FEATURES

- Breadth of line offers complete selection of pushbuttons (including encoding options), rockers, paddles and indicators to accommodate different functions and promote operator efficiency.
- Printed wiring board (PWB) or panel mounted switches, plus multi-unit strip mounting, and single level termination for cost-effective installation.
- Tactile feedback imparts a definite feel of switching action.
- Coordinated appearance enhances panel harmony.
- Illumination by long-life LED's and incandescent lamps—for lighted display versatility.
- Solid state, electronic control and power duty switching—for electrical versatility.
- Temperature range: –18° to 65°C (0° to 149°F).

DESIGN FREEDOM

Rocker and paddle switches have been added to the MICRO SWITCH MML Miniature Manual Line. They complement AML pushbuttons and indicators, providing you flexibility and design freedom to answer all your miniature manual control requirements. You can choose the actuator option that matches the switch function and natural habit pattern reflex of the operator. You no longer need to compromise quality, appearance, or human factors considerations, because of size constraints.

The MML pushbutton and indicator offering has also been expanded to include new square forms which are small enough to fit in the tightest places.

MOUNTING FLEXIBILITY

Printed wiring board (PWB) mounted switches can be arranged in individual panel openings, multi-unit strips or matrices, in a common panel cutout. Optional support brackets provide added rigidity for stand-alone PWB mounted devices. Units with bezels and mounting clips can be snap-in mounted from the panel front.

Single level PWB or solder/quick-connect termination throughout makes wiring faster, easier, and more economical. Housings are designed to accommodate washing, before and after wave soldering, to help prevent contamination during printed wiring board installation.

LIGHTED DISPLAY OPTIONS

Pushbuttons and indicators can be full-face illuminated by LED's or incandescent lamps for high visibility of colors and legends. Inherently rugged, long-life LED's reduce service and maintenance costs. Also, their low drive and inrush current (30 mA or less) reduces costs of drive circuitry.

Rockers can be furnished with colored lenses for illumination by LED's or incandescent lamps.

CONTROL VERSATILITY

Solid state pushbutton switches with Hall effect integrated circuits interface directly with microprocessors and other logic level devices. Time-proven for billions of cycles, Hall effect IC's provide the ultimate in reliability.

Electronic control pushbutton, rocker, and paddle switches, with gold or silver contacts, handle up to 1 amp; power duty switches, up to 6 amps.

Miniature Manual Line

MML ENHANCES PANEL HARMONY
The attractive clean line design of the total MML offering is coordinated to work in harmony and enhance the visual qualities of your product. MML will help make a good first impression with your customers by blending with other panel components. And also work hard over the long run to maintain operator satisfaction.

HOW TO ORDER
To specify MML catalog listings, refer to the order guides. They are based on a modular cataloging system which gives you the flexibility to choose the combination of feature options that best answers the requirements of your application.

ORDER GUIDES

MML medical application. Intravaneous fluid flow controller automatically dispenses fluids for medications, therapy, and nutrition.

MML communications application. Mobile radio control keeps businesses in touch with employees on the road.

Manual Switches

Miniature Manual Line

MML CHARACTERISTICS

|	MML 10 Series	MML 20 Series	MML 30 Series	MML 40 Series
Mechanical Lifetime*				N/A
Pushbuttons–Momentary	1,000,000	250,000	100,000	---
Pushbuttons–Alternate	100,000	100,000	100,000	---
Rockers	100,000	250,000	100,000	---
Paddles	100,000	250,000	100,000	---
Electrical Lifetime***				N/A
Pushbuttons–Momentary	1,000,000	25,000	25,000	---
Pushbuttons–Alternate	100,000	25,000	25,000	---
Rockers	100,000	25,000	25,000	---
Paddles	100,000	25,000	25,000	---
Agency Ratings				
UL	File E53576	File E12252	File E12252	File E58932
CSA	File L R4442	File LR4442	File LR4442	File LR4442

*95% Survival
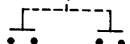**Lifetime at Full Rated Load

MML ELECTRICAL DATA
MML10 SERIES

Electrical Characteristics	Integrated Circuit Function	5-24 VDC Sinking
	Supply Current (Max.)	7 mA (Released) 8 mA (Operated no load)
	Output Voltage (Operated)	0.3 Volt (Sinking 10 mA)
	Output Leakage Current Max. (Released)	5.0 μA
	Switching Time Max. Rise 10% to 90% Fall 90% to 10%	 1.5 μ sec (Sinking 10 mA) 0.5 μ sec (Sinking 10 mA)
	Rated Output Current	10 mA Sinking
Absolute Maximum Ratings	Supply Voltage (V_s)	–28 to +28 VDC
	Voltage Externally Applied to Output	–0.5 Volt min. +28 Volts max. (Off condition)
	Loads to Output	20 mA (Sinking)
	Storage Temperature	–40° to +85°C (–40° to +185°F)
	Operating Temperature	–18° to +65°C (0° to +149°F) and supply voltage of 4.5 to 5.5 VDC

As with all solid state components, performance can be expected to deteriorate as rating limits are approached; however, they will not be damaged unless the limits are exceeded.

MML20 SERIES

Electrical Rating (silver contacts)	**Standard buttons** Up to 1 amp, 125 VAC
	1 piece plunger/lens cap buttons: Black—Up to 1 amp, 125 VAC All others—Up to 0.5 amp, 125 VAC
Electrical Rating Gold Contacts	**All button styles:** Up to 0.25 amp, 30 VDC UL rating—0.10 amp, 30 VDC
	One pole Form C

MML30 SERIES

MML31:

Electrical Rating Silver Contacts	6A @ 125 VAC, 250 VAC; 2A @ 30 VDC; 1A @ 125 VDC ''L''; 1/10 hp @ 125 VAC
Contact Arrangement	1 or 2 poles Form X

MOUNTING DIMENSIONS (For reference only)

PANEL CUTOUTS FOR PUSHBUTTON SWITCHES AND INDICATORS/RECTANGULAR TYPE

INDIVIDUAL SNAP-IN PANEL MOUNT

$\frac{11,5 \pm 0,13}{.453 \pm .005}$

$\frac{16,0 \pm 0,13}{.630 \pm .005}$

$\frac{1,27 — 2,39}{.050 — .094}$

Panel Thickness
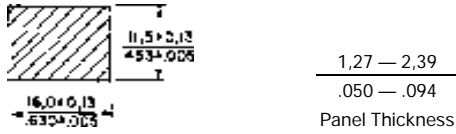
PANEL PUNCH FOR MML SERIES
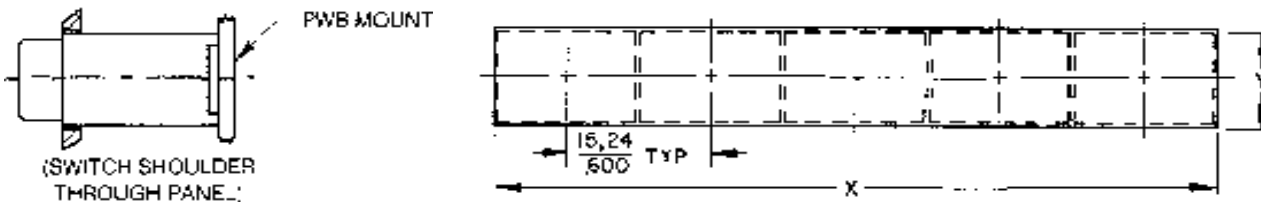A panel punch is manufactured by Greenlee-Textron Tool Co., Rockford, IL (815-926-3011).

INDIVIDUAL PRINTED WIRING BOARD (PWB) MOUNT

$\frac{8,26 \pm 0,13}{.325 \pm .005}$

$\frac{13,23 \pm 0,13}{.521 \pm .005}$

Pushbutton Plunger Thru Panel

$\frac{10,24 \pm 0,13}{.403 \pm .005}$

$\frac{15,9 - 0,8}{.599 - .006}$

Housing Thru Panel

$\frac{8,87 \pm 0,13}{.349 \pm .005}$

$\frac{13,64 \pm 0,13}{.545 \pm .005}$

Indicator Lens Thru Panel

MULTI-UNIT PRINTED WIRING BOARD (PWB) MOUNT

PWB MOUNT

(SWITCH SHOULDER THROUGH PANEL)

Horizontal Mount

$\frac{15,24}{.600}$ TYP

Establish tooling holes on X coordinate and use these holes to establish relationship between PWB and Panel

Terminals $\frac{0,20}{.008}$ x $\frac{0,76}{.030}$

Recommended hole size in PWB $\frac{1,17}{.046}$

Switches must be fixtured to insure proper panel cutout alignment

N = Number of switches

$X = N{-}1 \times \frac{15,24}{.600} + \frac{15,11}{.595}$
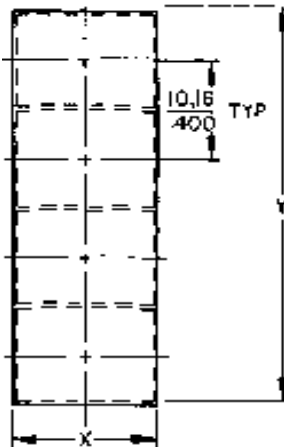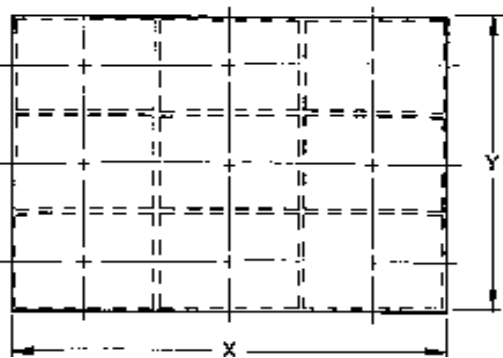
$Y = \frac{10,16}{.400}$

Example: N = 5 Switches

$X = 5{-}1 \times \frac{15,24}{.600} + \frac{15,11}{.595}$

$X = \frac{76,07}{2.995}$

Matrix Mount

N = Number of Switches
N_X = Number of Rows
N_Y = Number of Columns

$N = N_X{-}1 \times \frac{15,24}{.600} + \frac{15,11}{.595}$

$Y = N_Y \times \frac{10,16}{.400}$

Vertical Mount

$\frac{10,16}{.400}$ TYP

N = Number of Switches

$Y = N \times \frac{10,16}{.400}$

$X = \frac{15,11}{.595}$

Example: N = 4

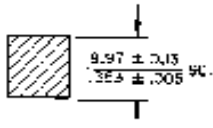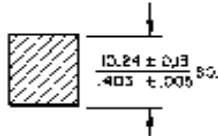$Y = 4 \times \frac{10,16}{.400}$

$Y = \frac{40,64}{1,600}$

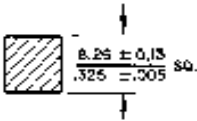**MOUNTING DIMENSIONS** (For reference only)

PANEL CUTOUTS FOR PUSHBUTTON SWITCHES AND INDICATORS/SQUARE TYPE

Individual Snap-in Panel Mount

Individual Printed Wiring Board PWB Mount

$\frac{11.5 \pm 0.13}{.453 \pm .005}$ SQ.

