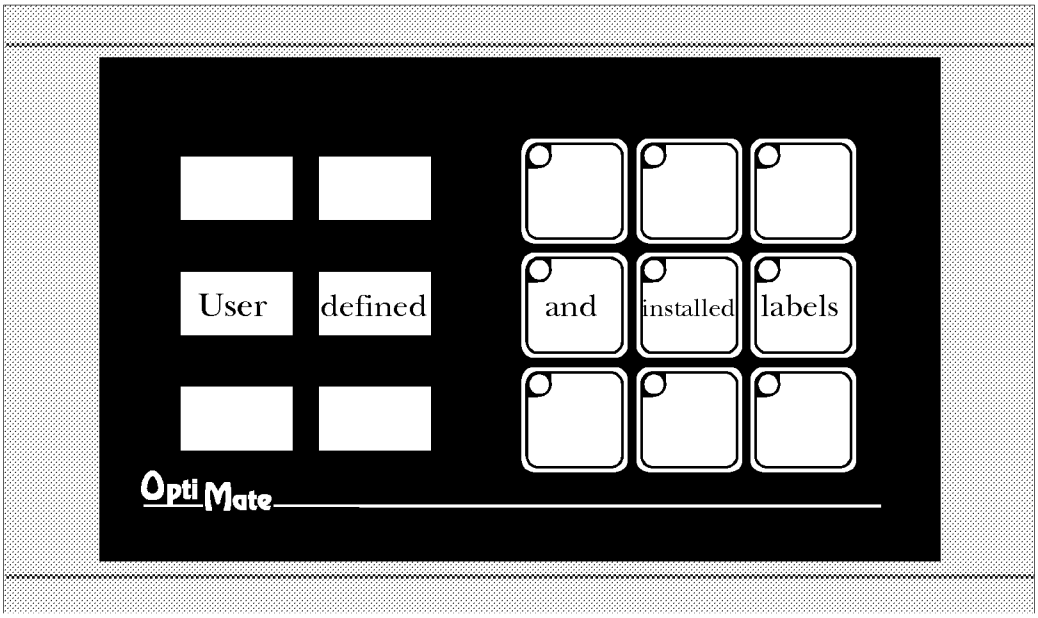


KM609 Combination Panel

General Overview

The KM609 Combination Panel features 6 high intensity LED light bars and 9 pushbuttons. Each of the lamps can be individually controlled to be on, off, or flash. Each of the pushbuttons can be individually configured to operate as either a momentary or alternate action pushbutton.

Lamps and pushbuttons can be custom labeled by the user with plastic inserts. The inserts can be legended with text and/or graphics, and slipped into protective pockets behind the faceplate.

The KM609 Lamp/Pushbutton Panel 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 modules can be used individually, or together with any combination of other OptiMate modules.

When used with a microprocessor system, simple communications over either an RS232 or RS422 communications cable allow the microprocessor to directly read the state of each button and control each lamp.

When used with a PLC, operation is transparent to the user. Lamps and buttons appear in the PLC ladder logic as coils and contacts. The KM609 takes care of the rest.

Applications

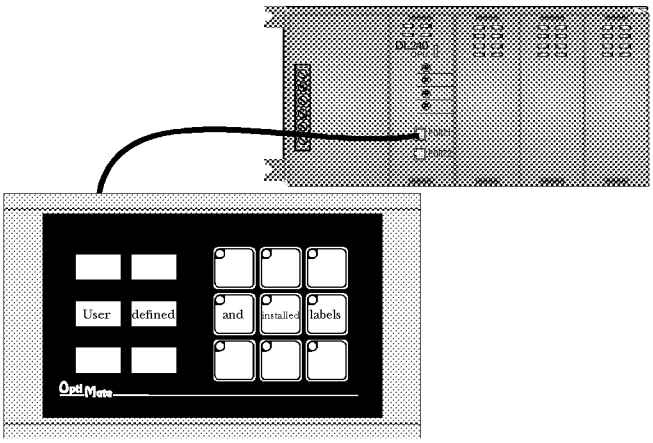
- Machine control
- Process control
- Security systems
- HVAC
- Plant monitoring/control
- PLC applications
- Microprocessor applications

Features

- 6 Plug-In LED Light Bars
- 9 tactile-snap membrane pushbuttons
- Independently configurable for momentary or alternate action
- User legendable
- PLC compatible
- RS232/RS422 communications
- Stand alone operation capable
- Multimodule operation capable

Contents

Configuration Options

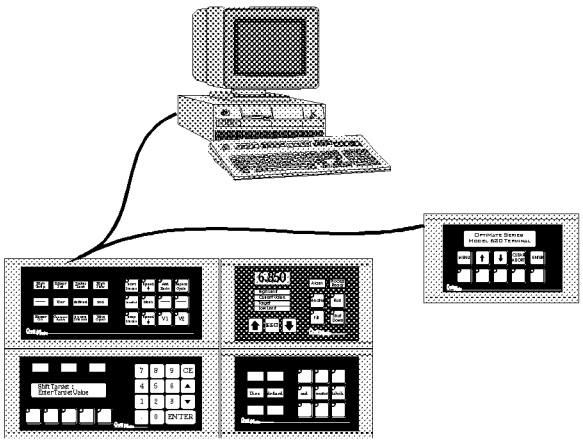


PLC Stand Alone

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

The KM609 Lamp/Pushbutton module uses a bank of four PLC registers to hold pushbutton state, control lights and force pushbutton states. The KM609 continuously communicates with the PLC registers and updates lamp operation and button status 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 communication most major PLC protocols. Configuration for particular PLC protocols and interconnect cabling is covered in the following pages.



Microprocessor-Based Systems

OptiMate modules can interface directly to most computers or microcontrollers. The modules communicate over either RS422 or RS232 serial communications. All that is required to interface OptiMate modules is a serial port. The OptiMate Hex communications protocol, detailed in this document, allows the user to directly control lamp operation and access pushbutton status.

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

In a microprocessor based system, the host microprocessor is the system master. The OptiMate modules are slave devices that respond to commands from the host. In the case of the KM609, these commands are requests for pushbutton status and messages that dictate lamps states.

Communications over RS422 allows placement of modules anywhere within a 4000 foot cable distance. Modules can be grouped together to form a panel. I/O modules can be placed near sensors and actuators. Modules can be grouped in several clusters all on the same communications cable.

