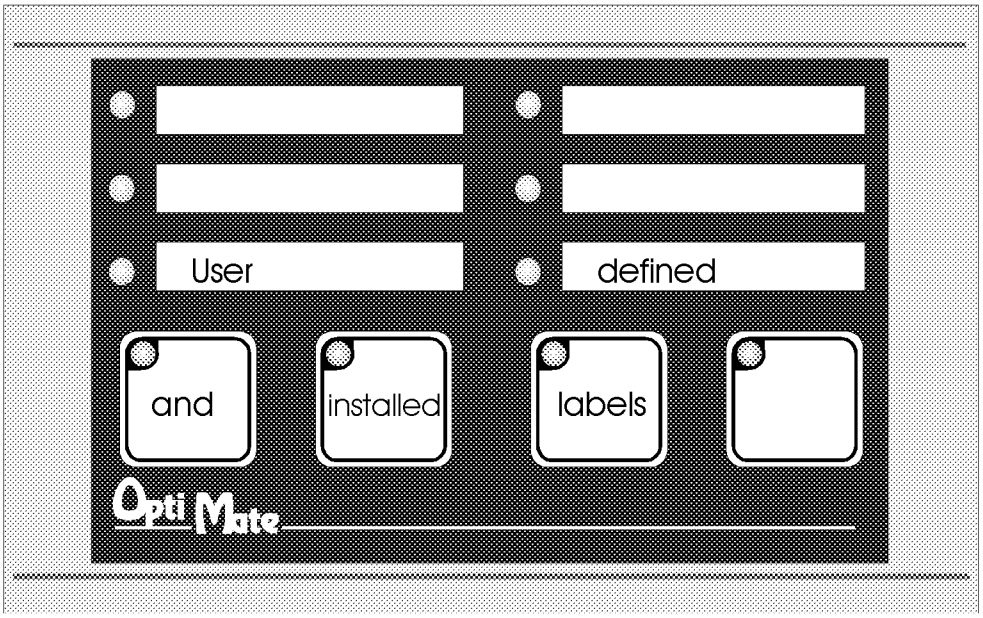


KM406 Indicator/Pushbutton Panel

General Overview

The KM406 Indicator/Pushbutton Panel features 6 LED indicator lamps and 4 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. When configured for momentary action, the LEDs inset in each pushbutton can be configured to indicate the button status or to act independently of the button status.

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 KM406 Indicator/Pushbutton Panel is part of Optimation's **OptiMate**® series. Each OptiMate module is designed to connect to a PLC with a single cable connection.

When used with a microprocessor system, a simple communications cable allows 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 KM406 takes care of the rest.

Applications

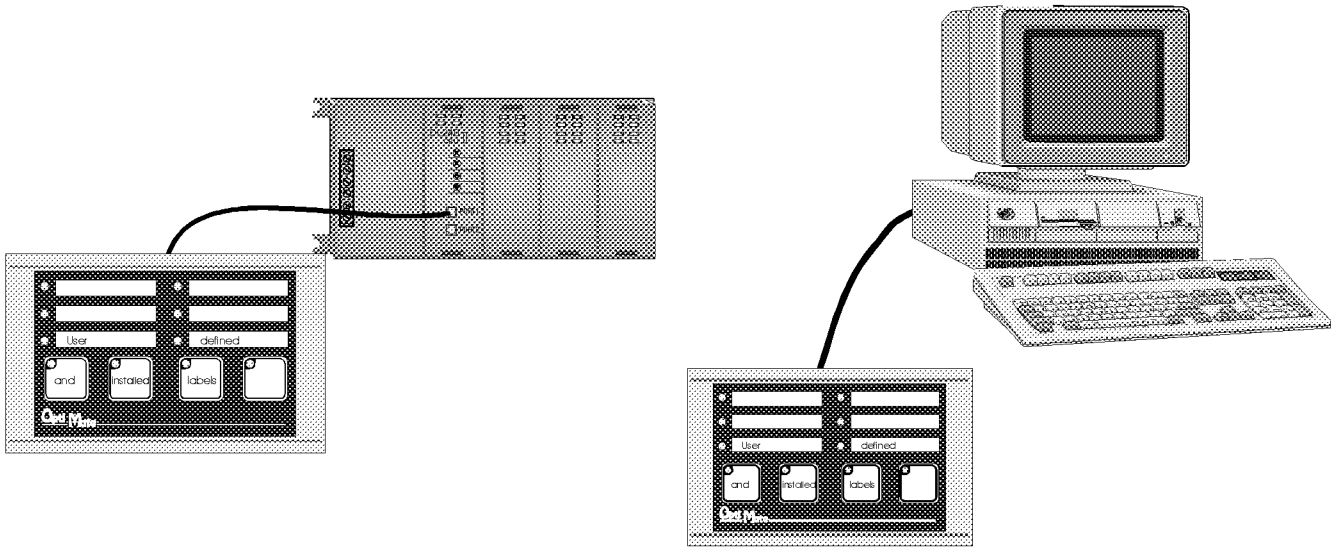
- Machine control
- Process control
- Security systems
- HVAC
- Plant monitoring/control
- PLC applications
- Microprocessor applications

Features

- 6 LED Indicator Lamps
- 4 tactile snap membrane pushbuttons
- Pushbuttons are independently configurable for momentary or alternate action
- User legendable
- PLC compatible
- RS232 communications
- Stand alone operation capable

Contents

Configuration Options



PLC Stand Alone

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

The KM406 Indicator/Pushbutton module uses a bank of four PLC registers to hold pushbutton state, control lights and force pushbutton states. The KM406 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 perform this communications for most major PLC protocols. Configuration for particular PLC protocols and interconnect cabling is covered in the following pages.

Microprocessor-Based Systems

OptiMate 400 Series modules can interface directly to most computers or microcontrollers. The modules communicate over RS232 serial communications. All that is required to interface OptiMate modules is 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 the OptiMate 400 Series panels can only communicate on RS232, only 1 panel can be interfaced on each serial communications port.

In a microprocessor based system, the host microprocessor is the system master. The OptiMate modules are slave devices that respond to commands from the host. In the case of the KM406, these commands are requests for pushbutton status and messages that dictate lamps states.