$\frac{8.26 \pm 0.13}{.325 \pm .005}$ SQ.

Pushbutton Plunger Thru Panel

$\frac{10.24 \pm 0.13}{.403 \pm .005}$ SQ.

Housing Thru Panel

$\frac{9.97 \pm 0.13}{.353 \pm .005}$ SQ.

Indicator Lens Thru Panel

See page 91 for panel punch manufacturer.

MULTI-UNIT PRINTED WIRING BOARD (PWB) MOUNT
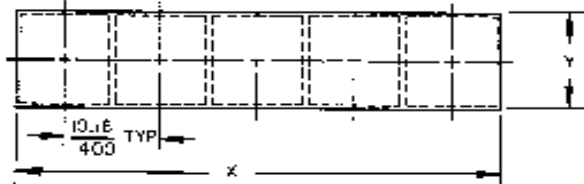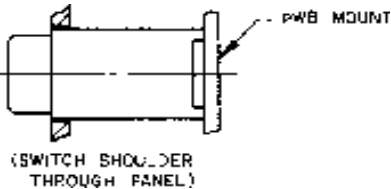
(SWITCH SHOULDER THROUGH PANEL)

Establish tooling holes on X coordinate and use these holes to establish relationship between PWB and Panel

Terminals $\frac{0.20}{.008} \times \frac{0.76}{.030}$

Recommended hole size in PWB $\frac{1.17}{.046}$

Switches must be fixtured to insure proper panel cutout alignment

Matrix Mounting

N = Number of Switches
N_X = Number of Rows
N_Y = Number of Columns

Formula: $X = N \times \frac{10,16}{.400}$

$Y = N \times \frac{10,16}{.400}$

Horizontal Mounting

$\frac{10,16}{.400}$ TYP

Formula:
N = Number of switches
$X = N \times \frac{10,16}{.400}$
$Y = \frac{10,16}{.400}$

Example: N = 5 Switches
$X = 5 \times \frac{10,16}{.400}$
$X = \frac{50,80}{2.00}$

Vertical Mounting

$\frac{10,16}{.400}$ TYP

N = Number of Switches
Formula: $Y = N \times \frac{10,16}{.400}$

$X = \frac{10,16}{.400}$

Example: N = 4
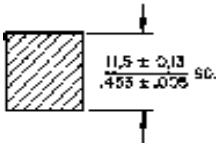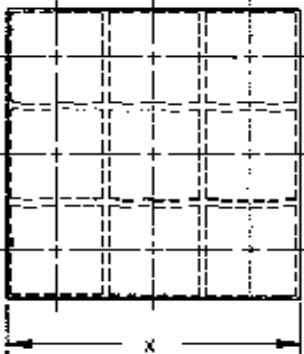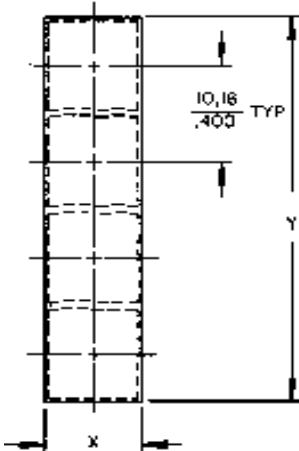$Y = 4 \times \frac{10,16}{.400}$
$Y = \frac{40,64}{1.600}$

Manual Switches
Miniature Manual Line

MOUNTING DIMENSIONS (For reference only)

PRINTED WIRING BOARD MOUNT PUSHBUTTON SWITCHES/RECTANGULAR TYPE

MML11 Switches   **PWB Pin Locations**
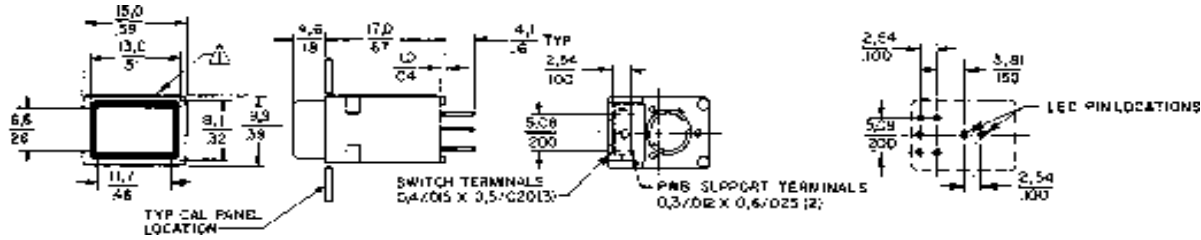
PWB Receptacle Installed (LED or Incandescent Lamp)

MML21 Switches   **PWB Pin Locations**

PWB Receptacle Installed (LED or Incandescent Lamp)
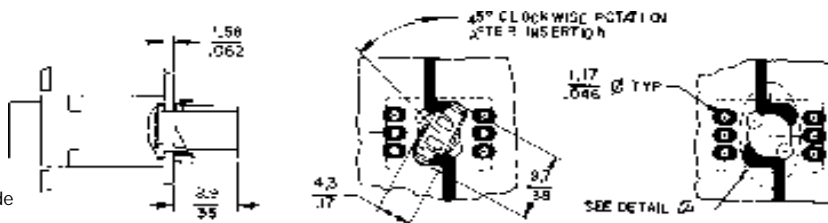
Notes:
⚠ Micro Switch Identification This Side
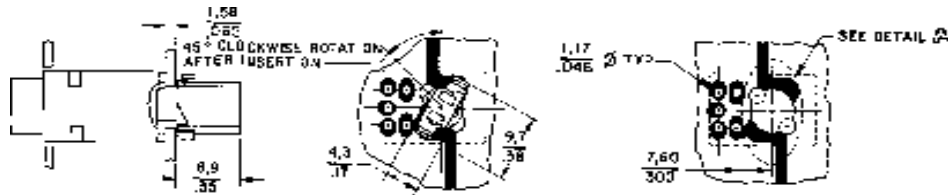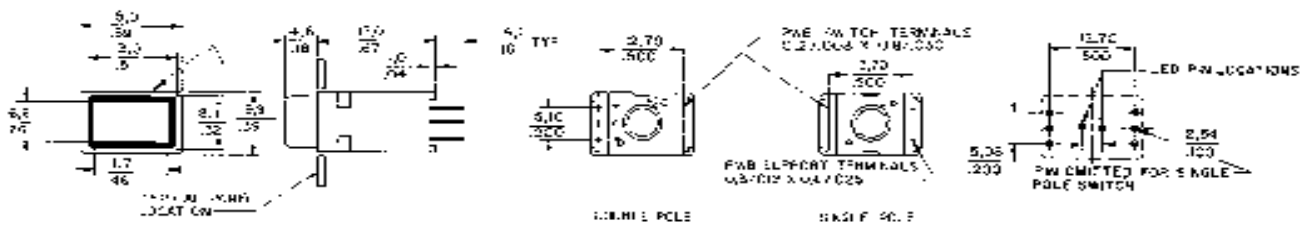2 – Linear measure mm/IN. or $\frac{mm}{IN.}$

MML31 Switches

Manual Switches

Miniature Manual Line

MOUNTING DIMENSIONS (For reference only)

PRINTED WIRING BOARD MOUNT INDICATORS/RECTANGULAR TYPE

MML41 Indicators

PWB Receptacle Installed (LED or Incandescent Lamp)

Notes:
⚠ Micro Switch Identification This Side
2 – Linear measure mm/IN. or $\frac{mm}{IN.}$

MML44 Indicators

MML46 Indicators

PWB Receptacle Installed (LED or Incandescent Lamp)
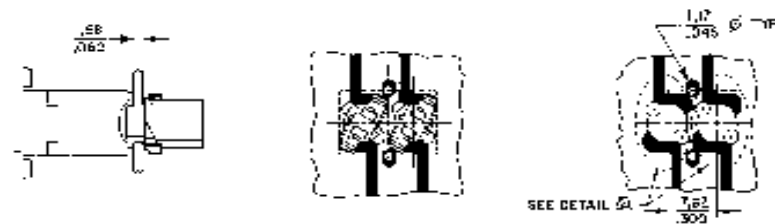
PWB Pad Location For Receptacle (LED or Incandescent Lamp)
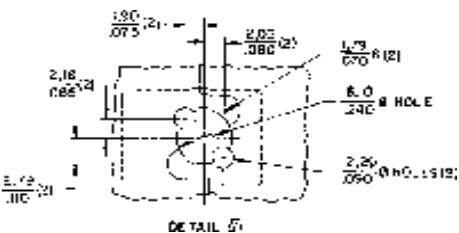
Manual Switches

Miniature Manual Line

MOUNTING DIMENSIONS (For reference only)

PANEL MOUNT PUSHBUTTON SWITCHES/RECTANUGLAR TYPE

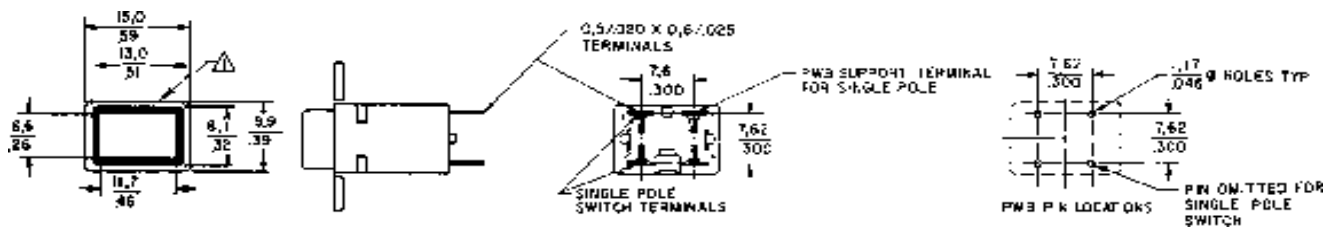**MML21 Switches**
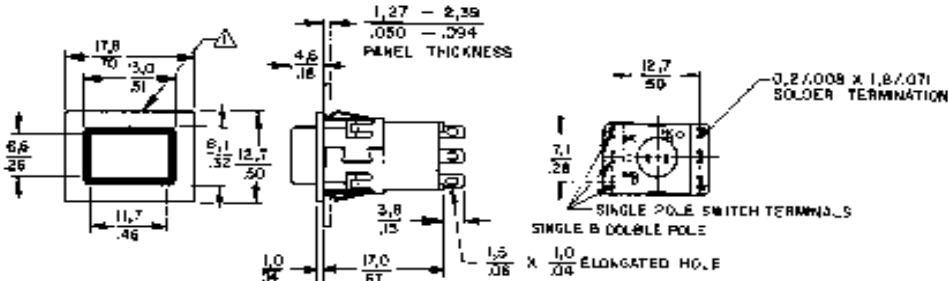
Solder Receptacle Installed (LED or Incandescent Lamp)
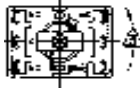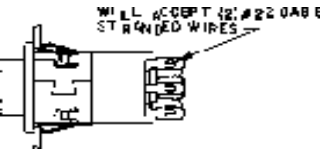
Notes:
⚠ Micro Switch Identification This Side
2 – Linear measure mm/IN. or $\frac{mm}{IN.}$
⚠ Rotate 45° counter clockwise for removal from switch or indicator