Use with a PLC

Memory Mapping

Memory mapping is a technique that "maps" the memory of an OptiMate module into the holding 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 by for 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.

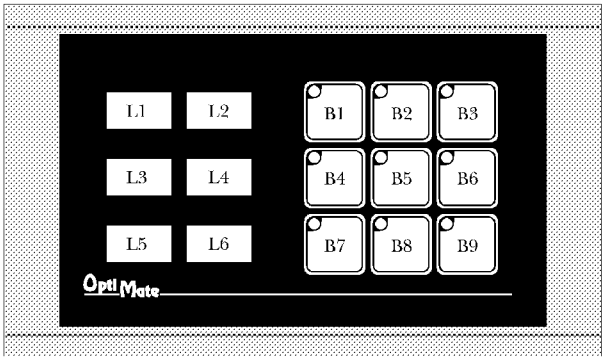
MSB															LSB
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

PLC Register

The KM609 Lamp/Pushbutton Module uses a bank of 4 contiguous holding registers. The register set definition is shown in the table below.

KM609 Lamp/Pushbutton Panel PLC Register Map

Holding Register	Register Function
X (first register of bank)	Indicator lamps and button LEDs on/off control
X+1	Indicator lamps and button LEDs flash control
X+2	Button on/off status
X+3	Force pushbutton data & commands



Configuration

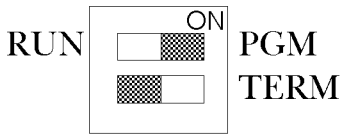
Configuration of the KM609 or system of OptiMate panels is performed via an IBM PC compatible computer. The OM-WINEDIT configuration software will allow you to select module configuration, system configuration and PLC protocol definition.

If the panel is to be operated in stand alone mode, with a PLC, the configuration selections must be made to select the proper PLC protocol information.

If the panel is part of a multi-panel system, the configuration editor will automatically set up communications between the OM9001 and the panel via OptiMate Hex. The OM9001 Communications Master will talk to the module over this protocol and to the PLC over the PLC protocol you select.

Note: OM9001 applications are not available with Keyence PLCs.

Note : When configuring, always remember to set the Run/Pgm DIP switch to PGM (towards the "ON") before applying power to the module.



When you are finished downloading configuration, power down the panel and switch to the "Run" position before connecting to the PLC.

Further configuration details are covered in the OM-WINEDIT help screens.

Register	MSB															LSB	
X	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED On/Off
X+1	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED Flash Control
X+2								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
X+3	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

Register Bit Association

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 figure below. The panel will automatically place status into this register. A 1 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 a Lamp

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 pushbutton simply provides a visual indication of the status of the pushbutton. However, if a module is configured for LED separation mode, the 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 illuminate 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.

Force Commands

If the KM609 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 pushbutton panel. For example, consider a situation where an operator initiates a control process by pressing an alternate action panel button. The button status and inset LED 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 data registers (x+3). Once these buttons are forced to the status set, the KM609 will automatically clear F1.
F2 (Force buttons on)	When the F2 bit is set, all buttons matching the bits set in the force data registers (x+3) will be forced on. Once these buttons are forced on, the KM609 will automatically clear F2.
F3 (Clear buttons)	When the F3 bit is set, all buttons matching the bits set in the force data registers (x+3) will be forced off. Once these buttons are forced off, the KM609 will automatically clear F3.

Force applies only to alternate action pushbuttons.

Register	MSB															LSB	
X	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED On/Off
X+1	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED Flash Control
X+2								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
X+3	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

Register Bit Association

Examples of Use with a Keyence PLC

Register Usage

The OptiMate Configuration Editor, OM-WINEDIT, allows you to configure the KM609 to use a block of 4 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 KM609 uses a block of 4 contiguous registers. It *reads* data to turn on lamps, flash them and to force buttons. It *writes* data to the button status register to indicate the status of the pushbuttons. Since individual bits are used to indicate control and status, these registers are better suited for the internal relay register range of memory. However, the KM609 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.

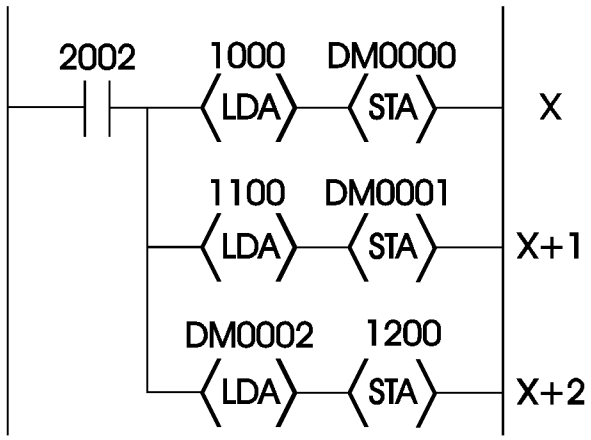
Keyence CPU	Control Relay Register address range
KV10/16	1000-1915
KV24/40/80	1000-1915, 3000-6915
KV300	1000-1915, 3000-6915

The program rung on the right should be placed in the program to copy the Indicator Lamp/LED ON/OFF control register (X) and the Indicator Lamp/LED Flash control register (X+1) from the internal relays, 1000 and 1100, to their corresponding data memory registers, DM0000 and DM0001, respectively. It will also copy the Pushbutton status register (X+2) from the data memory register to its corresponding internal relay memory register, 1200. The internal relay 2002 is ALWAYS ON, therefore it should be placed in the rung so that the memory map will occur every scan.

The table below shows the internal relay correlation for a KM609 when the data memory registers X through X+2 are mapped to/from the internal relays beginning with 1000 (as shown in the program rung on the bottom).

Device	Lamp/LED On/Off (X)	Lamp/LED Flash (X+1)	Button Status (X+2)
B1	1000	1100	1200
B2	1001	1101	1201
B3	1002	1102	1202
B4	1003	1103	1203
B5	1004	1104	1204
B6	1005	1105	1205
B7	1006	1106	1206
B8	1007	1107	1207
B9	1008	1108	1208
L1	1010	1110	
L2	1011	1111	
L3	1012	1112	
L4	1013	1113	
L5	1014	1114	
L6	1015	1115	

KM609 Memory Map

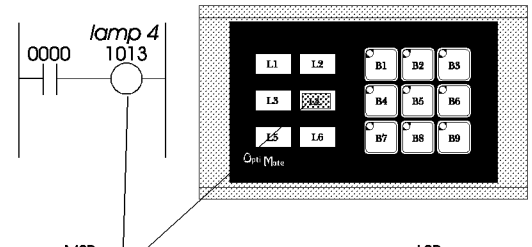


Program Examples

The following examples are KV10/24/40/80/300 programs with the KM609 configured for address DM0000. Also, assume that the memory mapping rung shown on the previous page is at the top of the program.

