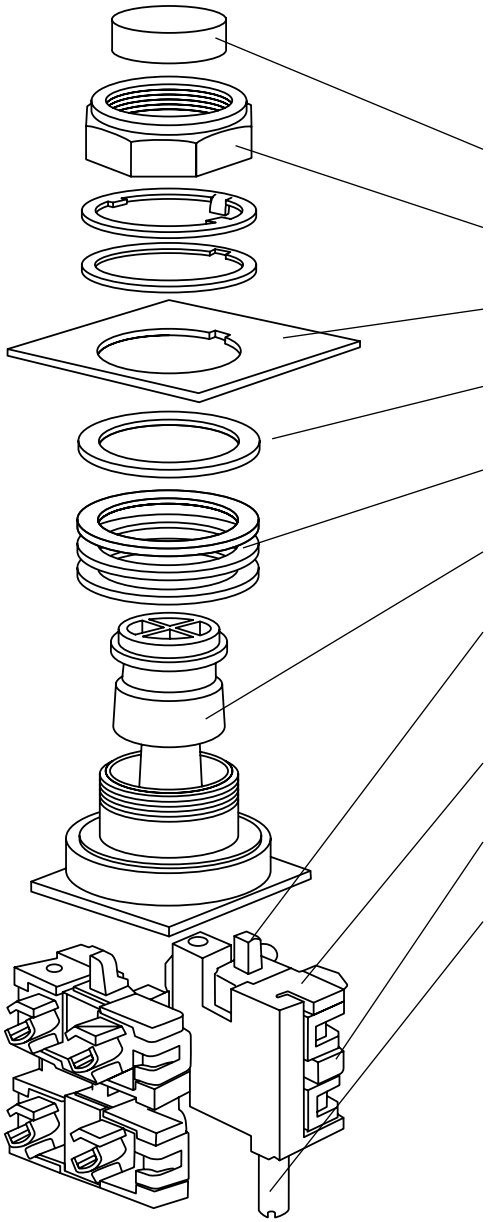
Push buttons at a glance

Contents

The inside story on CR104P push buttons



CR104P push buttons are suitable for use in Types 1, 3, 3R, 4, 4X, 12 and 13 applications when mounted in enclosures rated for those same applications.

Snap-on caps come in eight different colors and in clear.

Octagonal mounting rings meet stringent automotive industry standards.

Nameplates are available in red or black, blank or with standard markings.

Rubber gasket helps seal push button against oil, water and dust.

Spacers are added or removed to accommodate different panel thicknesses.

Bellows-type rubber seal keeps out contaminants.

Color-coded plungers allow tell you quickly and accurately whether contact is normally open or closed. On standard single block, NO is green; NC is red. On double block, NO/NC is white.

Modular contact blocks can be easily added to meet circuitry requirements.

Clear contact block covers facilitate fast, precise contact inspection.

Contact block mounting via a single captive screw saves installation time and money.

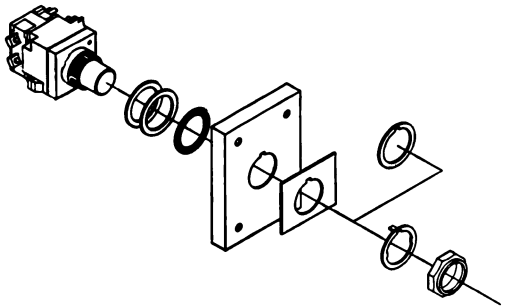
Hot Buttons

Description			Catalog numbers				
			Assembled for maximum simplicity	Legend plate	Components for maximum flexibility		
					Operator	+	Contact block (or other component)
PUSH BUTTONS	START (Black)	1NO	CR104PBG10B1	CR104PXN1BP037	CR104PBG00B1 or CR104PBG00U1	+	CR104PXC1
	STOP (Red)	1NC	CR104PG01R1	CR104PXN1RP040	CR104PBG00R1 or CR104PBG00U1	+	CR104PXC01
Emergency stop (mushroom-head)	Push-pull	1NC	CR104PBM01R5C	CR104PXN2RP009	CR104PBM00R5C	+	CR104PXC01
Illuminated push-pull	120V transformer	1NO-1NC	CR104PBT11R5C2	—	CR104PBT11R5C		—
Illuminated, guarded	120V transformer	1NO-1NC	CR104PBT11G3S2	—	CR104PBT11A1S2	+	CR104PXL05R (lens) + CR104PXG04 (guard)
SELECTOR SWITCHES	OFF-ON (Black)	1NO-1NC	CR104PSG21B91	CR104PXN1BP057	CR104PSG21B	+	CR104PXC91
	HAND-OFF-AUTO (Black)	1NO-1NC	CR104PSG34B91	CR104PXN1BP070	CR104PSG34B	+	CR104PXC91
PILOT LIGHTS	Red (ON)	120V Full voltage	CR104PLG22R	CR104PXN1BP025	CR104PLG22A	+	CR104PXL01R
	Green (OFF)	120V Full voltage	CR104PLG22G	CR104PXN1BP024	CR104PLG22A	+	CR104PXL01G
	Red Push-To-Test (ON)	120V Transformer	CR104PLT32R	CR104PXN1BP025	CR104PLT32A	+	CR104PXL07R
	Green Push-To-Test (OFF)	120V Transformer	CR104PLT32G	CR104PXN1BP024	CR104PLT32A	+	CR104PXL07G

Alternate buttons for local market needs

PUSH BUTTONS							
Emergency stop (mushroom-head)	Basic	1NC	CR104PBM01R5	CR104PXN2RP009	CR104PBM00R5	+	CR104PXC01
	Push/turn-to-release	1NC	CR104PTR20A0R01	CR104PXN2RP009	CR104PTR20A0R	+	CR104PXC01
PILOT LIGHTS	Red (ON)	120V Transformer	CR104PLG32R	CR104PXN1BP025	CR104PLG32A	+	CR104PXL01R
	Green (OFF)	120V Transformer	CR104PLG32G	CR104PXN1BP024	CR104PLG32A	+	CR104PXL01G
	Red Push-To-Test (ON)	120V Full voltage	CR104PLT22R	CR104PXN1BP025	CR104PLT22A	+	CR104PXL07R
	Green Push-To-Test (OFF)	120V Full voltage	CR104PLT22G	CR104PXN1BP024	CR104PLT22A	+	CR104PXL07G

Non-illuminated Push Buttons



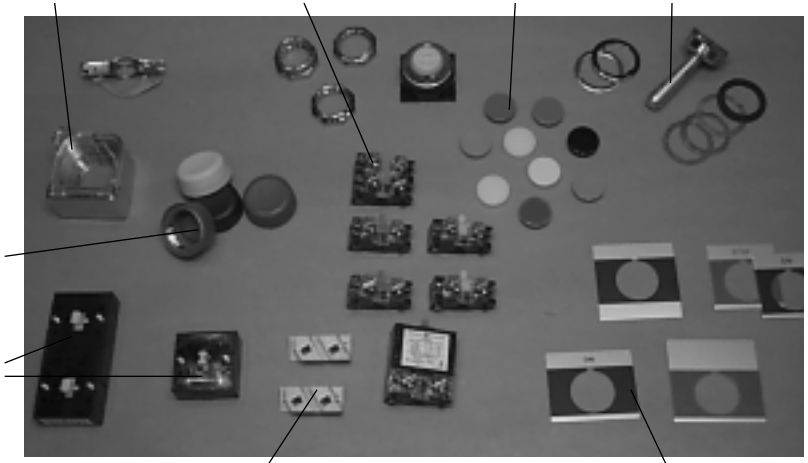
Push Button Cap
- Interchangeable, snap-in design
- 9 colors: red, black, green, brown, yellow, orange, blue, white, clear

