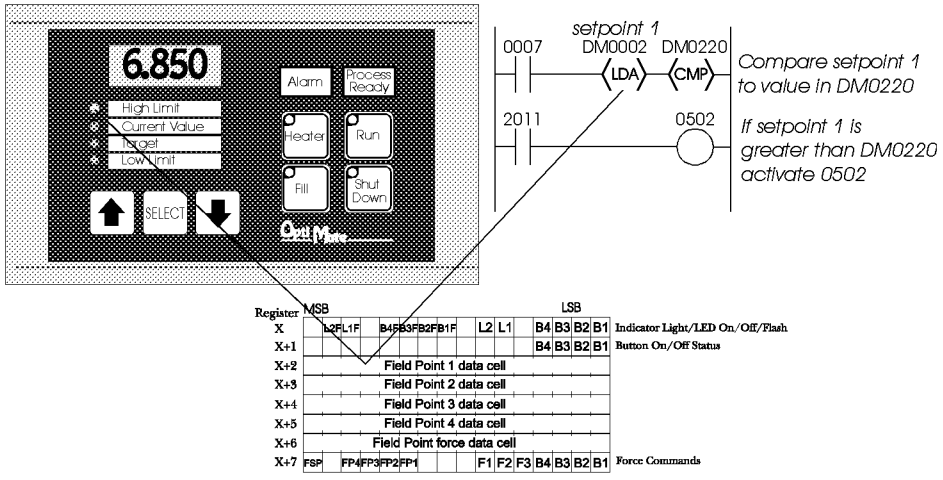
Displaying numeric data in one of the 4 field points is a very simple process. During the initial configuration, make sure you define the point as a display point, not a setpoint. When this is done, the PLC program must simply put data to be displayed into the register associated with the display data field.

The figure below illustrates a numeric display application with a Keyence PLC. In this application, the KM613 is configured for a base address of DM0000 and field point 2 for display. A value, held in DM0406 will be displayed in field point 2 as long as 0006 is active. The example shows the value transferred from DM0406 to DM0003. It will be displayed as field point 2.



Reading a Setpoint

The following example uses a KM613 at base address DM0000. Field point 1 has been configured as a setpoint. In the example program, field point 1 is a High Limit setpoint. Whenever 1007 is active, the program shown compares the value of setpoint 1 with a value held in DM0220. If setpoint 1 exceeds the value of DM0220, output 0502 will be turned on.



Using Force Functions

The KM613 gives you the ability to force alternate buttons to a given state and force setpoints to a given value. This capability may or may not be used on a given application. There are applications when it is desirable to have the PLC program automatically set or clear a button based on operational state. There are also cases when forcing a setpoint to a predetermined value is useful. Obviously, this capability should be used carefully.

The last two registers in the register bank are associated with force operations. Their use is detailed below.

Forcing Button Status

One of the more advanced capabilities of the KM613 panel is the ability to force button state from the PLC program. This may be desirable, for example, if an alternate-action pushbutton is used to start a function process. When it is pushed and while the function is active, the button will remain ON. You may want the PLC program to clear the button at the end of the function process.

Another example is one of a system that has individual enable or ON/OFF (alternate action) buttons for several different devices. You may also have other buttons (probably momentary) that enable a group of these same devices. You may want your program to force ON the device enable buttons when the group enable button is pressed.

There are many other cases where button force capability can be useful in a system.

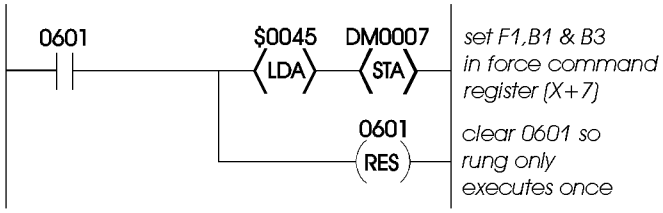
There are three types of force functions available for the KM613 panel - force status, force ON and force OFF. All three functions require moving appropriate data into the PLC registers defined as Force Data & Commands (see the table described in "Use with a PLC").

Note : Force only applies to Alternate-Action pushbuttons

Force Button Status

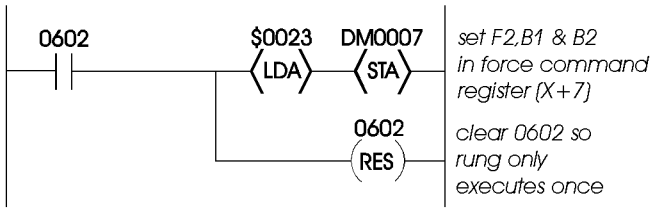
This function is used to set the state (ON or OFF) of every alternate-action pushbutton in the panel. To use the "Force Button Status" function, simply set the F1 bit to 1 and all buttons that you want to be ON to 1. The buttons whose corresponding bits are left at '0' will be forced OFF. The example below shows buttons 1 and 3 being forced ON and buttons 2 and 4 forced OFF when 0601 is active.

Notice that 0601 is used as a set/reset type relay. The force should be written to the force register once. The KM613 will automatically clear this register when the force is complete. This will normally happen very quickly (less than a second). The fact that the KM613 clears the force control register when the operation is done can be used by the PLC program to verify operation. However, this is generally not necessary.



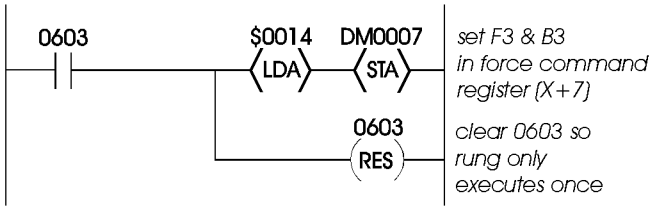
Force Button(s) ON

This function is used to turn individual button(s) ON without affecting the state of any other buttons. To use the "Force Buttons ON" function, set the F2 bit to 1 and all buttons that you want to turn ON to 1. Any buttons associated with bits that are left at '0' will not be affected. The following example shows buttons 1 and 2 being forced ON when 0602 is active.