Turning on a Lamp

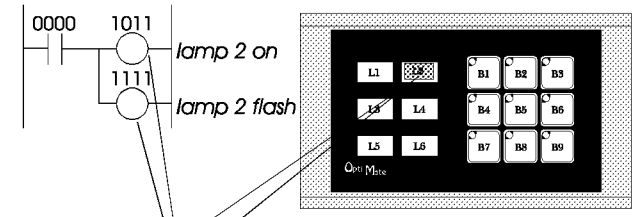
Turning on a lamp in the KM609 simply requires activating its associated internal relay coil. In the figure on the right, lamp 4 will be turned on whenever input 0000 is active (energizing 1013).



Register	MSB															LSB	
DM0000	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED On/Off Status
DM0001	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED Flash Control
DM0002								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
DM0003	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

Flashing a Lamp

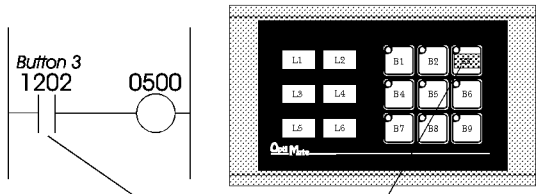
To flash a lamp, you simply need to turn it on and also set the associated flash bit. The example on the right shows a PLC program used to flash lamp 2 whenever 0000 is energized.



Register	MSB															LSB	
DM0000	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED On/Off Status
DM0001	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED Flash Control
DM0002								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
DM0003	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

Using a Pushbutton

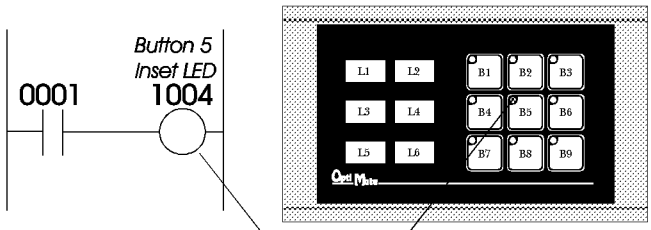
The following example illustrates the use of a KM609 pushbutton in a program. When pushbutton 3 is activated, 1202 will become active (due to the memory map on the previous page) and will turn on output 0500.



Register	MSB															LSB	
DM0000	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED On/Off Status
DM0001	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED Flash Control
DM0002								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
DM0003	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

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 example on the right shows a segment of a program that will light button 5's inset LED whenever input 0001 is energized. *In order for this to work, the panel must be configured for LED separation and button 5 must be a momentary pushbutton.*

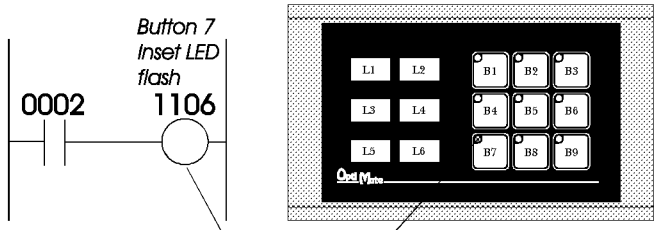


Register	MSB															LSB	
DM0000	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED On/Off Status
DM0001	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED Flash Control
DM0002								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
DM0003	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

Flashing an Inset LED

To flash an inset LED, you simply need to turn it on and set also the associated flash bit. If the panel is not set up for LED separation, 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 on the right shows a program used to set the LED inset in button 7 to flash whenever 0002 is energized. If the panel has been configured with button 7 being an alternate-action button, the LED will operate as shown in the table below.



Register	MSB															LSB	
DM0000	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED On/Off Status
DM0001	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED Flash Control
DM0002								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
DM0003	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

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

Forcing Button Status

One of the more advanced capabilities of the KM609 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 a system that has individual enable or on/off (alternate action) buttons for several different devices. You may also have other buttons (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.

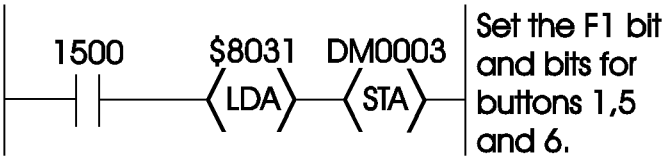
There are many other cases where button force capability can be useful in a system.

There are three types of force functions available for the KM609 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 below).

Note : Force only applies to Alternate-Action pushbuttons

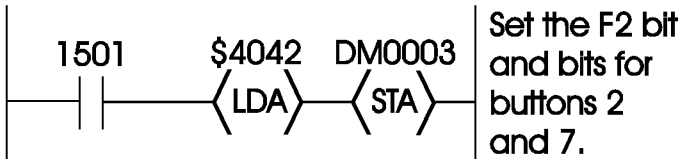
Force Button Status

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. Any buttons associated with bits that are left at '0' will be forced off. The example below shows buttons 1,5, and 6 being forced on and all other buttons forced off when 1500 is active.



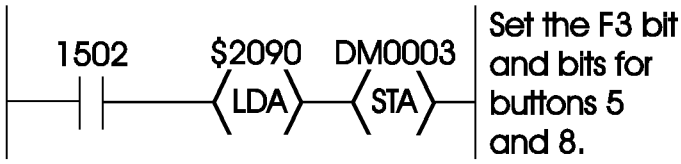
Force Button(s) On

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 2 and 7 being forced on when 1501 is active.



Force Button(s) Off

This function is used to selectively turn individual button(s) off without affecting the state of any other buttons. To use the "Force Buttons Off" 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 buttons 5 and 8 being cleared when 1502 is active.



Register	MSB															LSB	
X	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED On/Off
X+1	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED Flash Control
X+2								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
X+3	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

Register Bit Association

Examples of Use with a Modicon PLC

Register Usage

The OptiMate Configuration Editor, OM-WINEDIT, allows you to configure the KM609 to use a block of 4 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 OptiMate panels communicate in two basic ways with a PLC. They either read data from a register or write data to a register.