Mushroom Head
- 2 sizes: 1 3/8", 2 3/8"
- 4 colors: black, red, green, yellow

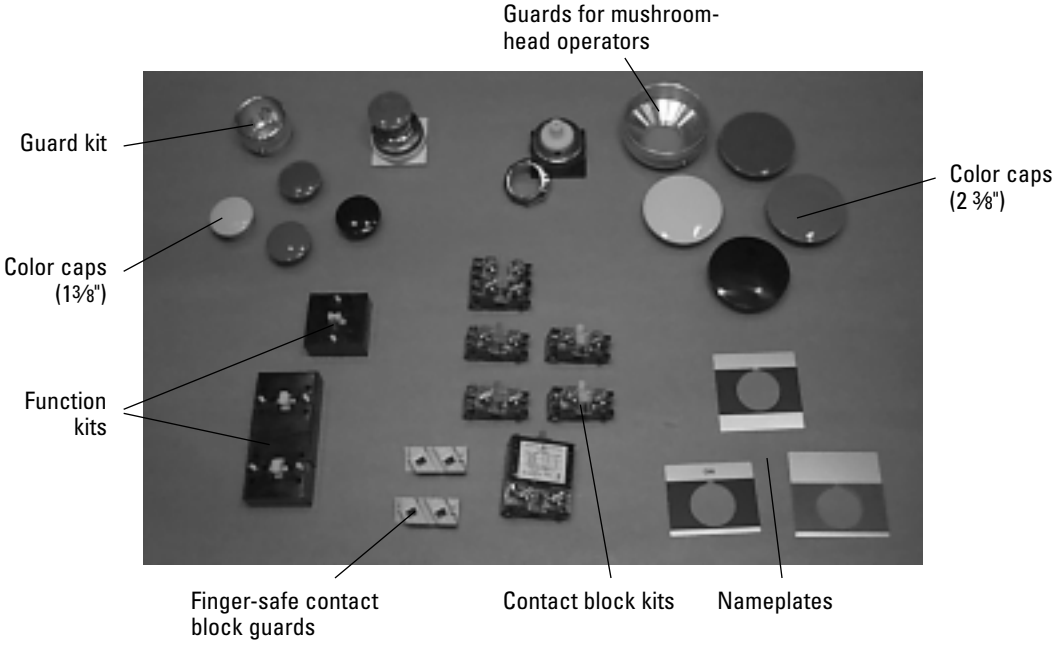
Mounting Ring
- Interchangeable design allows for flush, recessed or extended style on the same operator

Contact Blocks
- Color coded for quick installation
- Maximum of 8 single or 4 double contact blocks
- Visible contacts for easy, accurate inspections
- Special applications: early close, late open, gold flashed, reed switch

Accessories for push buttons



Accessories for mushroom-head push buttons



Non-illuminated Push Buttons

							Style	Contacts		Cap	Ring
C	R	1	0	4	P	B					

G = Standard
M = Mushroom-head

00 = None
01 = 1NC
10 = 1NO
91 = 1NO/1NC
92 = 2NO/2NC

Availability

	Standard	Mushroom-head
1 = Flush	■	
2 = Extended	■	
3 = Recessed	■	
5 = 1 3/8″ (35mm)		■
6 = 2 3/8″ (60mm)		■

Availability

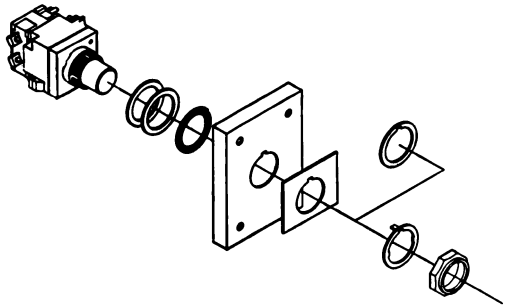
	Standard Push Button	Mushroom-head
A = No cap	■	■
B = Black	■	■
C = Clear	■	
E = Yellow	■	■
G = Green	■	■
L = Blue	■	
M = Orange	■	
N = Brown	■	
R = Red	■	■
W = White	■	

Other forms available:

- Push-on, push-off
- Push-pull
- Two push buttons with maintained latch kit
- Two push buttons with mechanical interlock kit
- Wobble stick
- Key-operated push buttons

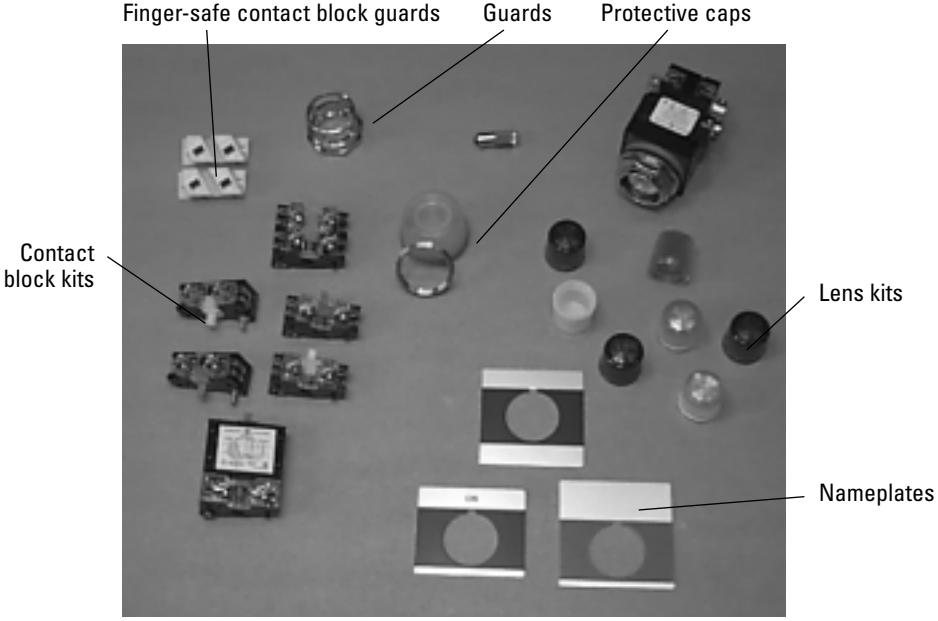
Tip for Quick Service: For small quantities, order operator with color cap universal kit and separate contact blocks. These items are typically in distributor stock (CR104PG00U1,V1). For OEM samples, order above components for field assembly and order any necessary recessed or extended rings separately.