Clear Button(s)

This function is used to selectively turn individual button(s) OFF without affecting the state of any other buttons. To use the "Clear Buttons" function, set the F3 bit to 1 and all buttons that you want to turn OFF to 1. Any buttons associated with bits that are left as '0' will not be affected. The example below shows button 3 being cleared when 0603 is active.



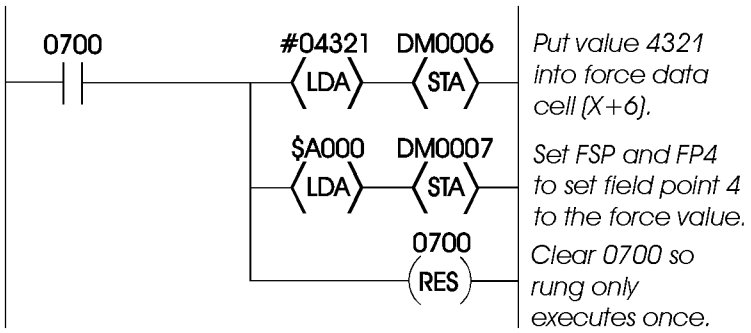
Forcing Setpoints

The KM613 gives you the capability to force a setpoint to a value from the PLC.

To force a setpoint to a value, the value should be placed in register X+6. Next, the force setpoint bit FSP and the bit(s) corresponding to the setpoint(s) to force to the value in X+6 must be set in the force control register (X+7). When the KM613 completes the force operation, it will clear the force control register.

The following example shows setpoint 4 being forced to 4321 when 0700 is active.

Notice that 0700 is used as a set/reset type relay. The force command should be written to the force register once. The KM613 will automatically clear this register when the force is complete. This will normally happen very quickly (less than a second). The fact that the KM613 clears the force control register when the operation is done can be used by the PLC program to verify operation. However, this is generally not necessary.



Examples of Use with a Modicon PLC

Register Usage

The OptiMate Configuration Editor, OM-WINEDIT, allows you to configure the KM613 to use a block of 8 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 the 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 area of memory. 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 OptiMate panels communicate in two basic ways with a PLC. They either read data from a register or write data to a register.

The KM613 uses a block of 8 contiguous registers. It *reads* data to turn ON and flash lamps, display data, force setpoints and buttons. It *writes* data to the button status register to indicate the status of the pushbuttons and to the setpoint registers to indicate the value of the setpoints.

The middle 5 PLC registers (X+2 thru X+6) in the block used by the KM613 panel are used for numeric information. As such they are ideally suited for the 4x memory registers (40001-40617). Since individual bits are used to indicate control and status, registers X, X+1 and X+7 are better suited for the 0x relay register range of memory. However, the KM613 only communicates with the 4x memory area. The solution to this minor conflict is to define the base register address in 4x memory and place a rung in your PLC program to copy the registers to/from 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.

The examples on the following pages use a KM613 connected to a Modicon PLC. The KM613 is configured for a base address of 40001. **The program rung on the right should be placed in the program to copy a block of relay memory starting at 00033 to the Lamp Control register (X). It also copies the Pushbutton status register (X+1) to a relay block beginning with 00049 and also copies a relay block starting with 00065 to the Force Control register (X+7).**

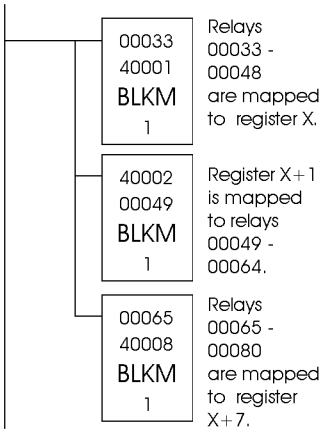
With the rung shown placed into the PLC program, the button status, lamp control bits and force control bits will be relays. The

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	bit	
Register	MSB															LSB		
X	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48		Lamp Control
X+1	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64		Button Status
X+2	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80		Force Register

register association is shown in the figure below.

The table below shows the relay correlation for a KM613 when the data memory registers X, X+1 and X+7 are mapped to/from the 0x relays beginning with 00033 (as shown in the program rung on the bottom).

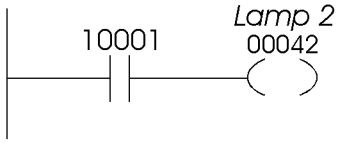
Lamp Control Register (X)		Button Status Register (X+1)		Force Command Register (X+7)	
bit	relay	bit	relay	bit	relay
B1	00048	B1	00064	B1	00080
B2	00047	B2	00063	B2	00079
B3	00046	B3	00062	B3	00078
B4	00045	B4	00061	B4	00077
	00044			F3	00076
L1	00043			F2	00075
L2	00042			F1	00074
	00041				00073
B1F	00040				00072
B2F	00039				00071
B3F	00038			FP1	00070
B4F	00037			FP2	00069
	00036			FP3	00068
L1F	00035			FP4	00067
L2F	00034				00066
	00033			FSP	00065



Operations with Lights & Buttons

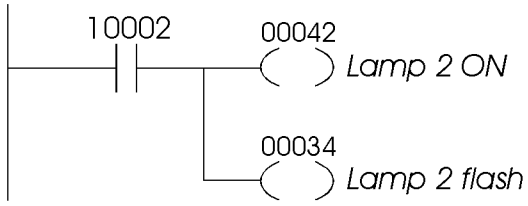
Turning on a Lamp

Turning on a lamp in the KM613 simply requires activating its associated relay coil. In the figure below, Lamp 2 will be turned ON whenever input 10001 is active (energizing 00042).