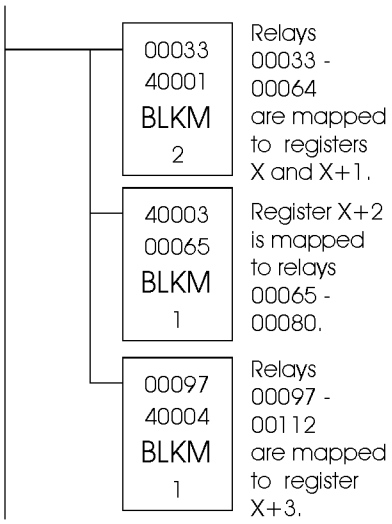
The KM609 uses a block of 4 contiguous registers. It *reads* data to turn on lamps, flash them and to force buttons. It *writes* data to the button status register to indicate the status of the pushbuttons. Since individual bits are used to indicate control and status, these registers are better suited for the internal relay register range of memory. In the following examples, we will use the 0x area relay memory. However, the KM609 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/from 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.

The program rung on the right should be placed in the program to copy the Indicator Lamp/LED ON/OFF control register (X), the Indicator Lamp/LED Flash control register (X+1) and the Pushbutton Force register (X+3) from the relay blocks starting at 00033, 00049 and 00097 to their corresponding data memory registers. It will also copy the Pushbutton status register (X+2) from the 4x memory register to its corresponding relay register, beginning at 00065.

The table below shows the relay correlation for a KM609 when the data memory registers X through X+3 are mapped to/from the 0x relays beginning with 00033 (as shown in the program rung on the bottom).

Device	Lamp/LED On/Off (X)	Lamp/LED Flash (X+1)	Button Status (X+2)	Force Buttons (X+3)
B1	00048	00064	00080	00112
B2	00047	00063	00079	00111
B3	00046	00062	00078	00110
B4	00045	00061	00077	00109
B5	00044	00060	00076	00108
B6	00043	00059	00075	00107
B7	00042	00058	00074	00106
B8	00041	00057	00073	00105
B9	00040	00056	00072	00104
L1	00038	00054		
L2	00037	00053		
L3	00036	00052		
L4	00035	00051		00099 (F3)
L5	00034	00050		00098 (F2)
L6	00033	00049		00097 (F1)

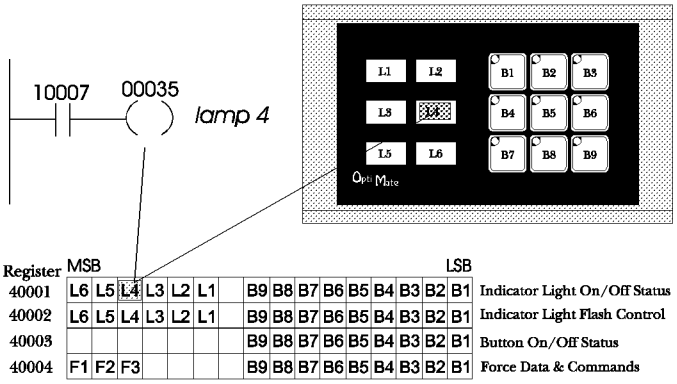


Program Examples

The following examples are Modicon program examples with the KM609 configured for address 40001. Also, assume that the memory mapping rung shown on the previous page is at the top of the program.

Turning on a Lamp

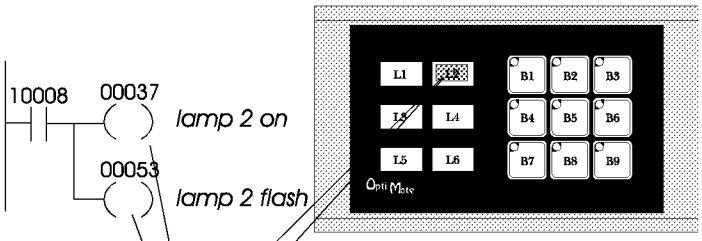
Turning on a lamp in the KM609 simply requires activating its associated relay coil. In the figure on the right, lamp 4 will be turned on whenever input 10007 is active (energizing 00035).



Register	MSB														LSB	
40001	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light On/Off Status
40002	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light Flash Control
40003								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
40004	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

Flashing a Lamp

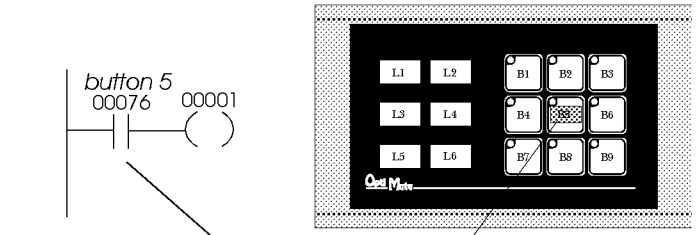
To flash a lamp, you need to turn it on and also set the associated flash bit. The example on the right shows a Modicon PLC program used to flash lamp 2 whenever 10008 is energized.



Register	MSB														LSB	
40001	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light On/Off Status
40002	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light Flash Control
40003								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
40004	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

Using a Pushbutton

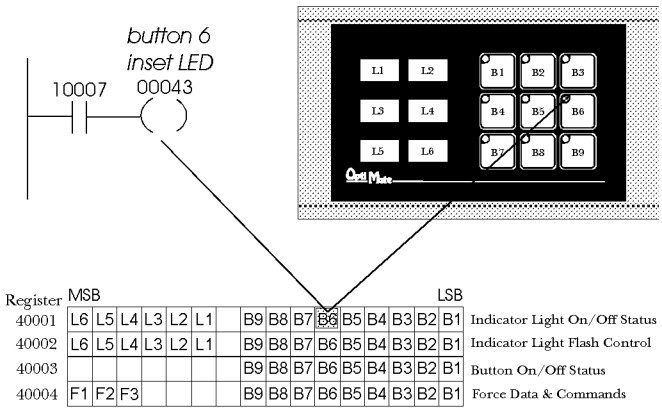
The example on the right illustrates the use of a KM609 with a Modicon PLC. When button 5 is activated, 00076 will become active (due to the memory mapping rung on the previous page) and turn on output 00001.



