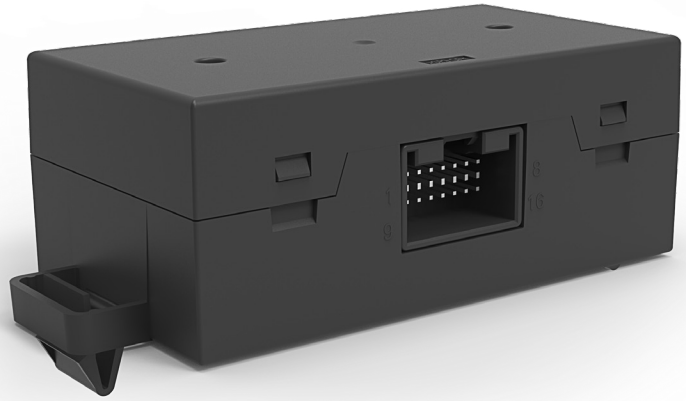
Littelfuse® | Carling Technologies®
A Littelfuse® Brand

CM-Series

Multiplexed CAN/LIN Switching System



The CM-Series system features a LIN Switch Module and a CAN/LIN Controller Module. The switch module includes a carrier that accommodates up to three uniquely identifiable switches and rheostats. The carrier also features two LIN connectors, one that connects to the controller module and one that allows for daisy-chaining to other switch modules. Additionally, the carrier can accommodate a two-pole hardwired switch. The controller module acts as the CAN interface to the system ECU and the LIN switches, and it accommodates up to 3 LIN buses for a total of 45 switch functions in one system.

12/24
VDC

100,000
Operations

up to 45
Switch Functions Controlled

Typical Applications

- Commercial Vehicles
- Construction Equipment
- Agricultural Equipment
- Work Trucks

Design Features

CARRIER
Versatile, 3-compartment Carrier provides easy installation and access.

SWITCH OPTIONS
Uniquely identifiable standard, locking, and rheostat laser etched switches.

ILLUMINATION
Up to 2 backlit icons and 1 center function light.

Above Panel

Behind Panel

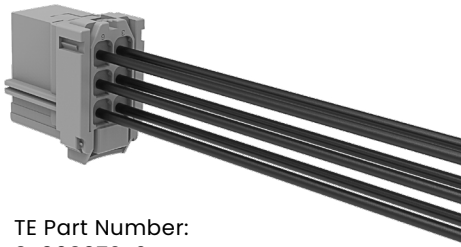
CONTROLLER MODULE
Accommodates up to 45 switch functions. LIN connection to switches and CAN connection to ECU.

Carling Part Number:
MPU-00000011

CONNECTIONS
Two LIN connectors: 1 to Controller Module and 1 for Daisy Chaining.

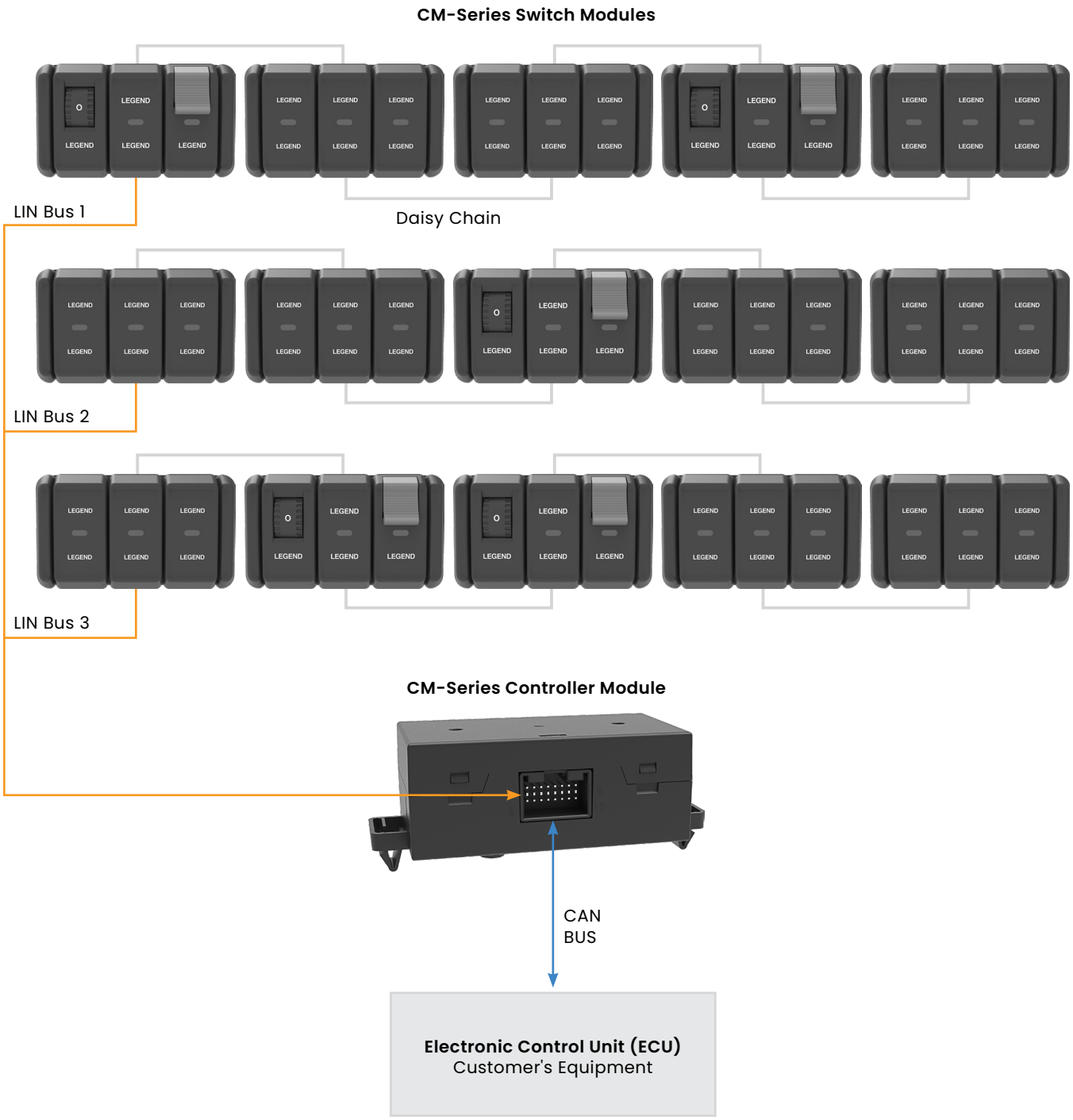
Carling Part Number:
MPU-00000010

HARDWIRE CONNECTOR
Option to hardwire loads. Status feedback through LIN connection



