OM609
Combination
Panel

General Overview

The OM609 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 slip into protective pockets behind the faceplate.

The OM609 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

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

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Configuration Options
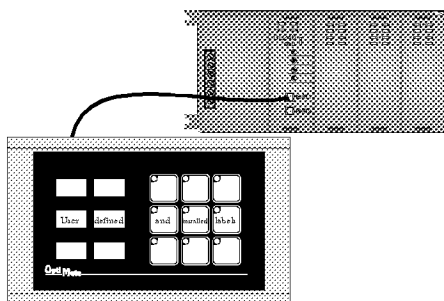
PLC Stand Alone

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 OM609 Lamp/Pushbutton module uses a bank of four PLC registers to hold pushbutton state, control lights and force pushbutton states. The OM609 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.
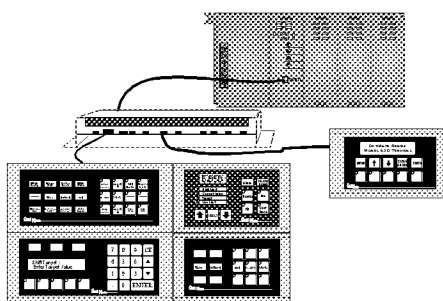
PLC Multi Modules

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

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

System configuration is simple via OP-WINEDIT configuration software that runs on any IBM PC compatible computer with the Windows operating system. Downloading of the configuration to the module requires a cable connection between the panel and the serial port of the PC.

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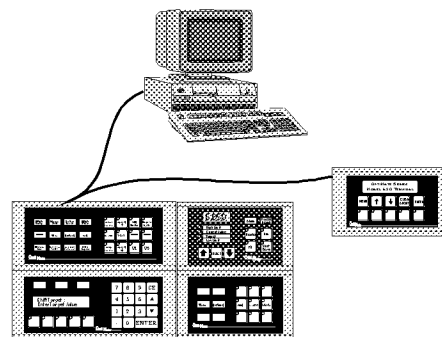
Microprocessor Based Systems

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 OM609, 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 know 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 OM609 Lamp/Pushbutton Module uses a bank of 4 contiguous holding registers. The register set definition is shown in the table below.

OM609 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
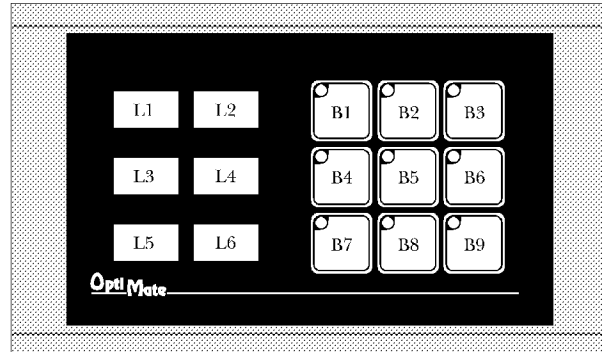
Configuration

Configuration of the OM609 or system of OptiMate panels is performed via an IBM PC compatible computer. The OP-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 with between the OP-9001 and the panel via OptiMate Hex. The OM9001 Communications Master will talk the the module over this protocol and to the PLC over the PLC protocol you select.

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

Run [ ] ON / Pgm
[ ] / Term
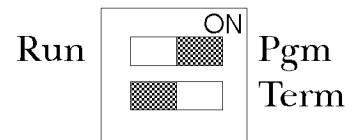
When you are finished downloading configuration, power down the panel and switch to the "Run" position before connecting to the PLC.

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

Register MSB   LSB

Register																	
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 an Inset LED

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

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

Turning on the Inset Indicator Light

In most cases, the LED inset in each 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 OM609 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 OM609 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 OM609 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 OM609 will automatically clear F3.

Force applies only to alternate action pushbuttons.

Register	MSB																		LSB	Description
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 PLC*Direct* PLC

Defining the Base Register Address

The simplest method of interfacing a PLC*Direct* PLC program to an OM609 module is to configure the module base address in the PLC's control relay memory. This allows your program to treat pushbuttons as contacts and LEDs as coils. The following table lists these address for various PLC Direct PLCs.