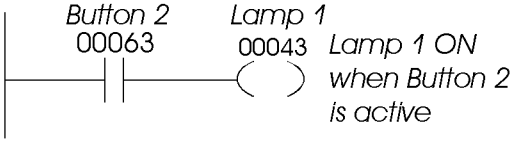
Flashing a Lamp

To flash a lamp, you simply need to turn it on and also set the associated flash bit. The example below shows a Modicon program used to flash Lamp 2 whenever 10002 is energized.



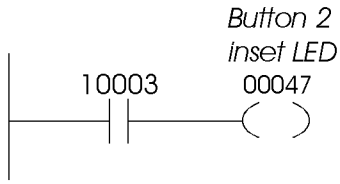
Using a Function Button

The four function buttons will appear as relay coils in your program. The following example turns ON output Lamp 1 when button B2 is active.



Lighting an Inset LED

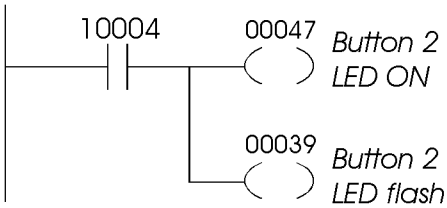
In LED separation mode, the LEDs in the corner of each momentary pushbutton may be directly controlled by the PLC program. The following example shows a segment of a Modicon program that will light Button 2's inset LED whenever input 10003 is energized. *In order for this to work, the panel must be configured for LED separation and Button 2 must be a momentary pushbutton.*



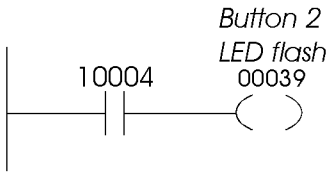
Flashing an Inset LED

To flash an inset LED, you simply need to turn it on and also set the associated flash bit. If the panel is not set up for LED separation, status is simply the button state. For momentary buttons with LED separation enabled, the ON/OFF state is controlled by the PLC as shown in the previous example. For alternate-action buttons, ON/OFF state is always the button state.

The example below shows a Modicon program used to set the LED inset in momentary Button 2 to flash whenever input 10004 is energized.



If the panel has been configured with Button 2 being an alternate-action button, the LED will operate as shown in the example and table below.



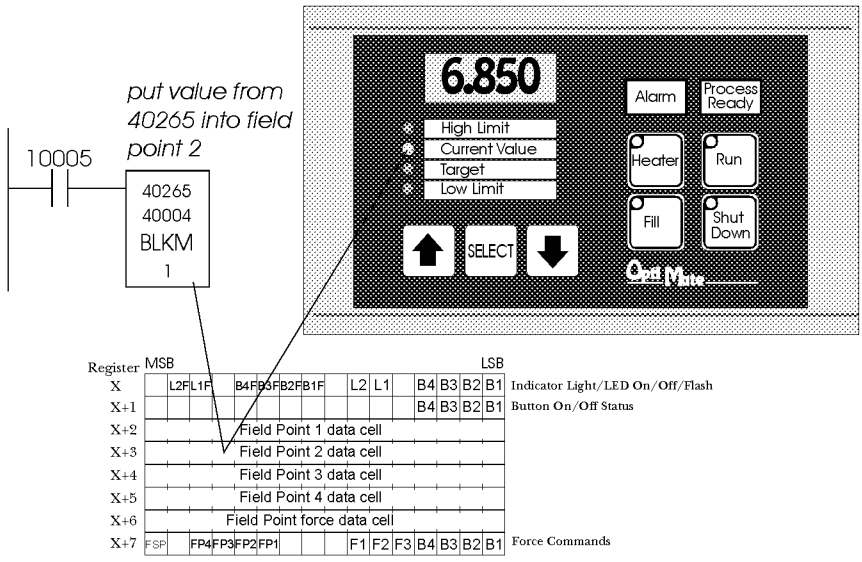
Button State	10004 State	LED operation
Inactive	de-energized	Off
Inactive	energized	Off
Active	de-energized	On solid
Active	energized	Flashing

Setpoint & Display Operations

Displaying Numeric Data

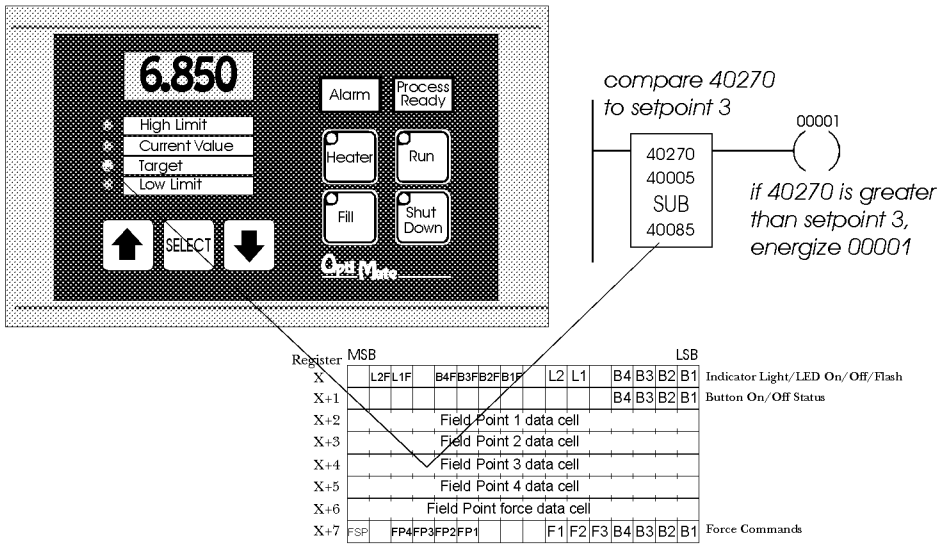
Displaying numeric data in one of the 4 field points is a very simple process. During the initial configuration, make sure you define the point as a display point, not a setpoint. When this is done, the PLC program must simply put data to be displayed into the register associated with the display data field.