Illuminated Push Buttons

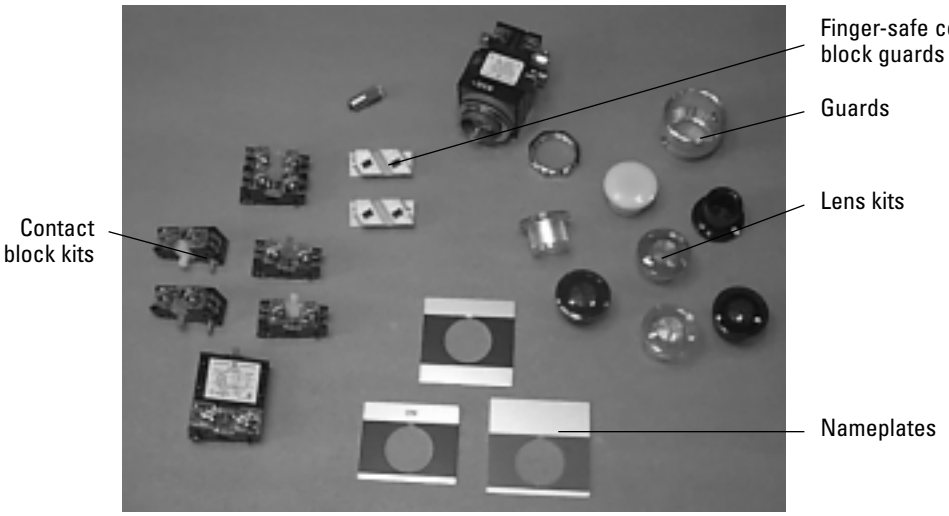


Lens Cap	• Interchangeable, threaded-on design • 6 colors: red, green, yellow, amber, blue, white + clear
Mushroom Head	• 1 3/8" • 6 colors: red, green, yellow, amber, blue, white + clear
Mounting Ring	• Standard or guarded
Lamp	• Incandescent, LED, neon
Power Supply	• 3 types: Full voltage, transformer, resistor
Contact Blocks	• Color coded for quick installation • Maximum of 4 single or 2 double contact blocks • Visible contacts for easy, accurate inspections • Special applications: early close, late open, gold flashed, reed switch

Accessories for push buttons



Accessories for mushroom-head push buttons



Illuminated Push Buttons

							Type	Contacts		Lens Color	Ring	Lamp	Voltage
C	R	1	0	4	P	B							

L = Full voltage
R = Resistor
T = Transformer

00 = None
10 = 1NO
01 = 1NC
11 = 1NO/1NC
92 = 2NO/2NC

F = Flashing
L = LED
N = Neon
S = Standard

2 = 120V
3 = 240V
4 = 480V
5 = 600V
6 = 6V
7 = 12V
8 = 24V

Availability

	Standard	Mushroom-head
1 = Extended	■	
3 = With guard	■	
5 = 1 3/8" (35mm)		■

Availability

	Standard	Mushroom-head
A = No lens/cap	■	
C = Clear	■	■
E = Yellow	■	■
G = Green	■	■
L = Blue	■	■
M = Amber	■	■
R = Red	■	■
W = White	■	■

Other forms available:

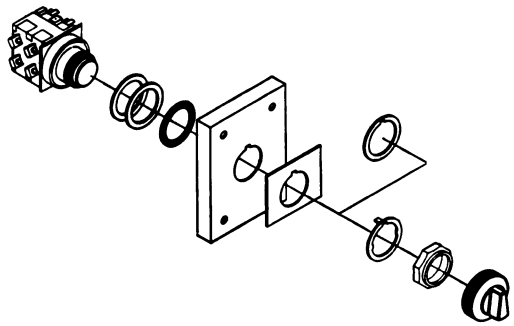
- Push-on, push-off
- 2-position push-pull mushroom-head
- 3-position push-pull mushroom-head
- Dual input (120v)

Available Combinations

Power Supply	Lamp	Lens Color Code (Digit 4)	Voltage						
			6	12	24	120	240	480	600
Full Voltage	Incandescent	All	■	■	■	■			
	LED	E,G,M,R	■	■	■	■			
	Neon	R,W,C				■			
	Flashing	All	■						
	Resistor	All				■	■		
Transformer	Incandescent	All				■	■	■	■
	LED	E,G,M,R				■	■	■	■
	Flashing	All				■	■	■	■

Tip for Quick Service: For small quantity orders of illuminated operators in colors other than red or green, order operator with red/green lens and order other color lenses separately.

Non-illuminated Selector Switches, 2-position

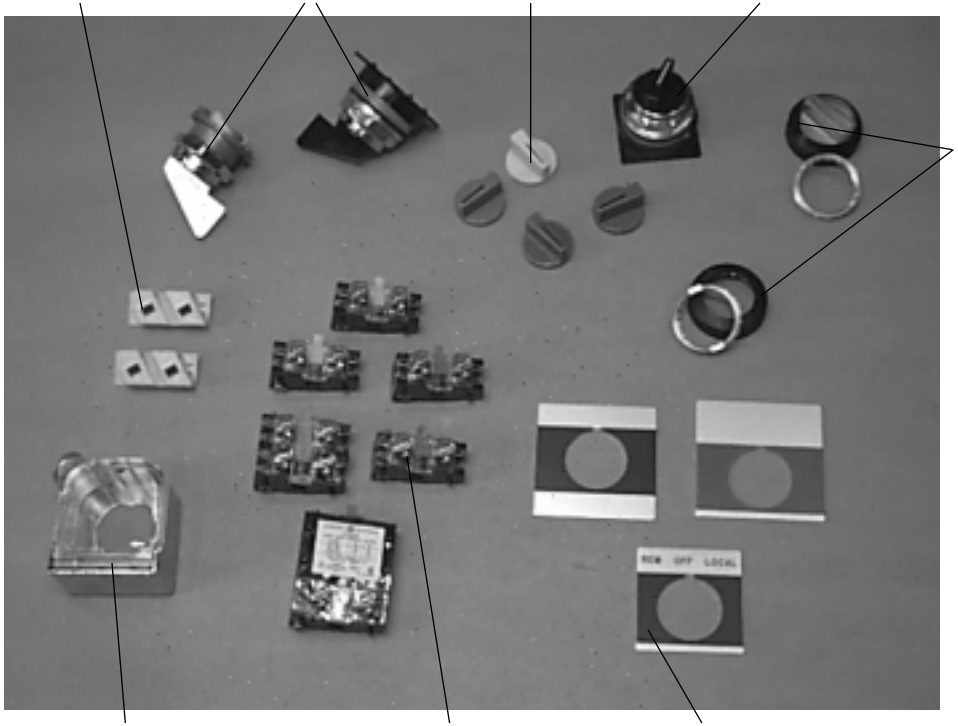


Knob
- Interchangeable design
- 5 colors: red, green, yellow, blue, black + levers in black and chrome for gloved-hand operation

Operator With Cam
- 2-position forms
- Multiple cam configurations allow optimum versatility
- Maintained and spring return forms

Contact Blocks
- Color coded for quick installation
- Maximum of 6 single or 6 double contact blocks
- Visible contacts for easy, accurate inspections
- Special applications: gold flashed, reed switch

Accessories



Non-illuminated Selector Switches, 2-position

							Type	Operation & Cam		Color	Contacts		Key Removal	Key Type
C	R	1	0	4	P	S							Used only with key-operated selector switches	

G = Knob-operated
M = Lever-operated
K = Key-operated

12 = Spring Return From Left
21 = Maintained
63 = Spring Return From Right

Blank = None
00 = None (Key-operated only)
91 = 1NO/1NC
92 = 2NO/2NC

Blank = Standard
51 = CH501

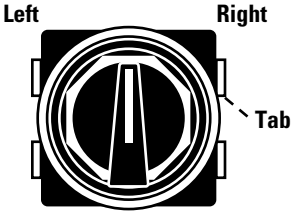
Color	Availability: Knob	Lever	Key
A = Chrome		■	■
B = Black	■	■	
E = Yellow	■		
G = Green	■		
L = Blue	■		
R = Red	■		

Key removal	Availability: Maintained	Spring return to center ↑
C = ↑		■
L = ↖	■	
M = ↖ ↗	■	
R = ↗	■	

Operation & Cam

Operation	Operator Position: Left ↖	Center ↑	Right ↗	Type Of Contact	Contact Mounting Position
Spring return from left (12)	0 X	X 0		NC NO	Left or Right Left or Right
Maintained (21)	X 0		0 X	NC NO	Left or Right Left or Right
Spring return from right (63)		X 0	0 X	NC NO	Left or Right Left or Right

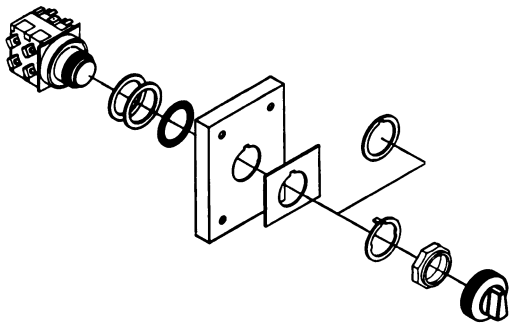
Note: When using double contact block 91, NC contact is that closest to and mounted on the left side of the operator. When using double contact block 92, NC contact is that closest to the operator on each side.