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 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.

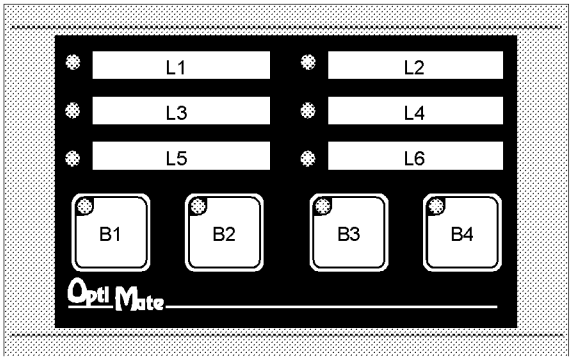
MSB															LSB
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

PLC Register

The KM406 Indicator/Pushbutton Module uses a bank of 4 contiguous holding registers. The register set definition is shown in the table below.

KM406 Indicator/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 KM406 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 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.

Note : When configuring, always remember to insert the programming cable into the panel to place it into configuration mode. When you are finished downloading the configuration, wait a few seconds then remove the programming cable. This will return the panel to the PLC run mode.

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

Register	MSB												LSB				
X			L6	L5	L4	L3	L2	L1					B4	B3	B2	B1	Indicator Light/LED On/Off
X+1			L6	L5	L4	L3	L2	L1					B4	B3	B2	B1	Indicator Light/LED Flash Control
X+2													B4	B3	B2	B1	Button On/Off Status
X+3	F1	F2	F3										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 figure below, 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 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 figure below. 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 figure below, the second 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 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 KM406 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 pushbutton. 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 KM406 will automatically clear the force data registers (X+3).
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 KM406 will automatically clear the force data registers (X+3).
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 KM406 will automatically clear the force data registers (X+3).

Force applies only to alternate action pushbuttons.

Register	MSB												LSB				
X			L6	L5	L4	L3	L2	L1					B4	B3	B2	B1	Indicator Light/LED On/Off
X+1			L6	L5	L4	L3	L2	L1					B4	B3	B2	B1	Indicator Light/LED Flash Control
X+2													B4	B3	B2	B1	Button On/Off Status
X+3	F1	F2	F3										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 KM406 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 is address 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 KM406 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 KM406 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	Internal Relay Register address range
KV10/16	1000 -1915
KV24/40/80	1000 -1915,3000 - 6915
KV300	1000 -1915,3000 - 6915

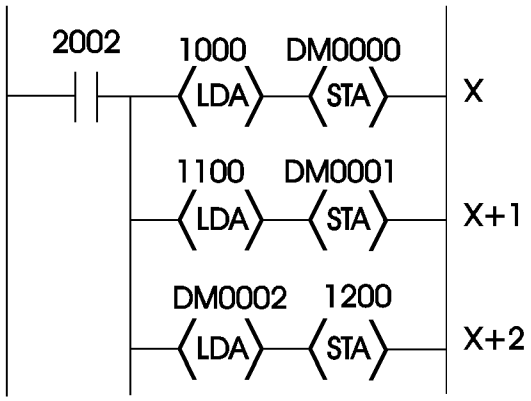
The program rung on the right should be placed in the program to copy the Indicator Lamp/LED ON/OFF control register (X) and the Indicator Lamp/LED Flash control register (X+1) from the internal relays to their corresponding data memory registers, 1000 and 1100 respectively. It will also copy the Pushbutton 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 in every scan.

The data memory registers (X - X+3) depend on the base register address that you define. In this case, the base register address is DM0000. Any valid internal relays may be used in the memory map. (If you do not use the relays shown, adjust each lamp, button, etc. to correspond to the relays that you define.)

The table below shows the internal relay correlation for a KM406 when the 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 right).

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
L1	1008	1108	
L2	1009	1109	
L3	1010	1110	
L4	1011	1111	
L5	1012	1112	
L6	1013	1113	

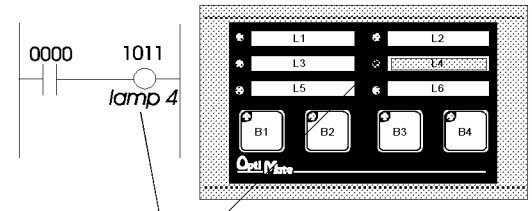
KM406 Memory Map



The following examples are KV10/16/24/40/80/300 programs with the KM406 configured for address DM0000. Also, assume that the memory mapping rung on the previous page is at the top of the program.

Turning on a Lamp

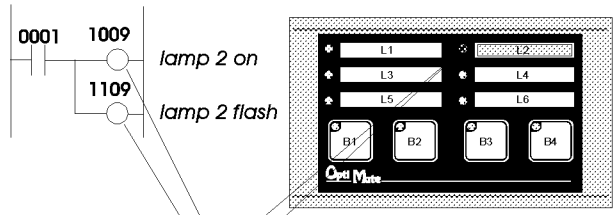
Turning on a lamp in the KM406 simply requires activating its associated internal relay coil. In the figure at right, lamp 4 will be turned on whenever input 0000 is active (energizing 1011).



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

Flashing a Lamp

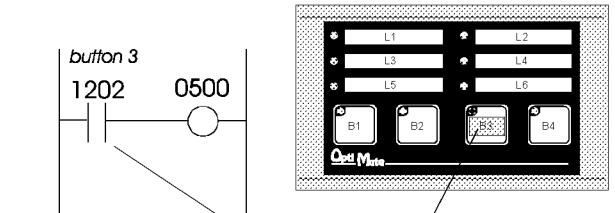
To flash a lamp, you simply need to turn it on and set the associated flash bit. The example on the right shows a PLC program used to flash lamp 2 whenever 0001 is energized.