The figure on the right illustrates a numeric display application with a Modicon PLC. In this application, the KM613 is configured for a base address of 40001 and field point 2 for display. A value, held in 40265 must be displayed in field point 2 as long as 10005 is active. The example shows the value transferred from 40265 to 40004. It will be displayed as field point 2.



Reading a Setpoint

The following example uses a KM613 at base address 40001. Field point 3 has been configured as a setpoint. In the example program, field point 3 is a Target value setpoint. The program shown on the right checks a value, held in 40270 against setpoint 3. If the value in 40270 exceeds setpoint 3, output 00001 will be turned ON.



Using Force Functions

The KM613 gives you the ability to force alternate buttons to a given state and force setpoints to a given value. This capability may or may not be used on a given application. There are applications when it is desirable to have the PLC program automatically set or clear a button based on operational state. There are also cases when forcing a setpoint to a predetermined value is useful. Obviously, this capability should be used carefully.

The last two registers in the register bank are associated with force operations. Forcing Button Status is detailed below. Forcing Setpoints is described on the next page.

Forcing Button Status

One of the more advanced capabilities of the KM613 panel is the ability to force button state from the PLC program. This may be desirable, for example, if an alternate-action is used to start a function process. When it is pushed and while the function is active, the button will remain ON. You may want the PLC program to clear the button at the end of the function process.

Another example is one of a system that has individual enable or ON/OFF (alternate action) buttons for several different devices. You may also have other buttons (probably momentary) that enable a group of these same devices. You may want your program to force ON the device-enable buttons when the group-enable button is pressed.

There are many other cases where button force capability can be useful in a system.

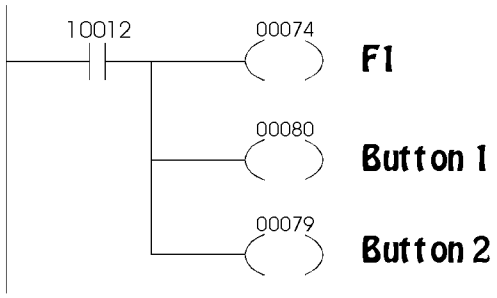
There are three types of force functions available for the KM613 panel - force status, force ON and force OFF. All three functions require moving appropriate data into the PLC registers defined as Force Data & Commands (see the table described in "Use with a PLC").

Note : Force only applies to Alternate-Action pushbuttons

Force Button Status

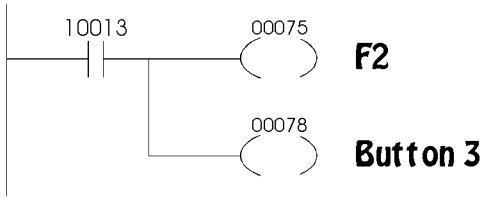
This function is used to set the state (ON or OFF) of every alternate-action pushbutton in the panel. To use the "Force Button Status" function, simply set the F1 bit to 1 and all buttons that you want to be ON to 1. The buttons whose corresponding bits are left at '0' will be forced OFF. The example below shows Buttons 1 and 2 being forced ON and Buttons 3 and 4 forced OFF when input 10012 is active.

The KM613 will automatically clear register X+7 when the force is complete. This will normally happen very quickly (less than a second). The fact that the KM613 clears the force control register when the operation is done can be used by the PLC program to verify operation. However, this is generally not necessary.



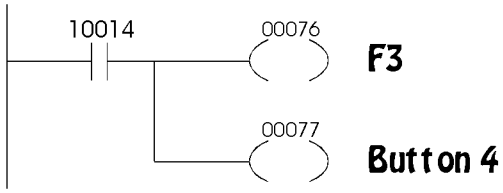
Force Button(s) ON

This function is used to turn individual button(s) ON without affecting the state of any other buttons. To use the "Force Buttons ON" function, set the F2 bit to 1 and all buttons that you want to turn ON to 1. Any buttons associated with bits that are left at '0' will not be affected. The following example shows Button 3 being forced ON when 10013 is active.



Clear Button(s)

This function is used to selectively turn individual button(s) OFF without affecting the state of any other buttons. To use the "Clear Buttons" function, set the F3 bit to 1 and all buttons that you want to turn OFF to 1. Any buttons associated with bits that are left as '0' will not be affected. The example below shows Button 4 being cleared when 10014 is active.



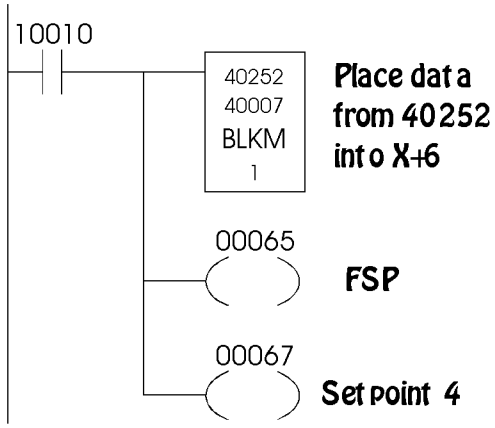
Forcing Setpoints

The KM613 gives you the capability to force a setpoint to a value from the PLC.

To force a setpoint to a value, the value should be placed in register X+6. Next, the force setpoint bit (FSP) and the bit(s) corresponding to the setpoint(s) to force to the value in X+6 must be set in the force control register (X+7). When the KM613 completes the force operation, it will clear the force control register.

The following example shows setpoint 4 being forced to the value contained in register 40252 whenever 10010 is active.

The force command should be written to the force register once. The KM613 will automatically clear this register when the force is complete. This will normally happen very quickly (less than a second). If the program continues to set the FSP bit, the force will continue to happen until the program stops setting that bit. The fact that the KM613 clears the force control register when the operation is done can be used by the PLC program to verify operation. However, this is generally not necessary.



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 module or read data from the module.

The KM613 uses OptiMate Hex protocol for fast and easy communications. The OptiMate Hex protocol is defined in subsequent pages.