Always view left-right facing operator

Tip for Quick Service: For small quantity orders of 2-position selector switches with contact configurations other than 91 or 92, order operator and contact blocks separately. Cam 12 is normally stocked with black knob; cam 21 is normally stocked with black knob or chrome lever.

Non-illuminated Selector Switches, 3-position

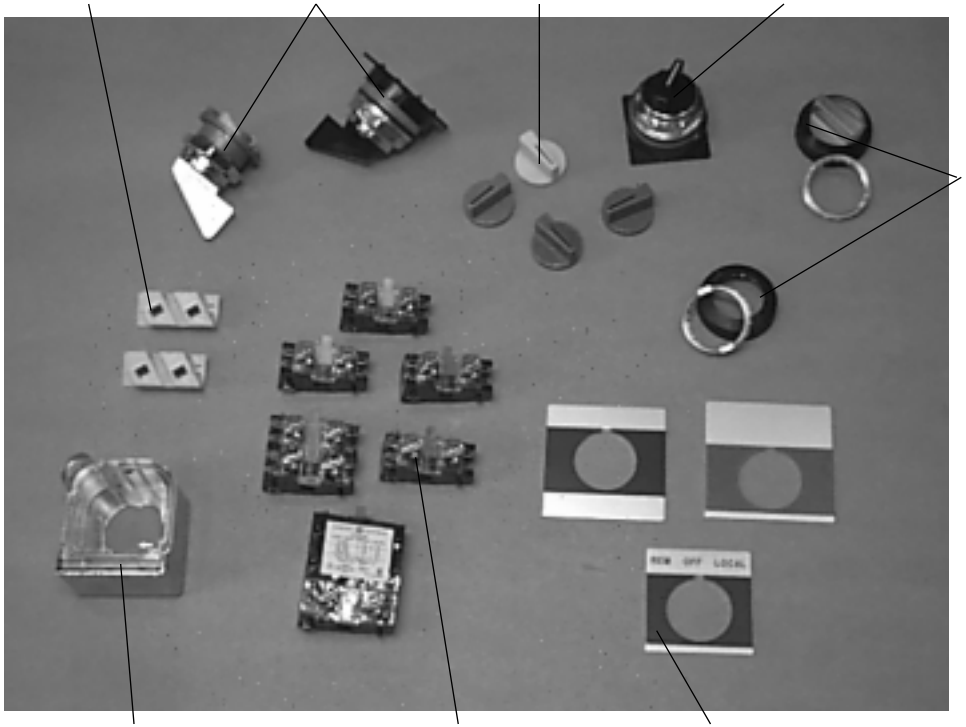


Knob
- Interchangeable design
- 5 colors: red, green, yellow, blue, black + levers in black and chrome for gloved-hand operation

Operator With Cam
- 3-position forms
- Multiple cam configurations allow optimum versatility
- Maintained and spring return forms

Contact Blocks
- Color coded for quick installation
- Maximum of 6 single or 6 double contact blocks
- Visible contacts for easy, accurate inspections
- Special applications: gold flashed, reed switch

Accessories



Non-illuminated Selector Switches, 3-position

							Type	Operation	Cam	Color	Contacts		Key Removal	Key Type
C	R	1	0	4	P	S							Used only with key-operated selector switches	

G = Knob-operated
M = Lever-operated
K = Key-operated

3 = Maintained
7 = Spring return left
8 = Spring return right
9 = Spring return left & right

2
3
4
5
6

Blank = None
00 = None (Key-operated)
91 = 1NO/1NC
92 = 2NO/'2NC

Blank = Standard
51 = CH501

Availability

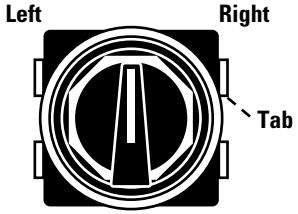
	Knob	Lever	Key
A = Chrome		■	■
B = Black	■	■	
E = Yellow	■		
G = Green	■		
L = Blue	■		
R = Red	■		

Availability

Key removal		Spring return from		
	Maintained	Left ↖	Right ↗	L & R ↖↗
C = ↑	■	■	■	■
D = ↖↑	■		■	
L = ↖	■		■	
M = ↖↗	■			
R = ↗	■	■		
Q = ↑↗	■	■		
W = ↖↑↗	■			

Cam

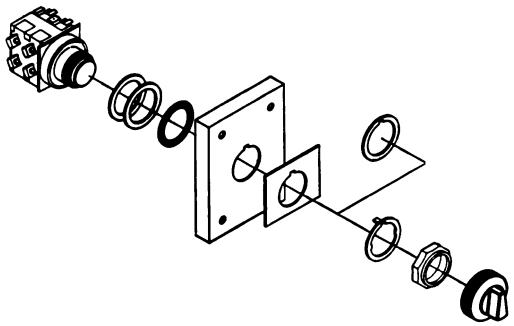
Cam Code	Operator Position			Type Of Contact	Contact Mounting Position
	Left ↖	Center ↑	Right ↗		
2	0 X	X 0	0 0	NC NO	Left or Right Left or Right
3	0 0	X 0	0 X	NC NO	Left or Right Left or Right
4	X 0	0 0	0 X	NC NO	Left or Right Left or Right
5	X 0 0	0 X 0	0 0 X	NC NC NO	Left Right Left or Right
6	X 0 0 X	X 0 X 0	0 X X 0	NC NO NC NO	Left Left Right Right



Always view left-right facing operator

Tip for Quick Service: Not all operator, cam and color combination variations are stock. Use 34B, 74B and 94B as samples for mechanical review.

