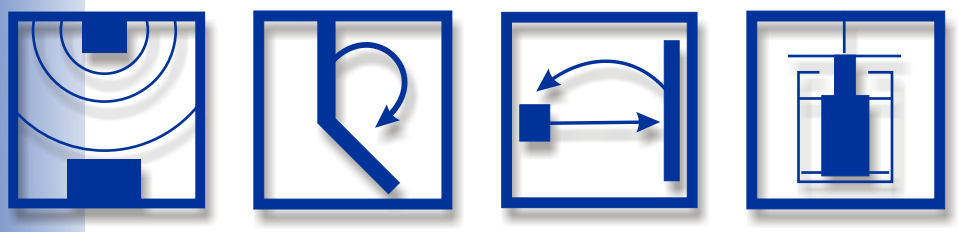
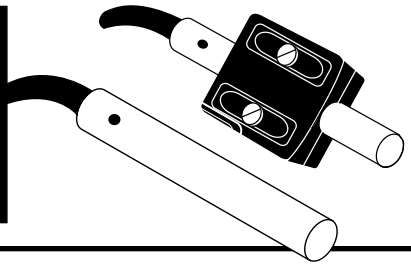
CD ROM General Catalog

- Proximity Sensors
- Photoelectric Sensors
- Special Application Sensors
- Limit Switches & Solenoids



 CDCAT-1.0

6.5 mm 20 mm 34 mm Inductive Tubular Smooth Barrel DC AC



Connector Type	Circuit Description	Housing Material	Housing Length	Shielded Model No.	Unshielded Model No.	Sensing Range	Maximum Load Current	Maximum Leakage Current	Voltage Drop*	Maximum Switching Frequency	Short Circuit Protected
6.5mm DC 10-30V Metal											
6.6' Cable	3W, NPN, NO	Metal	50mm	**ET110-71001**	—	1mm	200mA	<100µA	<2.0	4KHz	yes
6.6' Cable	3W, PNP, NO	Metal	50mm	**ET111-71003**	—	1mm	200mA	<100µA	<2.0	4KHz	yes
6.5mm NAMUR 5-25 VDC											
6.6' Cable	2W, Analog	Metal	30mm	**ET112-75403**	—	1mm	N/A	—	—	1KHz	N/A
20mm DC 10-30V Plastic											
6.6' Cable	3W, NPN, NO	Plastic	77mm	—	**ET210-73110**	10mm	400mA	<10µA	<2.5	200Hz	yes
6.6' Cable	3W, PNP, NO	Plastic	77mm	—	**ET211-73110**	10mm	400mA	<10µA	<2.5	200Hz	yes
20mm AC 20-250V Plastic											
6.6' Cable	2W, AC, NO	Plastic	77mm	—	**ET220-73410**	10mm	400mA	<1.5mA @220 VAC	<8 VAC	25Hz	no
34mm DC 10-30V Plastic											
6.6' Cable	3W, PNP, NO	Plastic	80mm	—	**ET211-83110**	20mm	400mA	<10µA	<2.5 VDC	100Hz	yes
34mm AC 20-250V Plastic											
6.6' Cable	2W, AC, NO	Plastic	80mm	—	**ET220-83410**	20mm	400mA	<1.5mA @220 VAC	<8 VAC	25Hz	no

* Across conducting sensor

▶ Consult factory for normally closed model availability.

Replacement Mounting Brackets	
6.5mm	**ET018-20000**
20mm	**ET018-20010**
34mm	**ET018-20020**

Protected by the NAMCO Lifetime Replacement Program

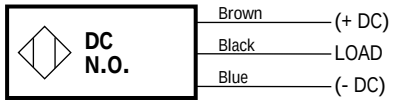
Common Sensor Characteristics

Sensor Diameter	6.5mm	20mm	34mm
Sensing Range (±10%)	1mm	10mm	20mm
Standard Target (mm) (mild steel)	6.5x6.5x1	30x30x1	60x60x1
Temperature Drift (max.)	±10%	±15%	±15%
Repeatability	± 2%		
Hysteresis	3-8% (typical); 15% (max.)		
Ambient Temperature Range	-13°F to +158°F		
Reverse Polarity Protected	yes		
Current Consumption	<10mA		
NEMA Enclosure Type	1,3,4,6,13	1,3,4,4x,6,13	
LED Indicator	red = target		
Metal Housings	Stainless	N/A	
Plastic Housings	N/A	Ultradur®	
Cable Type	PVC		
Shipping Weight	6 oz.	8 oz.	10 oz.

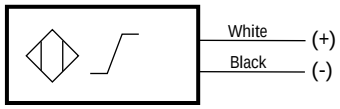
Circuit Drawings

CABLE MODELS

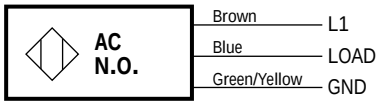
3 Wire DC N.O.



NAMUR

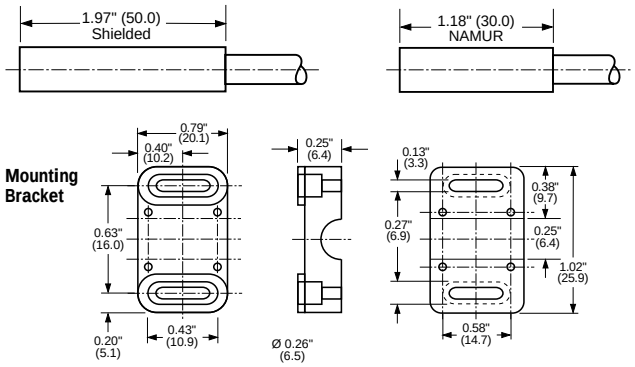


2 Wire AC N.O.

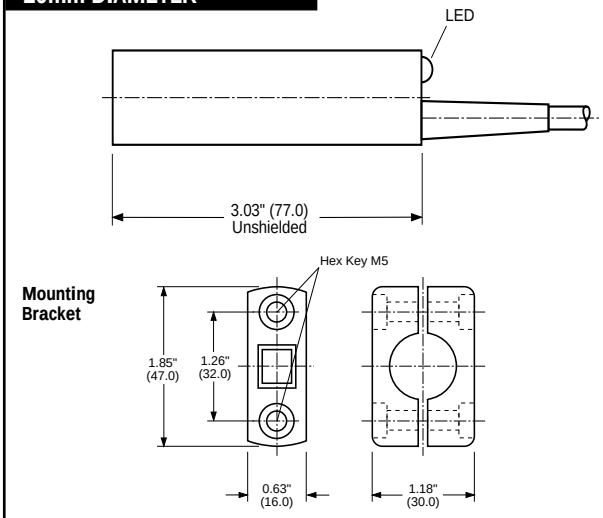


Dimensional Drawings 6.5, 20, 34mm

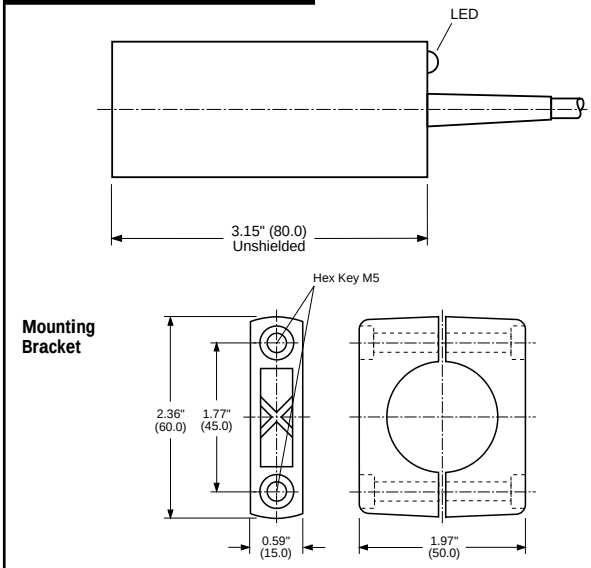
6.5mm DIAMETER



20mm DIAMETER



34mm DIAMETER

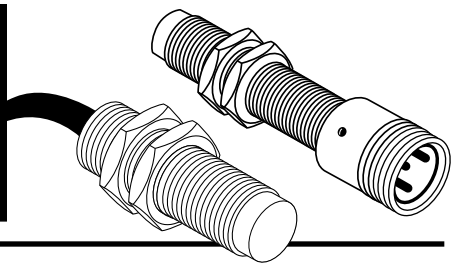


Mounting Brackets are included with Smooth Sensors.

Proximity Sensors

Namco Controls Corporation
Mayfield Village, OH 44143
(440) 460-1360 • FAX (440) 460-3800 • namcocontrols.com

8mm Inductive Tubular Threaded Barrel DC



Proximity Sensors

1mm (Shielded) and 2mm (Unshielded) Sensing Ranges

Connector Type	Circuit Description	Housing Material	Housing Length	Shielded Model No.	Unshielded Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency		Short Circuit Protected
									Shielded	Unshielded	
DC 10-30V Metal											
4-pin Euro	3W, PNP, NO	Metal	53mm	**ET311-10151**	**ET311-11151**	200mA	<10µA	<2.0 VDC	4KHz	2KHz	yes
6.6' Cable	3W, NPN, NO	Metal	50mm	**ET110-10110**	**ET110-11110**	200mA	<100µA	<2.0 VDC	4KHz	2KHz	yes
6.6' Cable	3W, PNP, NO	Metal	50mm	**ET111-10110**	**ET111-11110**	200mA	<10µA	<2.5 VDC	4KHz	2KHz	yes
NAMUR 5-25 VDC											
6.6' Cable	Analog	Metal	30mm	**ET112-10310**	—	N/A	—	—	1KHz	—	N/A

* Across conducting sensor

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

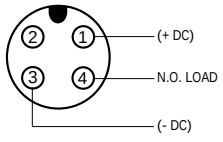
Common Sensor Characteristics

8mm DIAMETER DC SENSORS	
Shielded Sensing Range (±10%)	1mm
Unshielded Sensing Range (±10%)	2mm
Standard Target	8x8x1mm (mild steel)
Repeatability	± 2%
Hysteresis	3-8% (typ.); 15% (max.)
Temperature Drift (max.)	±15%
Ambient Temperature Range	-13°F to +158°F
Reverse Polarity Protected	yes
Current Consumption	<10mA
NEMA Enclosure Type	1, 3, 4, 6, 13
LED Indicator	yellow = target
Metal Housings	Chrome Plated Brass
Plastic Housings	N/A
Cable Type	PVC
Shipping Weight	Connector model: 3 oz. Cable model: 8 oz.