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

Using a Pushbutton

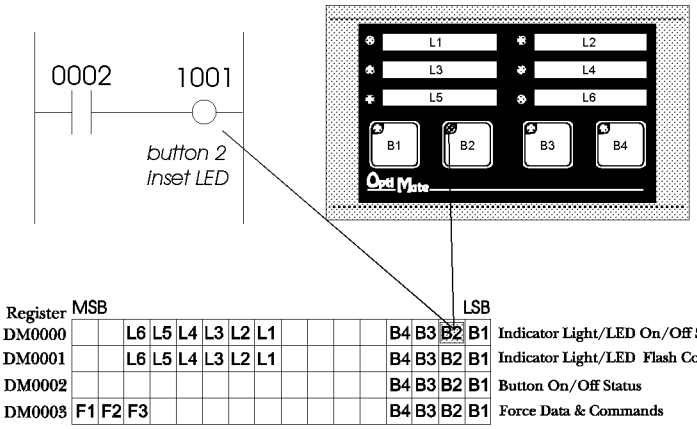
The example on the right illustrates the use of a KM406 pushbutton in a program. When pushbutton 3 is activated, 1202 will become active and turn on output 0500.



Register	MSB												LSB	
DM0000			L6	L5	L4	L3	L2	L1			B4	B3	B2	B1	Indicator Light/LED On/Off Status
DM0001			L6	L5	L4	L3	L2	L1			B4	B3	B2	B1	Indicator Light/LED Flash Control
DM0002											B4	B3	B2	B1	Button On/Off Status
DM0003	F1	F2	F3								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 2's inset LED whenever input 0002 is energized. *In order for this to work, the panel must be configured for LED separation and button 2 must be a momentary pushbutton.*

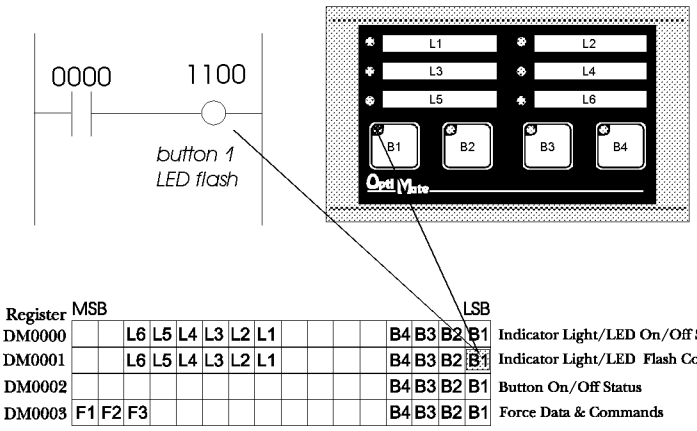


Register	MSB												LSB				
DM0000			L6	L5	L4	L3	L2	L1				B4	B3	B2	B1	Indicator Light/LED On/Off Status
DM0001			L6	L5	L4	L3	L2	L1				B4	B3	B2	B1	Indicator Light/LED Flash Control
DM0002												B4	B3	B2	B1	Button On/Off Status
DM0003	F1	F2	F3									B4	B3	B2	B1	Force Data & Commands

Flashing an Inset LED

To flash an inset LED, you simply need to turn it on and set 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 program used to set the LED inset in button 1 to flash whenever 0000 is energized. If the panel has been configured with button 1 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				B4	B3	B2	B1	Indicator Light/LED On/Off Status
DM0001			L6	L5	L4	L3	L2	L1				B4	B3	B2	B1	Indicator Light/LED Flash Control
DM0002												B4	B3	B2	B1	Button On/Off Status
DM0003	F1	F2	F3									B4	B3	B2	B1	Force Data & Commands

Button State	0000 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 KM406 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.

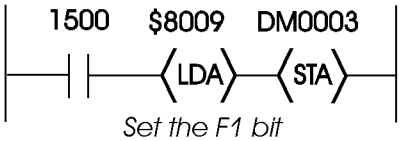
There are many other cases where button-force capability can be useful in a system.

There are three types of force functions available for the KM406 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

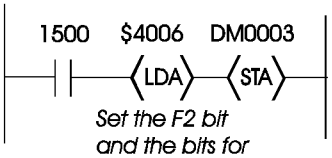
This function is used to set the state (on or off) of every alternate-action pushbutton in the panel. To use the "Force Button Status" function, simply set the F1 bit and all buttons that you want to be on, to 1. Any buttons associated with bits that are left at '0' will be forced off. The example below shows buttons 1 and 4 being forced on and all other buttons forced off when 1500 is active.



Set the F1 bit and the bits for buttons 1 & 4 on, buttons 2 & 3 off.

Force Button(s) On

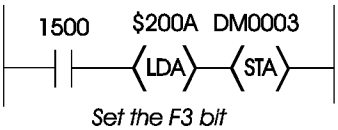
This function is used to turn individual button(s) on without affecting the state of any other buttons. To use the "Force Buttons On" function, set the F2 bit to 1 and all buttons that you want to turn on, to 1. Any buttons associated with bits that are left at '0' will not be affected. The following example shows buttons 2 and 3 being forced on when 1500 is active.



Set the F2 bit and the bits for buttons 2 & 3. Buttons 1 & 4 are unaffected.

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 2 and 4 being cleared when 1500 is active.



Set the F3 bit and the bits for buttons 2 & 4. Buttons 1 & 3 are unaffected.

Register	MSB												LSB				
X			L6	L5	L4	L3	L2	L1					B4	B3	B2	B1	Indicator Light/LED On/Off
X+1			L6	L5	L4	L3	L2	L1					B4	B3	B2	B1	Indicator Light/LED Flash Control
X+2													B4	B3	B2	B1	Button On/Off Status
X+3	F1	F2	F3										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 KM406 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 KM406 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 relay register range of memory. However, the KM406 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 relays to their corresponding data memory registers, beginning with 00033, 00049 and 00097 respectively. It will also copy the Pushbutton status register (X +2) from the 4x memory register to its corresponding relay register, beginning at 00065.

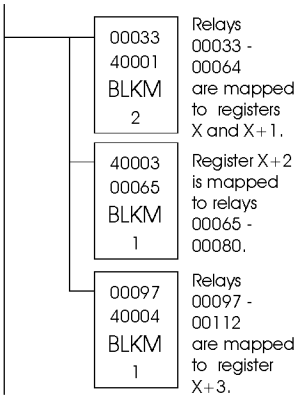
The data memory registers (X - X+3) depend on the base register address that you define. In this case, the base register address is 40001. Any valid internal relays may be used in the memory map. (If you do not use the relays shown, adjust each lamp, button, etc. to correspond to the relays that you define.)