Non-illuminated Selector Switches, 4-position

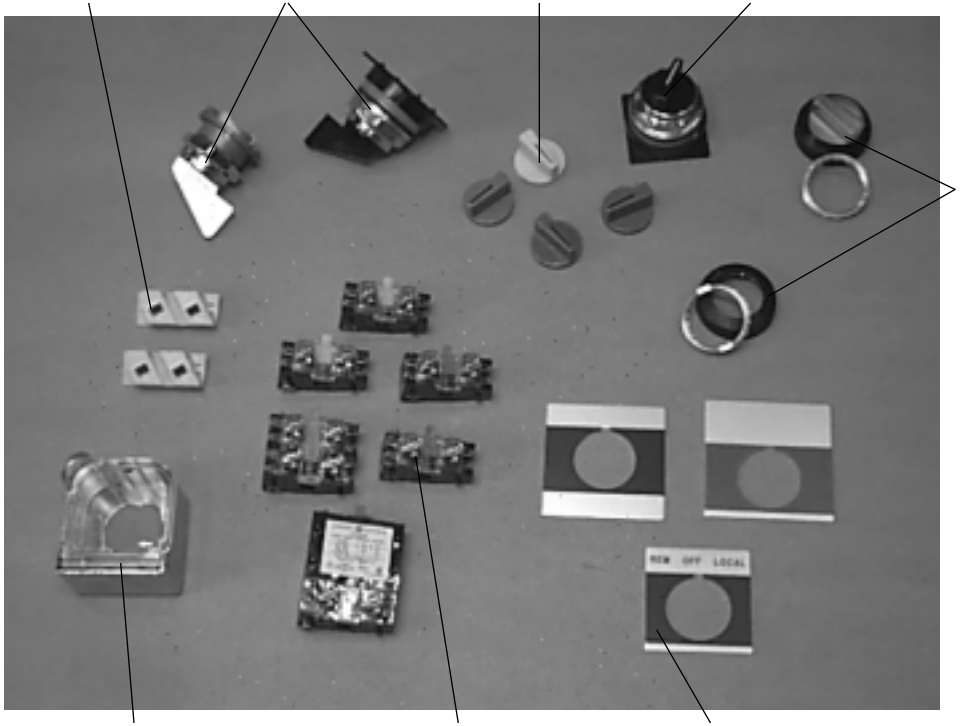


Knob
- Interchangeable design
- 5 colors: red, green, yellow, blue, black + levers in black and chrome for gloved-hand operation

Operator With Cam
- 4-position forms

Contact Blocks
- Color coded for quick installation
- Maximum of 2 double contact blocks
- Visible contacts for easy, accurate inspections
- Special applications: gold flashed, reed switch

Accessories



Non-illuminated Selector Switches, 4-position

							Type	Maintained Operation & Cam		Color	Contacts		Key Removal	Key Type
C	**R**	**1**	**0**	**4**	**P**	**S**		**4**	**7**				Used only with key-operated selector switches	

G = Knob-operated
M = Lever-operated
K = Key-operated

Blank = None
00 = None (Key-operated)
92 = 2NO/2NC

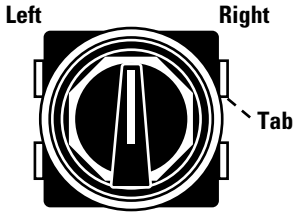
Z = All (Maintained)
Blank = Knob- & Lever-operated

Blank = Standard
51 = CH501

	Availability		
	Knob	Lever	Key
A = Chrome		■	■
B = Black	■	■	
E = Yellow	■		
G = Green	■		
L = Blue	■		
R = Red	■		

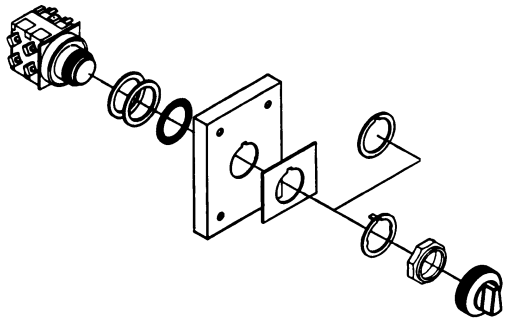
Operation & Cam

Operator Position				Type Of Contact	Contact Mounting Position
Left ↖	Mid-left ↖	Mid-right ↗	Right ↗		
X	0	0	0	NC	Left
0	0	X	0	NO	Left
0	0	0	X	NC	Right
0	X	0	0	NO	Right



Always view left-right facing operator

Illuminated Selector Switches, 2-position



Knob
- Interchangeable design
- 6 colors: red, green, yellow, blue, amber, white + clear

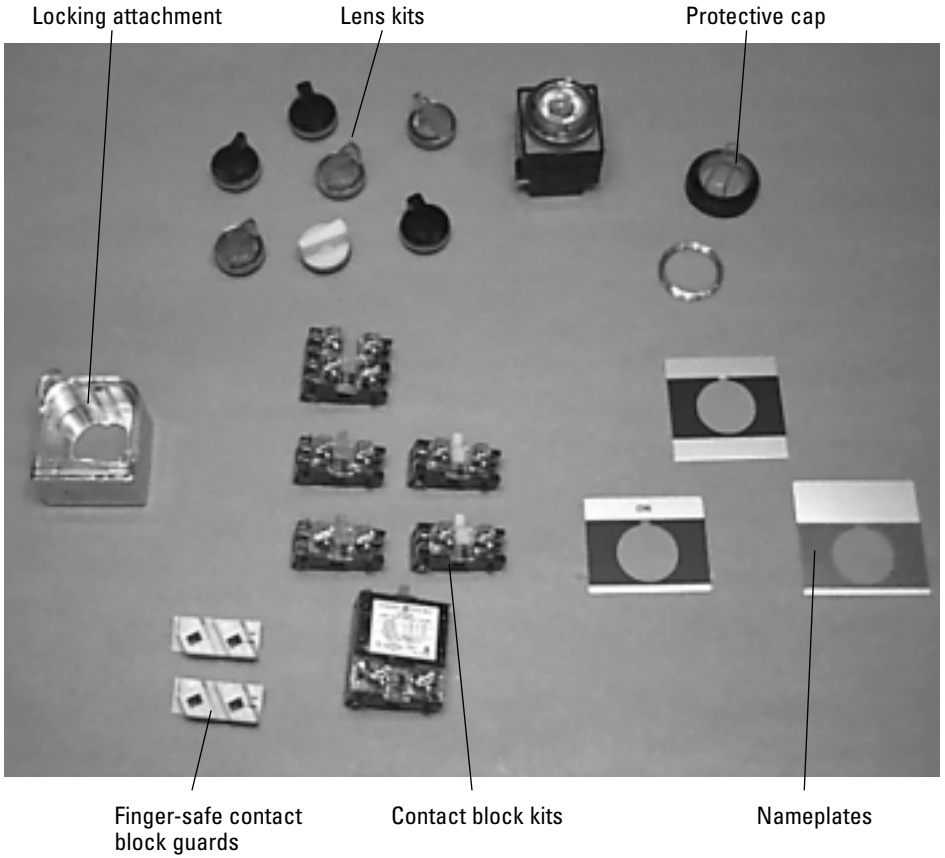
Lamp
- Incandescent, LED, neon

Operator With Cam
- 2-position forms
- Multiple cam configurations allow optimum versatility
- Maintained and spring return forms

Power Supply
- 3 types: full voltage, transformer, resistor

Contact Blocks
- Color coded for quick installation
- Maximum of 4 single or 2 double contact blocks
- Visible contacts for easy, accurate inspections
- Special applications: gold flashed, reed switch

Accessories



Illuminated Selector Switches, 2-position

							Power Supply	Maintained Operation & Cam		Color	Contacts		Lamp	Voltage
C	**R**	**1**	**0**	**4**	**P**	**S**		**2**	**1**					

L = Full voltage
T = Transformer

A = None
C = Clear
E = Yellow
G = Green
L = Blue
M = Amber
R = Red
W = White

00 = None
01 = 1NC
10 = 1NO
11 = 1NO/1NC
22 = 2NO/2NC

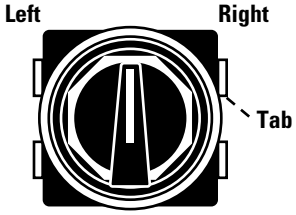
L = LED
S = Standard

2 = 120V
3 = 240V
4 = 480V
5 = 600V
6 = 6V
7 = 12V
8 = 24V

Operation & Cam

Operation	Operator Position		Type Of Contact	Contact Mounting Position
	Left ↖	Right ↗		
Maintained(21)	X	0	NC	Left or Right
	0	X	NO	Left or Right

Tip for Quick Service: For small quantities, order selector switch without lens; order lenses E, G, L, M or R; and contact blocks separately.