TE Part Number:
8-968970-2

System Diagram



Tech Specs

Physical

Function	Switch is LIN only, or LIN with hardwire (HW). Rheostat is LIN only. Carrier to hold up to 3 switches, rheostats and/or hole plugs Nodes/carriers must be used with Carling controller module.
Switch Circuits	2-position maintained, 2-position momentary, 3-position maintained, 3-position momentary, 3-position maintained-momentary, 3-position momentary-maintained, locking
Illumination	Switch can have up to 2 backlit laser marked icons. Switch can have 1 center function bar/light Rheostat has 1 backlit laser marked icon. 5 color choices for backlight and function lights – red, orange/amber, green, blue, white. Backlight and function light illumination control via LIN
Mounting	See dimensional specs for carrier and controller module mounting requirements. Switch and rheostat must be installed in carriers. No fasteners required. Assembly/disassembly of carrier and controller from front side of panel
Connector Interface	Controller module = MQS (Tyco p/n 966870-1). Harness connector is Tyco p/n 1534101-1 and 1534097-1. Carrier module = MQS (Tyco p/n 953698-1). Harness connector is Tyco p/n 953697-1. Switch hardwire = MQS (Tyco p/n 8-968970-2).
Actuation Force	Switch rocker actuation force = 4 to 10 Newtons. Switch lock actuation force = 4 to 6 Newtons.
Angular Movement	Switch rocker rotation = 12° from center. Rheostat wheel rotation = 190°, with detent at 67.6°.
LIN Bus	3 LIN buses max, 15 nodes per bus 5 rheostat limit per system
CAN Interface to Controller	Per CAN SAE J1939/71
CAN Baud Rate	250 kbps

Electrical

Operating Voltage	Controller module = 9 to 32VDC HW Switch = 5 to 32VDC
Electrical Rating	HW Switch = 5mA to 10A at 24VDC
Sleep Current	Switch = 90uA per switch Controller module = 550uA
Electrical Endurance	LIN Switch = 80k operations, resistive load 25uA, 24 VDC HW Switch = 80k operations, resistive load 10mA, 24 VDC HW Switch = 80k operations, resistive load 10A, 24VDC HW Switch = 100k operations, inductive load 10A, 24 VDC HW Switch = 100k operations, electronics load 5mA, 24 VDC Rheostat = 10k cycles
Reverse Voltage Test	–16 VDC for 4 hours
ESD	8kV direct, 15kV through air
EMC – Conducted	ISO 7637-2 pulse 1, 2A, 2B, 3A, 3B, starting profile, load dump A, load dump B, super imposed alternating voltage, slow increase/decrease of supply voltage, momentary drop in supply voltage, reset behavior at voltage drop ISO 7637-2 transient immunity on supply lines pulses 1, 2a, 2b, 3a, 3b, 4 ISO 7637-3 transient immunity on signal leads Frequency emission on power supply and signal leads from 0.15 to 108 MHz.
EMC – Radiated	BCI per ISO 11452-4 at 100mA Broadband radiated emissions per ECE-R10 annex 7 Narrowband radiated emissions per ECE-R10 annex 8

Environmental

Operating Temperature	-40°C to +70°C
Vibration	ISO 16750-3, Test VIII, 32 hours per plane
Mechanical Shock/Drop	ISO 16750-3, free fall 1-meter drop 3 times
Accelerated Aging	IEC 60068-2-2 test Bb, 336 hours at 95°C
Chemical Resistance	IEC 60068-2-74 condition A – gasoline, diesel, denatured alcohol, mineral oil, motor oil, brake fluid, ethylene glycol, Armor All, Windex
Ingress Protection	IP52 rated
High Temperature Test	IEC 60068-2-2 test B, 70°C for 24 hours
Damp Heat Test	IEC 60069-2-30, 6 cycles, -40°C to +70°C, 90%RH
Composite Temp/Humidity Test	IEC 60068-2-38, -40°C to +70°C, >90%RH
Low Temperature	IEC 60068-2-1 test A, -40°C, 72 Hours non-operational, 24 hours operational
Thermal Shock	IEC 6008-2-14 test Na, -40°C to +70°C, 20 cycles, 2-hour exposure
Sunlight (UV Aging)	ISO 4892-3, 8-hour dry UV at 70°C, 4-hour condensation no UV at 50°C; 25 cycles
Temperature Cycling	IEC 60068-2-14 test Nb, -40°C to +70°C, 10 cycles, 2-hour exposure

GPS-0025 Rev: A

*Manufacturer reserves the right to change product specification without prior notice.