Module Address

In a microprocessor based system, each module must have its own unique address. You define this address (between 0 and 30) during configuration. The module will respond to the host only if it is properly addressed.

Communications Protocol

To use an OptiMate module as a slave device in a microprocessor-based system, the module must be configured for 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 module.

The KM613 protocol for computer based operation is the OptiMate Hex protocol.

Computer-Based Operation

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

The details of the messages involved are covered in the protocol documentation on the following pages.

KM613 OptiMate Hex Protocol

General Format

STX Module function ftn_data checksum
address

where Module address = 0 to 30
Function = 0xA0 ; General status/control
= 0xA2 ; Force Buttons
= 0xA8 ; Read setpoint
= 0xA9 ; Write display point
= 0xAA ; Force setpoint
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 no spaces between message fields

General status/control

STX Module 0xA0 lite_on lite_flash checksum
address

where lite_on = Corresponds to Light Bars and LEDs inset in buttons. On/off state. If flash not set, on will cause On solid. If not on (0), lamp will be off regardless of flash bit.
bit 0 : button LED 1 bit 1 : Button LED 2
bit 2 : button LED 3 bit 3 : button LED 4
bit 5 : Light bar 1 bit 6 : Light bar 2
lite_flash = Flash bits for Light Bars and LEDs inset in buttons
bit 0 : button LED 1 bit 1 : button LED 2
bit 2 : button LED 3 bit 3 : button LE4 2
bit 5 : Light bar 1 bit 5 : Light bar 2

Response

STX pb_stat checksum if message received and processed OK
where pb_stat = pushbutton status
bits 0 - 3 = Button status for function buttons 1 - 4 respectively (1 = button active, 0 = button inactive)
or
NAK if any errors in message

Force Buttons message

STX Module 0xA2 flags pb_ctl checksum
address

where flags = bit 7 - All buttons forced to following data
bit 6 - Set the following selected buttons states on
bit 5 - Clear the following selected buttons
pb_ctl = bits 0-3 - Corresponds to buttons. LSB corresponds to button 1, etc. For force state command, Identifies required button states of all 4 buttons. For Set or Clear commands, identifies the Buttons to set or clear.

Response

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

Read Setpoint Data

STX Module 0xA8 setpt_no checksum
address

where setpt_no = number (0-3) of setpoint data to returned. Numbered 0 - 3 from top to bottom.

Response

STX data_MSB data_LSB checksum if message received and processed OK
where data_MSB, data_LSB = data in integer format, MSB first

or

NAK if any errors in message

Write Display Point

STX Module address 0xA9 displaypt_no data_MSB data_LSB checksum

where displaypt_no = 0 - 3 corresponding to field points in module. Points are numbered 0-3 from top to bottom.
data_MSB, data_LSB = data in integer format, MSB first.

Response

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

Force Setpoint

STX Module address 0xAA setpt_no data_MSB data_LSB checksum

where setpt_no = number (0-3) of setpoint data to returned. Numbered 0 - 3 from top to bottom.
data_MSB, data_LSB = data in integer format, MSB first.

Response

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

Broadcast message (sent to all modules, no response)

STX Broadcast address function

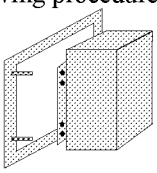
where Broadcast address = 99
function = 0 ; Synchronize lamp flash timing

Set Up and Interconnect

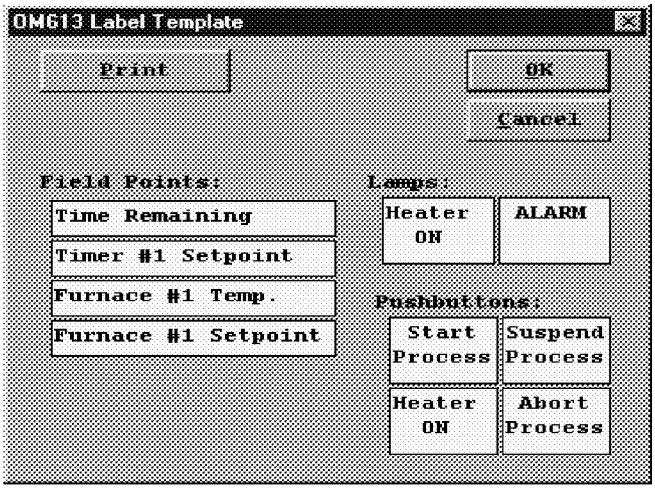
Legending the Lamps and Function Keys

Legending the KM613 module is a relatively simple process that basically involves sliding legend transparencies into pockets in the panel overlay. Use the following procedure.

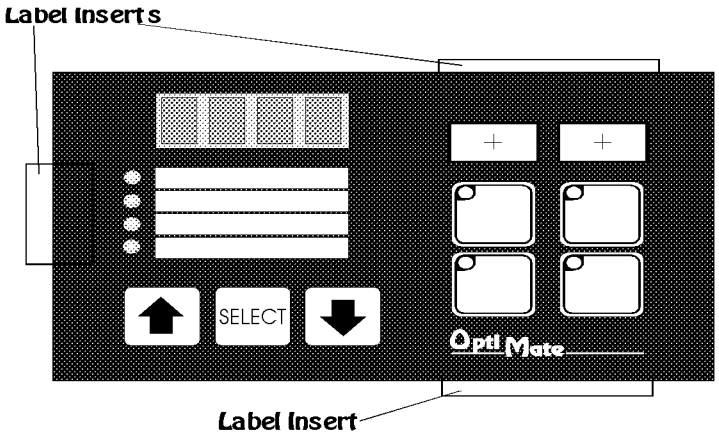
- Remove the bezel from the module. The bezel snaps to the module box along the top and bottom edges. Pull the bezel out and over the snaps to remove.



- 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 onto paper and photocopy onto the transparency. The figure below is a screen from OM-WINEDIT which illustrates the process.