Circuit Drawings

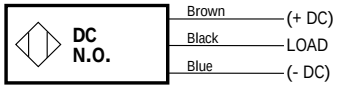
EURO CONNECTOR MODELS Male view shown

3 Wire DC N.O.



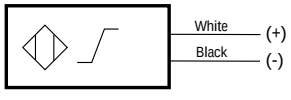
CABLE MODELS

3 Wire DC N.O.



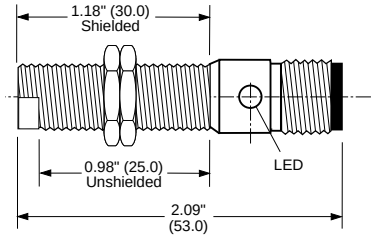
NAMUR MODELS

NAMUR

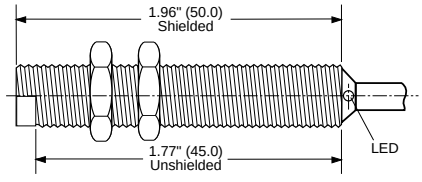


Dimensional Drawings

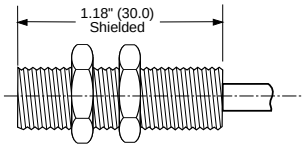
EURO CONNECTOR MODELS Body threads = M8x1



CABLE MODEL



CABLE MODELS-NAMUR

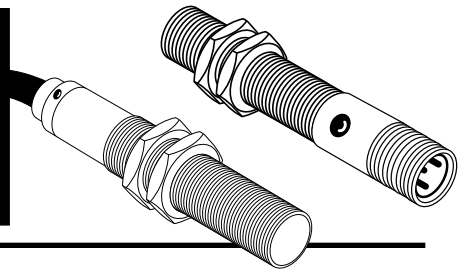


Proximity Sensors

NAMCO

Namco Controls Corporation
Mayfield Village, OH 44143
(440) 460-1360 • FAX (440) 460-3800 • namcocontrols.com

12mm Inductive Tubular Threaded Barrel DC



Proximity Sensors

2mm (Shielded) and 4mm (Unshielded) Sensing Ranges

Connector Type	Circuit Description	Housing Material	Housing Length	Shielded Model No.	Unshielded Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency		Short Circuit Protected
									Shielded	Unshielded	
DC 10-30V Metal											
4-pin Euro	3W, NPN, NO	Metal	54mm	**ET310-22151**	**ET310-23151**	400mA	<10µA	<2.5 VDC	700Hz	400Hz	yes
4-pin Euro	3W, PNP, NO	Metal	54mm	**ET311-22151**	**ET311-23151**	400mA	<10µA	<2.5 VDC	700Hz	400Hz	yes
6.6' Cable	3W, NPN, NO	Metal	35mm	**ET310-22110**	**ET310-23110**	200mA	<10µA	<2.5 VDC	1200Hz	800Hz	yes
6.6' Cable	3W, NPN, NO	Metal	78mm	**ET110-22110**	**ET110-23110**	400mA	<10µA	<2.5 VDC	700Hz	400Hz	yes
6.6' Cable	3W, PNP, NO	Metal	35mm	**ET311-22110**	**ET311-23110**	200mA	<10µA	<2.5 VDC	1200Hz	800Hz	yes
6.6' Cable	3W, PNP, NO	Metal	78mm	**ET111-22110**	**ET111-23110**	400mA	<10µA	<2.5 VDC	700Hz	400Hz	yes
DC 10-30V Plastic											
6.6' Cable	3W, NPN, NO	Plastic	35mm	**ET310-42110**	**ET310-43110**	200mA	<10µA	<2.5 VDC	1200Hz	800Hz	yes
6.6' Cable	3W, NPN, NO	Plastic	75mm	**ET210-22110**	**ET210-23110**	400mA	<10µA	<2.5 VDC	700Hz	400Hz	yes
6.6' Cable	3W, PNP, NO	Plastic	50mm	**ET311-42110**	**ET311-43110**	200mA	<10µA	<2.5 VDC	1200Hz	800Hz	yes
6.6' Cable	3W, PNP, NO	Plastic	75mm	**ET211-22110**	**ET211-23110**	400mA	<10µA	<2.5 VDC	700Hz	400Hz	yes
NAMUR 5-25 VDC											
6.6' Cable	Analog	Metal	30mm	**ET112-20310**	**ET112-21310**	N/A	—	—	800Hz	400Hz	N/A
6.6' Cable	Analog	Plastic	30mm	**ET212-20310**	**ET212-21310**	N/A	—	—	800Hz	400Hz	N/A

* Across conducting sensor

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

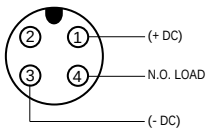
Common Sensor Characteristics

12mm DIAMETER DC SENSORS	
Shielded Sensing Range (±10%)	2mm
Unshielded Sensing Range (±10%)	4mm
Standard Target	12x12x1mm (mild steel)
Repeatability	± 2%
Hysteresis	3-8% (typ.); 15% (max.)
Temperature Drift (max.)	±15%
Ambient Temperature Range	-13°F to +158°F
Reverse Polarity Protected	yes
Current Consumption	3W DC = <6mA
NEMA Enclosure Type Metal Plastic	 1, 3, 4, 6, 13 1, 3, 4, 4x, 6, 13
LED Indicator	red = target
Metal Housings	Chrome Plated Brass
Plastic Housings	Ultradur®
Cable Type	PVC
Shipping Weight	Connector model: 4 oz. Cable model: 9 oz.

Circuit Drawings

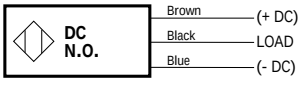
EURO CONNECTOR MODELS Male view shown

3 Wire DC N.O.

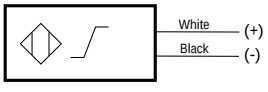


CABLE MODELS

3 Wire DC N.O.

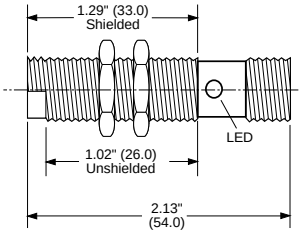


NAMUR MODELS

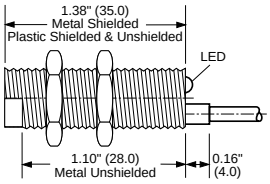


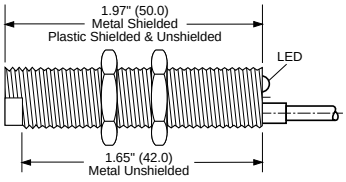
Dimensional Drawings

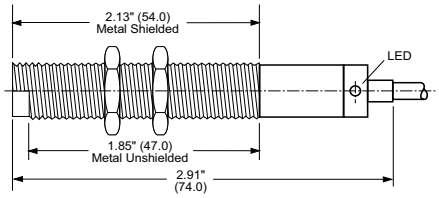
EURO CONNECTOR MODELS Body threads = M12x1

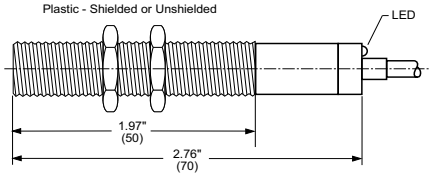


CABLE MODELS

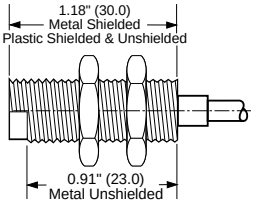








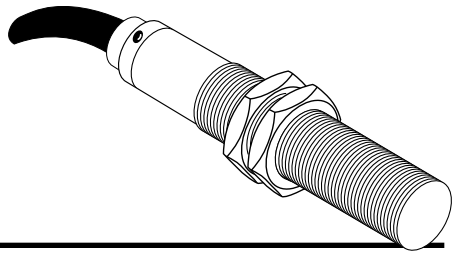
CABLE MODELS-NAMUR



NAMCO

Namco Controls Corporation
Mayfield Village, OH 44143
(440) 460-1360 • FAX (440) 460-3800 • namcocontrols.com

12mm Inductive Tubular Threaded Barrel AC



Proximity Sensors

2mm (Shielded) and 4mm (Unshielded) Sensing Ranges

Connector Type	Circuit Description	Housing Material	Housing Length	Shielded Model No.	Unshielded Model No.	Maximum Load Current	Leakage Current @220 VAC	Voltage Drop*	Maximum Switching Frequency		Short Circuit Protected
									Shielded	Unshielded	
AC 80-250V Metal											
3-pin Micro	2W, AC, NO	Metal	73mm	**ET320-22420**	**ET320-23420**	200mA	<2.5mA	<11 VAC	25Hz	25Hz	no
3-pin Micro	2W, AC, NO	Metal	86mm	**ET120-22420**	**ET120-23420**	200mA	<2.5mA	<11 VAC	25Hz	25Hz	no
6.6' Cable	2W, AC, NO	Metal	54mm	**ET320-22410**	**ET320-23410**	200mA	<2.5mA	<11 VAC	25Hz	25Hz	no
6.6' Cable	2W, AC, NO	Metal	78mm	**ET120-22410**	**ET120-23410**	200mA	<2.5mA	<11 VAC	25Hz	25Hz	no
AC 80-250V Plastic											
6.6' Cable	2W, AC, NO	Plastic	54mm	**ET320-42410**	**ET320-43410**	200mA	<2.5mA	<11 VAC	25Hz	25Hz	no
6.6' Cable	2W, AC, NO	Plastic	75mm	**ET220-22410**	**ET220-23410**	200mA	<2.5mA	<11 VAC	25Hz	25Hz	no