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

The following examples are DL105, DL205, DL350 or DL405 programs with the OM609 configured for address V40600. The table below shows the control relay correlation for an OM609 configured for address V40600.

Device	Lamp/LED On/Off	Lamp/LED Flash	Button Status	Force
B1	C0	C20	C40	C60
B2	C1	C21	C41	C61
B3	C2	C22	C42	C62
B4	C3	C23	C43	C63
B5	C4	C24	C44	C64
B6	C5	C25	C45	C65
B7	C6	C26	C46	C66
B8	C7	C27	C47	C67
B9	C10	C30	C50	C70
L1	C12	C32		
L2	C13	C33		
L3	C14	C34		
L4	C15	C35		C75(F3)
L5	C17	C36		C76(F2)
L6	C17	C37		C77(F1)

Turning on a Lamp

Turning on a lamp in the OM609 simply requires activating its associated control relay coil. In the figure below, lamp 4 will be turned on whenever input X1 is active (energizing C15).

Flashing a Lamp

To flash a lamp, you simply need to both turn it on and set the associated flash bit. The example below shows a PLC program used to flash lamp 2 whenever X5 is energized.

Using a Pushbutton

The following example illustrates the use of an OM609 pushbutton in a program. When pushbuton 3 is activated, C42 will become active and turn on output Y0.

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 X7 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	
V40600	L6	L5	L4	L3	L2	L1			B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED On/Off Status
V40601	L6	L5	L4	L3	L2	L1			B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED Flash Control
V40602									B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
V40603	F1	F2	F3						B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands
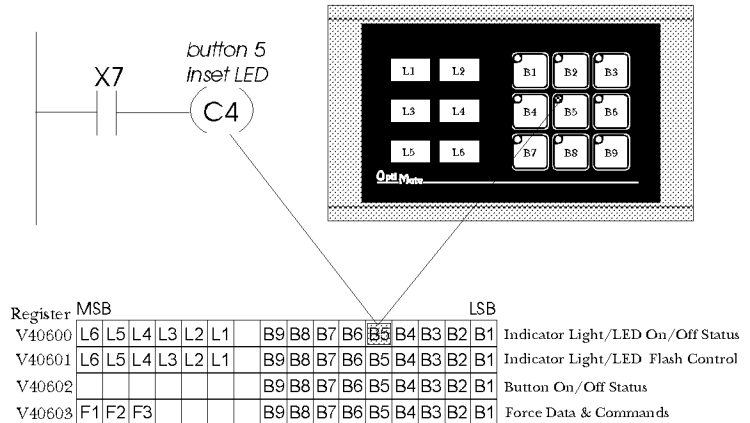
Flashing an Inset LED

To flash an inset LED, you simply need to 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 program used to set the LED inset in button 7 to flash whenever X2 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.
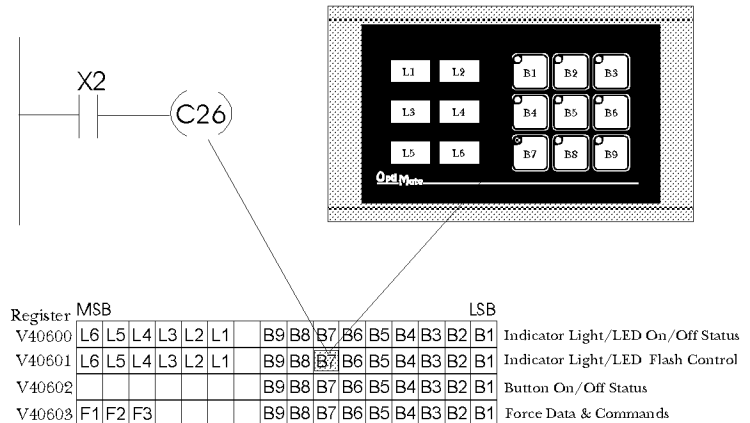
Button State	X2 State	LED operation
Inactive	de-energized	Off
Inactive	energized	Off
Active	de-energized	On solid
Active	energized	Flashing