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MML31 Switches
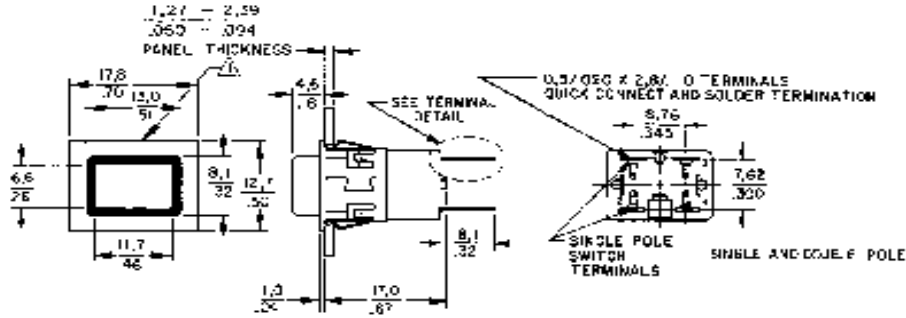
Terminal Detail
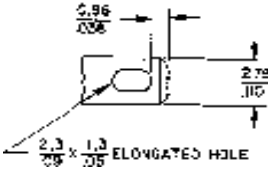
Manual Switches

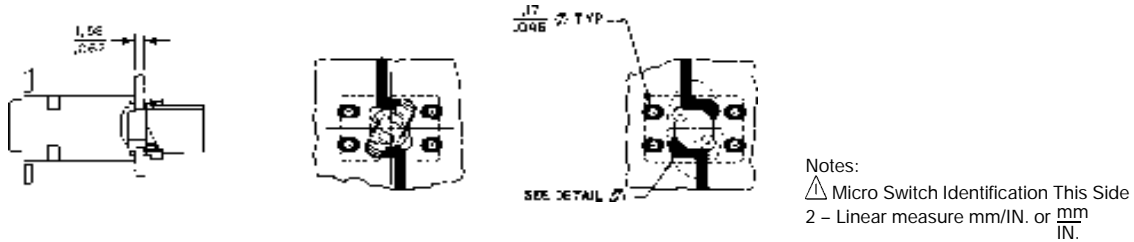## Miniature Manual Line

MOUNTING DIMENSIONS (For reference only)
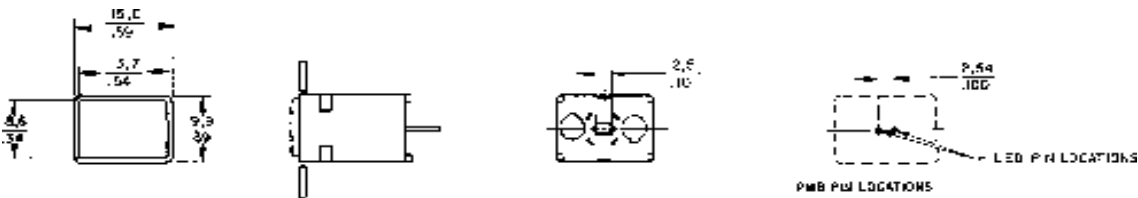
PANEL MOUNT INDICATORS/RECTANGULAR TYPE
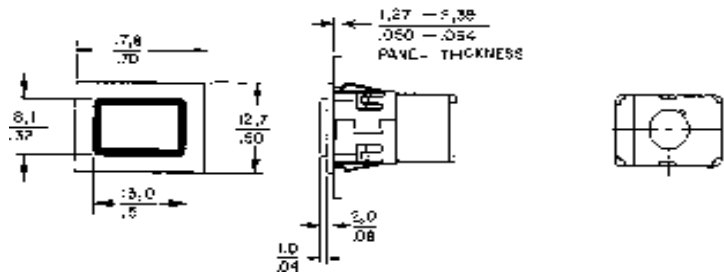
MML41 Indicators

Solder Receptacle Installed (LED or Incandescent Lamp)
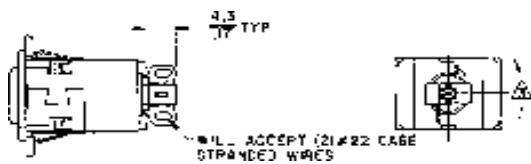
MML43 Indicators
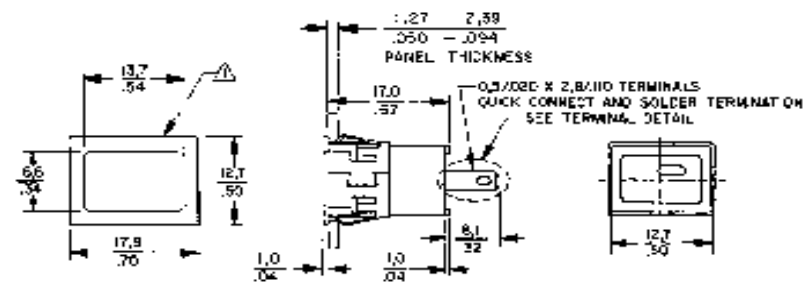
Terminal Detail

Notes:
⚠ Micro Switch Identification This Side
2 – Linear measure mm/IN. or $\frac{mm}{IN.}$

MML44 Indicators

MML46 Indicators

Solder Receptacle Installed (LED or Incandescent Lamp)
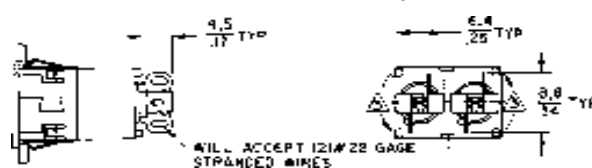
MOUNTING DIMENSIONS (For reference only)

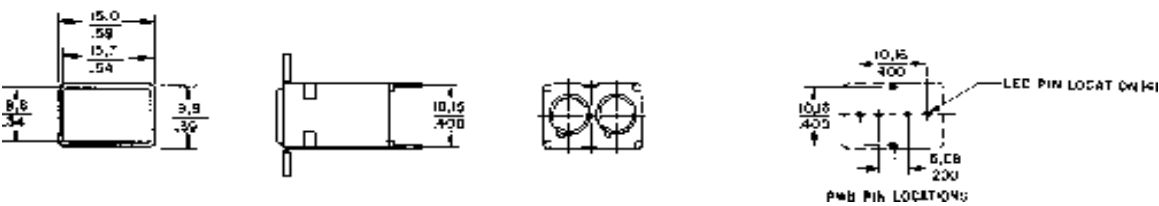**PRINTED WIRING BOARD MOUNT PUSHBUTTON SWITCHES AND INDICATORS/SQUARE TYPE**

MML21 Switches

PWB Receptacle Installed (LED or Incandescent Lamp)

MML46 Indicators

PWB Receptacle Installed (LED or Incandescent Lamp)

NOTES

⚠ MICRO SWITCH IDENTIFICATION THIS SIDE

⚠ MML41: 2,0/.08
  MML46: 1,0/.04

3–LINEAR MEASURE mm/IN OR $\frac{mm}{IN}$

PANEL MOUNT PUSHBUTTON SWITCHES/SQUARE TYPE

MML21 Switches
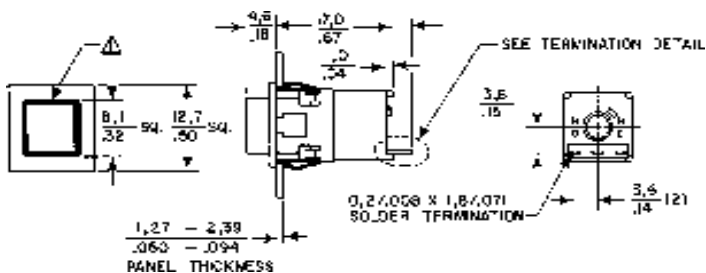
Termination Detail
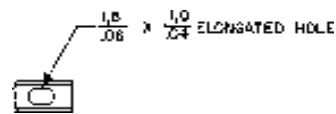
NOTE:
To install LED or lamp, use MML93L receptacle shown on page 90.

Manuals

Manual Switches

Miniature Manual Line

MOUNTING DIMENSIONS (For reference only)

LENSES

Rectangular Pushbutton Lens
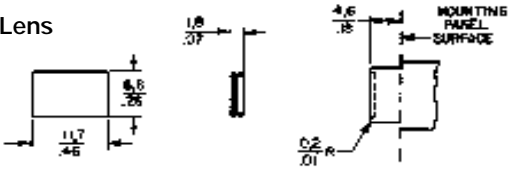
Rectangular Indicator Lens
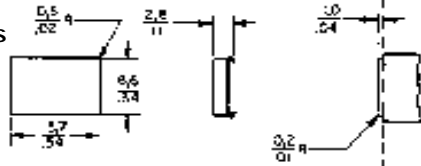
Square Pushbutton Lens
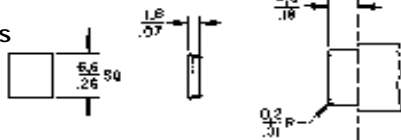
Square Indicator Lens
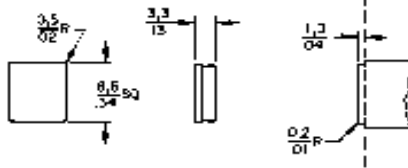
PWB SUPPORT BRACKETS

Rectangular	Square
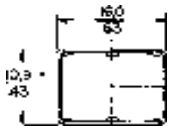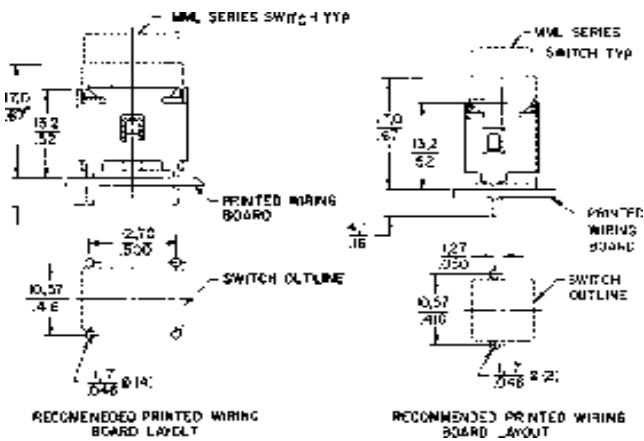
RECOMMENDED PRINTED WIRING BOARD LAYOUT

RECOMMENDED PRINTED WIRING BOARD LAYOUT

Miniature Manual Line

MOUNTING DIMENSIONS (For reference only)

PANEL CUTOUTS FOR PWB MOUNT PADDLE AND ROCKER SWITCHES
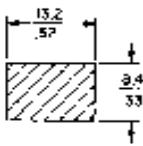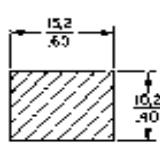
| Actuator Thru Panel | Housing Thru Panel | Umbrella Rocker Thru Panel | 2-Pole MML33, 34 Actuator Thru Panel | 2-Pole MML33, 34 Housing Thru Panel |
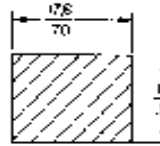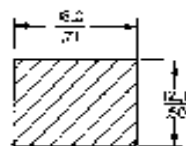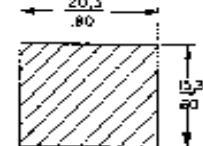
See page 91 for panel punch manufacturer.