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

	1 (MSB)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16 (LSB)	bit
Register 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	Lamp Flash
X+2	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	Button Status
X+3	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	Force Register

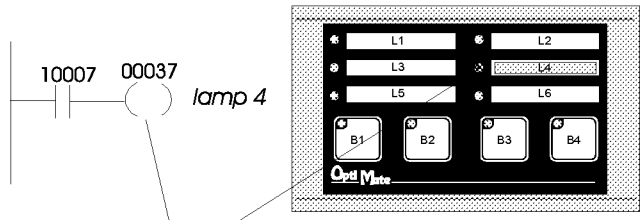
The table below shows the relay correlation for a KM406 when the data memory registers X through X+3 are mapped to/from the 0x relays beginning with 00033 (as shown in the program rung below).

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
L1	00040	00056		
L2	00039	00055		
L3	00038	00054		
L4	00037	00053		
L5	00036	00052		
L6	00035	00051		00099 (F3)
				00098 (F2)
				00097 (F1)



Turning on a Lamp

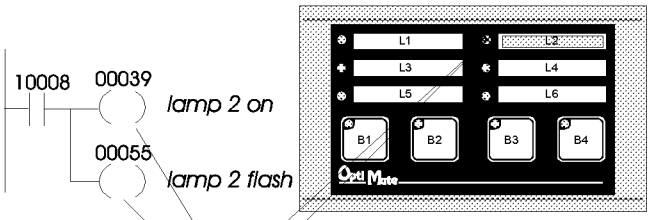
Turning on a lamp in the KM406 simply requires activating its associated relay coil. In the figure at right, lamp 4 will be turned on whenever input 10007 is active (energizing 00037).



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

Flashing a Lamp

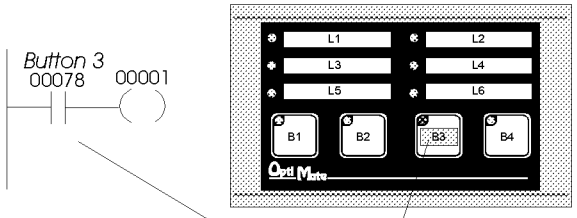
To flash a lamp, you need to turn it on and set the associated flash bit. The example on the right shows a Modicon program used to flash lamp 2 whenever 10008 is energized.



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

Using a Pushbutton

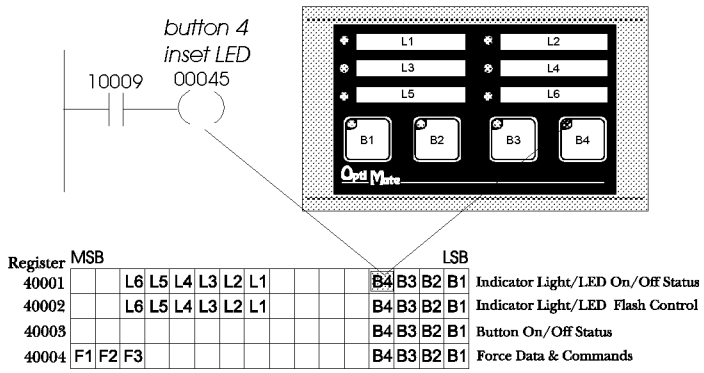
This example illustrates the use of a KM406 with a Modicon PLC. When button 3 is activated, 00078 will become active and turn on output 00001, due to the memory-mapping rung on the previous page.



Register	MSB												LSB				
40001			L6	L5	L4	L3	L2	L1					B4	B3	B2	B1	Indicator Light/LED On/Off Status
40002			L6	L5	L4	L3	L2	L1					B4	B3	B2	B1	Indicator Light/LED Flash Control
40003													B4	B3	B2	B1	Button On/Off Status
40004	F1	F2	F3										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 4's inset LED whenever input 10009 is energized. *In order for this to work, the panel must be configured for LED separation and button 4 must be a momentary pushbutton.*



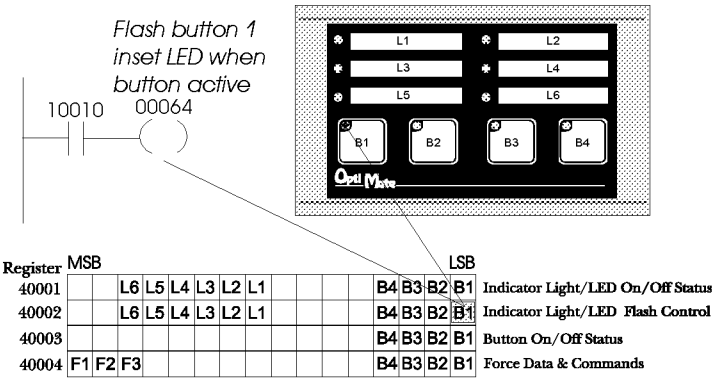
Register	MSB											LSB	
40001			L6	L5	L4	L3	L2	L1				B4 B3 B2 B1	Indicator Light/LED On/Off Status
40002			L6	L5	L4	L3	L2	L1				B4 B3 B2 B1	Indicator Light/LED Flash Control
40003												B4 B3 B2 B1	Button On/Off Status
40004	F1	F2	F3									B4 B3 B2 B1	Force Data & Commands

Flashing an Inset LED

To flash an inset LED, you need to both turn it on and 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 1 to flash whenever 10010 is energized. If the panel has been configured with button 1 being an alternate-action button, the LED will operate as shown in the table below.

Button State	10010 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				B4 B3 B2 B1	Indicator Light/LED On/Off Status
40002			L6	L5	L4	L3	L2	L1				B4 B3 B2 B1	Indicator Light/LED Flash Control
40003												B4 B3 B2 B1	Button On/Off Status
40004	F1	F2	F3									B4 B3 B2 B1	Force Data & Commands

Forcing Button Status

One of the more advanced capabilities of the KM406 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.

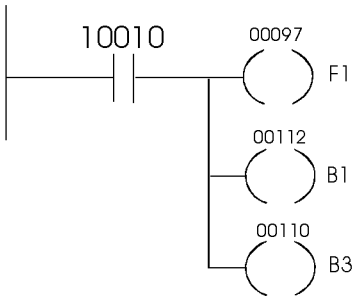
There are many other cases where button force capability can be useful in a system.