Register	MSB																		LSB	
V40600	L6	L5	L4	L3	L2	L1			B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED On/Off Status
V40601	L6	L5	L4	L3	L2	L1			B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light/LED Flash Control
V40602									B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
V40603	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 OM609 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.
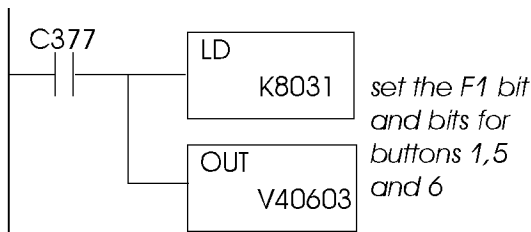
There are many other cases where button force capability can be useful in a system.

There are three types of force functions available for the OM609 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).

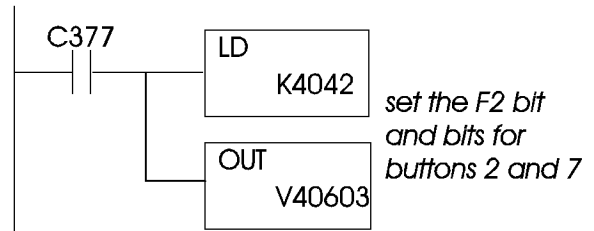**Note : Force only applies to Alternate Action pushbuttons**

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, while leaving all other bits off. The example below shows buttons 1,5, and 6 being forced on and all other buttons forced off when C377 is active.

```
  C377        ┌─────────────┐
 ──┤ ├────────┤ LD          │   set the F1 bit
              │      K8031   │   and bits for
              ├─────────────┤   buttons 1,5
              │ OUT         │   and 6
              │     V40603   │
              └─────────────┘
```
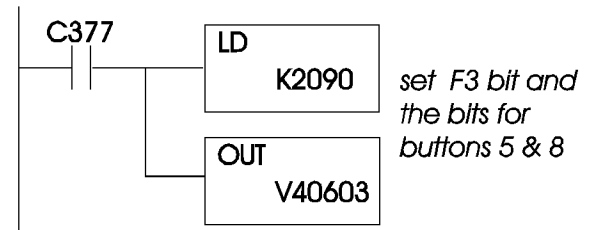
Force Button(s) On

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 C377 is active.

```
  C377        ┌─────────────┐
 ──┤ ├────────┤ LD          │   set the F2 bit
              │      K4042   │   and bits for
              ├─────────────┤   buttons 2 and 7
              │ OUT         │
              │     V40603   │
              └─────────────┘
```

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 C377 is active.

```
  C377        ┌─────────────┐
 ──┤ ├────────┤ LD          │   set F3 bit and
              │      K2090   │   the bits for
              ├─────────────┤   buttons 5 & 8
              │ OUT         │
              │     V40603   │
              └─────────────┘
```

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

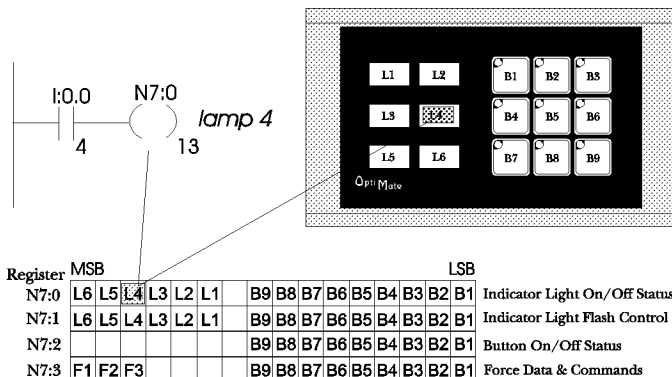# Examples of Use with an Allen Bradley PLC

Interfacing to A/B Memory

OptiMate modules interface to Allen Bradley SLC 5/03, SLC 5/04 and Micrologix PLCs via integer file type N. The 5/03 and 5/04 have file type N7 as standard. Other "N" type files can be created. The Micrologix has a fixed file type N7. Please refer to Allen Bradley programming documentation for information on setting up and using "N" type files. This allows your program to treat pushbuttons as contacts and LEDs as coils.