Register	MSB														LSB	
40001	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light On/Off Status
40002	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light Flash Control
40003								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
40004	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

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 example on the right shows a segment of a Modicon program that will light button 6's inset LED whenever input 10007 is energized. *In order for this to work, the panel must be configured for LED separation and button 6 must be a momentary pushbutton.*



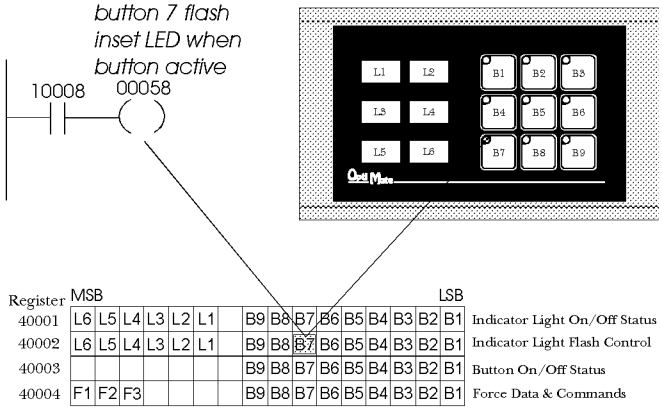
Register	MSB															LSB	
40001	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light On/Off Status
40002	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light Flash Control
40003								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
40004	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

Flashing an Inset LED

To flash an inset LED, you 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 on the right shows a Modicon program used to set the LED inset in button 7 to flash whenever 10008 is energized. If the panel has been configured with button 7 being an alternate-action button, the LED will operate as shown in the table below.

Button State	10008 State	LED operation
Inactive	de-energized	Off
Inactive	energized	Off
Active	de-energized	On solid
Active	energized	Flashing



Register	MSB															LSB	
40001	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light On/Off Status
40002	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light Flash Control
40003								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
40004	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

Forcing Button Status

One of the more advanced capabilities of the KM609 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.

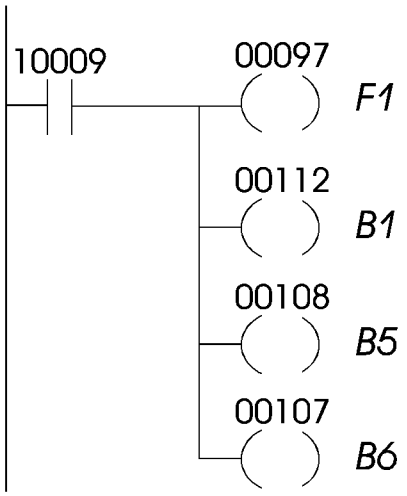
There are many other cases where button force capability can be useful in a system.

There are three types of force functions available for the KM609 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 below).

Note : Force only applies to Alternate-Action pushbuttons

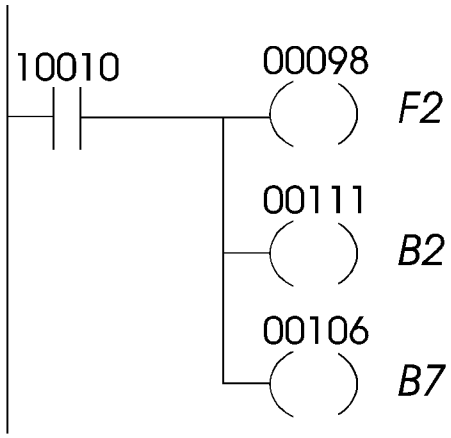
Force Button Status

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. Any buttons associated with bits that are left at '0' will be forced off. The example below shows buttons 1, 5 and 6 being forced on and all other buttons forced off when 10009 is active.



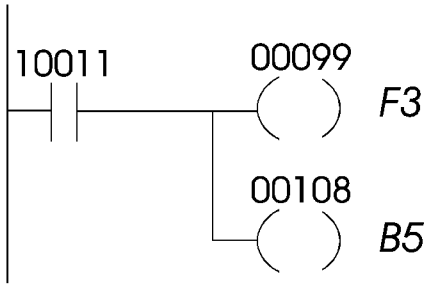
Force Button(s) On

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 2 and 7 being forced on when 10010 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 5 being cleared when 10011 is active.



Register	MSB															LSB	
X	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED On/Off
X+1	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED Flash Control
X+2								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
X+3	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

Register Bit Association

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.

Communication with a computer-based system (anything with a serial port that can be used as a master), is by use of the OptiMate Hex protocol. This protocol, shown below, is very straight forward and easy to use.

Module Address

The module address is done via the OM-WINEDIT configuration software. See the Addressing description in the "Configuration" section of this manual.

Configuration

Each of the 9 pushbuttons can be independently configured for either momentary or alternate-action operation. A momentary button is on or active only while it is being pressed. An alternate action button changes state each time it is pressed.

A second configuration option in a microprocessor-based system is whether the inset LEDs are directly linked to pushbutton state or are separated. In LED separation mode, the on/off state of LEDs inset into momentary pushbuttons can be controlled via messages from the host computer. Normally LED separation in not used.

Flash capability is always available in computer based systems. Remember that in order to flash, the LED must be on. This means for normal (non-LED separation) operation, the button must be active to flash. For LED separation mode, flashing an LED entails turning it on and setting the flash bit.

Communications Protocols

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 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.

OptiMate Hex Protocol

General Format

STX Module address function text checksum

where Module address = 0 to 30
Function = 0xA0 ; General Status/Control
= 0xA2 ; Force buttons
checksum = 8 bit sum of all characters after address until checksum

For function type A0 : General Status/Control

STX Module address ftn led1_8 lites |—— on —–| led1_8 lites |— flash —–| checksum

where Module address = 0 to 30
ftn = 0xA0 ; Write LED states
led1_8 = LEDs inset in buttons, in numeric order
lites = bit 0; button 9 lite, bits 2 - 7 correspond to LED light bars 1 - 6, in numeric order
on = Light or LED on/off state. For insert PB LEDs, applies only if configured for LED separation. If flash not set, on will cause on solid. If not on (0), LED will be off regardless of flash bit.
flash = Flash .5 sec on, .25 sec off (must be on for flash)

Response

STX pb1_8 pb9_stat checksum if message received and processed OK
or
NAK if any errors in message
where pbx_x = Corresponds to buttons. LSB of data character corresponds to lowest numbered button. Bits are in sequence left to right, top to bottom.
1 = Button active
0 = Button not active

For function type A2 : Force Buttons

STX Module address ftn flags pb1_8 pb9_12 checksum

where Module address = 0 to 30
ftn = 0xA2 ; Force buttons
flags = bit 7 - Force all buttons to the following status
bit 6 - Or all buttons with the following status
bit 5 - Clear all buttons selected in the following character
pbx_x = Corresponds to buttons. LSB of data corresponds to lowest numbered button. Bits are in sequence left to right, top to bottom.