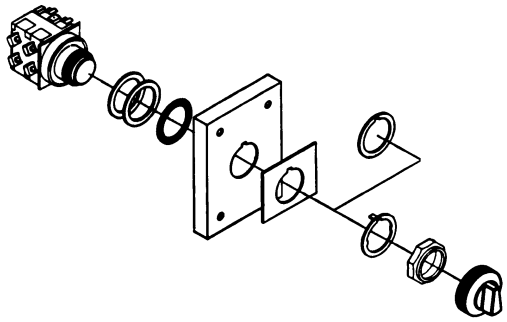


Always view left-right facing operator

Available Combinations

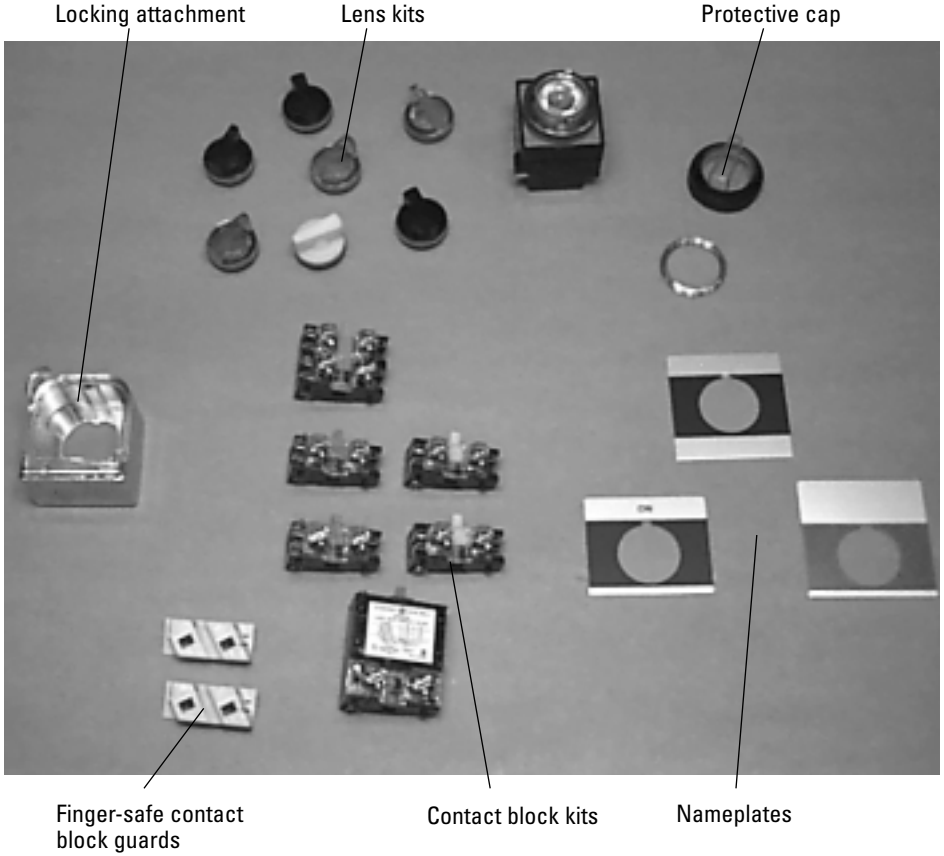
Power Supply & Lamp	Lens Color Code	Voltage						
		6	12	24	120	240	480	600
Full Voltage	All	■	■	■	■			
Full Voltage LED	E,G,M,R	■	■	■	■			
Transformer	All				■	■	■	■
Transformer LED	E,G,M,R				■	■	■	■
Resistor	All				■	■		
Neon	R,W,C				■			

Illuminated Selector Switches, 3-position



Knob	• Interchangeable design • 6 colors: red, green, yellow, blue, amber, white + clear
Lamp	• Incandescent, LED, neon
Operator With Cam	• 3-position forms • Multiple cam configurations allow optimum versatility • Maintained and spring return forms
Power Supply	• 3 types: full voltage, transformer, resistor
Contact Blocks	• Color coded for quick installation • Maximum of 4 single or 2 double contact blocks • Visible contacts for easy, accurate inspections • Special applications: gold flashed, reed switch

Accessories

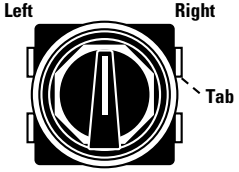


Illuminated Selector Switches, 3-position

							Power Supply	Operation	Cam	Color	Contacts		Lamp	Voltage
C	**R**	**1**	**0**	**4**	**P**	**S**								
							L = Full voltage **T** = Transformer	**3** = Maintained **9** = Spring return left & right	**2** **4** **6**	**C** = Clear **E** = Yellow **G** = Green **L** = Blue **M** = Amber **R** = Red **W** = White	**00** = None **01** = 1NC **10** = 1NO **11** = 1NO/1NC **22** = 2NO/2NC		**L** = LED **S** = Standard	**2** = 120V **3** = 240V **4** = 480V **5** = 600V **6** = 6V **7** = 12V **8** = 24V

Cam

Cam Code	Operator Position			Type Of Contact	Contact Mounting Position
	Left ↖	Center ↑	Right ↗		
2	0 X	X 0	0 0	NC NO	Left or Right Left or Right
4	X 0	0 0	0 X	NC NO	Left or Right Left or Right
6	X 0 0 X	X 0 X 0	0 X X 0	NC NO NC NO	Left Left Right Right

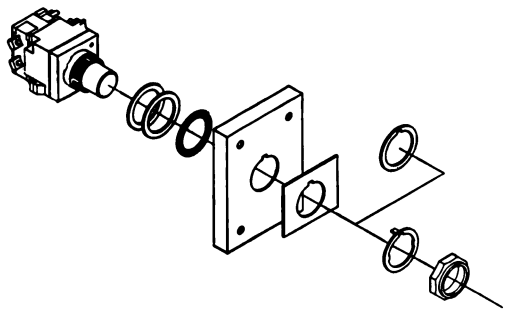


Always view left-right facing operator

Available Combinations

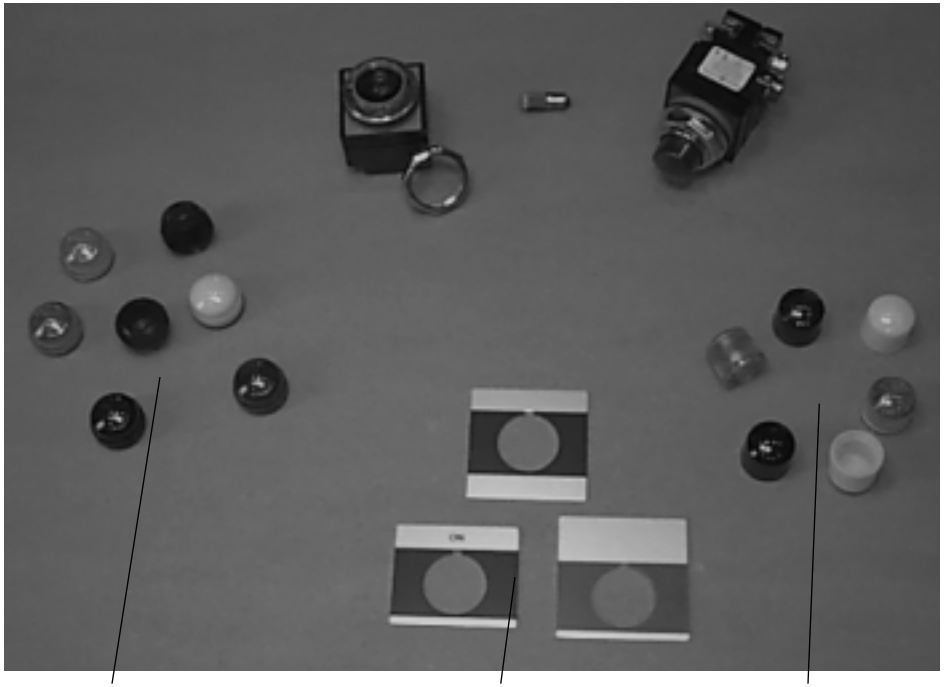
Power Supply & Lamp	Lens Color Code	Voltage						
		6	12	24	120	240	480	600
Full Voltage	All	■	■	■	■			
Full Voltage LED	E,G,M,R	■	■	■	■			
Transformer	All				■	■	■	■
Transformer LED	E,G,M,R				■	■	■	■
Neon	R,W,C				■			