* Across conducting sensor

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

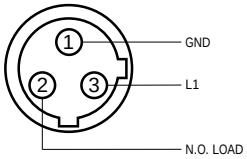
Common Sensor Characteristics

12mm DIAMETER AC SENSORS	
Shielded Sensing Range (±10%)	2mm
Unshielded Sensing Range (±10%)	4mm
Standard Target	12x12x1mm (mild steel)
Repeatability	± 2%
Hysteresis	3-8% (typ.); 15% (max.)
Temperature Drift (max.)	±15%
Ambient Temperature Range	-13°F to +158°F
Reverse Polarity Protected	yes
NEMA Enclosure Type Metal Plastic	 1, 3, 4, 6, 13 1, 3, 4, 4x, 6, 13
LED Indicator	red = target
Metal Housings	Chrome Plated Brass
Plastic Housings	Ultradur®
Cable Type	PVC
Shipping Weight	Connector model: 4 oz. Cable model: 9 oz.

Circuit Drawings

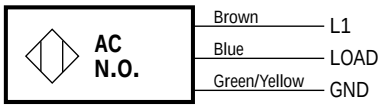
MICRO CONNECTOR MODELS Male view shown

2 Wire AC N.O.



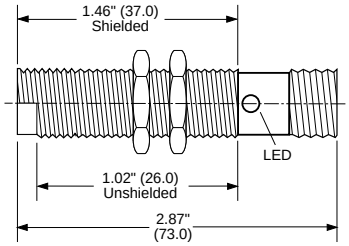
CABLE MODELS

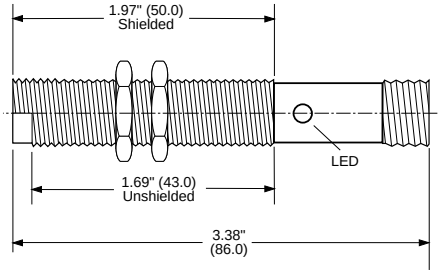
2 Wire AC N.O.



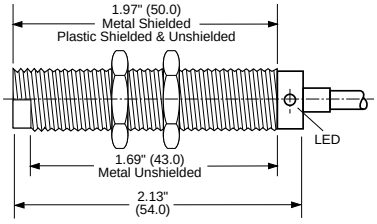
Dimensional Drawings

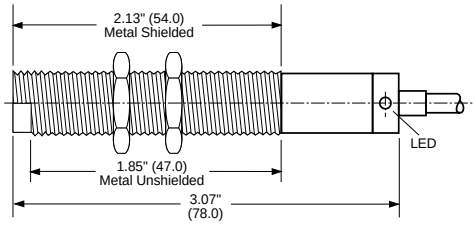
MICRO CONNECTOR MODELS Body threads = M12x1

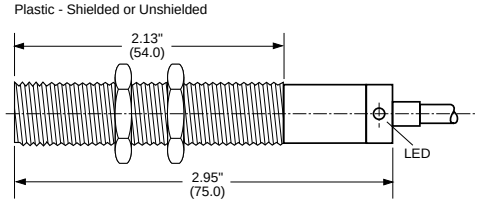




CABLE MODELS







NAMCO

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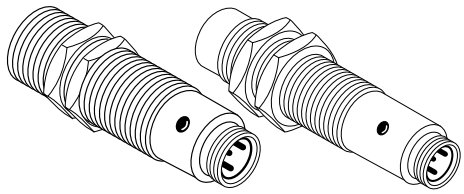
18mm Inductive Tubular Threaded Barrel DC



Proximity Sensors

5mm (Shielded) and 8mm (Unshielded) Sensing Ranges

Connector Type	Circuit Description	Housing Material	Housing Length	Shielded Model No.	Unshielded Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency		Short Circuit Protected
									Shielded	Unshielded	
DC 10-30V Metal											
4-pin Euro	3W, NPN, NO	Metal	76mm	**ET310-32151**	**ET310-33151**	400mA	<10µA	<2.5 VDC	300Hz	250Hz	yes
4-pin Euro	3W, PNP, NO	Metal	76mm	**ET311-32151**	**ET311-33151**	400mA	<10µA	<2.5 VDC	300Hz	250Hz	yes
4-pin Mini	3W, NPN, NO	Metal	70mm	**ET310-32100**	**ET310-33100**	400mA	<10µA	<2.5 VDC	300Hz	250Hz	yes
4-pin Mini	3W, PNP, NO	Metal	66mm	**ET311-32100**	**ET311-33100**	400mA	<10µA	<2.5 VDC	300Hz	250Hz	yes
6.6' Cable	3W, NPN, NO	Metal	50mm	**ET310-32110**	**ET310-33110**	400mA	<10µA	<2.5 VDC	300Hz	250Hz	yes
6.6' Cable	3W, NPN, NO	Metal	80mm	**ET110-32110**	**ET110-33110**	400mA	<10µA	<2.5 VDC	300Hz	250Hz	yes
6.6' Cable	3W, PNP, NO	Metal	50mm	**ET311-32110**	**ET311-33110**	400mA	<10µA	<2.5 VDC	300Hz	250Hz	yes
6.6' Cable	3W, PNP, NO	Metal	80mm	**ET111-32110**	**ET111-33110**	400mA	<10µA	<2.5 VDC	300Hz	250Hz	yes
DC 10-30V Plastic											
6.6' Cable	3W, NPN, NO	Plastic	50mm	**ET310-52110**	**ET310-53110**	400mA	<10µA	<2.5 VDC	300Hz	250Hz	yes
6.6' Cable	3W, NPN, NO	Plastic	80mm	**ET210-32110**	**ET210-33110**	400mA	<10µA	<2.5 VDC	300Hz	250Hz	yes
6.6' Cable	3W, PNP, NO	Plastic	50mm	**ET311-52110**	**ET311-53110**	400mA	<10µA	<2.5 VDC	300Hz	250Hz	yes
6.6' Cable	3W, PNP, NO	Plastic	80mm	**ET211-32110**	**ET211-33110**	400mA	<10µA	<2.5 VDC	300Hz	250Hz	yes
NAMUR 5-25 VDC											
6.6' Cable	Analog	Metal	30mm	**ET112-30310**	**ET112-31310**	N/A	—	—	500Hz	200Hz	N/A
6.6' Cable	Analog	Plastic	30mm	**ET212-30310**	**ET212-31310**	N/A	—	—	500Hz	200Hz	N/A

* Across conducting sensor

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

18mm-DC

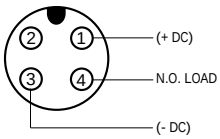
Common Sensor Characteristics

18mm DIAMETER DC SENSORS	
Shielded Sensing Range (±10%)	5mm
Unshielded Sensing Range (±10%)	8mm
Standard Target (mm) (mild steel)	18x18x1 (Shielded) 24x24x1 (Unshielded)
Repeatability	± 2%
Hysteresis	3-8% (typ.); 15% (max.)
Temperature Drift (max.)	±15%
Ambient Temperature Range	-13°F to +158°F
Reverse Polarity Protected	yes
Current Consumption	<1.5mA
NEMA Enclosure Type Metal Plastic	 1, 3, 4, 6, 13 1, 3, 4, 4x, 6, 13
LED Indicator	red = target
Metal Housings	Chrome Plated Brass
Plastic Housings	Ultradur®
Cable Type	PVC
Shipping Weight	Connector model: 4 oz. Cable model: 9 oz.

Circuit Drawings

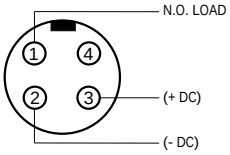
EURO CONNECTOR MODELS Male views shown

3 Wire DC N.O.



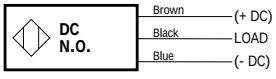
MINI CONNECTOR MODELS Male views shown

3 Wire DC N.O.

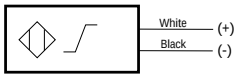


CABLE MODELS

3 Wire DC N.O.

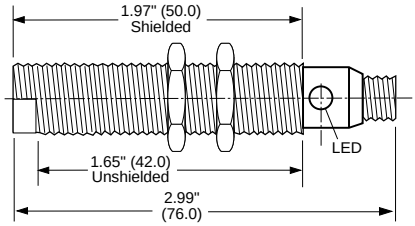


NAMUR MODELS

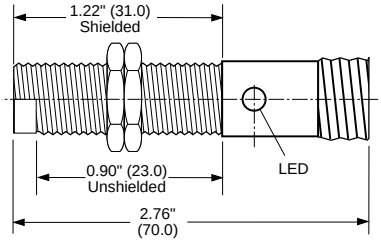


Dimensional Drawings

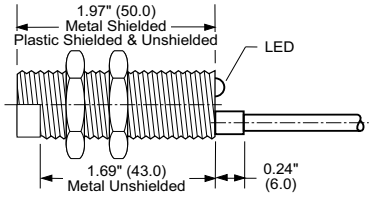
EURO CONNECTOR MODELS Body threads - M18x1