There are three types of force functions available for the KM406 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

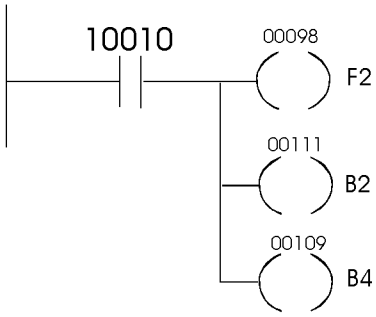
This function is used to set the state (on or off) of every alternate action pushbutton in the panel. To use the "Force Button Status" function, simply set the F1 bit to 1 and all buttons that you want to be on to 1. Any buttons associated with bits that are left at '0' will be forced OFF. The example below shows buttons 1 and 3 being forced on and buttons 2 and 4 being forced off when 10010 is active.



Set the F1 bit and the bits for buttons 1 & 3 on, buttons 2 & 4 off.

Force Button(s) On

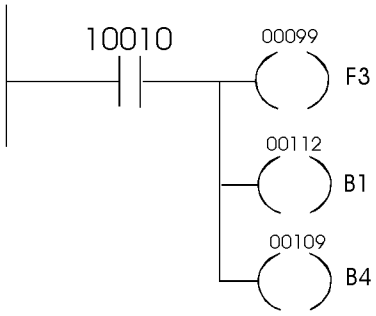
This function is used to turn individual button(s) on without affecting the state of any other buttons. To use the "Force Buttons On" function, set the F2 bit to 1 and all buttons that you want to turn on to 1. Any buttons associated with bits that are left at '0' will not be affected. The following example shows buttons 2 and 4 being forced on when 10010 is active.



Set the F2 bit and the bits for buttons 2 & 4. Buttons 1 & 3 are unaffected.

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 buttons 1 and 4 being cleared when 10010 is active.



Set the F3 bit and the bits for buttons 1 & 4. Buttons 2 & 3 are unaffected.

Register	MSB												LSB				
X			L6	L5	L4	L3	L2	L1					B4	B3	B2	B1	Indicator Light/LED On/Off
X+1			L6	L5	L4	L3	L2	L1					B4	B3	B2	B1	Indicator Light/LED Flash Control
X+2													B4	B3	B2	B1	Button On/Off Status
X+3	F1	F2	F3										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. For the OptiMate 400 Series line of panels, this link can only be RS232 (for point to point) with the microprocessor acting as the master. It can write data to the 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 straightforward and easy to use.

Panel Address

Panel address is configured in the OM-WINEDIT configuration software. The panel will normally be configured for a panel address of 0. The panel will respond only to the host if it is properly addressed. See the addressing description in the "Configuration" section of this manual.

Configuration

Each of the 4 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, that 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 the OptiMate Hex protocol. The other options that must be set are baud rate, parity and number of stop bits. If parity is set to even or odd, only one stop bit is allowed. Once selected, it must be downloaded to the module.

KM406 OptiMate Hex Protocol

General Format

STX Module address function text checksum

Where
- STX = 0x02
- 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_4 lites on led1_4 lites flash checksum

where
- Module address = 0 to 30
- ftn = 0xA0 ; Write LED states
- led1_4 = LEDs inset in buttons, in numeric order
- lites = LED indicator lamps in 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_4 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.
- 1 = Button active
- 0 = Button not active
- NAK = 0x15

For function type A2 : Force Buttons

STX Module address ftn flags pb1_4 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 status
- pbx_x = Corresponds to buttons. LSB of data character corresponds to lowest numbered button. Bits are in sequence left to right.

Response

ACK if message received and processed OK

where ACK = 0x06

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

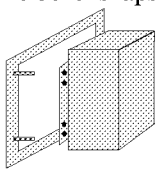
Note: Spaces are shown for readability only. There are no spaces between message fields.
0xXX denotes a Hex number.

Set Up and Interconnect

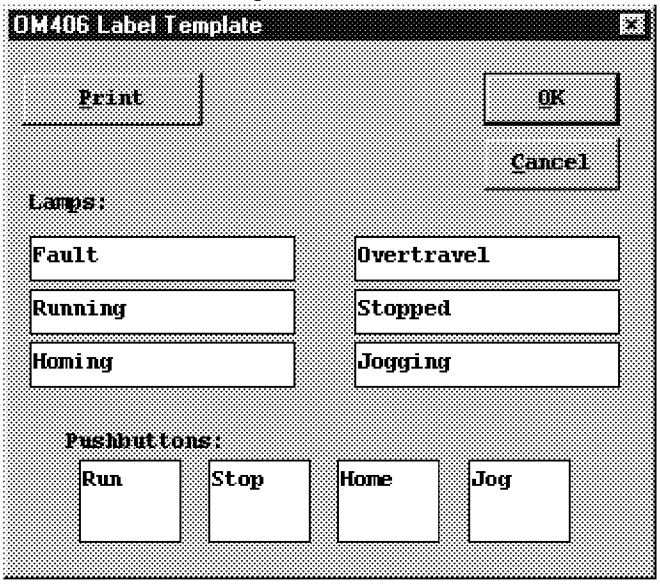
Legending the Lamps and Buttons

Legending the KM406 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.

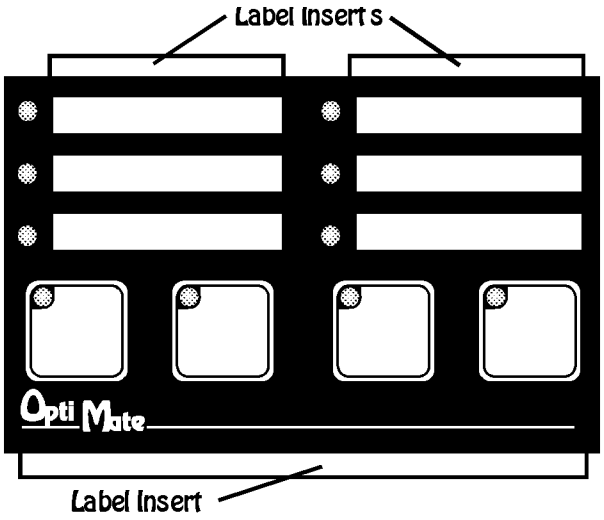


- Create a legend transparency. There are a number of available options for doing so. A pattern is provided on the specification sheet of this document.
  - > Use the built in label making capability of the OM-WINEDIT software to create labels. Either print on the transparency directly or print on paper and photocopy onto the transparency. The figure below is a screen from OM-WINEDIT which illustrates the process.