Pilot Lights



Lens Cap	• Interchangeable, threaded-on design • 6 colors: red, green, yellow, amber, blue, white + clear
Lamp	• Incandescent, LED, neon
Power Supply	• 3 types: Full voltage, transformer, resistor • Standard or push-to-test

Accessories



Lens kits, pilot lights

Nameplates

Lens kits, push-to-test pilot lights

Pilot Lights

							Type	Power Supply/ LampType	Voltage	Lens Color
C	R	1	0	4	P	L				

G =Standard
T = Push-to-test

1 = Full Voltage Incandescent, Bayonet Socket
2 = Full Voltage Incadescent, Slide Base (120V only)
3 = Transformer
4 = Resistor
5 = Full Voltage Flashing
6 = Transformer Flashing
7 = Full Voltage Neon
8 = Full Voltage LED

2 = 120V
3 = 240V
4 = 480V
5 = 600V
6 = 6V
7 = 12V
8 = 24V

Blank = No lens
C = Clear
E = Yellow
G = Green
L = Blue
M = Amber
R = Red
W = White

Available Combinations

Power Supply & Lamp	Lens Color Code	Voltage						
		6	12	24	120	240	480	600
Full Voltage Incandescent, Bayonet Socket	All	■	■	■	■			
Full Voltage Incandescent, Slide Base	All				■			
Transformer	All				■	■	■	■
Full Voltage Resistor	All				■	■		
Full Voltage Flashing	All	■						
Transformer Flashing	All				■	■	■	■
Full Voltage Neon	R,W,C				■			
Full Voltage LED	E,G,M,R	■	■	■	■			

Tip for Quick Service: For small quantity orders of units with lens colors other than red or green, order operator without lens and lens separately.

Special Forms

	Item	Description	Catalog Number
	Special Mushroom-head Push Buttons	Push-to-Latch, Turn-to-Release Protected (Metal Rim), Non-illuminated & Illuminated Push-Pull, Non-illuminated, 2- & 3-position Push-Pull, Illuminated, 2- & 3-position	CR104PTR... CR104PTY... CR104PBM... CR104PBT...
	Special Contact Blocks	Reed Switch Gold Flashed Early Close Late Open	CR104PXC...
	Push-Turn Push Buttons	2- & 3-position	CR104..PT...
	Potentiometer Operators	2 Watt, 100 to 5MM Ohms	CR104PXP...

	Joysticks	3-, 5- & 9-position, Momentary & Maintained	CR104PJ...
	Cluster Lights	2- & 4-lamp; 6V, 12V & 24V Full Voltage	CR104PLB... & CR104PLQ...
	Remote Test Lights	Lights All Illuminated Operators	CR104PBL...
	Time Delay Push Buttons	.5- to 30-second Adjustable Delay	CR104PBG99
	Cylinder Lock	Lock Capability in Any Position	CR104PBK...
	Enclosures	Sheet- & Stainless-Steel, 1 to 25 Operators	CR104PE...

Technical Data

General specifications

Standards & approvals	**UL Listed** - File Number E2403 **CSA Certified** - LR15492, Class 321103 **NEMA** - ICS2 - 1988 **IEC** 947.5.1 **VDE** 0660
Enclosure ratings	All units are suitable for use in **NEMA Type 1, 3, 3R, 3S, 4, 4X, 12 and 13** applications when mounted in enclosures rated for those same applications. For some NEMA 4X applications, protective caps will provide improved corrosion resistance.
Finger protection at terminals	**IP2X** according to IEC 529 Terminal identification per **CENELEC EN 50013**
Temperature range	Operating: -25° to +70° C / -13° to +158° F Storage: -40° to +70° C / -40° to 158° F
Climate suitability/humidity	Climate Type / Temperature / Relative Humidity Temperate: 74°F (23°C) / 50% Wet: 74°F (23°C) / 83% Hot Wet: 104°F (40°C) / 92% Variable Wet: 74°-104v F (23° to 40° C) / 83%-92%
Shock and vibration	**Resistance to shock** - 50g, 11ms **Frequency range** - 1-100 Hz **Vibration amplitude** - 1-13.2 Hz - displacement ±1mm 13.2-100 Hz - acceleration ±0.7g
Operating force	Standard recessed push buttons / Standard flush push buttons Without contact blocks: 1.625 lbf / 2.5 lbf With 1NO contact block: 2.5 lbf / 2.875 lbf With 2 NO contact blocks: 3.5 lbf / 3.5 lbf With 3 NO contact blocks: 4.0 lbf / 4.375 lbf
Wire size	22-12 AWG stranded or solid copper wire
Torque requirements	Terminal screws: 10-14 in-lbs Contact block mounting screws: 10-14 in-lbs

Technical Data

Contacts

Electrical reliability data

With indicating light loads, tested for 5,000,000 operations at 40mA and 115V resistive loads with no failures observed.

Electrical characteristics

Characteristic	Value
Thermal current	10A per IEC 947-5-1
Insulation voltage	Ui = 660V AC/DC
Protection from electrical shock	Class I per IEC 536 for metal operators; Class II (double insulation) per IEC 536 for plastic operators
Insulation category	Group C per VDE 0110
Dielectric strength	2500V
Short circuit protection	10A time delay fuse gG per IEC 269.1 & 269.3

Finger safe terminals

Available for silver and gold single contact blocks, as components and as assembled versions.

Contact characteristics

NC: slow make, double break (positive opening)

NO: slow make, double break

Opposite polarity

Self-cleaning below 300 volts

NO and NC snap action (for use on joysticks)

AC ratings, NEMA A600 Heavy Pilot Duty

Maximum AC voltage	Continuous current amperes	AC voltamperes @ 60/50 Hz[1]	
		Make	Break
600	10	7200	720

[1] Maximum make and break currents are 60 and 6 amperes respectively for voltages of 120 and below.