PRINTED WIRING BOARD MOUNT PADDLE AND ROCKER SWITCHES

MML23 Paddle Switches
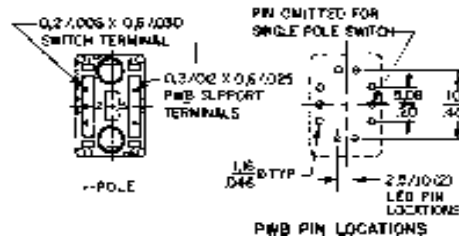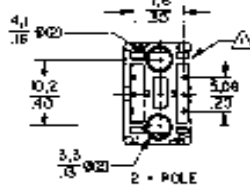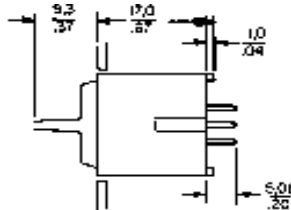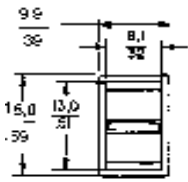
See MML24 drawing below for PWB receptacle dimensions

MML24 Rocker Switches
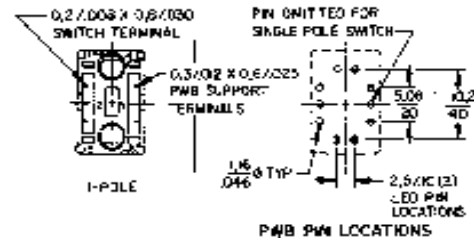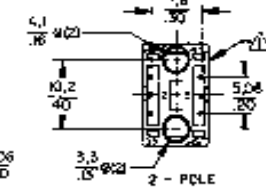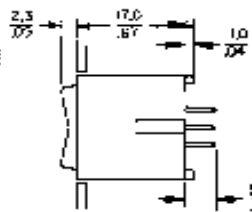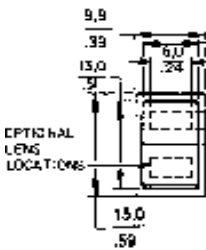
Manuals

With PWB Receptacle Installed (LED or Incandescent Lamp)
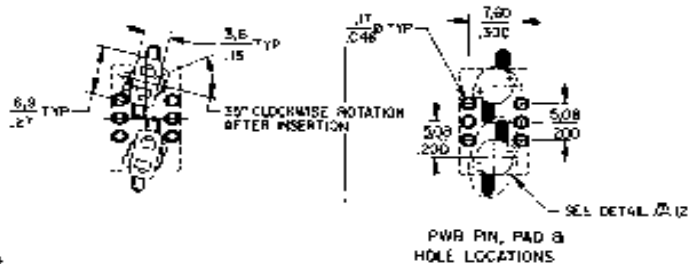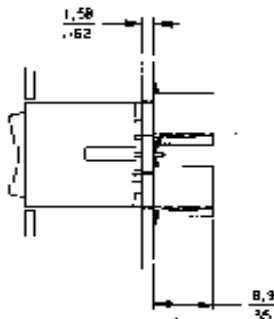
MML24 Rocker (Umbrella Type) Switches
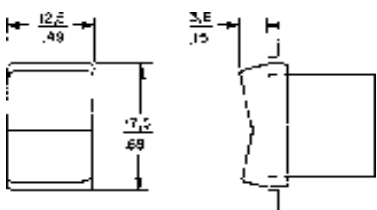
Notes:
⚠ Micro Switch Identification This Side
2 – Linear measure mm/IN. or $\frac{mm}{IN.}$
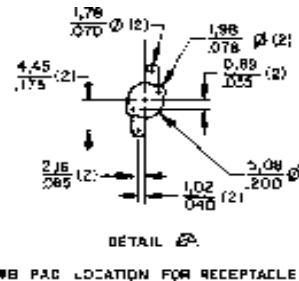
DETAIL B.

PWB PAD LOCATION FOR RECEPTACLE

Manual Switches
Miniature Manual Line

MML Series

MOUNTING DIMENSIONS (For reference only)

PANEL MOUNT PADDLE AND ROCKER SWITCHES

MML23 Paddle Switches
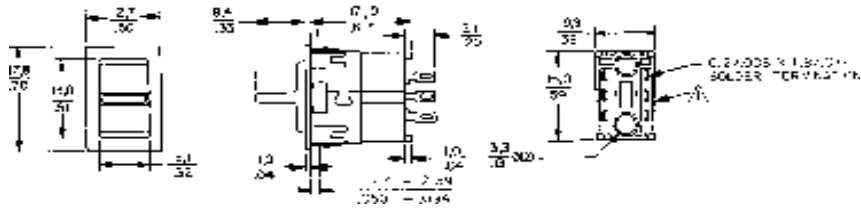
Notes:
⚠ Micro Switch Identification This Side
2 – Linear measure mm/IN. or $\frac{mm}{IN.}$

MML24 Rocker Switches
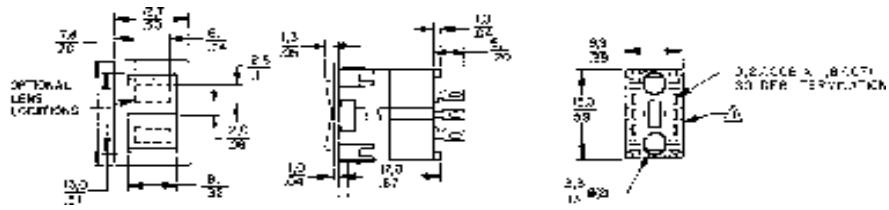
NOTE:
To install LED or lamp, use MML93R receptacle shown on page 89.

Miniature Manual Line

MOUNTING DIMENSIONS (For reference only)

HORIZONTAL MATRIX MOUNT/RECTANGULAR TYPE

Panel Mounting Detail

Printed Wiring Board Mounting Detail

Recommended Panel Cutout

Recommended Panel Cutout
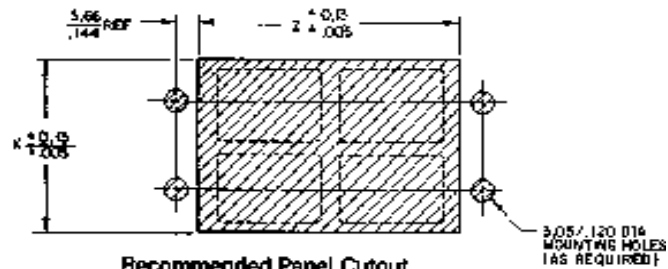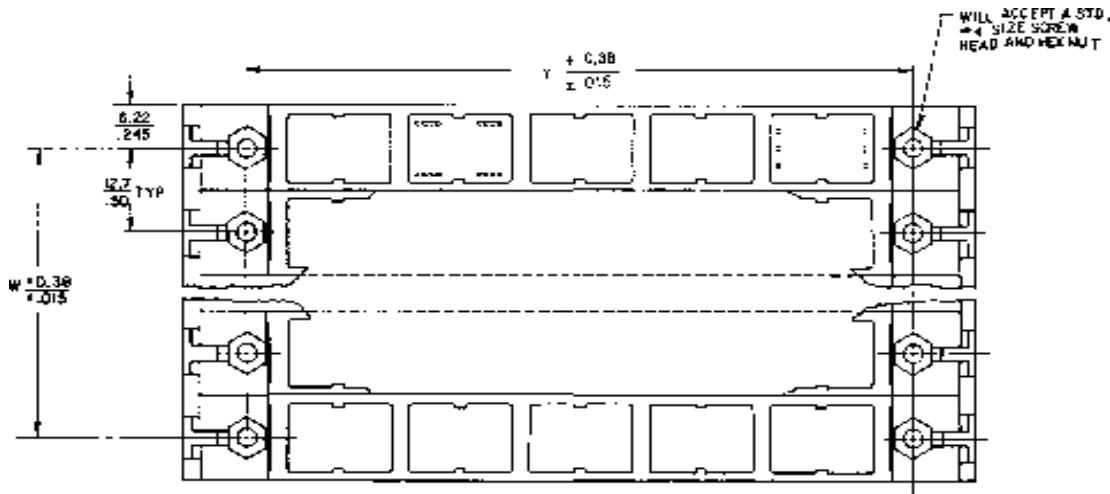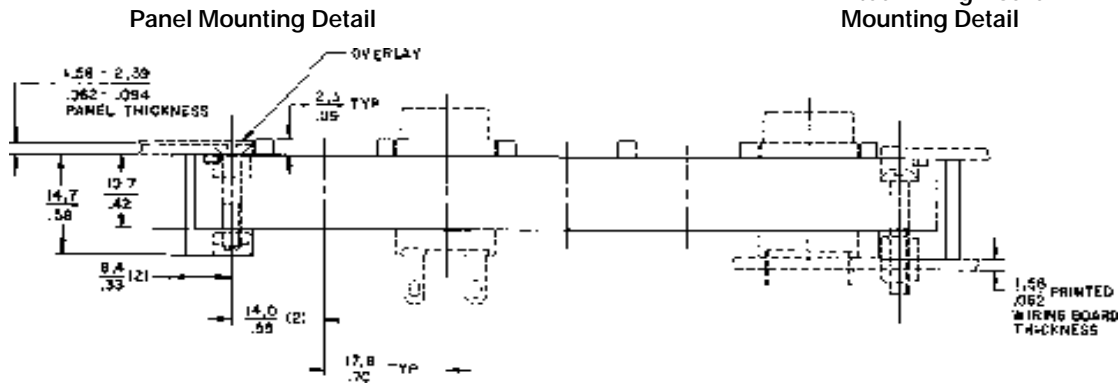
NO. OF STRIPS	W	X	NO. OF STATIONS	Y	Z
10	127,00/5.000	124,56/4.904	10	188,14/7.407	180,64/7.112
9	114,30/4.500	111,86/4.404	9	170,36/6.707	162,86/6.412
8	101,60/4.000	99,16/3.904	8	152,58/6.007	145,08/5.712
7	88,90/3.500	86,46/3.404	7	134,80/5.307	127,30/5.012
6	76,20/3.000	73,76/2.904	6	117,02/4.607	109,52/4.312
5	63,50/2.500	61,06/2.404	5	99,24/3.907	91,74/3.612
4	50,80/2.000	48,36/1.904	4	81,46/3.207	73,96/2.912
3	38,10/1.500	35,66/1.404	3	63,68/2.507	56,18/2.212
2	25,40/1.000	22,96/ .904	2	45,90/1.807	38.40/1.512
1	12,45/ 0.49	10,26/0.404	N/A	N/A	N/A