Tech Specs

Software Interface Integration

Click below for instructions on integrating the CM-Series:
www.carlingtech.com/sites/default/files/documents/cm-series_interface.pdf

Tables

Table A: Controller Connection Pin Definition

Pin Number	Pin Definition
Pin 1	LIN 3 Ground
Pin 2	LIN 3 Power (+12V)
Pin 3	LIN 3 Bus
Pin 4	LIN 2 Power (+12V)
Pin 5	LIN 2 Bus
Pin 6	LIN 1 Power (+12V)
Pin 7	LIN 1 Bus
Pin 8	VBat Input

Pin Number	Pin Definition
Pin 9	LIN 1 Ground
Pin 10	LIN 2 Ground
Pin 11	CAN Term Connect A
Pin 12	CAN Term Connect B
Pin 13	CAN L
Pin 14	CAN H
Pin 15	CAN Shield
Pin 16	VBat (Vehicle Ground)

Table B: Carrier Connection Pin Definition

Pin Number	Pin Definition
Pin 1	LIN Ground
Pin 2	LIN Bus
Pin 3	LIN Power (+12V)

GPS-0025 Rev: A

Ordering Scheme

Standard Switch

Sample Part No.	CM	18	C	H	C	0	-	A	2	1	Z	53	-	1	LV	00	00	A
Selection	1		2	3	4	5	6	7	8	9	10	11		12	13	14	15	16

1. SERIES

CM Standard Switch

2. CIRCUIT

Terminal connections as viewed from bottom of switch
Single pole uses 1, 2, and 3. Douple pole uses 1, 2, 3 and 4, 5, 6
( ) = momentary. SP = Single Pole. DP = Double Pole.

Position:		Pole			1	0	2
SP LIN Only	SP LIN & HW	1 Lin	2 HW	DP HW & LIN	1&2 4&5	Connected Terminals	2&3 5&6
16	**26**				ON	OFF	ON
17	**27**				ON	OFF	(ON)
18	**28**				(ON)	OFF	(ON)
Special Circuits							
40	**50**				OFF	2&3	None
41	**51**				ON	OFF	None
42	**52**				(ON)	OFF	None
43	**53**				(ON)	2&3	None
44	**54**				ON	2&3	None
45	**55**				(ON)	OFF	ON
46	**56**				None	1&2	ON
47	**57**				None	1&2	(ON)
48	**58**				None	OFF	2 & 3
49	**59**				None	OFF	(ON)
		71			1&2, 4&5	5&6	None
	72				(4&5)	OFF	None
		76			None	4 & 5	2&3, 5&6
		77			None	4 & 5	(2&3, 5&6)
		78			(1&2, 4&5)	OFF	(2&3, 5&6)
				C4	(1&2, 4&5)	OFF	(2&3, 5&6)

3. ILLUMINATION

	Lamp #	Illumination Type
S	None	---
A	1	Independent
B	3	Independent
C	1	Independent
	2	Independent
D	2	Independent
	3	Independent

	Lamp #	Illumination Type
E	1	Independent
	3	Independent
F	1	Independent
	2	Independent
	3	Independent

4,5. LAMP 1 AND/OR LAMP 2 [4]

No Lamp	**0**				
LED	Red	Amber	Green	Blue	White
12VDC	**A**	**C**	**H**	**2**	**6**

6. LAMP 3 OR LOCK OPTION [4]

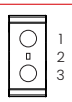
No Lamp	**0**				
Lock Option	**W**				
LED	Red	Amber	Green	Blue	White
12VDC	**A**	**C**	**H**	**2**	**6**

7. ACTUATOR STYLE AND COLOR [3]

Style	Black	Red
Rocker - Laser Etched	**A**	**D**
Locking Rocker - Laser Etched	**P**	**R**

8. IMAGE 1 COLOR [1]

Z No Image
2 White

Image Location 

9. IMAGE 2 COLOR [1]

Z No Image
1 Clear

Image Location 

10. IMAGE 3 COLOR OR LOCK FUNCTION & COLOR [2]

Image 3 Color
Z No Image
2 White

Image Location 

Actuator Lock Function & Color

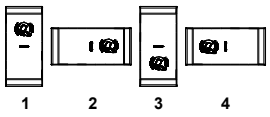
Lock in 0 POS	Lock Color
H	Match Actuator
J	Black
K	White
L	Red
M	Orange
G	Gray

11. LEGEND - IMAGE 1

00 No legend
For standard legends, see "Standard Legend Codes" page. For additional legends, please consult factory

12. LEGEND ORIENTATION

0 No legend
1 Orientation 1
2 Orientation 2
3 Orientation 3
4 Orientation 4



13. LEGEND - IMAGE 2

00 No legend
LV Function Light - Orientation 1 and 3
LY Function Light - Orientation 2 and 4

14. LEGEND - IMAGE 3

00 No legend
For standard legends, see "Standard Legend Codes" page. For additional legends, please consult factory

15. SOURCE ADDRESS

The Source Address is a unique two digit code (**01-5F**) assigned to each switch on the CAN network, and is determined based on the specific CAN architecture of each customer application.

16. ILLUMINATION DECISION

	Illumination Group	Wake/No Wake
A	Drive	No Wake
B	Drive	Wake
C	Entry	No Wake
D	Entry	Wake

Notes:
1. If LIN switch only, rating is 12VDC Max.
   If LIN & hardwire, hardwire portion of switch rating is 5mA-10A 24VDC.
2. Use (0) in lock callout location when creating laser etched locking rocker description.
3. Bracket color is black.
4. LED voltage to be supplied by the network at 12V.
5. Switches **must be** mounted in Carrier & interfaced with Controller Module.
6. Hole plug also available. Part number 390-41022-001.