  - > 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. Place into overlay pocket. The indicator lamp's legends slide in from the top in two places while the pushbutton's legend slides in from the bottom.
- Re-attach bezel. Push bezel onto box until it snaps together. Ensure that the bezel covers all housing snaps before installing the panel.



Configuration

Configuration Selections

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

For the KM406 panel, the following are important configuration parameters. Further configuration details are covered in the OM-WINEDIT help screens.

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.
Configuration starting point	First time configuration, start with defaults for module. Subsequent configurations can utilize disk files you create.
PLC Type	Select OptiMate Hex
Panel Address	Normally set to 0 with 400 Series Panels
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 Panel PLC-Based Systems

Decision	Selection
Single/Multi Panel	Choose single panel 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 OP-9001Communications Master)

Not applicable with the 400 Series Panels

Note : When configuring, always remember to insert the programming cable into the panel to place it into configuration mode. When you are finished downloading the configuration, wait a few seconds then remove the programming cable. This will return the panel to the PLC run mode. Communication cables are available from Optimation.

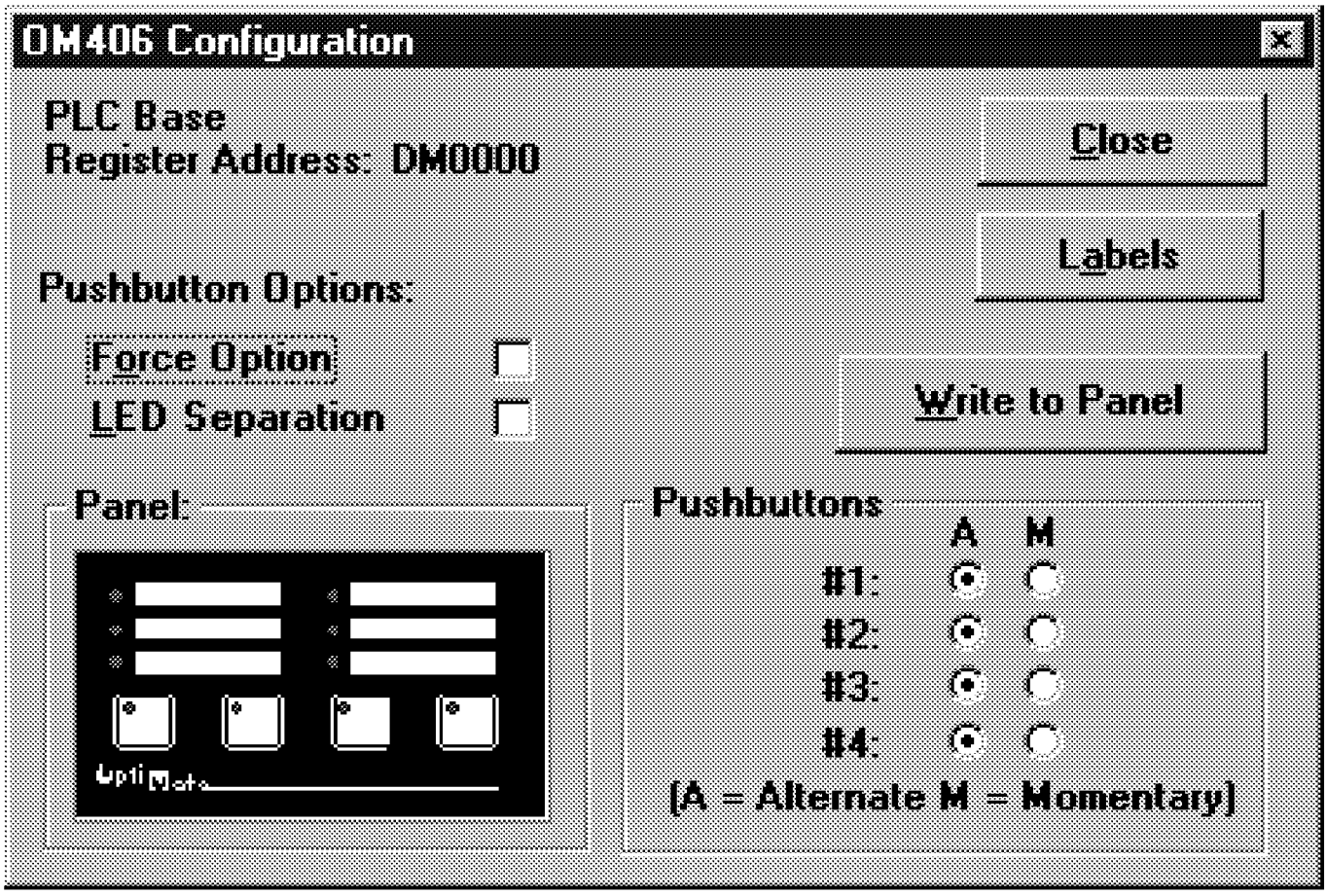
Configuration of the KM406 Indicator/Pushbutton Panel is performed via an IBM PC compatible computer. The OM-WINEDIT configuration software allows you to select panel type, panel application and PLC protocol definition.

If the KM406 is to be operated with a PLC, the configuration selection must be made to select the proper PLC protocol information such as baud rate, parity, stop bits, etc.

Specific configuration of the KM406 begins with defining the block of PLC registers to be used. Next, each of the pushbuttons must be configured for either alternate or momentary. If momentary action is selected for some or all of the pushbuttons, LED separation should be selected if you want the LEDs inset in all of the momentary pushbuttons to act independently of the button status. If alternate action is selected for some or all of the pushbuttons, the force option should be enabled if you want the capability of forcing the state of an alternate-action pushbutton on or off without touching the panel.