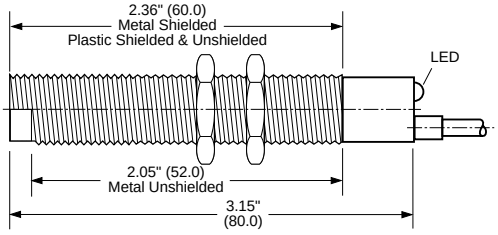


MINI CONNECTOR MODELS

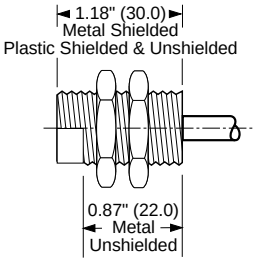


CABLE MODELS





CABLE MODELS-NAMUR



Proximity Sensors

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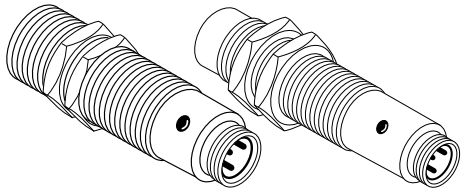
18mm Inductive Tubular Threaded Barrel AC



Proximity Sensors

5mm (Shielded) and 8mm (Unshielded) Sensing Ranges

Connector Type	Circuit Description	Housing Material	Housing Length	Shielded Model No.	Unshielded Model No.	Maximum Load Current	Leakage Current @220 VAC	Voltage Drop*	Maximum Switching Frequency		Short Circuit Protected
									Shielded	Unshielded	
AC 20-250V											
3-pin Micro	2W, AC, NO	Metal	92mm	**ET120-32420**	**ET120-33420**	400mA	<1.5mA	<8 VAC	25Hz	25Hz	no
3-pin Mini	2W, AC, NO	Metal	94mm	**ET120-32400**	**ET120-33400**	400mA	<1.5mA	<8 VAC	25Hz	25Hz	no
6.6' Cable	2W, AC, NO	Metal	80mm	**ET120-32410**	**ET120-33410**	400mA	<1.5mA	<8 VAC	25Hz	25Hz	no
6.6' Cable	2W, AC, NO	Plastic	80mm	**ET220-32410**	**ET220-33410**	400mA	<1.5mA	<8 VAC	25Hz	25Hz	no
AC 80-250V											
3-pin Micro	2W, AC, NO	Metal	80mm	**ET320-32420**	**ET320-33420**	200mA	<2.5mA	<11 VAC	25Hz	25Hz	no
3-pin Mini	2W, AC, NO	Metal	83mm	**ET320-32400**	**ET320-33400**	200mA	<2.5mA	<11 VAC	25Hz	25Hz	no
6.6' Cable	2W, AC, NO	Metal	50mm	**ET320-32410**	**ET320-33410**	200mA	<2.5mA	<11 VAC	25Hz	25Hz	no
6.6' Cable	2W, AC, NO	Plastic	50mm	**ET320-52410**	**ET320-53410**	200mA	<2.5mA	<11 VAC	25Hz	25Hz	no

* Across conducting sensor

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

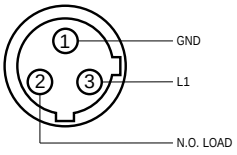
Common Sensor Characteristics

18mm DIAMETER AC SENSORS	
Shielded Sensing Range (±10%)	5mm
Unshielded Sensing Range (±10%)	8mm
Standard Target (mm) (mild steel)	18x18x1 (Shielded) 24x24x1 (Unshielded)
Repeatability	± 2%
Hysteresis	3-8% (typ.); 15% (max.)
Temperature Drift (max.)	±15%
Ambient Temperature Range	-13°F to +158°F
Reverse Polarity Protected	yes
NEMA Enclosure Type Metal Plastic	 1, 3, 4, 6, 13 1, 3, 4, 4x, 6, 13
LED Indicator	red = target
Metal Housings	Chrome Plated Brass
Plastic Housings	Ultradur®
Cable Type	PVC
Shipping Weight	Connector model: 4 oz. Cable model: 9 oz.

Circuit Drawings

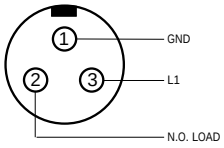
MICRO CONNECTOR MODELS Male view shown

2 Wire AC N.O.



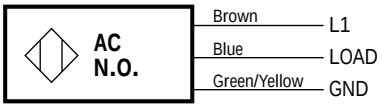
MINI CONNECTOR MODELS Male view shown

2 Wire AC N.O.



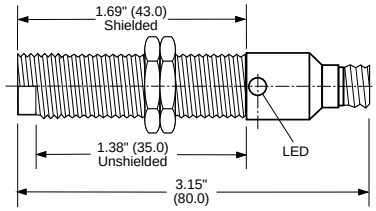
CABLE MODELS

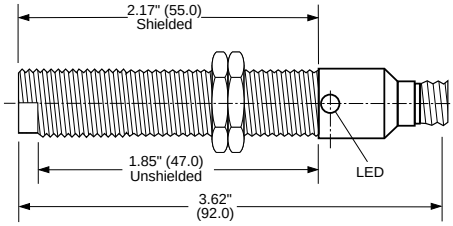
2 Wire AC N.O.



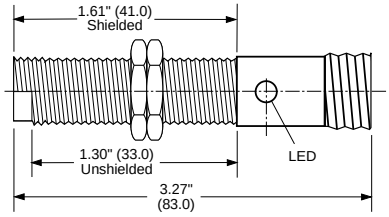
Dimensional Drawings

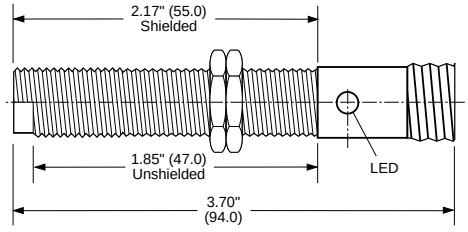
MICRO CONNECTOR MODELS Body threads = M18x1



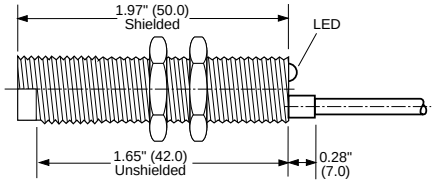


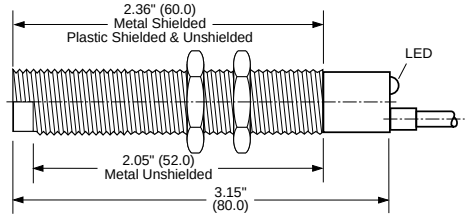
MINI CONNECTOR MODELS





CABLE MODELS





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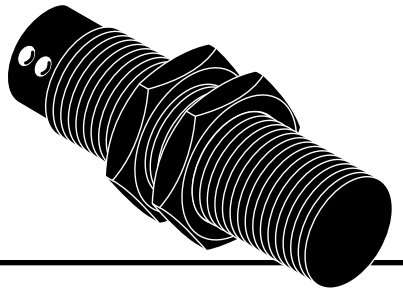
12mm 18mm Inductive Tubular Threaded Barrel

Weld Field Immune



Proximity Sensors

- **Weld Field and Electrical Noise Immunity**
- **Standard Latching Short Circuit Protection (SCP), Non-Latching SCP available for DC models only**
- **Predictable, consistent electrical performance**
- **New Hardcoat housings are resistant to weld expulsion**

These sensors are specifically designed for extreme duty use in harsh applications (i.e., automotive fabrication, assembly plants, etc.). The tubular series is popular as part present and machine location sensors for demanding applications such as resistance welding of body assemblies. Namco's proprietary Hardcoat housings will not allow the hot weld expulsion to adhere to the housing.

Connector Type	Circuit Description	Housing Material	Housing Length	Shielded Model No.	Unshielded Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency		Short Circuit Protected
									Shielded	Unshielded	
12mm WFI DC 10-30V Hardcoat, 2mm (Shielded) and 4mm (Unshielded) Sensing Ranges)											
4-pin Euro	3W, PNP, NO	Metal-HC**	76mm	**EE510-78442**	**EE510-79442**	200mA	10µA	2 VDC @ 100mA	16Hz	16Hz	Latching
18mm WFI DC 10-30V Hardcoat, 5mm (Shielded) and 8mm (Unshielded) Sensing Ranges)											
4-pin Euro	3W, PNP, NO	Metal-HC**	76mm	**EE510-73442**	**EE510-72442**	200mA	10µA	2 VDC @ 100mA	16Hz	16Hz	Latching
90° 4-pin Euro	3W, PNP, NO	Metal-HC**	67mm	**EE510-73452**	**EE510-72452**	200mA	10µA	2 VDC @ 100mA	16Hz	16Hz	Latching
4-pin Mini	3W, PNP, NO	Metal-HC**	76mm	**EE510-73402**	**EE510-72402**	200mA	10µA	2 VDC @ 100mA	16Hz	16Hz	Latching
90° 4-pin Mini	3W, PNP, NO	Metal-HC**	67mm	**EE510-73422**	**EE510-72422**	200mA	10µA	2 VDC @ 100mA	16Hz	16Hz	Latching
18mm WFI AC/DC 20-230V Hardcoat, 5mm (Shielded) and 8mm (Unshielded) Sensing Ranges)											
3-pin Mini	2W, NO	Metal-HC**	76mm	**EE530-73402**	**EE530-72402**	500mA	1.7mA	<10V	16Hz	16Hz	Latching
3-pin Mini	2W, NO	Metal-HC**	76mm	**EE560-73402**	**EE560-72402**	500mA	4.5mA	<10V	16Hz	16Hz	Latching
3-pin Micro	2W, NO	Metal-HC**	76mm	**EE530-73432**	**EE530-72432**	500mA	1.7mA	<10V	16Hz	16Hz	Latching
90° 3-pin Mini	2W, NO	Metal-HC**	67mm	**EE530-73422**	**EE530-72422**	500mA	1.7mA	<10V	16Hz	16Hz	Latching
90° 3-pin Mini	2W, NO	Metal-HC**	67mm	**EE560-73422**	**EE560-72422**	500mA	4.5mA	<10V	16Hz	16Hz	Latching
18mm WFI DC 10-30V Hardcoat, 5mm (Shielded) and 8mm (Unshielded) Sensing Ranges)											
4-pin Euro	3W, PNP, NO	Metal-HC**	76mm	**EE510-73042**	**EE510-72042**	200mA	10µA	2 VDC @ 100mA	16Hz	16Hz	Non-Latching
90° 4-pin Euro	3W, PNP, NO	Metal-HC**	76mm	**EE510-73052**	**EE510-72052**	200mA	10µA	2 VDC @ 100mA	16Hz	16Hz	Non-Latching
4-pin Mini	3W, PNP, NO	Metal-HC**	76mm	**EE510-73002**	**EE510-72002**	200mA	10µA	2 VDC @ 100mA	16Hz	16Hz	Non-Latching
90° 4-pin Mini	3W, PNP, NO	Metal-HC**	76mm	**EE510-73022**	**EE510-72022**	200mA	10µA	2 VDC @ 100mA	16Hz	16Hz	Non-Latching