Response

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

Broadcast message (sent to all modules)

Synchronize lamp flashing (between all system modules that have flashing lamps or LEDs)

STX Broadcast address function checksum

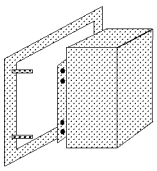
where broadcast address = 99
function = 0

Set Up and Interconnect

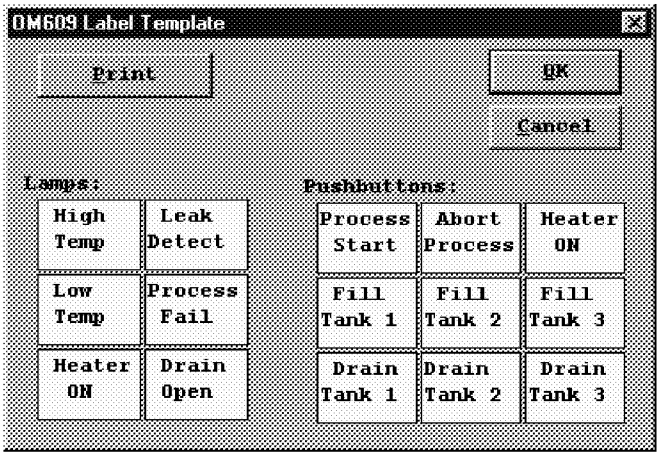
Legending the Lamps and Buttons

Legending the KM609 module is a relatively simple process that basically involves sliding legend transparencies into a pocket in the panel overlay. Use the following procedure.

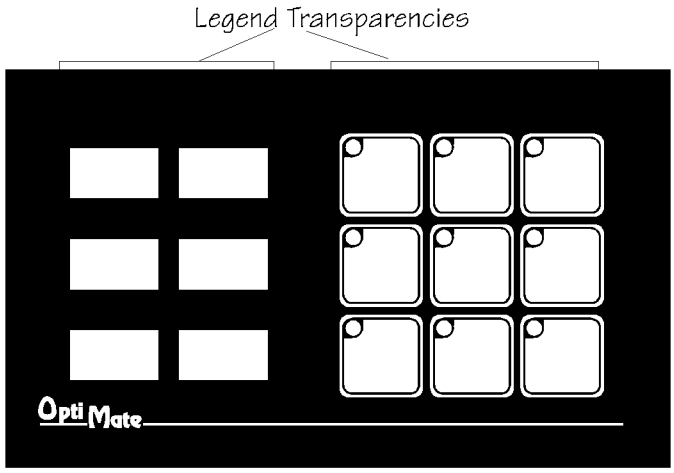
- Remove the bezel from the module. The bezel snaps to the module box along the top and bottom edges. Pull the bezel out and over the snaps to remove.



- Create a legend transparency. There are a number of available options for doing so. A pattern is provided on the Label Templates 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.



- Re-attach bezel. Push bezel onto box until it snaps together.

Configuration

Configuration Selections

OptiMate modules can be configured for the specific application by using the OptiMate Configuration Editor, OM-WINEDIT. The Configuration Editor runs on any IBM PC compatible computer that runs Windows, Windows 95, 98 or NT. It allows the user to select the exact functionality to meet application requirements.

For the KM609 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
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. Hex protocol requires 8 data bits.
Alternate/ Momentary	Set as required for application
LED Separation	Enable LED separation only if all momentary buttons inset LEDs are to be controlled from the host computer
Force option	Force capability is always available for computer-based systems.

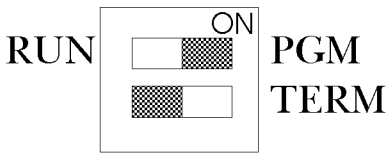
Single Module PLC-Based Systems

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
Momentary/ Alternate	Set as required for application
LED Separation	Enable LED separation only if all momentary button inset LEDs are to be controlled from the host PLC
Force Option	Set as required for application

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
Alternate/ Momentary	Set as required for application
LED separation	Enable LED separation only if all momentary button inset LEDs are to be controlled from the host PLC
Force option	Set as required for application

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



Configuration using a Keyence PLC

The KM609 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 KM609 should always be set to the following:

KM609 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 KM609. 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 KM609 with the parameters shown in the table above.

Communication through the KV-L2

The KM609 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

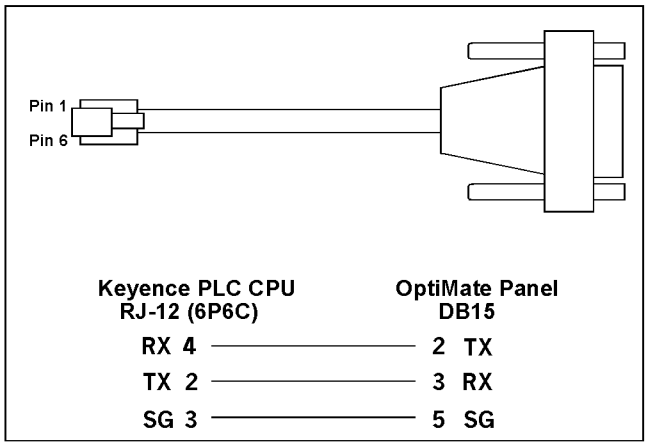
The dip switch settings shown above are dependent on the port that the KM609 is connected to. If the panel is connected to Port 1, then switches A1 and A2 should be OFF. If you have another device on Port 2 , then the switches for Port 2 should be set to the proper protocol for that device.

The KM609 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.