The following examples are SLC or Micrologix programs with the OM609 configured for address N7:0. The table below shows the correlation for an OM609 configured for address N7:0.

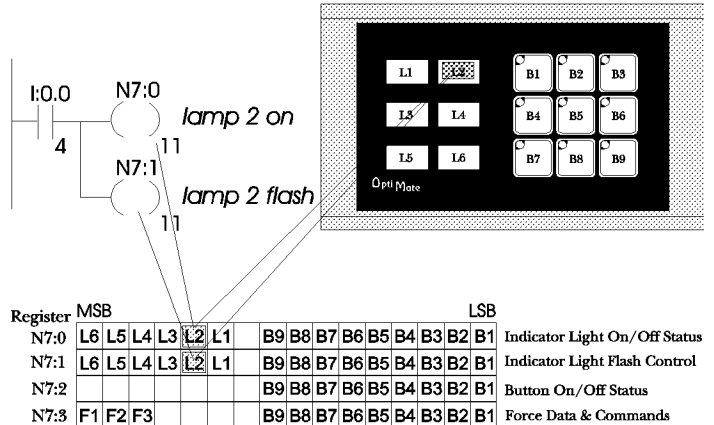| Device	Lamp/LED On/Off	Lamp/LED Flash	Button Status	Force
B1	N7:0/0	N7:1/0	N7:2/0	N7:3/0
B2	N7:0/1	N7:1/1	N7:2/1	N7:3/1
B3	N7:0/2	N7:1/2	N7:2/2	N7:3/2
B4	N7:0/3	N7:1/3	N7:2/3	N7:3/3
B5	N7:0/4	N7:1/4	N7:2/4	N7:3/4
B6	N7:0/5	N7:1/5	N7:2/5	N7:3/5
B7	N7:0/6	N7:1/6	N7:2/6	N7:3/6
B8	N7:0/7	N7:1/7	N7:2/7	N7:3/7
B9	N7:0/8	N7:1/8	N7:2/8	N7:3/8
L1	N7:0/10	N7:1/10		
L2	N7:0/11	N7:1/11		
L3	N7:0/12	N7:1/12		
L4	N7:0/13	N7:1/13		N7:3/13(F3)
L5	N7:0/14	N7:1/14		N7:3/14(F2)
L6	N7:0/15	N7:1/15		N7:3/15(F1)

Turning on a Lamp

Turning on a lamp in the OM609 simply requires activating its associated control relay coil. In the figure below, lamp 4 will be turned on whenever input I:0.0/4 is active (energizing N7:0/13).

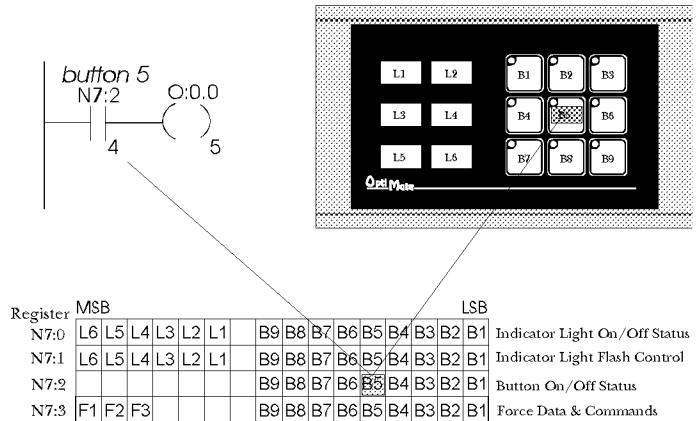| Register	MSB											LSB				
N7:0	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light On/Off Status
N7:1	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light Flash Control
N7:2								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
N7:3	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

Flashing a Lamp

To flash a lamp, you need to both turn it on and set the associated flash bit. The example below shows a SLC or Micrologix program used to flash lamp 2 whenever I:0.0/4 is energized.