* Across conducting sensor

** Hard Coat: Weld spatter resistant

*** Non-hardcoat versions

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

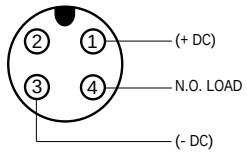
Common Sensor Characteristics

18mm DIAMETER WFI SENSORS		
	18mm	**12mm**
Shielded Sensing Range (±10%)	5mm	2mm
Unshielded Sensing Range (±10%)	8mm	4mm
Short Circuit Protection	yes	yes
Repeatability	<±1%	
Hysteresis	3-10%	
Temperature Drift (max.)	±10%	
Ambient Temperature Range	-4°F to +158°F	
Reverse Polarity Protected	yes	
Current Consumption (3-wire DC only)	10mA	
NEMA Enclosure Type	1, 3, 4, 6, 13	
LED Indicator (AC/DC)	red = power, grn = target	
LED Indicator (DC)	grn = pwr, Amber = target	
Metal Housings	Weld Flash Proof	
Shipping Weight	4 oz.	

Circuit Drawings

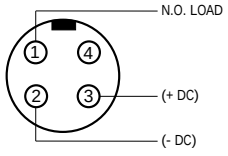
EURO CONNECTOR MODELS Male view shown

3 Wire DC N.O.

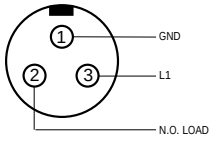


MINI CONNECTOR MODELS Male views shown

3 Wire DC N.O.

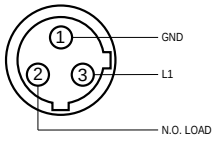


2 Wire AC/DC N.O.



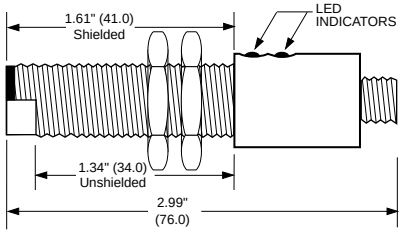
MICRO CONNECTOR Male view shown

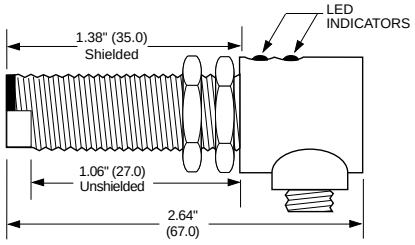
2 Wire AC/DC N.O.



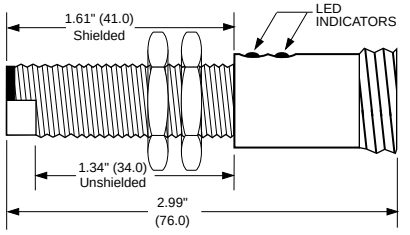
Dimensional Drawings

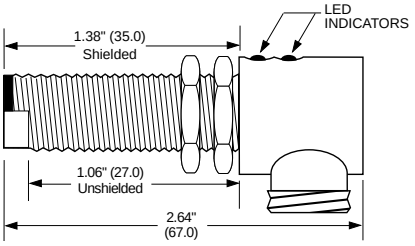
18mm EURO CONNECTOR Body threads = M18x1



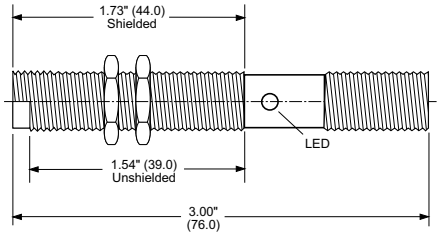


18mm MINI CONNECTOR





12mm EURO CONNECTOR Body threads = M12x1



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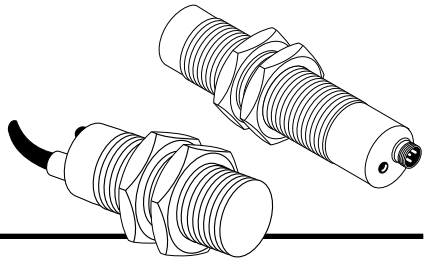
30mm Inductive Tubular Threaded Barrel DC



Proximity Sensors

10mm (Shielded) and 15mm (Unshielded) Sensing Ranges

Connector Type	Circuit Description	Housing Material	Housing Length	Shielded Model No.	Unshielded Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency		Short Circuit Protected
									Shielded	Unshielded	
DC 10-30V Metal											
4-pin Euro	3W, NPN, NO	Metal	73mm	**ET310-62151**	**ET310-63151**	400mA	<10µA	<2.5 VDC	200Hz	100Hz	yes
4-pin Euro	3W, PNP, NO	Metal	73mm	**ET311-62151**	**ET311-63151**	400mA	<10µA	<2.5 VDC	200Hz	100Hz	yes
4-pin Mini	3W, NPN, NO	Metal	78mm	**ET110-42100**	**ET110-43100**	400mA	<10µA	<2.5 VDC	200Hz	100Hz	yes
4-pin Mini	3W, PNP, NO	Metal	78mm	**ET111-42100**	**ET111-43100**	400mA	<10µA	<2.5 VDC	200Hz	100Hz	yes
6.6' Cable	3W, NPN, NO	Metal	50mm	**ET310-62110**	**ET310-63110**	400mA	<10µA	<2.5 VDC	200Hz	100Hz	yes
6.6' Cable	3W, NPN, NO	Metal	80mm	**ET110-42110**	**ET110-43110**	400mA	<10µA	<2.5 VDC	200Hz	100Hz	yes
6.6' Cable	3W, PNP, NO	Metal	50mm	**ET311-62110**	**ET311-63110**	400mA	<10µA	<2.5 VDC	200Hz	100Hz	yes
6.6' Cable	3W, PNP, NO	Metal	80mm	**ET111-42110**	**ET111-43110**	400mA	<10µA	<2.5 VDC	200Hz	100Hz	yes
DC 10-30V Plastic											
6.6' Cable	3W, NPN, NO	Plastic	50mm	**ET310-72110**	**ET310-73110**	400mA	<10µA	<2.5 VDC	200Hz	100Hz	yes
6.6' Cable	3W, NPN, NO	Plastic	80mm	**ET210-42110**	**ET210-43110**	400mA	<10µA	<2.5 VDC	200Hz	100Hz	yes
6.6' Cable	3W, PNP, NO	Plastic	50mm	**ET311-72110**	**ET311-73110**	400mA	<10µA	<2.5 VDC	200Hz	100Hz	yes
6.6' Cable	3W, PNP, NO	Plastic	80mm	**––**	**ET211-43110**	400mA	<10µA	<2.5 VDC	200Hz	100Hz	yes
NAMUR 5-25 VDC											
6.6' Cable	Analog	Metal	40mm (Sh) 42mm (UnSh)	**ET112-40310**	**ET112-41310**	N/A	—	—	300Hz	100Hz	N/A
6.6' Cable	Analog	Plastic	40mm	**ET212-40310**	**ET212-41310**	N/A	—	—	300Hz	100Hz	N/A

* Across conducting sensor

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

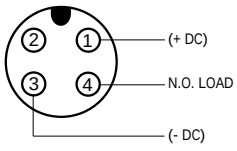
Common Sensor Characteristics

30mm DIAMETER DC SENSORS	
Shielded Sensing Range (±10%)	10mm
Unshielded Sensing Range (±10%)	15mm
Standard Target (mm) (mild steel)	30x30x1 (Shielded) 45x45x1 (Unshielded)
Repeatability	± 2%
Hysteresis	3-8% (typ.); 15% (max.)
Range Drift over Temperature	±15%
Operating Temperature Range	-13°F to +158°F
Reverse Polarity Protected	yes
Current Consumption	<1.5mA
NEMA Enclosure Type Metal Plastic	 1, 3, 4, 6, 13 1, 3, 4, 4x, 6, 13
LED Indicator	red = target
Metal Housings	Chrome Plated Brass
Plastic Housings	Ultradur®
Cable Type	PVC
Shipping Weight	Connector model: 5 oz. Cable model: 10 oz.