Notes:
1 – Linear measure mm/IN. or mm

Miniature Manual Line

MOUNTING DIMENSIONS (For reference only)

VERTICAL MATRIX MOUNT/RECTANGULAR TYPE

Panel Mounting Detail

**Printed Wiring Board
Mounting Detail**

Recommended Panel Cutout

RECOMMENDED DIMENSIONS				
10	177,80/7.000	175,26/6.900	10	137,34/5.407	129,69/5.106
9	160,02/6.300	157,48/6.200	9	124,64/4.907	116,99/4.606
8	142,24/5.600	139,70/5.500	8	111,94/4.407	104,29/4.106
7	124,46/4.900	121,92/4.800	7	99,24/3.907	91,59/3.606
6	106,68/4.200	104,14/4.100	6	86,54/3.407	78,80/3.106
5	88,90/3.500	86,36/3.400	5	73,84/2.907	66,19/2.606
4	71,12/2.800	68,58/2.700	4	61,14/2.407	53,49/2.106
3	53,34/2.100	50,80/2.000	3	48,44/1.907	40,79/1.606
2	35,56/1.400	33,02/1.300	2	35,74/1.407	28,09/1.106
1	17,78/ .700	15,24/ .600	1	23,04/ .907	15,39/ .606
NO. OF STRIPS	W	X	NO. OF STATIONS	Y	Z

Notes:
1 – Linear measure mm/IN. or $\frac{mm}{IN.}$

Manual Switches

Miniature Manual Line

MML Series

MOUNTING DIMENSIONS (For reference only)

MATRIX MOUNT/SQUARE TYPE

Panel Mounting Detail

Printed Wiring Board Mounting Detail

Recommended Panel Cutout

RECOMMENDED DIMENSIONS					
10	127,00/5.000	124,56/4.904	10	137,16/5.400	129,84/5.112
9	114,30/4.500	111,86/4.404	9	124,46/4.900	117,14/4.612
8	101,60/4.000	99,16/3.904	8	111,76/4.400	104,44/4.112
7	88,90/3.500	86,46/3.404	7	99,06/3.900	91,74/3.612
6	76,20/3.000	73,76/2.904	6	86,36/3.400	79,04/3.112
5	63,50/2.500	61,06/2.404	5	73,66/2.900	66,34/2.612
4	50,80/2.000	48,36/1.904	4	60,96/2.400	53,64/2.112
3	38,10/1.500	35,66/1.404	3	48,26/1.900	40,94/1.612
2	25,40/1.000	22,96/ .904	2	35,56/1.400	28,24/1.112
1	12,70/ .500	10,26/ .404	1	22,86/ .900	15,54/ .612
NO. OF STRIPS	W	X	NO. OF STATIONS	Y	Z

Notes:
1 – Linear measure mm/IN. or $\frac{mm}{IN.}$

LED, INCANDESCENT, OR NON-LIGHTED DISPLAY

PWB Mount   Panel Mount

FEATURES
- Hall effect reliability
- Provides low voltage signals that interface with nearly all DC logic
- Accepts one LED or incandescent lamp
- Printed wiring board or snap-in panel mounting
- UL recognized, CSA certified
- Bezels and mounting clips, LEDs and legended lenses can be furnished installed or ordered separately

Example: MML11KA3AAK
Solid state pushbutton housing (black), no bezel; PWB terminals; momentary action; 5 VDC, current sinking output, black plunger.

Example: MML11KK3AAKRSDR
As above, except furnished with black bezel; mounting clips (long sides); red LED, and red lens installed.

MML11 ORDER GUIDE

Catalog listing codes for switch, less assembled display options
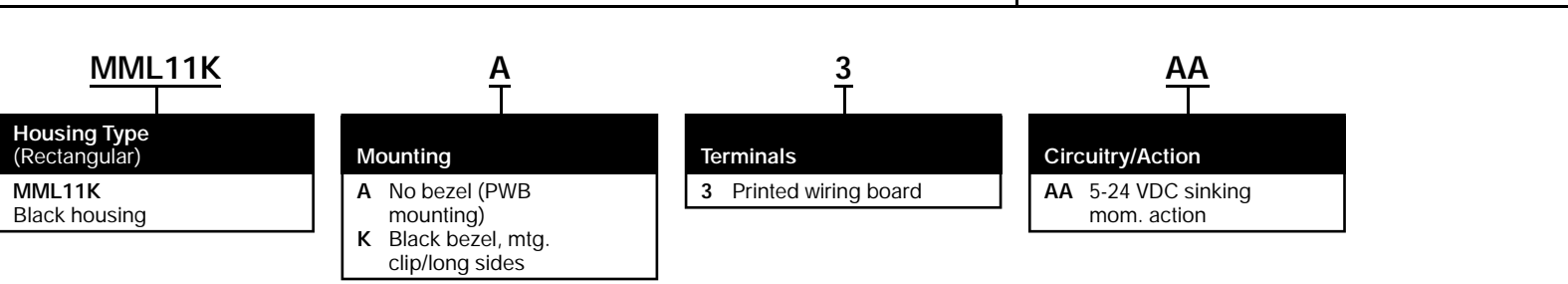
MML11K   **A**   **3**   **AA**

Housing Type (Rectangular)	**Mounting**	**Terminals**	**Circuitry/Action**
MML11K Black housing	**A** No bezel (PWB mounting) **K** Black bezel, mtg. clip/long sides	**3** Printed wiring board	**AA** 5-24 VDC sinking mom. action

Current Sinking Output
A permanent magnet plunger moves adjacent to the Hall effect integrated circuit to give a digital, current sinking (normally high and normally low) output.
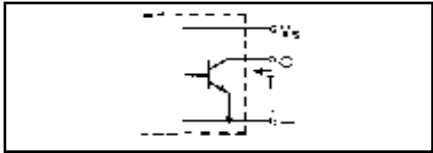
Order display options assembled to switch by adding codes below

K

RS

DR

Leave this space blank, if legend not desired

Plunger
K Black

LED (Stanley Type)
XX No LED
RS Red*
YS Yellow*
GS Green*

* Permanently installed.

Lens
For LED display:
DR Red
DY Yellow
DG Green
For incandescent or non-lighted display:
LR Red
LY Yellow
LG Green
LW White
LK Black

Legend
20 With Legend
Use Legend Order Sheet FO-74024 to cover each catalog listing (see page 83).

CUSTOMER INSTALLATION:

LED
1. Order LED and receptacle, page 87.
2. Installation instructions, page 88.

Incandescent Lamp
1. Order lamp/PWB receptacle or lamp/solder receptacle, page 89.
2. Installation instructions, page 90.

Manuals

Electronic Control Pushbutton

LED, INCANDESCENT, OR NON-LIGHTED DISPLAY

PWB Mount
(Standard plunger)

Panel Mount
(Standard plunger)

PWB Mount
(One-piece plunger)

FEATURES
- Silver or gold contacts
- Choice of rectangular or square housings
- Accepts one LED or incandescent lamp
- Printed wiring board or snap-in panel mounting
- Bezels and mounting clips, LEDs and legended lenses can be furnished installed or ordered separately
- UL recognized, CSA certified

Example: MML21KK3AAK
Electronic control pushbutton switch with standard plunger; rectangular housing (black); bezel (black); mounting clips on long sides, PWB terminals; 1-pole, momentary action, silver contacts, black plunger.

Example: MML21KK3AAKRSDR
As above, except furnished with red LED and red lens installed.

MML21KK3AAHRSXX20 as above, legended.

Catalog listing codes for switch, less assembled display options

MML21 STANDARD PLUNGER SWITCHES ORDER GUIDE

MML21K   K   3   AA

Housing Type	Mounting		Terminals	Circuitry/Action (Each pole is double throw)	
	Rectangular	**Square**		**Rectangular**	**Square**
MML21K Rectangular Black Housing **MML21H** Square Black Housing	**A** No bezel (PWB mounting) **K** Black bezel, mtg. clip/long sides	**A** No bezel (PWB mounting) **R** Black bezel & mtg. clip	**3** Printed Wiring Board **2** Solder	**Silver Contacts:** **AA** 1 pole, mom. action **AB** 1 pole, alt. action **AC** 2 pole, mom. action **AD** 2 pole, alt. action **Gold Contacts:** **BA** 1 pole, mom. action **BB** 1 pole, alt. action **BC** 2 pole, mom. action **BD** 2 pole, alt. action	**Silver contacts:** **AA** 1-pole, mom. action **AB** 1-pole, alt. action **Gold contacts** **BA** 1-pole, mom. action **BB** 1-pole, alt. action

MML21 ONE PIECE LENS/PLUNGER SWITCHES ORDER GUIDE

Catalog listing codes for switch, less assembled display options

MML21H   K   3   AA

Housing Type	Mounting		Terminals	Circuitry/Action (Each pole is double throw)	
	Rectangular	**Square**		**Rectangular**	**Square**
MML21K Rectangular Black Housing **MML21H** Square Black Housing	**A** No bezel (PWB mounting) **K** Black bezel, mtg. clip/long sides	**A** No bezel (PWB Mounting) **R** Black bezel & mtg. clip	**3** Printed Wiring Board **2** Solder	**Silver Contacts:** **AA** 1 pole, mom. action **AB** 1 pole, alt. action **AC** 2 pole, mom. action **AD** 2 pole, alt. action **Gold Contacts:** **BA** 1 pole, mom. action **BB** 1 pole, alt. action **BC** 2 pole, mom. action **BD** 2 pole, alt. action	**Silver contacts:** **AA** 1-pole, mom. action **AB** 1-pole, alt. action **Gold contacts** **BA** 1-pole, mom. action **BB** 1-pole, alt. action

Order display options assembled to switch by adding codes below

K   RS   DR

Plunger Type

K	Black
W	White

LED*

XX	No Led
RS	Red
YS	Yellow
GS	Green

Lens

XX	No Lens		
For LED Display		For Incandescent or Unlighted Display	
DR	Red		
DY	Yellow	**LR**	Red
DG	Green	**LY**	Yellow
		LG	Green
		LW	White
		LK	Black

Legend

20
With Legend (Leave Blank if no legend needed

Use Legend Order Sheet FO-74024 to cover each catalog listing. (See page 83.)