DC ratings, NEMA P600

Maximum make or break amperes		
125V	250V	600V
1.1	0.55	0.2

Reed switch block ratings

	AC ratings	DC ratings
Operating voltage	2-120 VAC	2-30 VDC
Continuous current (maximum)	.001-.15 A	.001-.15 A
Resistive, watts (VA)	8 VA maximum	4.5 VA maximum

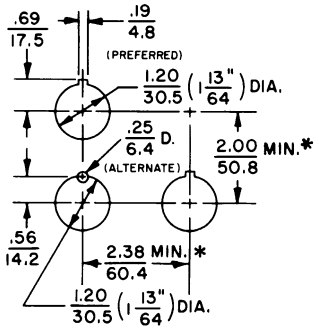
Power supply resistor values

Input	Resistor value
120V AC/DC	750 ohms ±5%, 5 watts, 2 resistors in series
240V AC/DC	2700 ohms ±5%, 5 watts, 2 resistors in series

Mounting

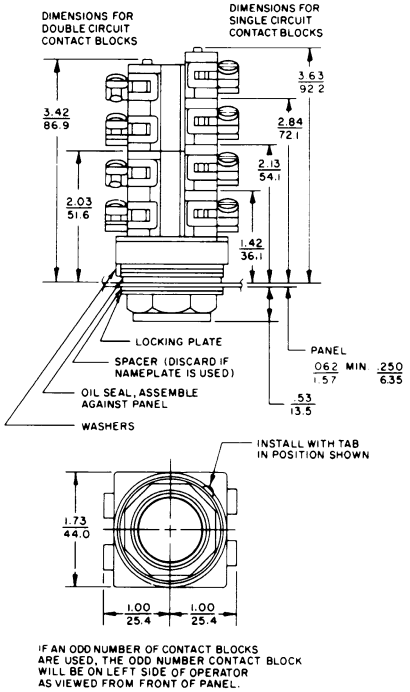
CR104P push buttons are designed for front mounting, with or without nameplates, in 1 13/64" diameter holes. Operators are provided with an octagonal ring, spacers and gaskets to ensure an oiltight, uniform front protrusion.

Drilling Plan, Dual Dimensions Inches/Millimeters



Acceptable panel thickness - 0.04 - 0.25 inches (1.02 - 6.35 mm)

Dual Dimensions Inches/Millimeters (For Estimating Only)



For dimensional information on other operators, contact nearest GE Electrical Distribution & Control sales office. Manufacturing tolerances apply to all untoleranced dimensions.

Panel thickness (inches)	No. of washers required
.062	3
.093	2
.125	2
.188	1
.25	0

Mechanical life ratings

Operator	Number of Operations
Standard push buttons	3,000,000
Illuminated push buttons (including push on/push off)	1,000,000
Momentary mushroom-head push buttons	3,000,000
Maintained & push to latch, turn to release mushroom-head push buttons	500,000
Selector switches (all)	1,000,000
Joysticks	500,000
Toggle switches	500,000
Wobble sticks	1,000,000
Key operated push buttons	500,000
Selector push buttons	1,000,000
Time-delay push buttons	1,000,000

Electrical life ratings

Push buttons - 5,000,000 operations

Selector switches - 500,000 operations

Materials

Component	Material
Cap (non-illuminated)	Unfilled polyacetal
Cap (illuminated)	Polycarbonate
Metal housings	Chromium or zinc plated zinc ingot
Plastic housing	Nylon
White plunger	Unfilled polyacetal
Flange	Nylon
Grease	Good for temperatures of -42° to +204°C
Plate spacer	Polycarbonate
Locking plate	Chromium plated zinc ingot
Locking ring	Chromium plated zinc ingot
Hexagonal ring	Chromium plated zinc ingot
Contact block housing	Nylon
Cam	Unfilled Polyacetal
Cam follower	Unfilled Polyacetal
Joystick protective housings	Vinyl nitrile
Terminal screw	#6-32
Gasket	Vinyl nitrile
Contacts	Silver alloy
Push button guards	Chromium plated zinc ingot
Wobble stick	Aluminum
Key	Brass
Protective caps	Silicon rubber
Locking attachment	Polycarbonate

Lamp selection

Incandescent, neon and light emitting diode (LED) lamps are available for use in indicating lights, illuminated push buttons and illuminated selector switches. Although incandescent lamps have traditionally been the most frequently used, it is wise to review the the characteristics of the different types of lamps and select the one that is most appropriate for the application. Although the incandescent lamp offers the lowest initial cost, the LED is usually the most economical over the long term, due to its long life, resistance to shock and vibration, and lower power consumption. Benefits of LEDs include:

- **Resistance to shock and vibration** — Since LEDs are solid state, they are completely impervious to the problems associated with shock and vibration that can significantly reduce the life of incandescent lamps by mechanically breaking the filament. The high inrush currents at startup associated with incandescents also act to significantly reduce the life of lamps used in frequent on-off applications.

- **Longer Life** — The LEDs used with CR104P push buttons have a service life of 100,000 hours (11 years) compared to 20,000 hours (28 months) for the neon lamps, and 2,000 hours (3 months) for the standard incandescent lamps.

- Reduced Power Consumption — The LEDs used for the CR104P push buttons consume between 10% and 52% less power than the equivalent incandescent lamp. The table below shows the power consumption of each type:

Type	Volts AC/DC	Incandescent CR104P	Watts	LED CR104P	Watts	Neon CR104P	Watts
Full voltage/	6 (20,000 hours)	PXA16	.95	PXA36*	0.54	—	—
transformer	12 (15,000 hours)	PXA12	1.12	PXA32*	0.72	—	—
	24 (2,500 hours)	PXA14	1.12	PXA34*	0.72	—	—
	120 (slide base)	PXA52	3	—	—	—	—
	130 (bayonet socket)	PXA54	2.6	PXA38*	1.2	PXA19	
Resistor	240	PXA52	3	—	—	—	—
	120	PXA15		—	—	—	—
Cluster Lights	12	PXA22	.96	—	—	—	—
	24	PXA24	1.12	—	—	—	—
	6	PXA26	1.2	—	—	—	—

- **Lower Operating Temperature** - Because of the lower power consumption and greater efficiency of LEDs, they operate much cooler than incandescent lamps. Thus, in applications where heat in the enclosure could be a problem, LED lamps are a better choice.

Incandescent bulbs are recommended for light duty applications and panels not subject to shock and vibration. Neon lamps offer a middle ground, at a cost and performance between the LED and the incandescent, but can have problems associated with flicker induced by noise and frequency. LED lamps offer the best overall performance for the long term.

Technical Data

Lamp comparison

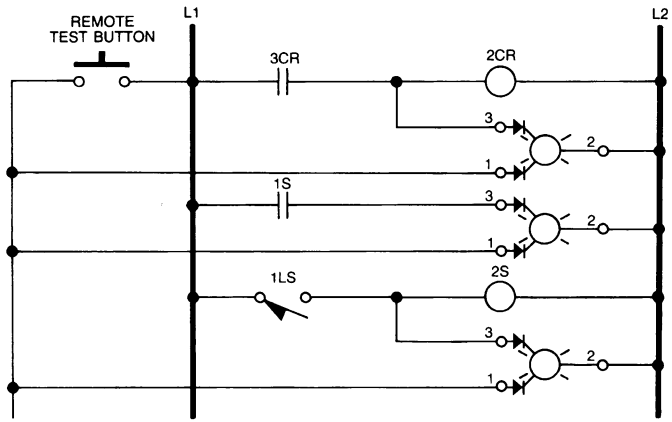
Bulb type	Lifespan (hours)	Shock & vibration immunity	Operating temperature	Power consumption	Brightness
LED	100,000	High	Medium	Medium	Medium
Incandescent	2,000	Low	High	High	High
Neon	20,000	Medium	Low	Low	Low

Potentiometers

Resistance	100 ohms ±10% (list resistance by catalog number)
End resistance	4 ohms maximum
Dielectric strength	1000Vac
2 watts maximum at 70°C	

Dual input illuminated push buttons (also called remote test lights)

Dual input illuminated push buttons and indicating lights allow a number of lights to be tested from a single test button without operating the control circuit. A dual input illuminated push button without contacts becomes a remote test indicating light.



Typical wiring diagram for remote test of lights using dual input “remote test” lights.

GE Electrical Distribution & Control

General Electric Company
41 Woodford Avenue, Plainville, CT 06062

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