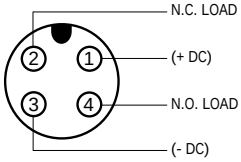
Circuit Drawings

EURO CONNECTOR MODELS — Male views shown

3 Wire DC N.O.

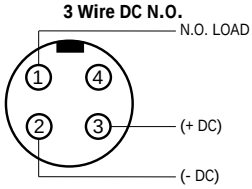


4 Wire DC N.O. & N.C.



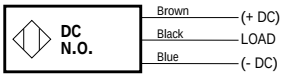
MINI CONNECTOR MODELS — Male view shown

3 Wire DC N.O.

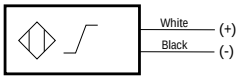


CABLE MODELS

3 Wire DC N.O.

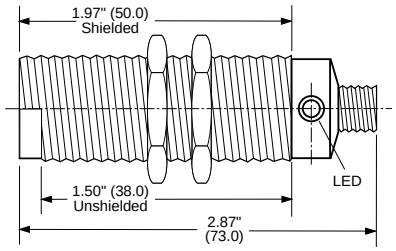


NAMUR MODELS

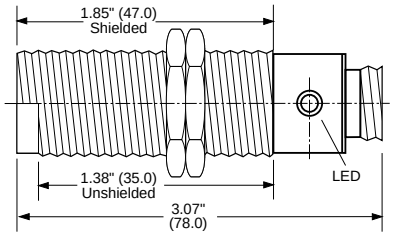


Dimensional Drawings

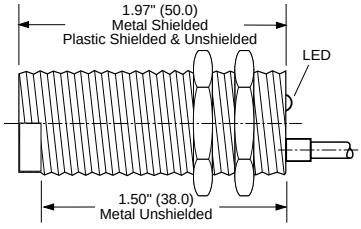
EURO CONNECTOR MODELS — Body threads = M30x1.5

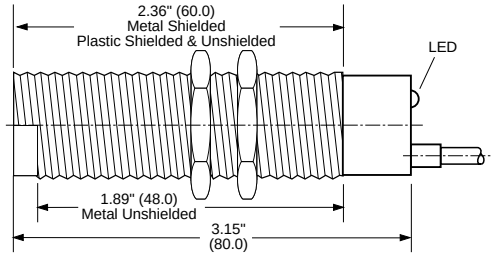


MINI CONNECTOR MODELS

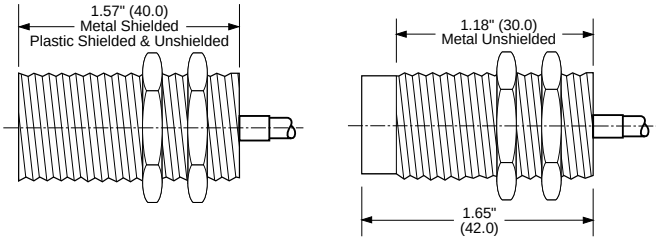


CABLE MODELS





CABLE MODELS-NAMUR



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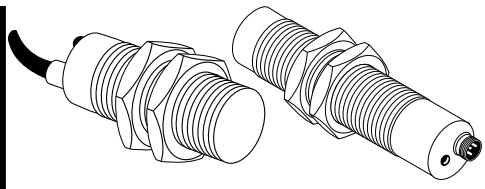
30mm Inductive Tubular Threaded Barrel AC



Proximity Sensors

10mm (Shielded) and 15mm (Unshielded) Sensing Ranges

Connector Type	Circuit Description	Housing Material	Housing Length	Shielded Model No.	Unshielded Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency		Short Circuit Protected
									Shielded	Unshielded	
AC 20-250V Metal											
3-pin Micro	2W, AC, NO	Metal	78mm	**ET120-42420**	—	400mA	<1.5mA	<8 VAC	25Hz	25Hz	no
3-pin Mini	2W, AC, NO	Metal	82mm	**ET120-42400**	—	400mA	<1.5mA	<8 VAC	25Hz	25Hz	no
6.6' Cable	2W, AC, NO	Metal	50mm	**ET320-62410**	**ET320-63410**	400mA	<1.5mA	<8 VAC	25Hz	25Hz	no
6.6' Cable	2W, AC, NO	Metal	80mm	**ET120-42410**	**ET120-43410**	400mA	<1.5mA	<8 VAC	25Hz	25Hz	no
AC 20-250V Plastic											
6.6' Cable	2W, AC, NO	Plastic	80mm	**ET220-42410**	**ET220-43410**	400mA	<1.5mA	<8 VAC	25Hz	25Hz	no
6.6' Cable	2W, AC, NO	Plastic	50mm	**ET320-72410**	**ET320-73410**	400mA	<1.5mA	<8 VAC	25Hz	25Hz	no

* Across conducting sensor

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

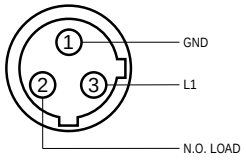
Common Sensor Characteristics

30mm DIAMETER AC SENSORS	
Shielded Sensing Range (±10%)	10mm
Unshielded Sensing Range (±10%)	15mm
Standard Target (mm) (mild steel)	30x30x1 (Shielded) 45x45x1 (Unshielded)
Repeatability	± 2%
Hysteresis	3-8% (typ.); 15% (max.)
Range Drift over Temperature	±15%
Operating Temperature Range	-13°F to +158°F
Reverse Polarity Protected	yes
NEMA Enclosure Type Metal Plastic	 1, 3, 4, 6, 13 1, 3, 4, 4x, 6, 13
LED Indicator	red = target
Metal Housings	Chrome Plated Brass
Plastic Housings	Ultradur®
Cable Type	PVC
Shipping Weight	Connector model: 5 oz. Cable model: 10 oz.

Circuit Drawings

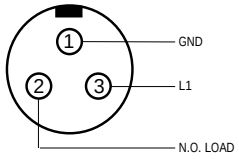
MICRO CONNECTOR MODELS Male view shown

2 Wire AC N.O.



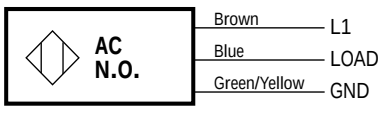
MINI CONNECTOR MODELS Male view shown

2 Wire AC N.O.



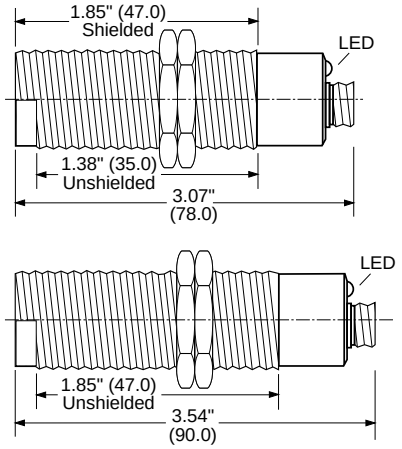
CABLE MODELS

2 Wire AC N.O.

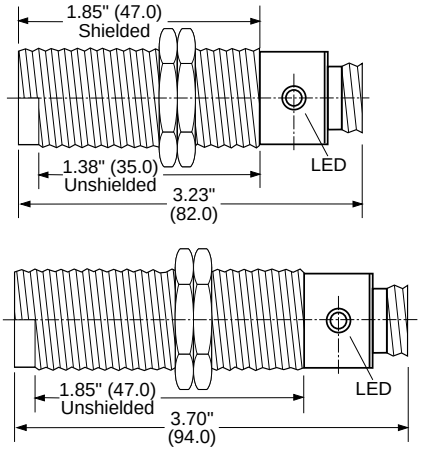


Dimensional Drawings

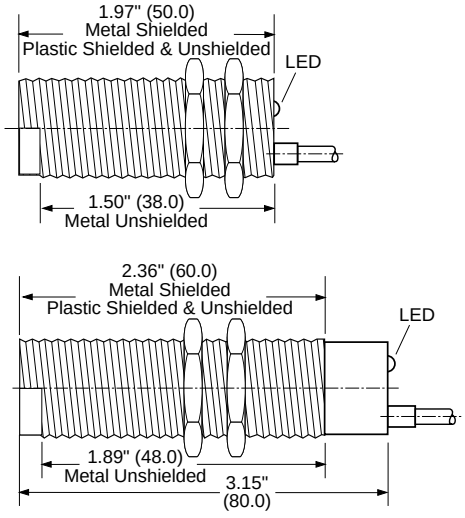
MICRO CONNECTOR MODELS Body threads = M30x1.5



MINI CONNECTOR MODELS



CABLE MODELS



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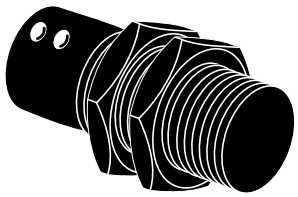
30mm Inductive Tubular Threaded Barrel Weld Field Immune



Proximity Sensors

- **Weld Field and Electrical Noise Immunity**
- **Standard Latching Short Circuit Protection (SCP), Non-Latching SCP available for DC models only.**
- **Dual LED indicators**
- **Predictable, consistent electrical performance**
- **100% tested & burned-in**
- **New Hardcoat housings are resistant to weld expulsion**

These sensors are specifically designed for extreme duty use in harsh applications (i.e., automotive fabrication, assembly plants, etc.). The tubular series is popular as part present and machine location sensors for demanding applications such as resistance welding of body assemblies. Namco's proprietary Hardcoat housings will not allow the hot weld expulsion to adhere to the housing.