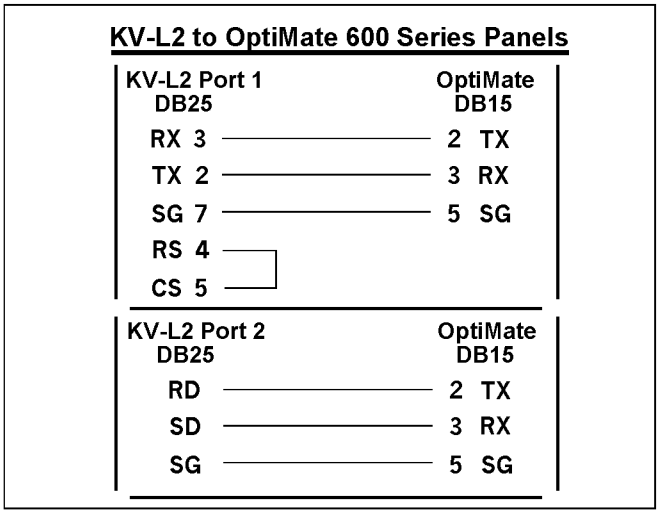
If using Port 2, ensure that the port switch is set either for RS232 or RS422, depending on the cable that you are using. If using RS232, always have the terminator dip switch OFF on both the KV-L2 and on the KM609 panel.

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

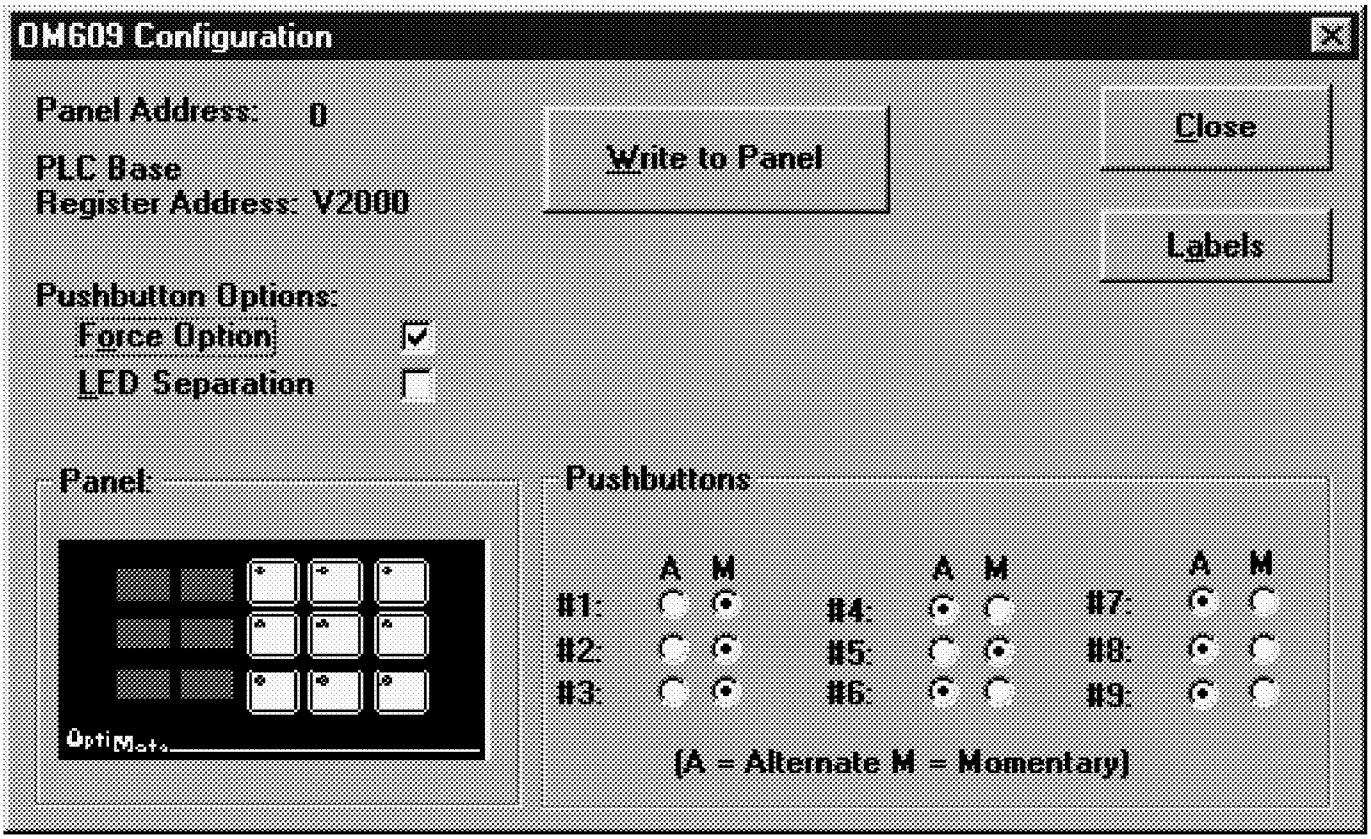
The figure below shows the pinouts to connect a KM609 to a Keyence PLC CPU. This cable is available from Optimation.



The figure below shows the pinouts to connect a KM609 to a KV-L2 Serial Interface Module. The pinouts shown are for RS232.



The figure below illustrates configuration via the OM-WINEDIT software As you can see, the selection of the items discussed is a very straightforward process, presented in graphical form.



Addressing

The panel address is set via the configuration editor. The particular address selection for a panel connected directly to a PLC is not important (any address will work). For systems using OptiMate Hex, each panel in the system must be assigned a unique address.

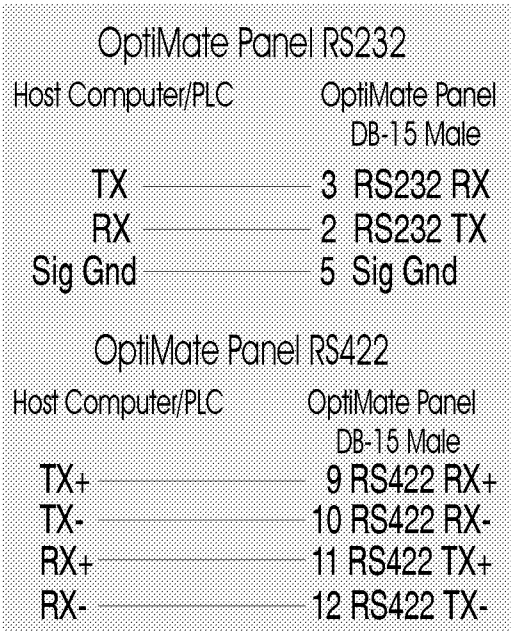
Connection to the System

OptiMate panels are designed for communications connection to system devices. The panel 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 panel to a computer or PLC can be accomplished over either an RS232 or RS422 link. RS232 is limited to one OptiMate panel to one computer serial port. RS422 allows up to 31 panels to be connected to one computer port. Since PLCs are slave devices, the RS422 link for a PLC is limited to one OptiMate panel.