The KM406 pushbutton configuration screen in the OM-WINEDIT software is shown below.

Note : When configuring, always remember to insert the programming cable into the panel to place it into configuration mode. When you are finished downloading the configuration, wait a few seconds then remove the programming cable. This will return the panel to the PLC run mode.



Configuration using a Keyence PLC

The KM406 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 KM406 should always be set to the following:

KM406 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 KM406. If you try to connect the panel to the KV300 CPU's communcations port, the panel will not communicate because the CPU will not recognize the protocol.

Direct Connection to the CPU

If you are connected to the KV300 through the CPU communications port, configure the KM406 with the parameters shown in the table above.

The KM406 uses the KV mode protocol to communicate with the PLC, therefore, the port that the panel is communicating with should be set for KV mode also.

Communications through the KV-L2

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

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

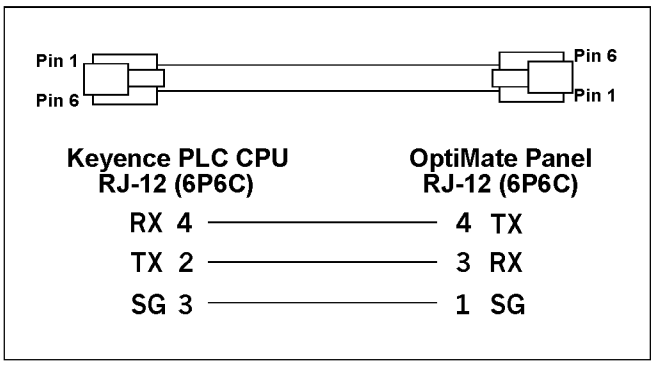
The dip switch settings shown above are dependent on the on the port that the KM406 is connected to. If the panel is connected to Port 1, then switches A1 and A2 should be OFF. If you have another device on Port 2, then the switches for Port 2 should be set to the proper protocol for that device.

The KM406 uses the KV Mode protocol to communicate with Keyence PLCs. Regardless of the "B" dip switch settings, the port that the panel is connected to will automatically default to the communication parameters shown in the table above.

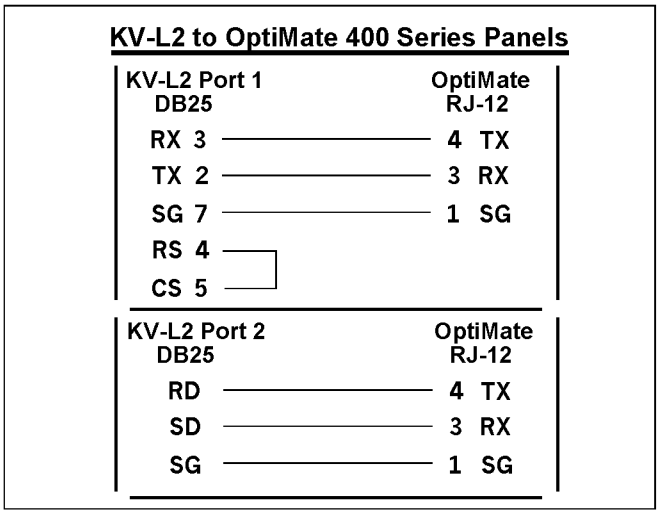
Note: If using Port 2, ensure that the port switch is set for RS232.

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

The figure below shows the pinouts to connect a KM406 to a Keyence PLC CPU. This cable is available from Optimation.



The figure below shows the pinouts to connect a KM406 to a KV-L2 Serial Interface Module. The pinouts shown are for RS232.



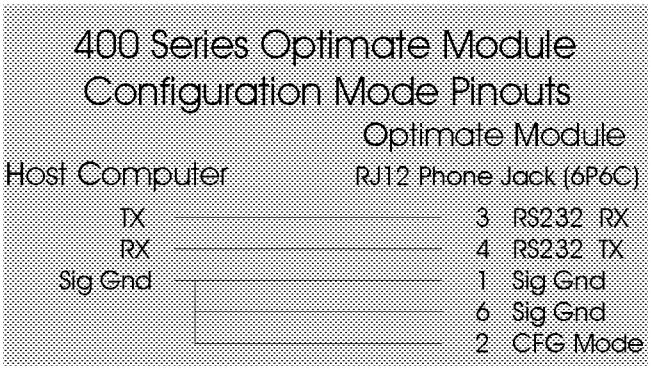
Connection to the System

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

Connection to a Computer for Configuration

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

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

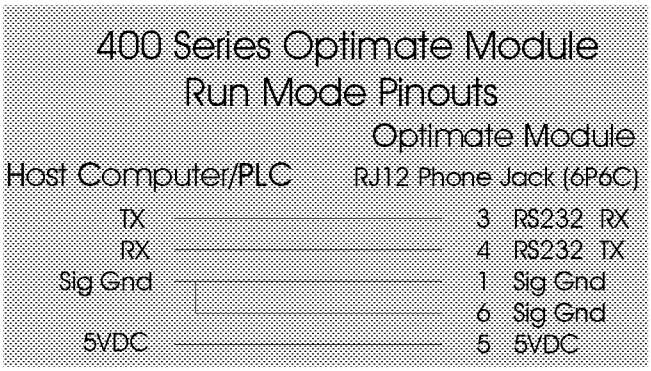


Configuration cables are available for connection to IBM PC-AT compatible ports.

Run Mode Connection to a Computer or PLC

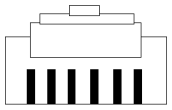
Connection of a 400 Series OptiMate module to a computer or PLC can be accomplished over an RS232 link. RS232 is limited to one OptiMate module to one computer serial port. Since PLCs are slave devices, the RS232 link for a PLC is limited to one OptiMate module. See the figure below for 400 Series OptiMate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

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



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

The figure below shows the RJ12 connector pinout for connection to an OptiMate 400 Series module.



RJ12 Connector
Optimate End

Power

The KM406 Setpoint/Display Panel will operate only on a DC voltage of *5VDC*. Steady state current is listed on the specification page.