Configure Complete Part Number >

COS-0087 Rev: G

Ordering Scheme

Rheostat Switch

Sample Part No.	CMR	B	C	A	N	W	-	A	D	A	4L	1	-	81	A
Selection	1	2	3	4	5	6		7	8	9	10	11		12	13

1. SERIES

CMR Rheostat with LIN Termination

2. POTENTIOMETER ROTATION

B 190 Degree Rotation

3. RESISTANCE RANGE

C LIN Signal Controlled

4. RATING

A 12V

5. BACKLIGHTING LED

No Lamp	**0**				
LED	Red	Amber	Green	Blue	White
12VDC	**C**	**N**	**H**	**A**	**6**

6. BRACKET COLOR

W White

7. THUMB WHEEL COLOR

A Black

8. THUMB WHEEL DETENTS

D 1 Detent Position at 67.6 Degrees

9. COVER COLOR AND STYLE

	Color	Style
A	Black	Painted, Laser-Etched

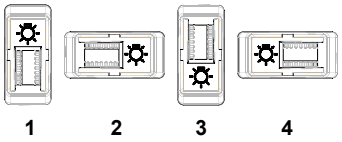
10. LEGEND

00 No legend

For standard legends, see "Standard Legend Codes" page.
For additional legends, please consult factory

11. LEGEND ORIENTATION

0 No legend
1 Orientation 1
2 Orientation 2
3 Orientation 3
4 Orientation 4



12. SOURCE ADDRESS

The Source Address is a unique two digit code (**81-85**) assigned to each rheostat on the CAN network, and is determined based on the specific CAN architecture of each customer application.

13. ILLUMINATION DECISION

	Illumination Group	Wake/No Wake
A	Drive	No Wake
C	Entry	No Wake

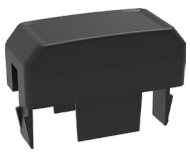
Notes:
1. Rheostats **must be** mounted in Carrier & interfaced with Controller Module.
2. Thumb wheel marking available. Consult factory.

Additional Part Numbers

Hole Plug

390-41022-001

Hole Plugs are inserts that can be mounted in Carriers populated with less than 3 switches, to occupy the vacant space .



Carrier

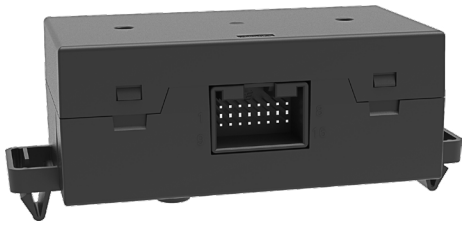
MPU - 00000010

Switches, Rheostats and Hole Plugs must be mounted in a Carrier. Each Carrier has three slots.

Controller Module

MPU - 00000011

The Controller Module translates the LIN to CAN for communication with the rest of the vehicle's system.

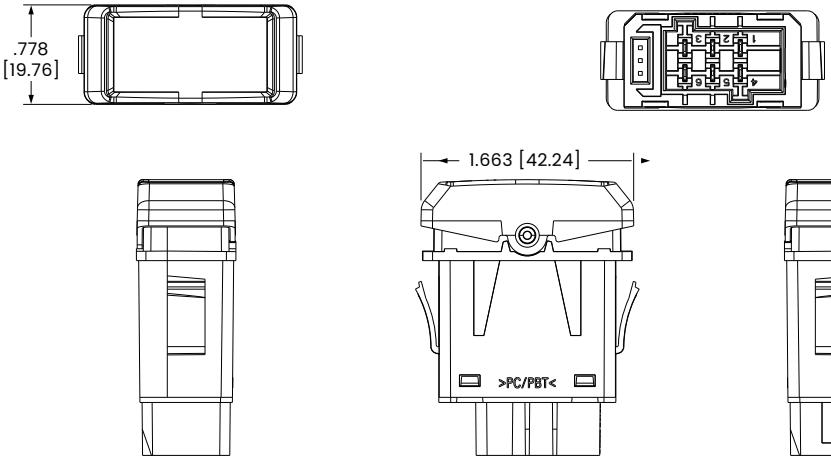


COS-0093 Rev: B

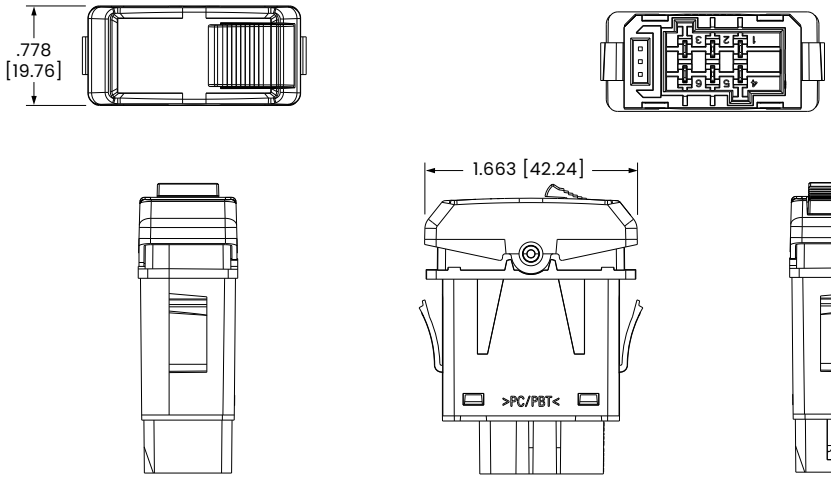
Dimensional Specs

inches [millimeters]

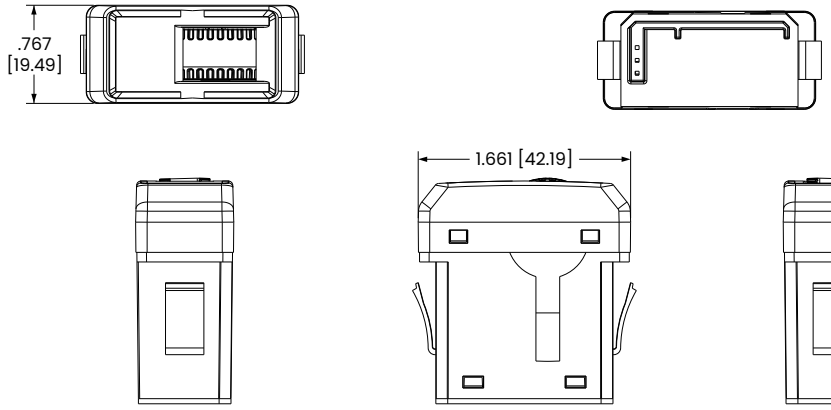
Rocker Switch



Locking Rocker Switch

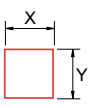


Rheostat



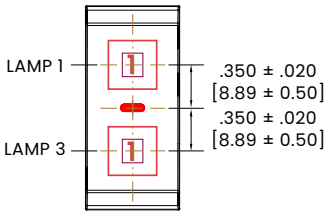
Legend Marking Area

	MARKING AREA 1
X	.375[9.53]
Y	.375[9.53]