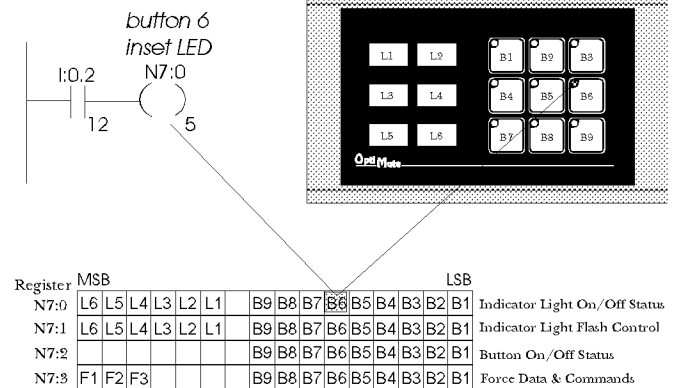| Register	MSB											LSB				
N7:0	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light On/Off Status
N7:1	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light Flash Control
N7:2								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
N7:3	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

Using a Pushbutton

The following example illustrates the use of an OM609 with a SLC or Micrologix PLC. When button 5 is activated, N7:2/4 will become active and turn on output O:0.0/5.

Register	MSB											LSB				
N7:0	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light On/Off Status
N7:1	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light Flash Control
N7:2								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
N7:3	F1	F2	F3					B9	B8	B7	B6	B5	B4	B3	B2	B1	Force Data & Commands

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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 SLC or Micrologix program that will light button 6's inset LED whenever input I:0.2/12 is energized. *In order for this to work, the panel must be configured for LED separation and button 6 must be a momentary pushbutton.*
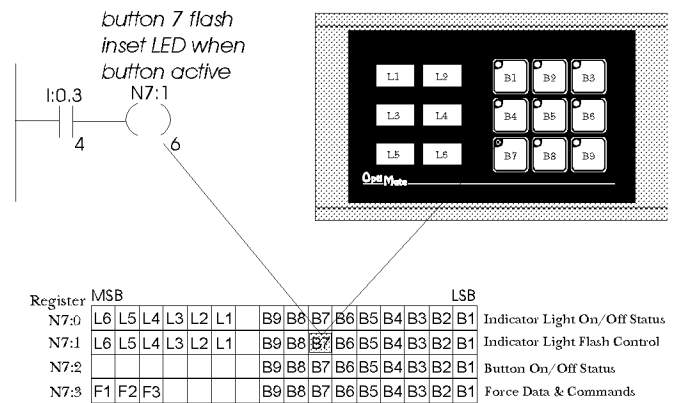
button 6
inset LED
I:0.2   N7:0
12   5

Register	MSB																LSB	
N7:0	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light On/Off Status
N7:1	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light Flash Control
N7:2								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
N7:3	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 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 SLC or Micrologix program used to set the LED inset in button 7 to flash whenever I:0.3/4 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	I0.3/4 State	LED operation
Inactive	de-energized	Off
Inactive	energized	Off
Active	de-energized	On solid
Active	energized	Flashing

button 7 flash
inset LED when
button active
I:0.3   N7:1
4   6

Register	MSB																LSB	
N7:0	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light On/Off Status
N7:1	L6	L5	L4	L3	L2	L1		B9	B8	B7	B6	B5	B4	B3	B2	B1	Indicator Light Flash Control
N7:2								B9	B8	B7	B6	B5	B4	B3	B2	B1	Button On/Off Status
N7:3	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 OM609 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 OM609 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, while leaving all other bits off. The example below shows buttons 1,5 and 6 being forced on and all other buttons forced off when B3:4/2 is active.
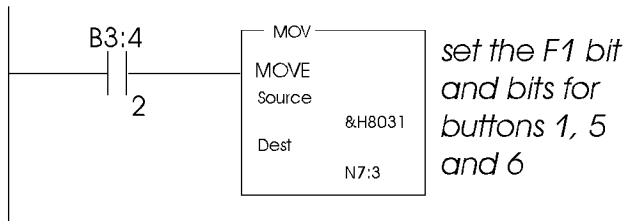
```
         B3:4          ┌─ MOV ──────────┐
        ──┤ ├──        │  MOVE          │    set the F1 bit
           2           │  Source        │    and bits for
                       │         &H8031 │    buttons 1, 5
                       │  Dest          │    and 6
                       │          N7:3  │
                       └────────────────┘
```