  - > Use 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 or lettering machine 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.

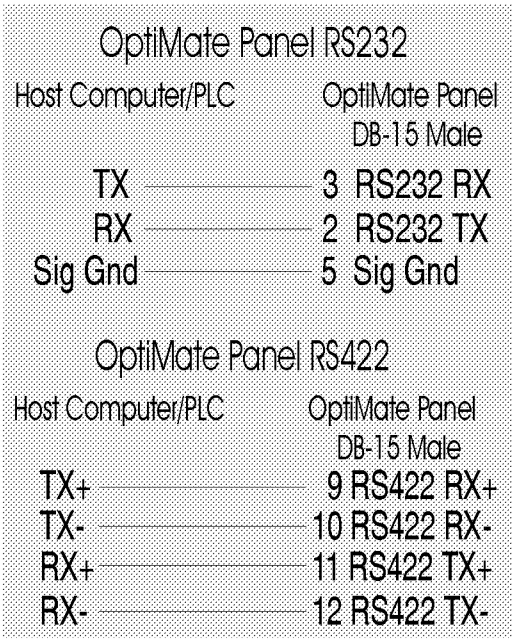
Connection to the System

OptiMate modules are designed for communications connection to system devices. The KM613 can be connected to a computer or PLC over the serial port (RS232 or RS422).

Connection to a Computer or PLC

Connection of an OptiMate module to a computer or PLC can be accomplished over either an RS232 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.

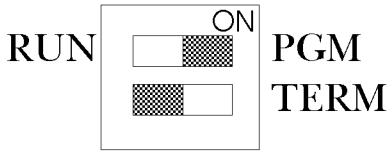
Refer to manufacturer's documentation for PLC or computer serial link connector pinouts. See the figure below for RS232 and RS422 pinouts for OptiMate modules.



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

Termination

The termination DIP switch on the back of the panel switches on a terminating resistor. **This terminating resistor does not apply to an RS232 connection, therefore, it should be in the OFF position for RS232.** In an RS422 connected system, the termination DIP switch should be ***ON*** *in the last, and only the last*, panel on the cable.



Power

The KM613 panel will operate on any DC voltage between 8 and 30VDC. Power must be connected to the terminal plug located on the back of the module. Pin 1 of the plug is the 8-30VDC (+) terminal and pin 2 is the 0VDC (-) terminal. Steady state current is listed on the specification page.

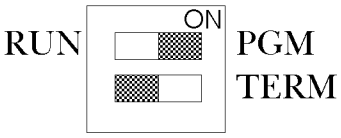
There is a very brief (0.5 - 2 millisecond) power on surge up to 1.5 amps. This is typical of nearly any type of electronic equipment and is due to the initial charging of power capacitors. This surge is not normally a problem for a commercial power supply.

Configuration

Configuration of the KM613 operator panel is performed via an IBM PC compatible computer. The OM-WINEDIT configuration software that will allow you to select panel type, panel application, system configuration and PLC protocol definition.

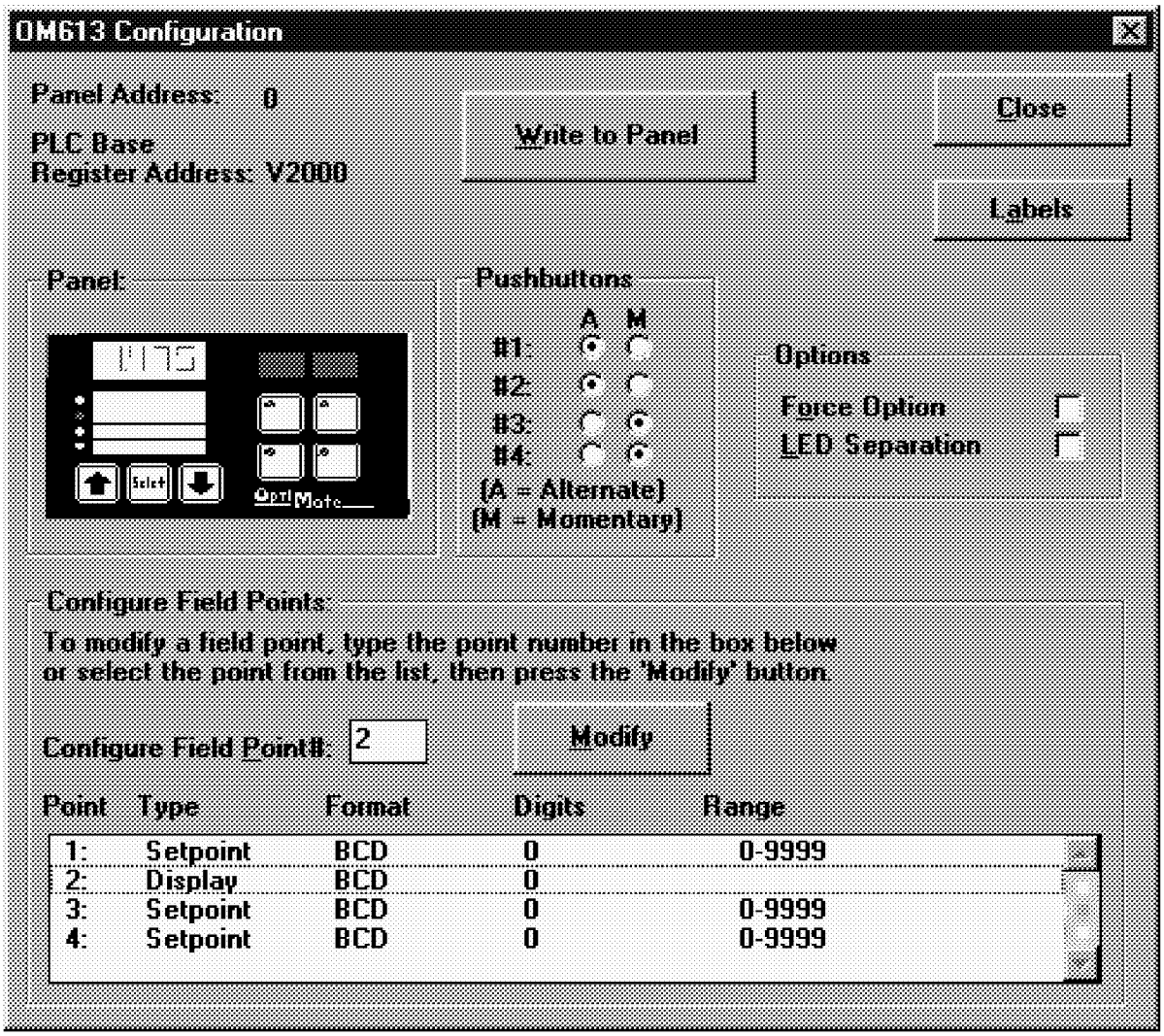
If the KM613 is to be operated stand alone with a PLC, the configuration selection must be made to select the proper PLC protocol information.