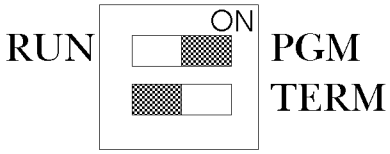
Refer to manufacturer's documentation for PLC or computer serial link connector pinouts. See the figure below for RS232 ans RS422 pinouts for OptiMate modules.



Standard interface 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 module switches on a terminating resistor. This terminating resistor does not apply to an RS232 connection and should always be placed in the OFF position. In an RS422 connected system, the termination should be ON in the last, and only the last, panel on the cable.

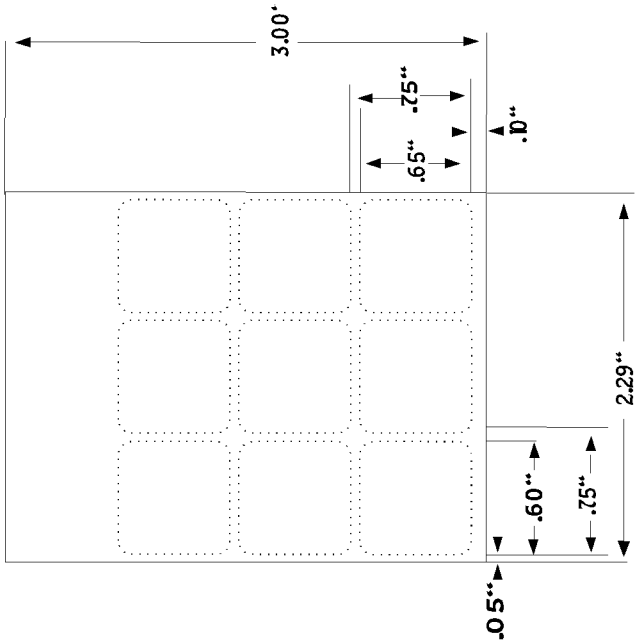


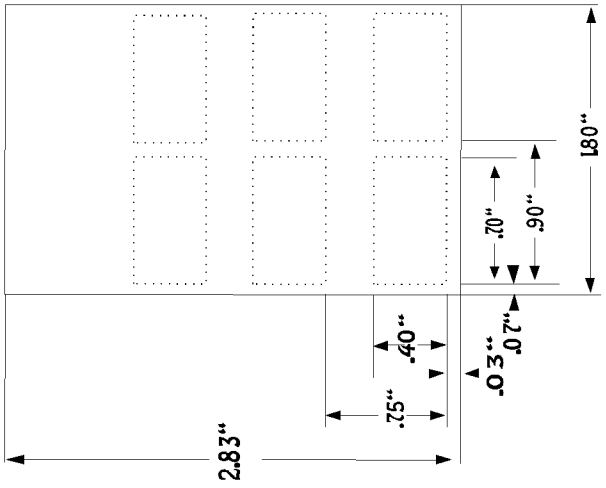
Power

The KM609 can operate on any voltage between 8 and 30 VDC. Power must be connected to the terminal plug located on the back of the module. Pin 1 of the plug is the 8-30VDC (+) terminal and pin 2 is the 0VDC (-) terminal.

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

Label Templates

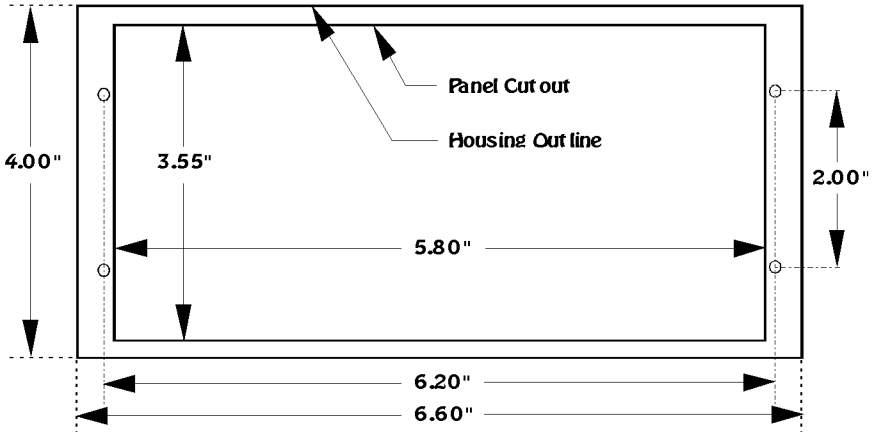




Specifications

Physical

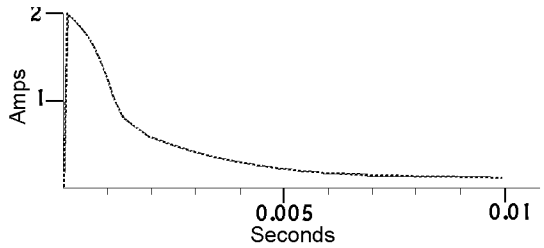
- Recessed Mount Housing 6.6"L x 4.0"H x 1.25"D
- Cutout size for above: 3.55"Hx5.8"L
- Panel Fasteners : Four, 6x32 threaded studs, shown above (on ends, symmetrical about center line)
- Weight : 10 ounces
- Colors : Dark gray with black panel
- Pushbutton dimensions : .65 inches square on .75 inch centers
- Pushbutton life : 1,000,000 switch cycles
- Lamp Colors Available : Red, Green, Yellow
- Lamp window size .7" x .4"



Panel Mounting Dimensions

Electrical

- Power (all lamps on) : 8 - 30VDC @ 2.4VA
  200 mA @ 12VDC 100 mA @ 24VDC
- Power on surge (see figure below)
  2A for 2 milliseconds maximum



Power on Surge

- Power connector : Pluggable terminal block, 2 position

Communications

- RS232 and RS422
- 4800 to 19200 baud
- Compatible with most major PLC protocols
- Microprocessor compatible OptiMate Hex protocol
- 15 pin female 'D' shell connector (screw terminal adapter available)

Communications Failure Operation

Should the panel (when not selected for configuration) ever fail to communicate successfully for a period of 12 seconds, all lamps and inset LEDs will flash rapidly.

Environmental

- Enclosure - NEMA 4 recessed mount
- Temperature - 0 to 50 C
- Humidity - 95% Non-condensing