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 B3:4/2 is active.

```
         B3:4          ┌─ MOV ──────────┐
        ──┤ ├──        │  MOVE          │    set the F2 bit
           2           │  Source        │    and bits for
                       │         &H4042 │    buttons 2 & 7
                       │  Dest          │
                       │          N7:3  │
                       └────────────────┘
```
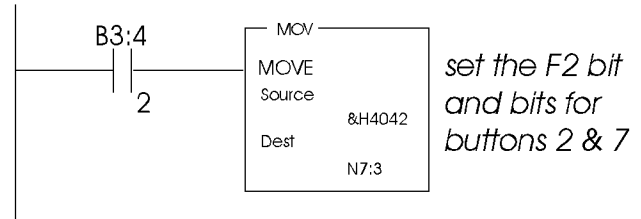
Clear Button(s)

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 bbelow shows button 5 being cleared when B3:4/2 is active.

```
         B3:4          ┌─ MOV ──────────┐
        ──┤ ├──        │  MOVE          │    set the F3 bit
           2           │  Source        │    and bits for
                       │         &H2010 │    button 5
                       │  Dest          │
                       │          N7:3  │
                       └────────────────┘
```

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

Switches 1-5 of a six position DIP switch on the back of each OptiMate module provides a method for setting the address. By use of this DIP switch you can set the module address to any number between 0 and 31. 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, that the button must be active to flash. For LED separation mode, flashing an LED entails turning it on and setting the flash bit.

Further configuration details are covered in Optimation's Configuration Editor Manual.

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 function text checksum
        address
    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 ftn led1_8 lites led1_8 lites checksum
        address |—— on —| |— flash —|
    where   Module address   = 0 to 30
             ftn   = 0xA0 ; Write LED states
             led1_8   = LEDs inset in buttons, in numeric order
             lites   = LED light bars in order, plus button LED 9 in
                               bit 7
             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 ftn flags pb1_8 pb9_12 checksum
        address
    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
                     pbx_x   = Corresponds to buttons. LSB of data
    character
                               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 function checksum
            address
            where   broadcast address = 99
                     function   = 0

Set Up and Interconnect

## Legending the Lamps and Buttons

Legending the OM609 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 OP-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 OP-WINEDIT which illustrates the process.
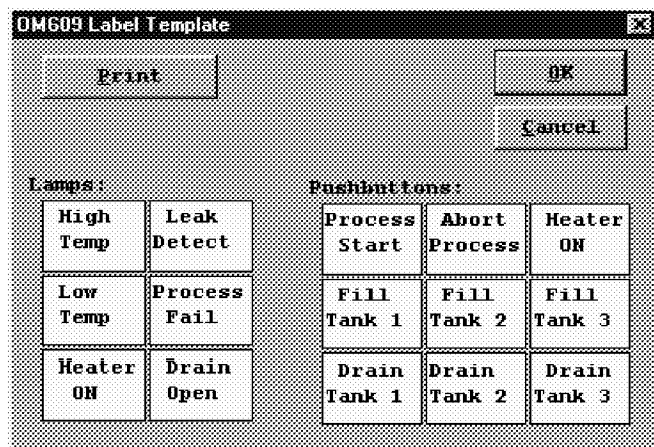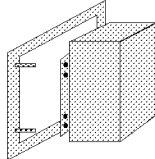
> Use a computer graphics program and a laser printer to create the transparency directly. Alternately print on paper and photocopy to a transparency.
> Use press on letters onto a transparency sheet.
> Use a typewriter or lettering machine to letter onto paper, then photocopy