Note : When configuring, always remember to set the "RUN/PGM" DIP switch on the back of the panel to "PGM" (towards the "ON"). When you are finished downloading, wait about 5 seconds before switching the DIP switch back to the "RUN" position. The switch



has to be in the "RUN" position before it will operate with the selected host.

Specific configuration of the KM613 begins with defining the block of 8 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 field points must be configured for setpoint or display. Additional options exist for setpoint range limits, LED separation (or not), and force enable/disable.



Configuration Selections

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

For the KM613 module, the following are important configuration parameters.

Computer-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. After configuration, multiple modules can be connected together to form a system.
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
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
Field Points	Define as setpoints or display points as required. Define number format in PLC (binary or BCD) For setpoints, define limits.
LED separation	If the LEDs inset in the momentary pushbuttons are to be controlled by the PLC program, rather than reflect button state, enable. Otherwise, disable.
Force option	If you intend to force button states of setpoint values, enable the force option.

Single Panel PLC-Based Systems

Decision	Selection
Single/ Multi Module	Choose single module configuration
Configuration starting point	First-time configuration start with defaults for module. 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
Field Points	Define as setpoints or display points as required. Define number format in PLC (binary or BCD) For setpoints, define limits.
LED separation	If the LEDs inset in the momentary pushbuttons are to be controlled by the PLC program, rather than reflect button state, enable. Otherwise, disable.
Force option	If you intend to force button states of setpoint values, enable the force option.

Multi Panel PLC Applications (Uses Communications Master...Not available with Keyence)

Decision	Selection
Single/Multi Module	Choose Multi panel
PLC Type	This applies to the Communications master. Choose appropriate type
Address	Each panel must have a unique address.
Protocol	This applies to the 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.
Module Protocol	Choose OptiMate Hex
Buttons	Select momentary or alternate action as required for your application
Messages	Define messages as required for your application.
LED separation	If the LEDs inset in the momentary pushbuttons are to be controlled by the PLC program, rather than reflect button state, enable. Otherwise, disable.
Force option	If you intend to force button states of setpoint values, enable the force option.

The configuration must be downloaded from an IBM PC compatible computer to each module. This is done over the serial link. The "PGM/RUN" DIP switch on the back of the KM613 must be selected for "PGM." After the download is complete, wait at least five seconds before changing the DIP switch to "RUN." The DIP switch must be in the "RUN" position for the module to operate with the selected host. Various communication cables are available from Optimation.

Configuration using a Keyence PLC

The KM613 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 KM613 should always be set to the following:

KM613 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 KM613. If you try to connect the panel to the KV300 CPU's communications 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 KM613 with the parameters shown in the table above.

Communication through the KV-L2

The KM613 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.

If you are using a KV-L2, the following dip switch parameters 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 KM613 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.

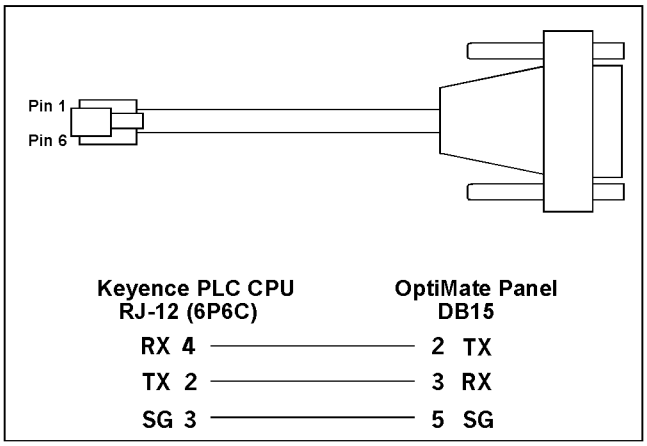
The KM613 uses the KV Mode protocol to communicate with Keyence PLCs. Regardless of the "B" dip switch settings, the port that the panel is connected to will automatically default to the communication parameters shown in the table above.

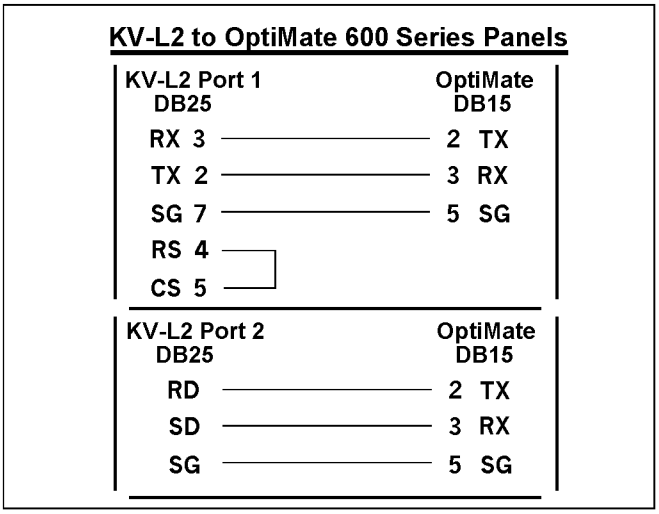
If using Port 2, ensure that the port switch is set either for RS232 or RS422, depending on the cable that you are using. If using RS232, always have the terminator dip switch OFF on both the KV-L2 and on the KM613 panel.