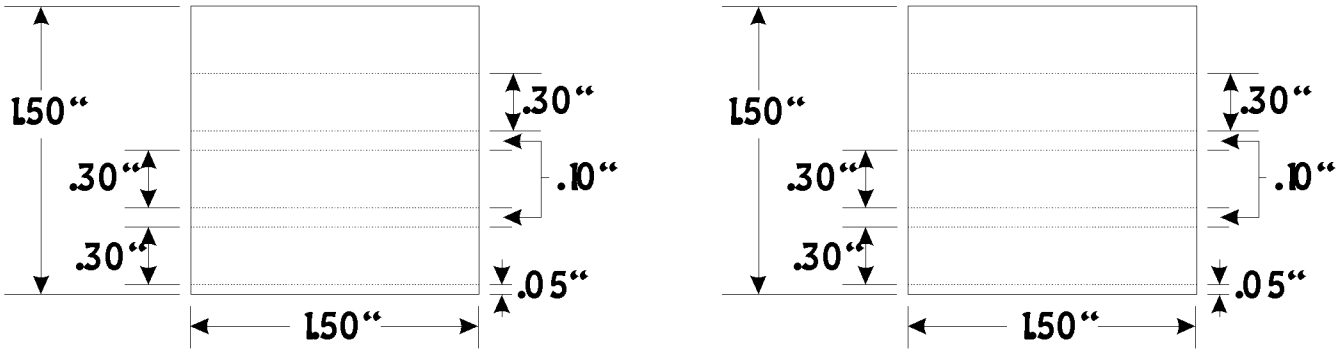
The KM406 panel can draw power from its communications cable if the host device has a 5VDC connection on its comm port.

The KM406 panel can be powered from a 5VDC adapter for panel configuration or connection to PLCs or microprocessor based devices that do not have a 5VDC connection in their communication ports. A description of the DC power connector is listed on the specification page.

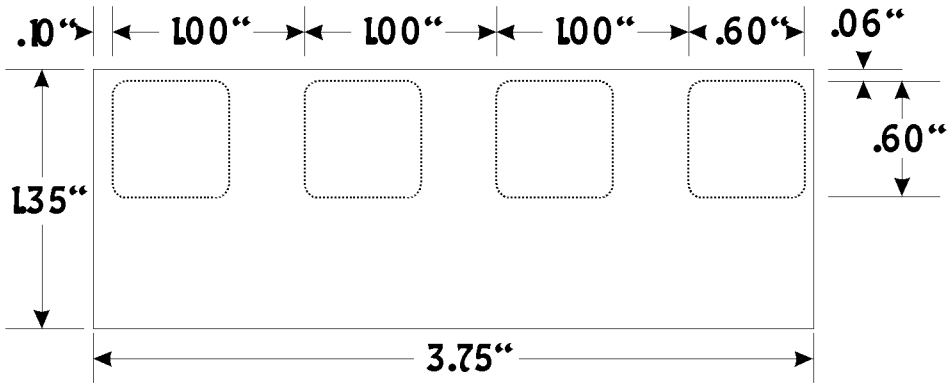
Note: Only use an Optimation approved 5VDC power supply or equivalent that contains a center negative DC power jack.

There is a very brief (0.1 -1 millisecond) power on surge up to 0.35 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.

Label Templates



Indicator Lamp Label Insert Templates

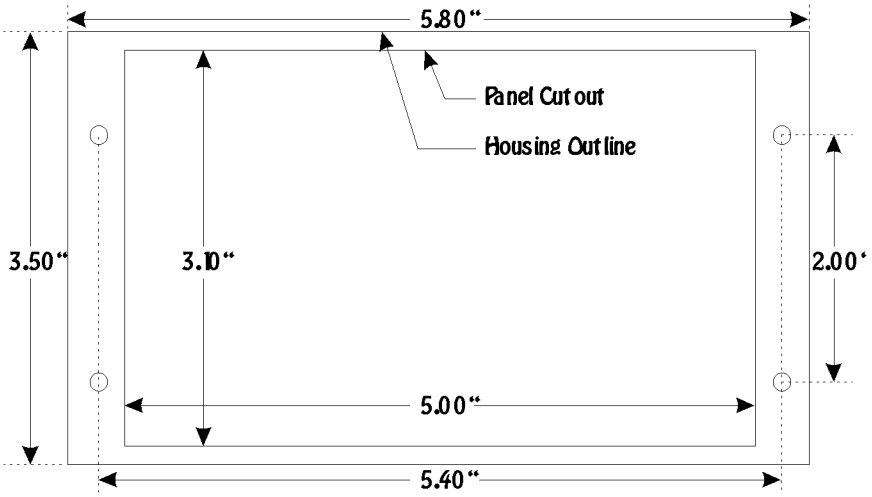


Pushbutton Label Insert Template

Specifications

Physical

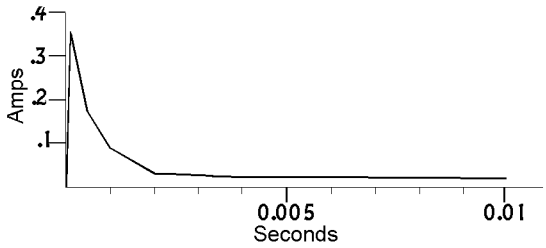
- Recessed Mount Housing: 6.00"L x 3.50"H x 1.25"D
- Cutout size: 3.20"H x 5.10"L
- Panel Fasteners: Four, 6x32 threaded studs, shown at right (on ends, symmetrical about center line)
- Weight : 8 ounces
- Colors : Dark gray housing with dark gray panel.
- Pushbutton dimensions: .65 inches square on 1.00 inch centers
- Pushbutton life: 1,000,000 switch cycles
- Indicator Lamp Colors: Red



Panel Mounting Dimensions

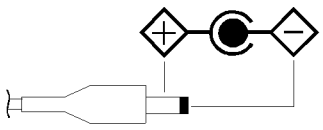
Electrical

- Power: 5VDC @ 0.25Watts
  50 mA @ 5VDC
- Power On Surge (see figure below)
  0.35A for 1 millisecond max



Power on Surge

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



Always use an Optimation approved 5VDC power supply with a center negative plug.

Communications

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

Communications Failure Operation

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

Environmental

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