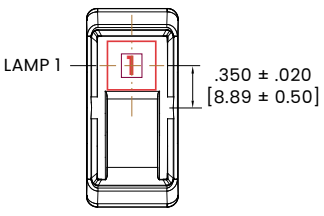


Icon marking area and location
Unless otherwise specified, icon size and location should follow this drawing and is applicable to all 4 orientations

Rocker Switch



Locking Rocker Switch

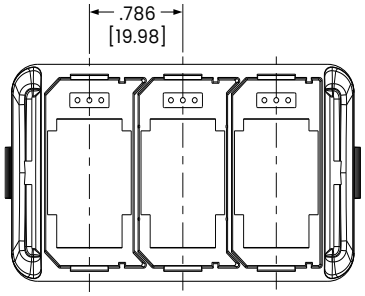


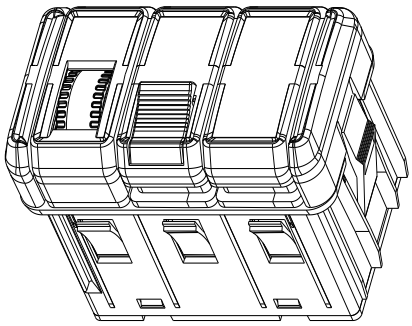
CLA-0149 Rev: A,

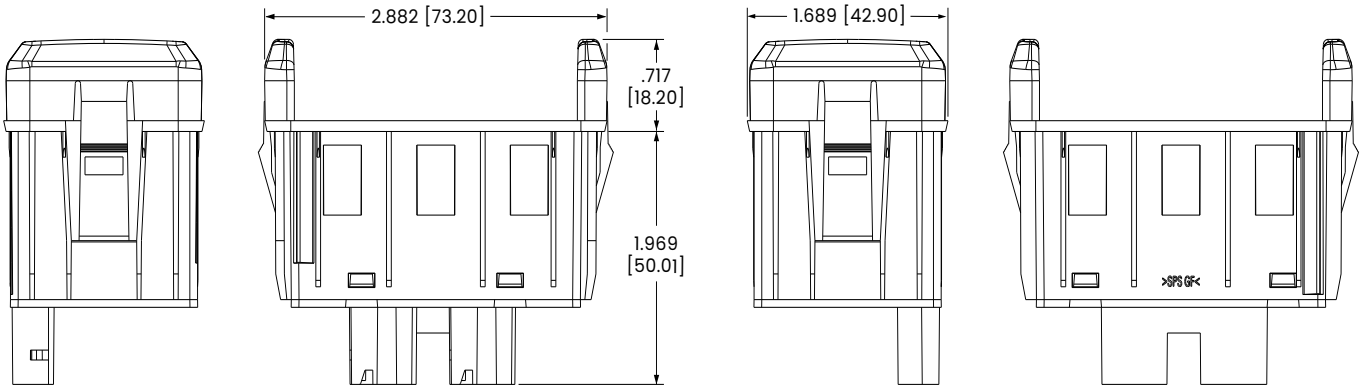
Dimensional Specs

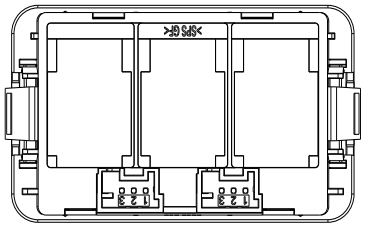
inches [millimeters]