CUSTOMER INSTALLATION:

LED
1. Order LED and receptacle, page 87.
2. Installation instructions, page 88.

Incandescent Lamp
1. Order lamp/PWB receptacle or lamp/solder receptacle, page 89.
2. Installation instructions, page 90.

Manuals

Order display options assembled to switch by adding codes below

H   RS

Button Color (One Piece Plunger)

For LED Display		For Incandescent or non-light display	
H	Red	**R**	Red
L	Yellow	**Y**	Yellow
N	Green	**G**	Green
		Z	Black

LED*

XX	No LED
RS	Red
YS	Yellow
GS	Green

Legend

XX20
With Legend (Leave Blank if no legend needed

Use Legend Order Sheet FO-74024 to cover each catalog listing. (See page 83.)

*Notes:
1. When an LED is specified in a **rectangular** MML21 listing, MICRO SWITCH will permanently install it in the housing.
2. MICRO SWITCH does **not** permanently install an LED in a **square** MML21 listing. To install an LED in a square housing, order a MML93L or MML93G receptacle and a MML92 LED (see pages 88 and 90).

Manual Switches

Electronic Control Paddle
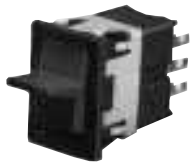
NON-LIGHTED DISPLAY

PWB Mount   Panel Mount

FEATURES
- Printed circuit board or snap-in panel mounting
- Bezels and mounting clips can be furnished installed or ordered separately
- UL recognized, CSA certified

Example: MML23KA3AA01K
Electronic control paddle switch with black housing; printed wiring board mounting; printed wiring board terminals; 1 pole, silver contacts; 2-position, maintained action; one circuit ON in each position; black paddle.

MML23 ORDER GUIDE

MML23K	A	3	AA
Housing Type	**Mounting**	**Terminals**	**Circuitry**
MML23K Black housing	A No bezel (PWB mounting) K Black bezel, mtg. clip/long sides	3 Printed wiring board 2 Solder	Insert code letters from Circuitry Chart

Electronic Control Rocker Switches   MML24

LED, INCANDESCENT, OR NON-LIGHTED DISPLAY

PWB Mount   Panel Mount   PWB Mount
(Lighted rocker)   PWB Mount
(Umbrella rocker)
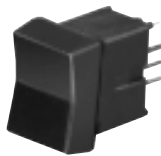
FEATURES
- Accepts one or two LEDs or incandescent lamps which are ordered separately
- Printed wiring board mounting or snap-in panel mounting
- Bezels and mounting clips can be furnished installed or ordered separately
- UL recognized, CSA certified

MML24 ORDER GUIDE   (Catalog listing for switch, less assembled display options)

MML24K	A	3	AA
Housing Type	**Mounting**	**Terminals**	**Circuitry**
MML24K Black housing	A No bezel (PWB mounting) K Black bezel, mtg. clip/long sides	3 Printed wiring board 2 Solder	Insert code letters from Circuitry Chart

Rockers and paddles are permanently installed.

01		K
Action		**Paddle**
Insert code numbers from Operating Action Chart		**K** Black

Example: MML24KA3AA01HDRXX
Electronic control rocker switch with black housing, printed wiring board terminals; 1 pole, silver contacts; 2-position, maintained action; one circuit ON in each position; black rocker, red lens for LED display in Side 1 and no lens in Side 2.

Note: Umbrella rockers are available with PWB terminals only.

CIRCUITRY

		2-Position	3-Position
Silver Contacts	**Gold Contacts**		
AA	BA	1 2 3 1 2 3	1 2 3 1 2 3 1 2 3
AC	BC	1 2 3 1 2 3 4 5 6 4 5 6	1 2 3 1 2 3 1 2 3 4 5 6 4 5 6 4 5 6
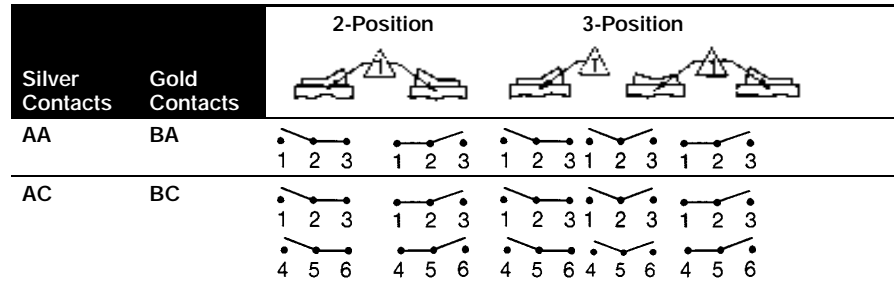
⚠ The "MICRO SWITCH" identification is shown on this side of the switch housings.

Side 1
Side 2
①
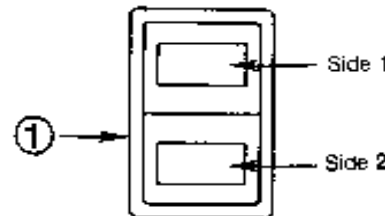
OPERATING ACTION

2-Position	01	Maint.	None	Maint.
	02	Mom.	None	Maint.
3-Position	03	Maint.	None	Mom.
	04	Maint.	Maint.	Maint.
	05	Mom.	Maint.	Mom.
	07	Mom.	Maint.	Maint.

Order display options assembled to switch by adding codes below.

01	H	DRXX	Leave blank, if legend not desired
Action	**Rocker**		**Legend**
Insert code numbers from Operating Action Chart	**K** Black rocker, non-lighted **H** Black rocker, one lens* **F** White rocker, one lens* * Lighted switches with solder terminals require MML93R receptacle to install lamps or LEDs. See Page 90.		**20** With legend Use legend order sheet FO-74193 to cover each catalog listing (see page 84).

Lens

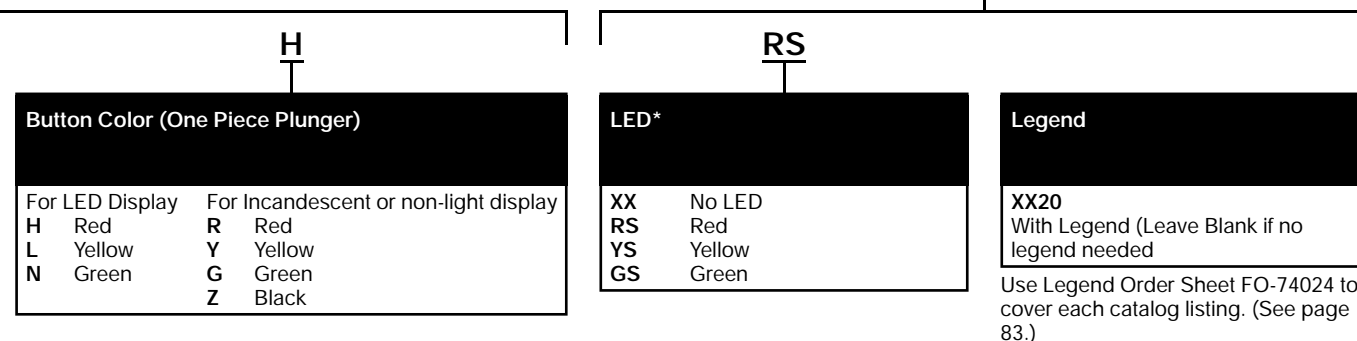| Side 1		Side 2	
XX None		**XX** None	
LED display:	Incand. display:	LED display:	Incand. display:
DR Red	**LR** Red	**DR** Red	**LR** Red
DY Yellow	**LY** Yellow	**DY** Yellow	**LY** Yellow
DG Green	**LG** Green	**DG** Green	**LG** Green
	LW White		**LW** White

CUSTOMER INSTALLATION:

LED
1. Order LED and receptacle, page 87.
2. Installation instructions, page 88.

Incandescent Lamp
1. Order lamp/PWB receptacle or lamp/solder receptacle, page 89.
2. Installation instructions, page 90.

Manuals

Power Duty Pushbutton

NON-LIGHTED DISPLAY

PWB Mount   Panel Mount

FEATURES
- Printed circuit board or snap-in panel mounting
- Bezels and mounting clips, and legended lenses can be furnished installed or ordered separately
- UL recognized, CSA certified.

Example: MML31KK2AAK
Power duty pushbutton switch housing (black); bezel (black) and mounting clips; solder terminals; 1 pole, momentary action; black plunger.

Example: MML31KK2AAKLR
As above, except furnished with red lens.

Catalog listing codes for switch, less assembled display options

MML31 ORDER GUIDE

MML31K	K	2	AA
Housing Type (Rectangular)	**Mounting**	**Terminals**	**Circuitry/Action** (Each pole is single-throw, normally open)
MML31K Black housing, non-lighted	**A** No bezel (PWB mounting) **K** Black bezel, mtg. clip/long sides	**3** Printed wiring board **2** Solder/Quick-connect	**AA** 1 pole, mom. action **AB** 1 pole, alt. action **AC** 2 poles, mom. action **AD** 2 poles, alt. action

Manual Switches
Power Duty Pushbutton

MML31 Series

Order display options assembled to
switch by adding codes below

K

LR

**Leave this space blank,
if legend not desired**

Plunger
K Black

Lens
LR Red
LY Yellow
LG Green
LW White
LK Black

Legend
20 With Legend
Use Legend Order Sheet FO-74024 to cover each catalog listing (see page 83).

Manuals

Indicators/Pushbutton Style

LED OR INCANDESCENT DISPLAY

PWB Mount

Panel Mount

FEATURES

● Accepts one LED or incandescent lamp

MML41 indicators resemble a pushbutton switch with the button in the ''down'' position.