- Cut along outline. Place into overlay pocket. The OM609 overlay is not glued to the faceplate. This facilitates changing of LED light bars. The legend transparency should be placed between the overlay and the faceplate. The faceplate and overlay are keyed on both ends to ensure proper alignment when reassembled. (If LED colors do not need to be changed, the overlay may be glued to the faceplate by pulling off the backing and pressing the overlay onto the faceplate).
- Re-attach bezel. Push bezel onto box until it snaps together.
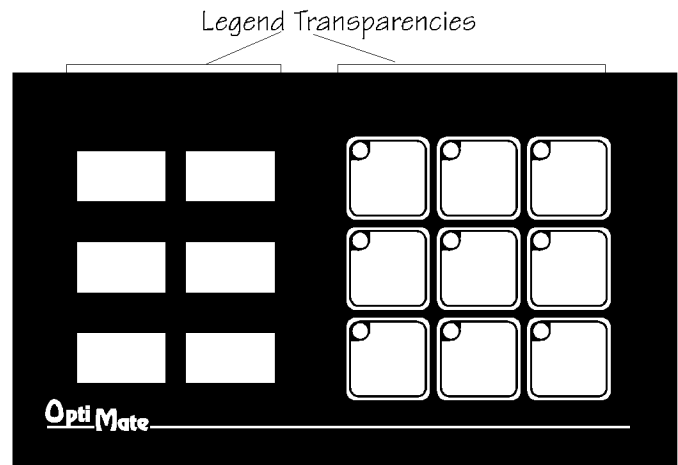
Lamp Colors

OM609 come with either all red LED light bars or with one row each of red, yellow and green light bars (the -1 option). All light bars are socketed. Light bars are available from Optimation in packets of four.

Replacing a light bar involves removing the bezel and overlay (as in the labeling procedure on the left). Once the bezel and overlay are removed, individual LED light bars may be extracted by use of needle nose pliers. Replacement light bars can be pushed into place. (The light bars are symmetrical, so orientation is not important.)

Configuration

Configuration Selections

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

For the OM609 module, the following are important configuration parameters. Further configuration details are covered in Optimation's OptiMate Configuration Editor manual

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 Module PLC Applications (Uses Communications Master)

Decision	Selection
Single/Multi Module	Choose Multi module
PLC Type	This applies to the Communications Master. Choose appropriate type
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	Will be OptiMate Hex
Momentary / Alternate	Set as required for application
LED Separation	Enable LED separation only if all momentary buttons are to be controlled from 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) prior to application of power for panel to accept configuration data. The panel must be powered down and the DIP switch changed from "Pgm" to "Run" before reapplying power for the module to operate with the selected host.

Run — ON Pgm / Term
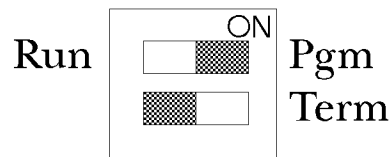
The figure below illustrates configuration via the OP-WINEDIT software As you can see the selection of the items discussed is a very straighforward process, presented in graphical form.

Addressing

Setting the panel address is performed through theconfiguration editor. The particular address selection for a panel connected directly to a PLC is not important (any address will work). For multi-panel systems, 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, PLC or OP-9001 communication master over the serial port (RS232 or RS422).

Connection to a Computer or PLC

Connection of an OptiMate panel to a computer or PLC can be accomplished over either an 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

OptiMate Panel RS232		OptiMate Panel RS422	
Host Computer/PLC	OptiMate Panel DB-15 Male	Host Computer/PLC	OptiMate Panel DB-15 Male
TX	3 RS232 RX	TX+	9 RS422 RX+
RX	2 RS232 TX	TX-	10 RS422 RX-
Sig Gnd	5 Sig Gnd	RX+	11 RS422 TX+
		RX-	12 RS422 TX-

panel.

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

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

Serial Connection to Communications Master

Connection to an OP-9001 Communications Master over a serial link is via RS422. The Communication master port connections are reversed from the module ports to enable direct pin to pin connection. For distances under 50 feet (in a low electrical noise environment), a ribbon cable connection works quite well. For longer distances or in noisy environments, a two pair shielded RS422 cable is recommended.

Termination

The termination DIP switch on the back of the module switches in a terminating resistor. This terminating resistor does not apply to an RS232 connection (and should 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.