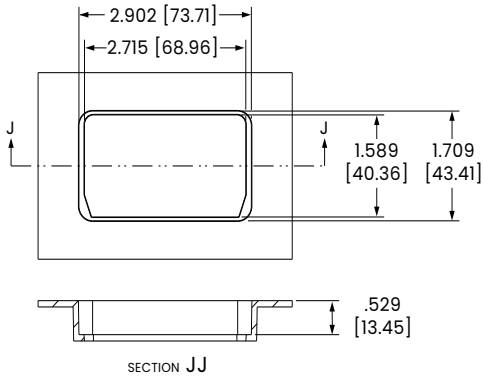
Carrier











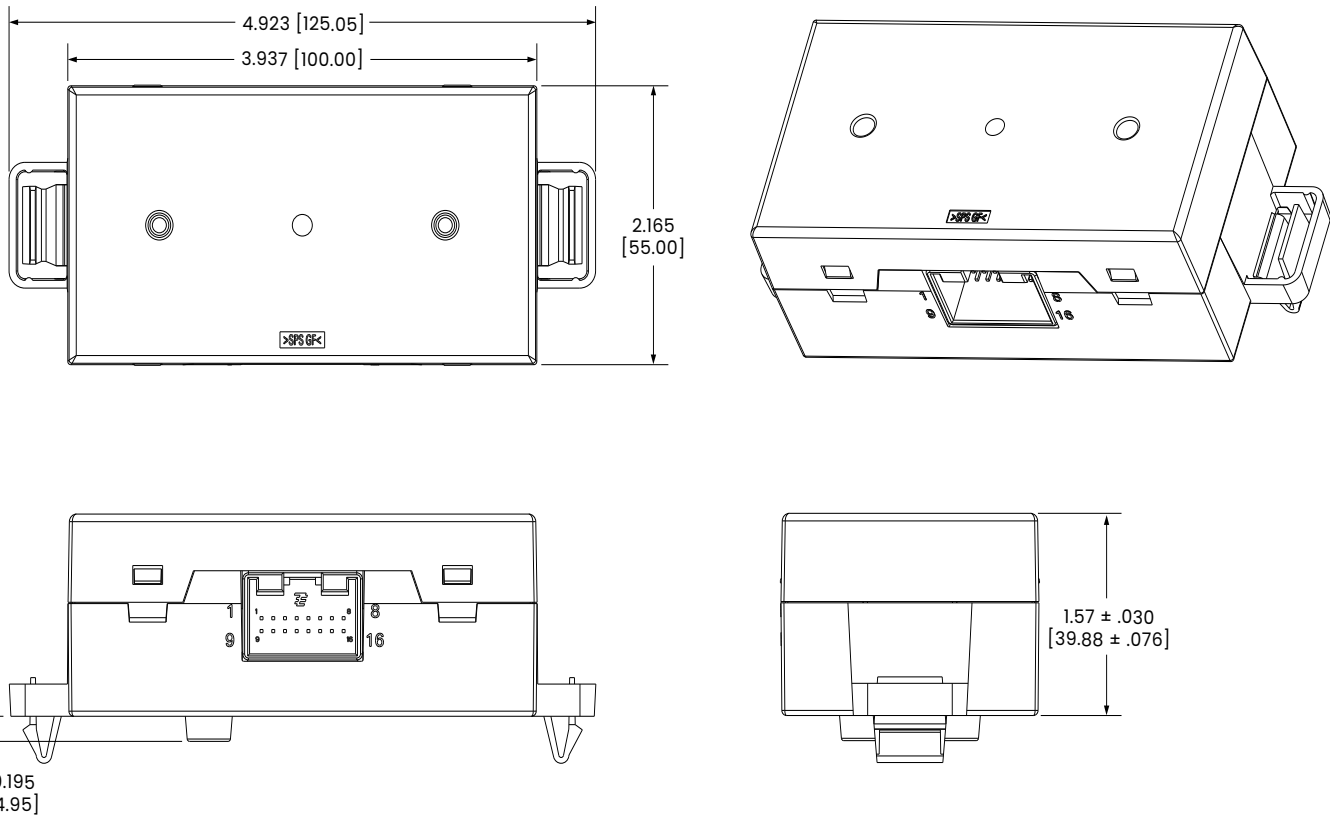
PANEL CUTOUT SIZE

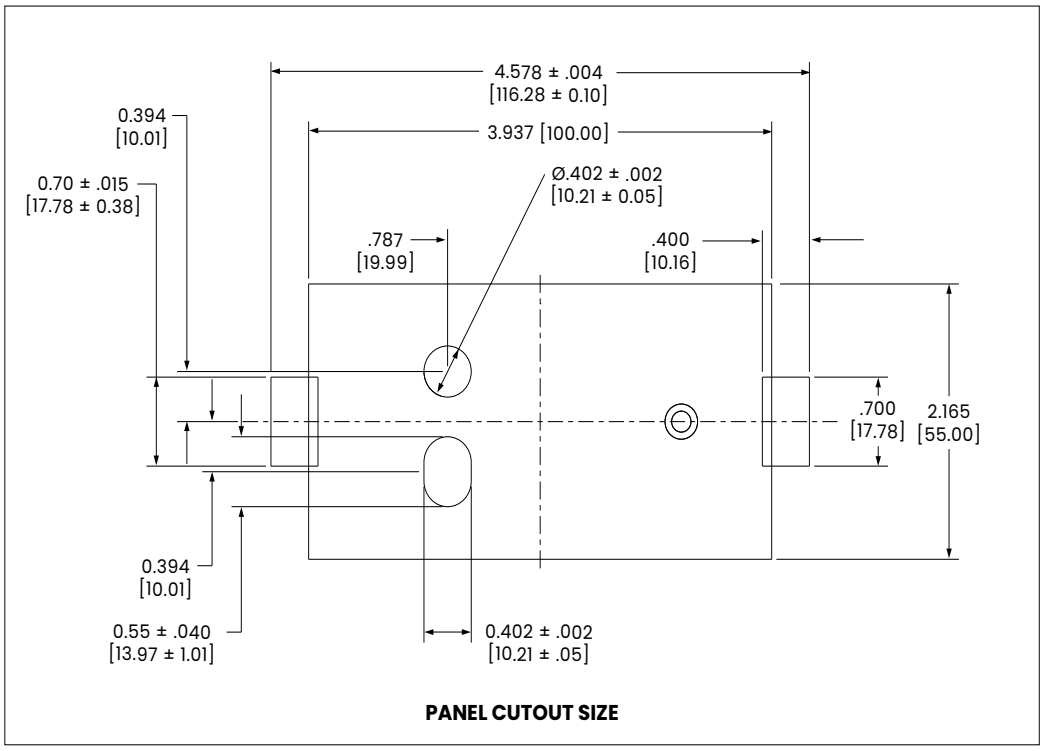
CLA-0149 Rev: A

Dimensional Specs

inches [millimeters]