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

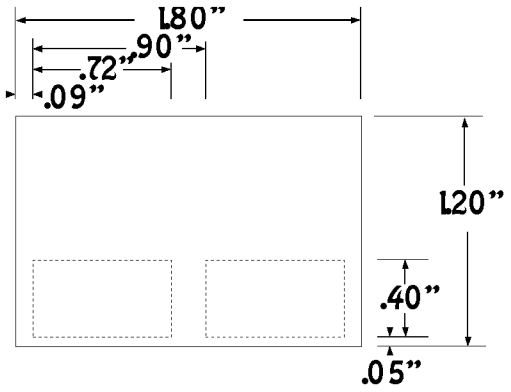
The figure below shows the pinouts to connect a KM613 to a Keyence PLC CPU. This cable is available from Optimation.

The figure below shows the pinouts to connect a KM613 to a KV-L2 Serial Interface Module. The pinouts shown are for RS232.

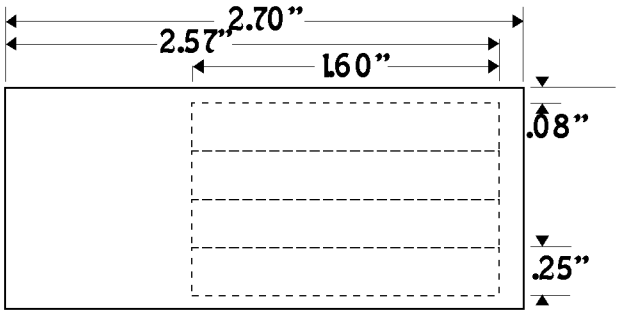




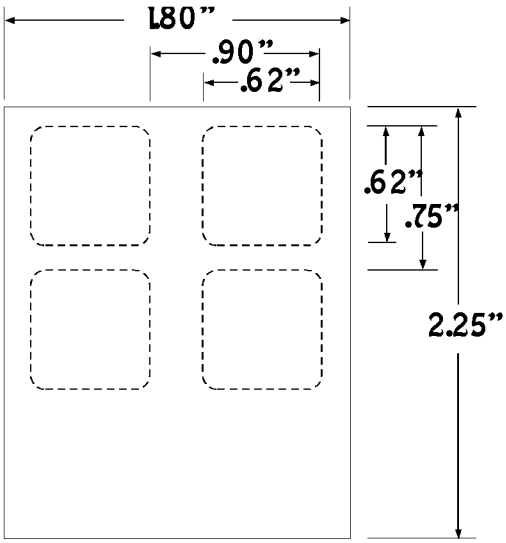
Label Templates



Lamp Label Insert Template



Field Point Label Insert Template

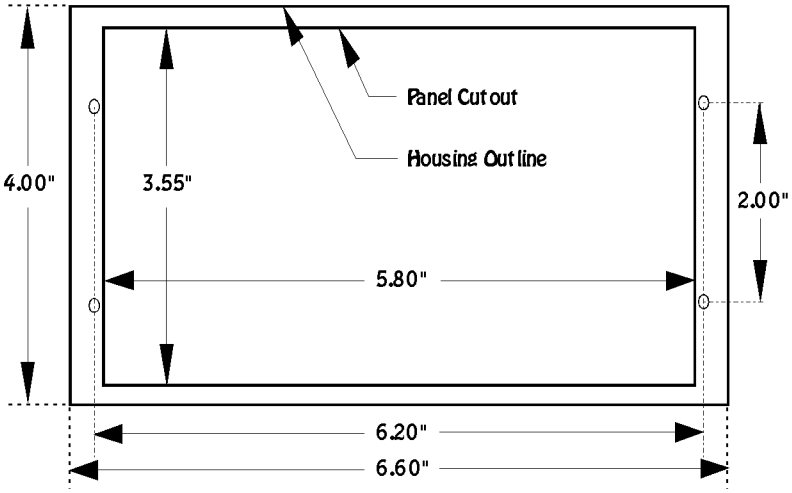


Pushbutton Label Insert Template

Specifications

Physical

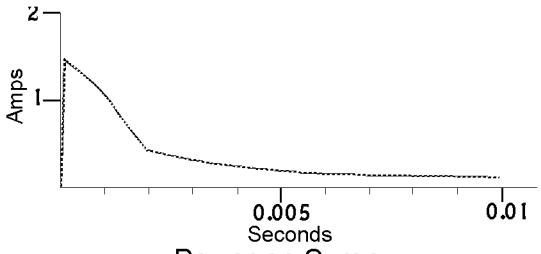
- Recessed Mount Housing: 6.6"L x 4.0"H x 1.25"D
- Cutout size for above: 3.55"Hx5.80"L
- Panel Fasteners : Four, 6x32 threaded studs, shown above (on ends, symmetrical about center line)
- Weight : 10 ounces
- Colors : Dark gray housing with dark gray panel. Keypad keys; white with gray letters. Function keys ; White with user supplied label.
- Numeric LED height : 0.35 inch
- Pushbutton life : 1,000,000 switch cycles
- Lamp Colors : Red, Green
- Lamp window size : 0.7" x 0.4"



Panel Mounting Dimensions

Electrical

- Power (all lamps on) : 8 - 30VDC @ 2.2Watts
  180 mA @ 12VDC 90 mA @ 24VDC
- Power On Surge (see figure below)
  1.5 A for 2 milliseconds maximum



Power on Surge

Power connector : Pluggable terminal block, 2 position

Environmental

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

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 light bars and LEDs will flash rapidly.