MML41 ORDER GUIDE

Catalog listing codes for indicator, less assembled display options

MML41K	A	3	K
Housing Type (Rectangular)	**Mounting**	**Support Posts/Terminals**	**Plunger**
MML41K Black housing	**A** No bezel (PWB mounting only) **K** Black bezel, mtg. clip/long sides	**3** PWB* (''A'' mtg. only) **2** Solder **0** None For panel mount and strip/matrix mount	**K** Black
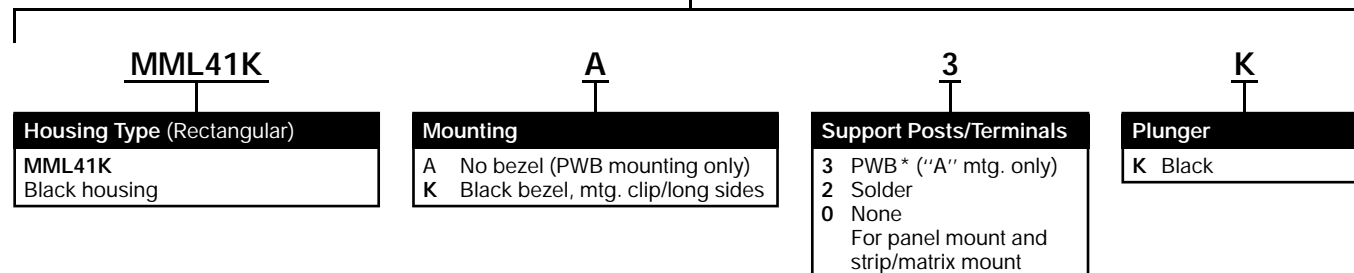
Indicators/Flush Mount MML46

LED OR INCANDESCENT DISPLAY

PWB Mount

Panel Mount

PWB Mount

Panel Mount

FEATURES

● Accepts one or two LEDs or incandescent lamps
● Bezels and mounting clips, LEDs and legended lenses can be furnished installed or ordered separately

MML46 ORDER GUIDE

Catalog listing codes for indicator, less assembled display options

MML46K		A		3
Housing Type		**Mounting**		**Support Posts**
Rectangular* (1 or 2 LEDs or incand. lamps)	**Square*** (1 LED or incand. lamp)	**Rectangular:** **A** No bezel (PWB mounting only) **K** Black bezel, mtg. clip/long sides	**Square:** **A** No bezel (PWB mounting only) **R** Black bezel, mounting clips	**3** PWB (''A'' mtg. only) **2** Solder** **0** None For snap-in and strip/ matrix mount
MML46K Black housing	**MML46H** Black housing			
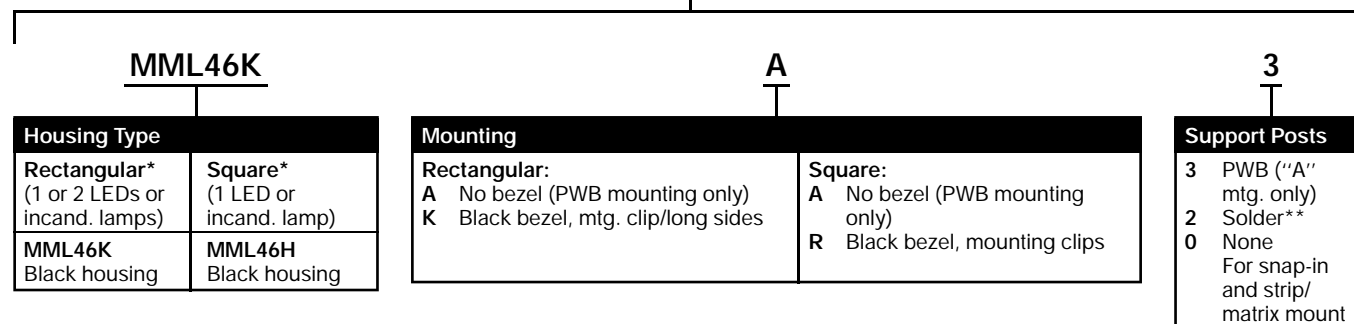
** Rectangular housings only.

* Notes:

1. When an LED is specified in a **rectangular** MML46 listing, MICRO SWITCH will permanently install it in the housing.
2. MICRO SWITCH does **not** permanently install an LED in a **square** MML46 listing. To install an LED in a square housing, order a MML93L or MML93G receptacle and a MML92 LED (see pages 88 and 90).

Indicators

LED DISPLAY

PWB Mount　　Panel Mount

FEATURES
- Accepts **one LED only**
- Bezels and mounting clips, and legended lenses can be furnished installed or ordered separately

Example: MML44KAA
Indicator housing (black) which will accommodate one LED, no bezel

Example: MML44KA3RSDR
As above, except furnished with red LED (PWB terminals) and lens installed.

MML44 ORDER GUIDE

Catalog listing codes for indicator, less assembled display options

MML44K	A	3	RS

Housing Type (Rectangular)	**Mounting**	**Terminals**	**LED** (Stanley type)
MML44K Black housing	**A** No bezel (PWB mounting) **K** Black bezel, mtg. clip/long sides **M** Black bezel, mtg. clip/short sides	**A** None 2 Solder **3** Printed wiring board*	**XX** No **RS** Red **YS** Yellow **GS** Green

* Use only if assembled LED is specified.

Order display options assembled to
indicator by adding codes below

DR

**Leave this space blank
if legend not desired**

Lens

DR Red
DY Yellow
DG Green
DC Clear

Legend

20   With legend

Use Legend Order Sheet FO-74024 to cover each
catalog listing.

**CUSTOMER
INSTALLATION:**

LED
1. Order LED and
   receptacle, page 87.
2. Installation instructions,
   page 88.

Manuals

Button Lenses/Incandescent or Non-lighted Display

MML51 ORDER GUIDE
For standard plunger MML pushbuttons.

MML51E	20	R

Lens Type	**Display/Legend Type**	**Color**
Rectangular Lenses:	Transmitted Color:	**R** Red
MML51E	**10** No legend	**Y** Yellow
Switch lens*	**20** With legend	**G** Green
MML51G		**W** White
Indicator lens		**K** Black
		(Opaque)

* Use MML51E with MML41 rectangular pushbutton style indicators.

Example: MML51E20R
Incandescent or non-lighted display switch lens; red transmitted color, with legend.

LEGENDING
Use the MML Legend Order Sheets on pages 83 and 84 to specify legending.

Button Lenses/LED or Neon Display   MML52

MML52 ORDER GUIDE
For standard plunger MML pushbuttons.

MML52G	10	Y

Lens Type	**Display/Legend Type**	**Color/ Illumination**
Rectangular Lenses:	Transmitted Color:	LED Display:
MML52E	**10** No legend	**R** Red
Switch lens, LED display	**20** With legend	**Y** Yellow
MML52G*		**G** Green
Indicator lens		**C** Clear
LED display		

* Use MML52E with MML41 rectangular pushbutton style indicators.

Example: MML52G10Y
LED display indicator lens; yellow transmitted color, no legend.

HOW TO INSTALL LENSES
Keytabs on two sides of the lenses mate with matching button slots.

Rectangular lenses have tabs on the long sides. Seat a long side before snapping in place.

HOW TO INSTALL LENSES

1. Seat lens.

2. Snap in place.

Strip Mounting Frames

MML61 ORDER GUIDE

<u>**MML61K**</u>   <u>5</u>

Orientation/Color
For Rectangular* Housings:
MML61K
Horizontal strip, black
MML61G
Vertical strip, black
For Square Housings
MML61J
Black

* * .4″ x .6″ housings only.

No. of Stations	
1	One
2	Two
3	Three
4	Four
5	Five
6	Six
7	Seven
8	Eight
9	Nine
10	Ten

Note: Switches and indicators are ordered as separate items.

FEATURES
- Provides back of panel or printed wiring board mounting in a multi-unit strip of switches/indicators.
- Devices can be pre-wired prior to installation.
- Holes at each end of frame will accept No. 4 screws.

Example: MML61K5
Black 5-station strip mounting frame, horizontal orientation.

Refer to pages 101, 102 and 103 for mounting dimensions.

Manuals

Manual Switches
Bezels/Mounting Clips
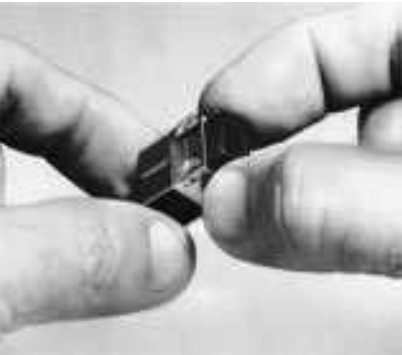
1. Slip mounting clip over top of switch/indicator housing.

MML72 ORDER GUIDE
(Incl. bezel & mounting clips)

MML72EE

Type
For Rectangular* Housings:
MML72EE*
Switch: Mtg. clips on long sides

* Use this type with MML41 rectangular pushbutton style indicators.

K

Color	
K	Black

Example: MML72EEK
Black switch bezel, mounting clips on long sides.

2. Snap bezel onto mounting clip.

Recommended panel thickness for panel mounted units is .050 to .094 in. (1,27 to 2,39 mm).

TO ORDER MOUNTING CLIPS SEPARATELY

For Rectangular Housings:
MML73EA (long sides)
MML73EB (short sides)
For Square Housings:
MML73BA

PWB Mount Support Bracket   MML74 Series
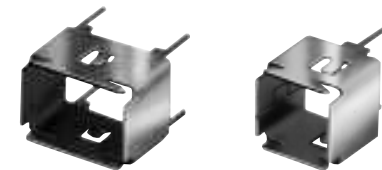
These metal frames with PWB support terminals provide added rigidity for stand-alone PWB mounted switches and indicators. They are not for use with MML57 buttons.

See page 98 for mounting dimensions.

MML74 ORDER GUIDE

Catalog Listing	For Use With:
MML74E	Rectangular .4″ x .6″ housings
MML74B	Square housings

Incandescent Lamp Assemblies

MML91 LAMP/PWB RECEPTACLE ORDER GUIDE

Lamp Type	Use To Illuminate	Voltage	Catalog Listing Incl. Lamp & PWB Receptacle	Industry Lamp No.
T-1 ① (unbased)	**Rectangular** button lens	5 10 14 28	MML91C MML91BC MML91CC MML91DC	715 7218 8111 6838
T-1 ② (bi-pin)	Square button lens and MML24 rocker lens	5 10 14 28	MML91E MML91BE MML91CE MML91DE	7715 8095 8098 7839

Notes:
① To order PWB receptacle separately, specify **MML93H.**
② To order PWB receptacle separately, specify **MML93G.**

MML91 LAMP/SOLDER RECEPTACLE ORDER GUIDE

Lamp Type	Use To Illuminate	Voltage	Catalog Listing Incl. Lamp & Solder Receptacle	Industry Lamp No.
T–1 ③ (bi-pin)	**Rectangular** button lens	5 10 14 28	MML91D MML91BD MML91CD MML91DD	7715 8095 8098 7839

Lamp Type	Use To Illuminate	Voltage	Catalog Listing ④ Solder Receptacle	T-1 (Unbased) Lamp Only	Industry Lamp No.
T-1 (unbased)	**Square** button lens	5 10 14 28	MML93L MML93L MML93L MML93L	MML91A MML91BA MML91CA MML91DA	715 7218 8111 6838
T-1 (unbased)	MML24 rocker lens	5 10 14 28	MML93R MML93R MML93R MML93R	MML91A MML91BA MML91CA MML91DA	715 7218 8111 6838

Notes:
③ To order solder receptacles separately, specify **MML93J.**
④ Order solder receptacles and T-1 lamp listings for complete assembly.