Controller Module

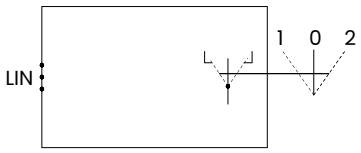
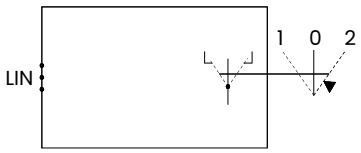
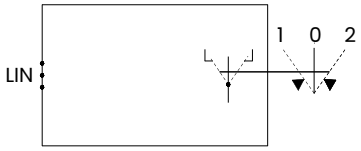
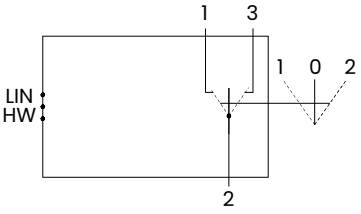
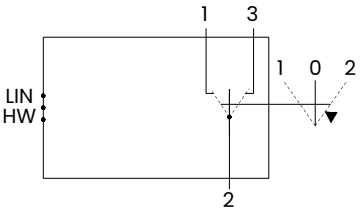
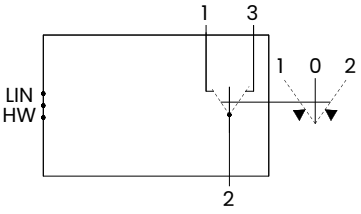
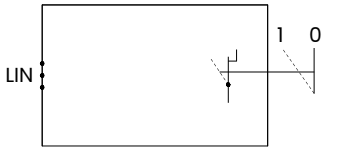
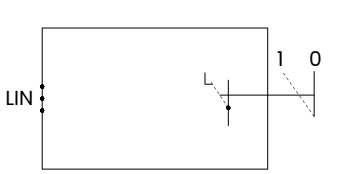
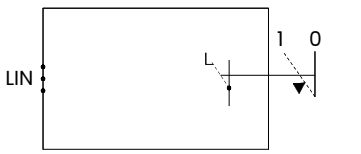


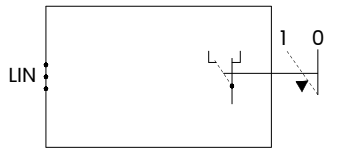
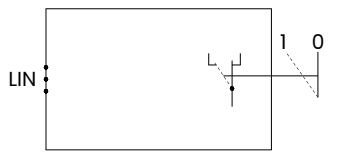
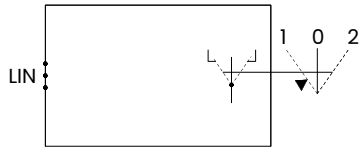
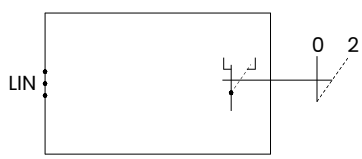
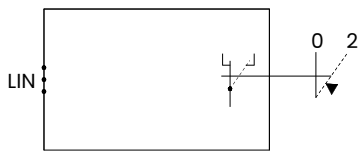
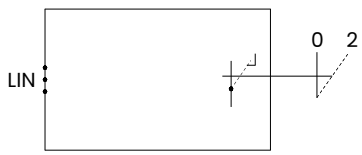
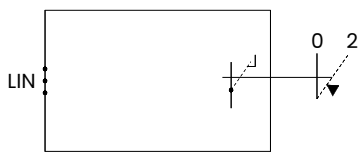
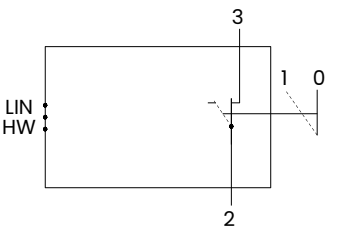
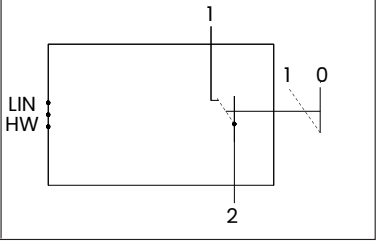


PANEL CUTOUT SIZE

CLA-0151 Rev: A

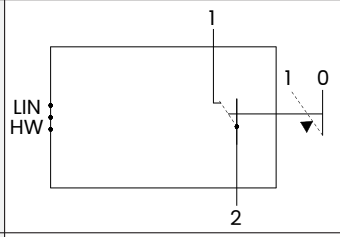
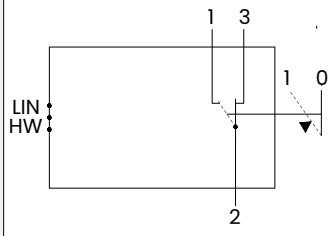
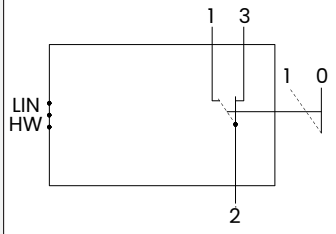
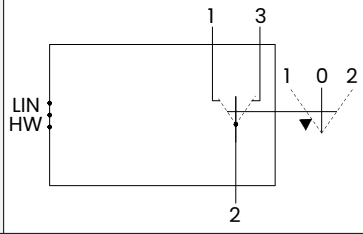
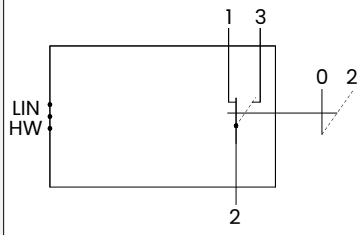
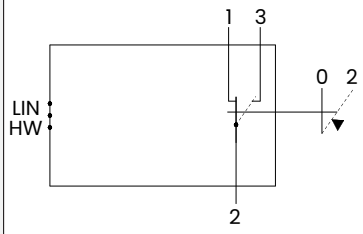
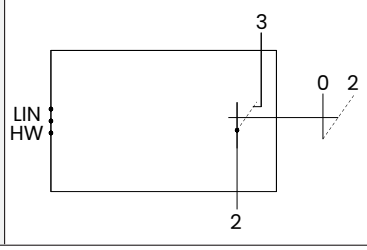
Circuit Diagrams