10mm (Shielded) and 15mm (Unshielded) Sensing Range

Connector Type	Circuit Description	Housing Material	Housing Length	Shielded Model No.	Unshielded Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency		Short Circuit Protected
									Shielded	Unshielded	
WFI DC 10-30V											
4-pin Euro	3W, PNP, NO	Metal-HC	76mm	**EE510-77442**	**EE510-76442**	200mA	10µA	2 VDC @ 100mA	16Hz	16Hz	Latching
4-pin Mini	3W, PNP, NO	Metal-HC	76mm	**EE510-77402**	**EE510-76402**	200mA	10µA	2 VDC @ 100mA	16Hz	16Hz	Latching
4-pin Euro	3W, PNP, NO	Metal-HC	76mm	**EE510-77042**	**EE510-76042**	200mA	10µA	2 VDC @ 100mA	16Hz	16Hz	Non-Latching
4-pin Mini	3W, PNP, NO	Metal-HC	76mm	**EE510-77002**	**EE510-76002**	200mA	10µA	2 VDC @ 100mA	16Hz	16Hz	Non-Latching
WFI AC/DC 20-230V											
3-pin Mini	2W, AC/DC, NO,LL	Metal-HC	76mm	**EE530-77402**	**EE530-76402**	500mA	1.7mA	<10V	16Hz	16Hz	Latching
3-pin Mini	2W, AC/DC, NO, HL	Metal-HC	76mm	**EE560-77402**	**EE560-76402**	500mA	4.5mA	<10V	16Hz	16Hz	Latching
3-pin Micro	2W, AC/DC, NO	Metal-HC	76mm	**EE530-77432**	**EE530-76432**	500mA	1.7mA	<10V	16Hz	16Hz	Latching

* Across conducting sensor

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

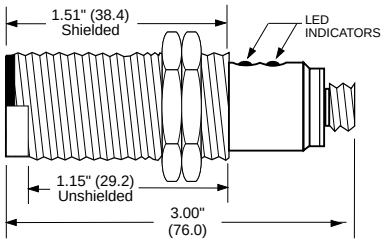
Common Sensor Characteristics

30mm DIAMETER WFI SENSORS	
Shielded Sensing Range (±10%)	10mm
Unshielded Sensing Range (±10%)	15mm
Short Circuit Protection	yes
Repeatability	<±1%
Hysteresis	3-10%
Range Drift over Temperature	±10%
Operating Temperature Range	-4°F to +158°F
Reverse Polarity Protected	yes
Current Consumption (3-wire DC only)	10mA
NEMA Enclosure Type	1, 3, 4, 6, 13
LED Indicator (AC/DC)	red = pwr, green = target
LED Indicator (DC)	green = pwr, amber = target
Metal Housings	Weld Flash Proof
Shipping Weight	5 oz.

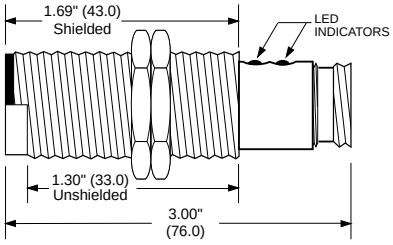
Dimensional Drawings

EURO/MICRO CONNECTOR MODELS

Body threads = M30x1.5



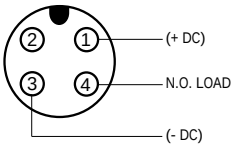
MINI CONNECTOR MODELS



Circuit Drawings

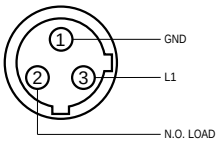
EURO CONNECTOR MODELS Male view shown

3 Wire DC N.O.



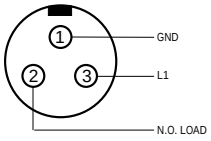
MICRO CONNECTOR MODELS Male view shown

2 Wire AC/DC N.O.

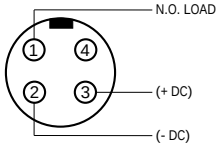


MINI CONNECTOR MODELS Male views shown

2 Wire AC/DC N.O.



3 Wire DC N.O.



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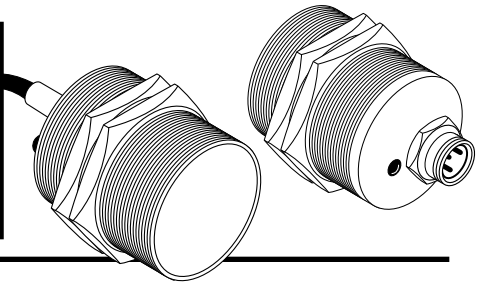
47mm Inductive Tubular Threaded Barrel DC AC



20mm (Shielded) Sensing Range

Connector Type	Circuit Description	Housing Material	Housing Length	Shielded Model No.	Unshielded Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency		Short Circuit Protected
									Shielded	Unshielded	
DC 10-30V Metal											
4-pin Mini	3W, NPN, NO	Metal	83mm	**ET110-92100**	—	400mA	<10µA	<2.5 VDC	50Hz	—	yes
4-pin Mini	3W, PNP, NO	Metal	83mm	**ET111-92100**	—	400mA	<10µA	<2.5 VDC	50Hz	—	yes
6.6' Cable	3W, NPN, NO	Metal	60mm	**ET110-92110**	—	400mA	<10µA	<2.5 VDC	50Hz	—	yes
6.6' Cable	3W, PNP, NO	Metal	60mm	**ET111-92110**	—	400mA	<10µA	<2.5 VDC	50Hz	—	yes
AC 20-250V Metal											
3-pin Mini	2W, AC, NO	Metal	83mm	**ET120-92400**	—	400mA	<1.8mA	<8 VAC	25Hz	—	no
6.6' Cable	2W, AC, NO	Metal	60mm	**ET120-92410**	—	400mA	<1.8mA	<8 VAC	25Hz	—	no

* Across conducting sensor

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

Common Sensor Characteristics

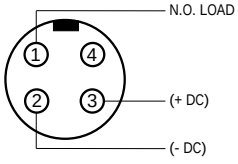
47mm DIAMETER DC & AC SENSORS	
Shielded Sensing Range (±10%)	20mm
Unshielded Sensing Range (±10%)	N/A
Standard Target (mm) (mild steel)	60x60x1
Repeatability	± 2%
Hysteresis	3-8% (typ.); 15% (max.)
Range Drift over Temperature	±15%
Operating Temperature Range	-13°F to +158°F
Reverse Polarity Protected	yes
Current Consumption (3-wire DC only)	<7mA
NEMA Enclosure Type	1, 3, 4, 6, 13
LED Indicator	red = target
Metal Housings	Chrome Plated Brass
Cable Type	PVC
Shipping Weight	Connector model: 6 oz. Cable model: 11 oz.

Circuit Drawings

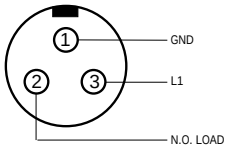
MINI CONNECTOR MODELS

Male views shown

3 Wire DC N.O.

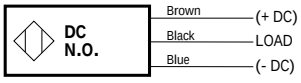


2 Wire AC N.O.

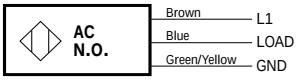


CABLE MODELS

3 Wire DC N.O.



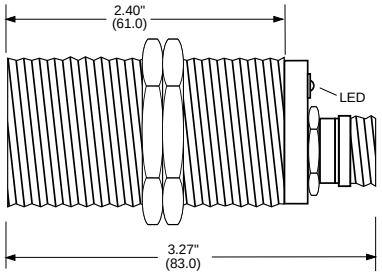
2 Wire AC N.O.



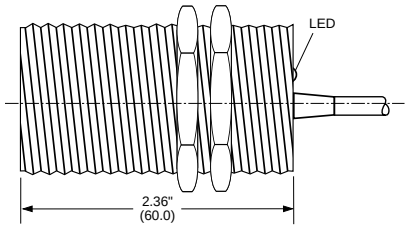
Dimensional Drawings

MINI CONNECTOR MODELS

Body threads = PG36



CABLE MODELS



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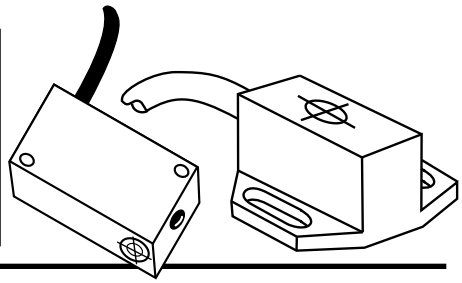
Small Plastic Inductive Rectangular DC AC



Proximity Sensors

Connector Type	Circuit Description	Housing Dimensions	Shielded Model No.	Unshielded Model No.	Sensing Range	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency	Short Circuit Protected
MINIATURE FLAT PACK DC 10-30V										
6.6' Cable	3W, NPN, NO	17x35x35mm	—	**ET910-23110**	10mm	400mA	<10µA	<2.5 VDC	200Hz	yes
MINIATURE FLAT PACK AC 80-250V										
6.6' Cable	2W, AC, NO	17x35x35mm	—	**ET920-23410**	10mm	200mA	<2.5mA @220 VAC	<11VAC @200mA	25Hz	no
SMALL RECTANGULAR DC 10-30V										
6.6' Cable	3W, NPN, NO	12x26x40mm	**ET910-12110**	—	2mm	400mA	<10µA	<2.5 VDC	1200Hz	yes
6.6' Cable	3W, NPN, NO	12x26x40mm	—	**ET910-13110**	4mm	400mA	<10µA	<2.5 VDC	800Hz	yes
6.6' Cable	3W, PNP, NO	12x26x40mm	**ET911-12110**	—	2mm	400mA	<10µA	<2.5 VDC	1200Hz	yes
6.6' Cable	3W, PNP, NO	12x26x40mm	—	**ET911-13110**	4mm	400mA	<10µA	<2.5 VDC	800Hz	yes
SMALL RECTANGULAR AC 20-250V										
6.6' Cable	2W, AC, NO	12x26x40mm	**ET920-12410**	—	2mm	400mA	<1.5mA @220 VAC	<8 VAC @400mA	25Hz	no
6.6' Cable	2W, AC, NO	12x26x40mm	—	**ET920-13410**	4mm	400mA	<1.5mA @220 VAC	<8 VAC @400mA	25Hz	no
SMALL RECTANGULAR NAMUR 5-25 VDC										
6.6' Cable	Analog	12x26x40mm	**ET912-10310**	—	2mm	N/A	—	—	800Hz	N/A
6.6' Cable	Analog	12x26x40mm	—	**ET912-11310**	4mm	N/A	—	—	400Hz	N/A

* Across conducting sensor

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

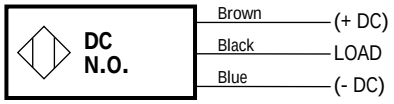
Common Sensor Characteristics

SMALL PLASTIC RECTANGULAR DC & AC SENSORS	
Shielded Sensing Range (±10%)	2mm
Unshielded Sensing Ranges (±10%)	4mm & 10mm
Standard Target (mm) (mild steel)	12x12x1 (2mm Shielded) 16x16x1 (4mm Unshielded) 30x30x1 (10mm Unshielded)
Repeatability	±1% (Shielded) ± 2% (Unshielded)
Hysteresis	3-8% (typ.); 15% (max.)
Range Drift over Temperature	±15%
Operating Temperature Range	-13°F to +158°F
Reverse Polarity Protected	yes
Current Consumption (3-wire DC only)	<1.5mA
NEMA Enclosure Type	1, 3, 4, 4x, 6, 13
LED Indicator	red = target
Plastic Housings	Ultradur®
Cable Type	PVC
Shipping Weight	10 oz.