Manuals

LED/Incandescent Lamp Receptacles

User installed. Certain MML switches and indicators will accept incandescent lamps, where specified in the order guides.

These lamps are ordered separately and installed by the user, per the procedures described below.

LAMP INSTALLATION

1. With Printed Wiring Board Receptacle for MML93G and MML93H only.
Use PWB receptacles to permit lamps to be added or replaced from behind the printed wiring board, without soldering.

These receptacles are for use with rectangular pushbuttons, square pushbuttons and MML24 rocker lens only.

Printed wiring boards are not supplied.

1. Insert the PWB receptacle/ incandescent lamp assembly through a hole in the printed wiring board.

2. A ⅛–turn applied clockwise to the receptacle locks it in the printed wiring board and establishes the electrical connection.

2. With Solder Terminal Receptacle for MML93J bi-pin only
This receptacle attaches directly to the rear of panel-mounted units. It enables lamps to be added or replaced without rewiring.

This receptacle is for use with all rectangular pushbuttons and MML41 or MML46 rectangular indicators only.

1. Insert solder terminal receptacle into hole in base of panel mount unit.

2. A ⅛–turn clockwise applied to the receptacle locks it in the base.

3. With Solder Terminal Receptacles for MML93L/93R Unbased Only or T-1 LED.
Use the receptacles shown at right to install T–1 LEDs or T–1 unbased lamps in panel-mounted MML21 square pushbutton switches and MML24 rocker switches.

Procedure:
1. Assemble LEDs or lamps to receptacles (leads first).
2. Snap receptacle into slots in housing base.
3. Solder directly to leads.

LEDs

Factory installed. Certain MML switches and indicators can be furnished with LEDs **permanently** factory installed, where specified in the order guides.

User installed. LEDs can also be ordered separately and installed in these products by the user, per the procedures described below.

LED INSTALLATION

1. With Printed Wiring Board Receptacle. (MML93K)
PWB receptacle enables T-1 ¾ or T-1 LEDs to be added or replaced from behind the printed wiring board, without soldering. LEDs and receptacles are ordered separately. See page 87.

Printed wiring boards are not supplied.

1. Insert the LED/PWB receptacle assembly through a hole in the printed wiring board.

2. A ⅛–turn applied clockwise to the receptacle locks it in the printed wiring board and establishes the electrical connection.

2. With Solder Terminal Receptacle. (MML93J)
This receptacle attaches directly to the rear of panel-mounted units. It enables incandescent lamps to be added or replaced without rewiring. LEDs and receptacles are ordered separately.

This receptacle is for use with all rectangular pushbuttons and MML41 or MML46 rectangular indicators only.

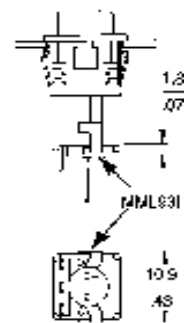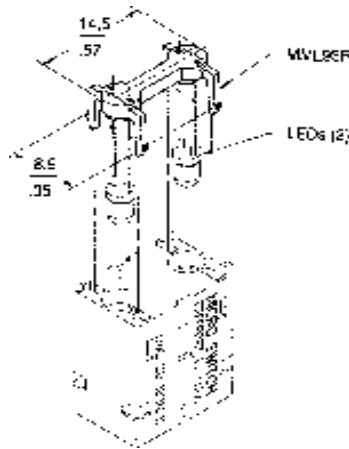1. Insert solder terminal receptacle into hole in base of panel mount unit.

2. A ⅛–turn clockwise applied to the receptacle locks it in the base.

3. By Soldering To Printed Wiring Board.
In this procedure, the housing is mounted on the printed wiring board after the T-1 ¾ LED has been seated.

This procedure can be used with any MML having PWB terminals.

1. Assemble stand-off spacer to LED terminals and seat on printed wiring board.

2. Seat housing on printed wiring board, with LED projecting into hole at the base of the housing.

4. By Soldering to Printed Wiring Board or Leadwire (MML44 indicators only).
T-1 ¾ LEDs are added to MML44 indicators via a procedure which is unique to this product. The LED is inserted from the top of the housing with the leadwires protruding through the housing base.
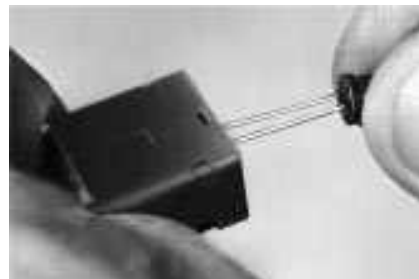
1. Assemble LED to MML44 indicator, with the LED terminals protruding through assembly slot in the middle of housing base.

2. Use pencil eraser to snap LED securely in place.

LED APPLICATION INFORMATION

To insure stable conditions, suitable external control of the LED current must be provided. It is recommended that a minimum of 5 VDC open circuit voltage with an appropriate series resistance be used to drive LED devices. This minimizes current variation and its effect on temperature and forward voltage of the LED.

Maximum drive current is 30 mA. Reverse voltage breakdown of the LED's is 4 volts (min.).

Resistor values can be determined by supply voltage or current for LED:

$$R_S = \frac{E - V_f}{I_f}$$

WHERE: R_S = Series Resistance
　　　　 E　= Supply Voltage
　　　　 V_f = Forward Voltage
　　　　　　　　 of LED
　　　　 I_f = Circuit Current

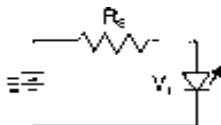## MML92 ORDER GUIDE

LEDs should be the same color as the lenses they illuminate. They are packed 10 per listing, including stand-off spacers for use when solder terminating to a printed wiring board, per procedure 3 on page 88.

LED Type	Use To Illuminate	Catalog Listing	LED Color	Forward Characteristics Typ. @ 20mA	Max.	LED Manufacturers' Part Numbers
T–1¾	Rectangular button lens	MML92ERS MML92EGS MML92EYS	Red Green Yellow	1.7 V 2.1 V 2.1 V	**Stanley:** 2.0 V 2.5 V 2.5 V	ESBR5633 ESBG5633 ESAY5633
		MML92ERH MML92EGH MML92EYH	Red Green Yellow	2.2 V 2.3 V 2.2 V	**Hewlett Packard:** 3.0 V 3.0 V 3.0 V	HLMP-3366 HLMP-3568 HLMP-3466
T–1	Square button lens, MML24 rocker lens rectangular button lens	MML92HRS MML92HGS MML92HYS	Red Green Yellow	1.7 V 2.1 V 2.2 V	**Stanley:** 2.0 V 2.5 V 2.5 V	ESBR3901 ESPY3901 ESAY3901
		MML92HRH MML92HGH MML92HYH	Red Green Yellow	2.2 V* 2.3 V* 2.2 V	**Hewlett Packard:** 3.0 V 3.0 V 3.0 V	HLMP-1340 HLMP-1540 HLMP-1440

Long lead: Anode (+). Short lead: Cathode (−).
* @ 25 mA.

MML93 LED PWB RECEPTACLE ORDER GUIDE

LED Type	Use to Illuminate	Catalog Listing
T-1¾	Rectangular button lens or umbrella button lens	MML93K
T-1	Square button lens or MML24 rocker lens	MML93G

MML93 LED SOLDER TERMINAL ORDER GUIDE

LED Type	Use to Illuminate	Catalog Listing
T-1	Square button	MML93L
T-1	MML24 rocker lens	MML93R
T-1	Rectangular button	MML93J

Manuals

Incandescent Lamp Assemblies

MML91 LAMP/PWB RECEPTACLE ORDER GUIDE

Lamp Type	Use To Illuminate	Voltage	Catalog Listing Incl. Lamp & PWB Receptacle	Industry Lamp No.
T-1 ① (unbased)	**Rectangular** button lens	5 10 14 28	MML91C MML91BC MML91CC MML91DC	715 7218 8111 6838
T-1 ② (bi-pin)	Square button lens and MML24 rocker lens	5 10 14 28	MML91E MML91BE MML91CE MML91DE	7715 8095 8098 7839

Notes:
① To order PWB receptacle separately, specify **MML93H.**
② To order PWB receptacle separately, specify **MML93G.**

MML91 LAMP/SOLDER RECEPTACLE ORDER GUIDE

Lamp Type	Use To Illuminate	Voltage	Catalog Listing Incl. Lamp & Solder Receptacle	Industry Lamp No.
T–1 ③ (bi-pin)	**Rectangular** button lens	5 10 14 28	MML91D MML91BD MML91CD MML91DD	7715 8095 8098 7839

Lamp Type	Use To Illuminate	Voltage	Catalog Listing ④		Industry Lamp No.
			Solder Receptacle	T-1 (Unbased) Lamp Only	
T-1 (unbased)	**Square** button lens	5 10 14 28	MML93L MML93L MML93L MML93L	MML91A MML91BA MML91CA MML91DA	715 7218 8111 6838
T-1 (unbased)	MML24 rocker lens	5 10 14 28	MML93R MML93R MML93R MML93R	MML91A MML91BA MML91CA MML91DA	715 7218 8111 6838

Notes:
③ To order solder receptacles separately, specify **MML93J.**
④ Order solder receptacles and T-1 lamp listings for complete assembly.

Manuals

Manual Switches

LED/Incandescent Lamp Receptacles

User installed. Certain MML switches and indicators will accept incandescent lamps, where specified in the order guides.

These lamps are ordered separately and installed by the user, per the procedures described below.

LAMP INSTALLATION

1. With Printed Wiring Board Receptacle for MML93G and MML93H only.
Use PWB receptacles to permit lamps to be added or replaced from behind the printed wiring board, without soldering.

These receptacles are for use with rectangular pushbuttons, square pushbuttons and MML24 rocker lens only.

Printed wiring boards are not supplied.

1. Insert the PWB receptacle/ incandescent lamp assembly through a hole in the printed wiring board.

2. A ⅛–turn applied clockwise to the receptacle locks it in the printed wiring board and establishes the electrical connection.

2. With Solder Terminal Receptacle for MML93J bi-pin only
This receptacle attaches directly to the rear of panel-mounted units. It enables lamps to be added or replaced without rewiring.

This receptacle is for use with all rectangular pushbuttons and MML41 or MML46 rectangular indicators only.

1. Insert solder terminal receptacle into hole in base of panel mount unit.

2. A ⅛–turn clockwise applied to the receptacle locks it in the base.

3. With Solder Terminal Receptacles for MML93L/93R Unbased Only or T-1 LED.
Use the receptacles shown at right to install T–1 LEDs or T–1 unbased lamps in panel-mounted MML21 square pushbutton switches and MML24 rocker switches.

Procedure:
1. Assemble LEDs or lamps to receptacles (leads first).
2. Snap receptacle into slots in housing base.
3. Solder directly to leads.