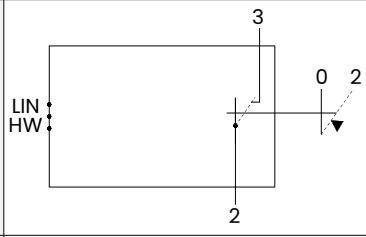
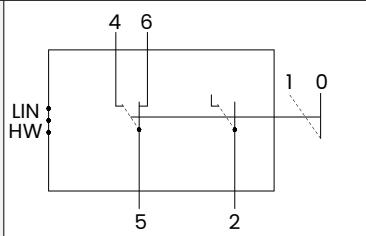
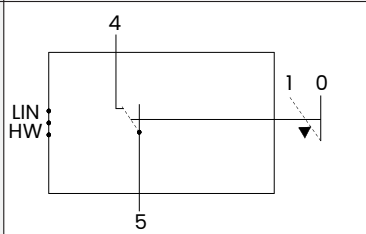
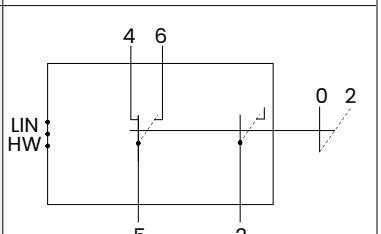
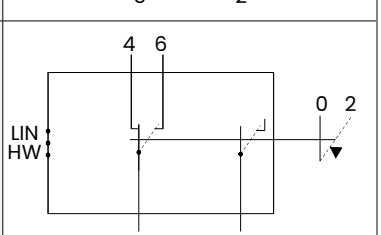
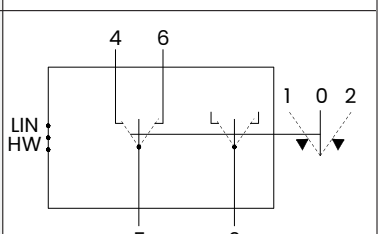
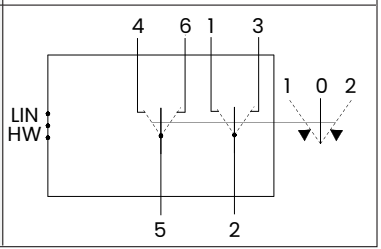
Circuit Code	CIRCUIT DIAGRAM
16	
17	
18	
26	
27	
28	
40	
41	
42	

Circuit Code	CIRCUIT DIAGRAM
43	
44	
45	
46	
47	
48	
49	
50	
51	

COS-0087 Rev: B

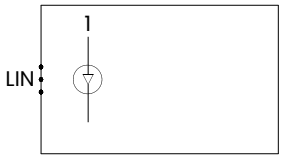
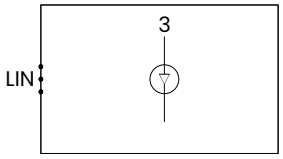
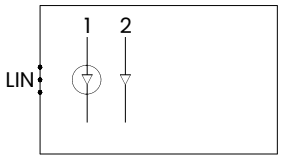
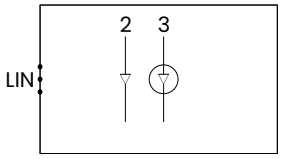
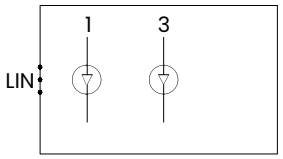
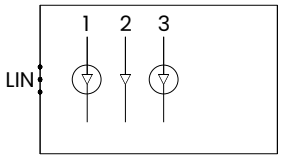
Circuit Diagrams

Circuit Code	CIRCUIT DIAGRAM
52	
53	
54	
55	
56	
57	
58	

Circuit Code	CIRCUIT DIAGRAM
59	
71	
72	
76	
77	
78	
C4	

COS-0087 Rev: B

Illumination Diagrams

Illumination Code	ILLUMINATION DIAGRAM
A	
B	
C	
D	
E	
F	

COS-0087 Rev: B

Standard Legend Codes

												
YK	UA	UB	US	UV	UW	UX	UY	MP	MR	PX	MS	MT
												
VU	MW	NZ	NX	NY	YM	VW	PS	PW	PZ	WG	WM	RN
			NAV LIGHTS	COURT LIGHTS	PANEL LIGHTS	ANCH LIGHTS	HEAD LIGHTS	FOG LIGHTS	DASH LIGHTS	DOCK LIGHTS	BEACON	LIGHT
RP	YG	TX	VD	VE	VF	VG	SH	SM	SN	SP	SR	SY
DIM	BRIGHT						BILGE PUMP	BILGE				
WY	WZ	UH	UJ	PD	PE	PF	VC	VJ	UF	UG	MU	TN
		WIPER										
NS	PB	SE	VZ	YE	NN	RW	PU	WA	YN	UE	NM	RJ
				ENG FAN	BLWR					HORN		
NR	YD	TL	VR	SL	VA	UC	VN	PK	VY	UZ	RH	NU
							UP	DOWN				
NV	RB	RC	RK	RL	MZ	RG	WS	WT	UD	UR	WD	TY
		WATER PUMP			ANCHOR							
PA	UK	WR	UU	UT	YR	PM	VV	WB	TB	TC	TD	TE
											ENG HATCH	ENG BRAKE
MY	PV	TA	TZ	WC	PT	PN	PH	RA	TU	TT	YL	SK
						TCS						
VS	UL	UM	WK	TS	VT	WL	VP	YJ	PJ	RY	UP	NW
NP	RE	RF	PP	PR	TV	PC	YT	YU	PL	WJ	MV	RR
		SEAT					CRUISE					
TK	RT	SZ	VX	WF	WH	PG	SJ	YA	YB	RM	TM	RD
RS	UN	TP	TR	NT	MX	YC	TW	TJ	YF	TH	TF	TG
		AUX	ON OFF	OFF ON	I O	O I	OFF ON	ON	OFF	I	O	II
YS	YH	SX	RZ	YP	WN	WP	WW	WX	SA	SB	SC	SD
RAISE	LOWER	HIGH	LOW	FWD	REV	DEPTH	TRIM TAB	ACC	NAV ANCH	WIND LASS UP/DN	LIVE WELL	REAR
ST	SU	WU	WV	SV	SW	VB	VH	VK	VL	VM	WE	SF
PARK	AUTO											
SG	SS	RU	RV	RX								

CLA-0146 Rev: A
ISO compliant symbols. Consult factory for custom legends.