Run   ON
                Pgm
                Term
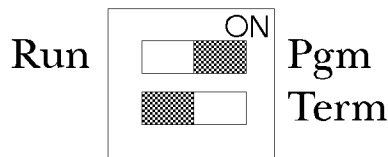
Power

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

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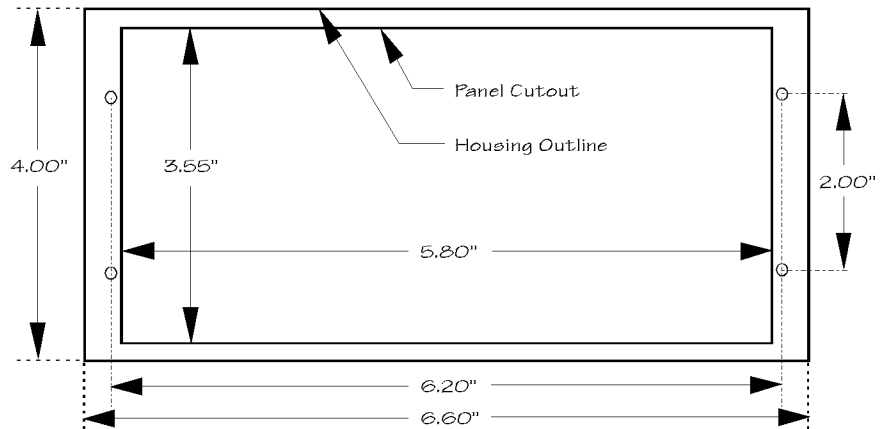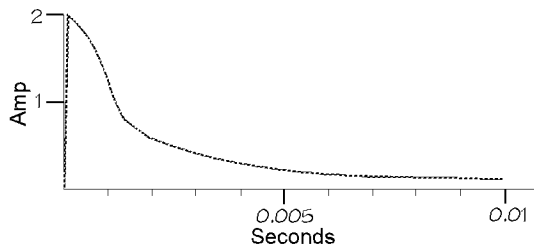
Label Templates
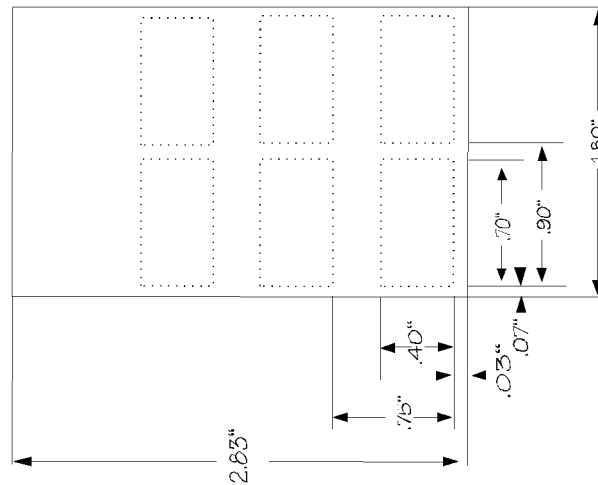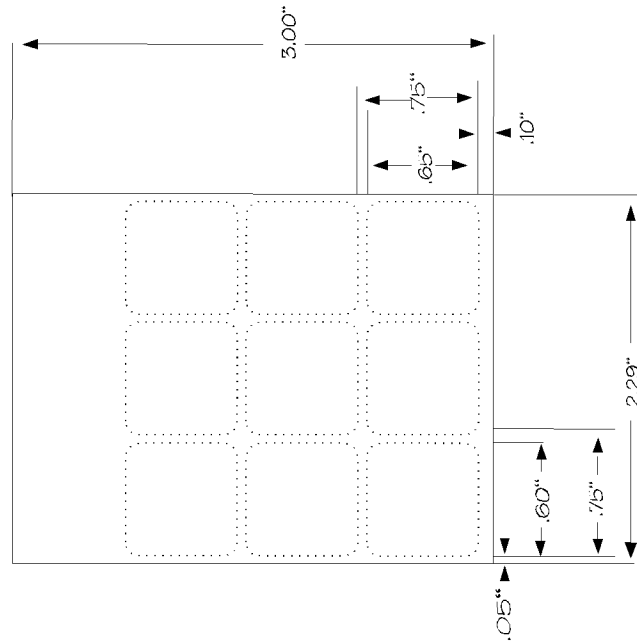
Specifications

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"

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.

Panel Mounting Dimensions

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