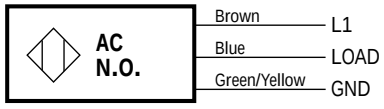
Circuit Drawings

CABLE MODELS

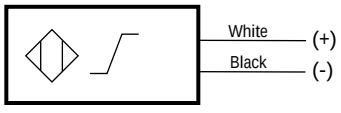
3 Wire DC N.O.



2 Wire AC N.O.



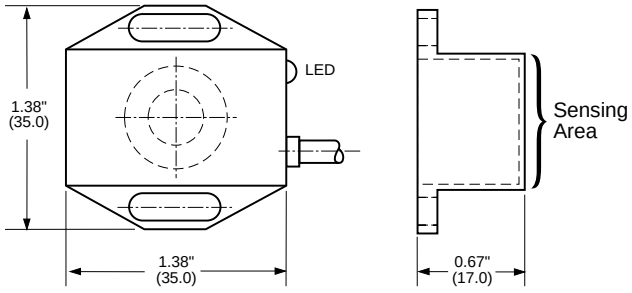
NAMUR MODELS



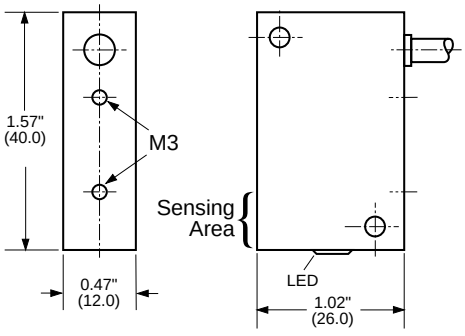
Dimensional Drawings

CABLE MODELS

Miniature Flat Pack



Small Rectangular



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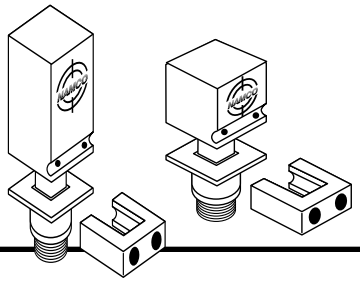
Weld Field Immune

Inductive Rotatable Rectangular

DC AC/DC



Proximity Sensors

- **Weld Field and Electrical Noise Immunity**
- **Predictable, Consistent Performance**
- **100% Tested and Burned-in**
- **New Ultra Long Range models in latching and non-latching**

These sensors are specifically designed for extreme duty use in harsh applications such as automotive fabrication and assembly plants. The rectangular series has been the standard of the automotive industry for over 25 years. In that time several different versions, all with a common mounting, have been developed for use as part present and machine location sensors. In addition, specific accessories have been developed to make these sensors even more reliable in your application.

0.5"/1.0" Range (Unshielded) Rotatable Sensors

Connector Type	Circuit Description	Front Sense Model No.	Left Sense Model No.	Right Sense Model No.	Top Sense Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Short Circuit Protected	Inrush Current
SHORT HOUSING DC 10-30V 0.5" Range										
4-pin Euro	3W, PNP, NO	**EE510-15440**	**EE510-16440**	**EE510-18440**	**EE510-19440**	200mA	10µA	2.0V @ 100mA	Latching	N/A
4-pin Euro	3W, PNP, NO	**EE510-15040**	**EE510-16040**	**EE510-18040**	**EE510-19040**	200mA	10µA	2.0V @ 100mA	Non-Latching	N/A
4-pin Mini	3W, PNP, NO	**EE510-15400**	**EE510-16400**	**EE510-18400**	**EE510-19400**	200mA	10µA	2.0V @ 100mA	Latching	N/A
4-pin Mini	3W, PNP, NO	**EE510-15000**	**EE510-16000**	**EE510-18000**	**EE510-19000**	200mA	10µA	2.0V @ 100mA	Non-Latching	N/A
SHORT HOUSING AC/DC 20-230V 0.5" Range										
3-pin Mini	2W, NO, LL	**EE530-15400**	**EE530-16400**	**EE530-18400**	**EE530-19400**	500mA	1.7mA	<10V	Latching	3A (20ms)
3-pin Micro	2W, NO, LL	**EE530-15420**	**EE530-16420**	**EE530-18420**	**EE530-19420**	500mA	1.7mA	<10V	Latching	3A (20ms)
LONG HOUSING DC 10-30V 0.5" Range										
4-pin Euro	3W, PNP, NO	**EE510-10440**	**EE510-11440**	**EE510-13440**	**EE510-14440**	200mA	10µA	2.0V @ 100mA	Latching	N/A
4-pin Euro	3W, PNP, NO	**EE510-10040**	**EE510-11040**	**EE510-13040**	**EE510-14040**	200mA	10µA	2.0V @ 100mA	Non-Latching	N/A
4-pin Mini	3W, PNP, NO	**EE510-10400**	**EE510-11400**	**EE510-13400**	**EE510-14400**	200mA	10µA	2.0V @ 100mA	Latching	N/A
4-pin Mini	3W, PNP, NO	**EE510-10000**	**EE510-11000**	**EE510-13000**	**EE510-14000**	200mA	10µA	2.0V @ 100mA	Non-Latching	N/A
8' Cable	3W, PNP, NO	**EE510-10415**	**EE510-11415**	**EE510-13415**	**EE510-14415**	200mA	10µA	2.0V @ 100mA	Latching	N/A
8' Cable	3W, PNP, NO	**EE510-10015**	**EE510-11015**	**EE510-13015**	**EE510-14015**	200mA	10µA	2.0V @ 100mA	Non-Latching	N/A
LONG HOUSING AC/DC 20-230V 0.5" Range										
3-pin Mini	2W, NO, LL	**EE530-10400**	**EE530-11400**	**EE530-13400**	**EE530-14400**	500mA	1.7mA	<10V	Latching	3A (20ms)
3-pin Micro	2W, NO, LL	**EE530-10420**	**EE530-11420**	**EE530-13420**	**EE530-14420**	500mA	1.7mA	<10V	Latching	3A (20ms)
LONG HOUSING DC 10-30V 1.0" Range										
4-pin Euro	3W, PNP, NO	**EE510-30440**	**EE510-31440**	**EE510-33440**	**EE510-34440**	200mA	10µA	2.0V @ 100mA	Latching	N/A
4-pin Euro	3W, PNP, NO	**EE510-30040**	**EE510-31040**	**EE510-33040**	**EE510-34040**	200mA	10µA	2.0V @ 100mA	Non-Latching	N/A
LONG HOUSING AC/DC 20-150V 1.0" Range										
3-pin Mini	2W, NO, LL	**EE530-30400**	**EE530-31400**	**EE530-33400**	**EE530-34400**	200mA	1.7mA	<10V	Latching	1.5A

* Across conducting sensor

▶ "LL" indicates *Low Leakage*

▶ Consult factory for normally closed and *High Leakage* model availability.

Protected by the NAMCO Lifetime Replacement Program

Common Sensor Characteristics

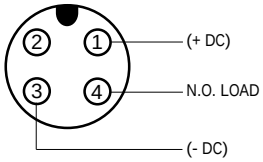
ROTATABLE INDUCTIVE RECTANGULAR SENSORS	
Nominal Sensing Range (±10%)	0.5"/1.0"*
Short Circuit Protection	yes
Repeatability	<±1%
Hysteresis	3-10%
Temperature Drift (max.)	±10%
Ambient Temperature Range	-4°F to +158°F
Reverse Polarity Protected	yes
Current Consumption (3-wire DC only)	10mA
LED Indicator (AC/DC)	red = pwr, green = target
LED Indicator (DC)	green = pwr, amber = target
Housing	Weld Flash Resistant
Cable Type	PVC
Shipping Weight	Connector model: 6 oz. Cable model: 11 oz.
Maximum Switching Frequency	16Hz

* 1" range is for the Ultra Long Range models only

Circuit Drawings

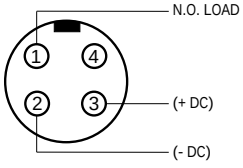
EURO CONNECTOR MODELS Male view shown

3 Wire DC N.O.

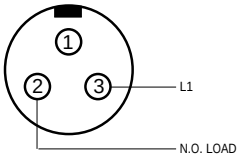


MINI CONNECTOR MODELS Male views shown

3 Wire DC N.O.

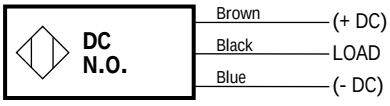


2 Wire AC/DC N.O.

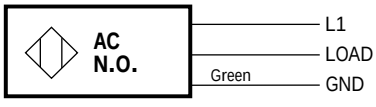


CABLE MODELS

3 Wire DC N.O.

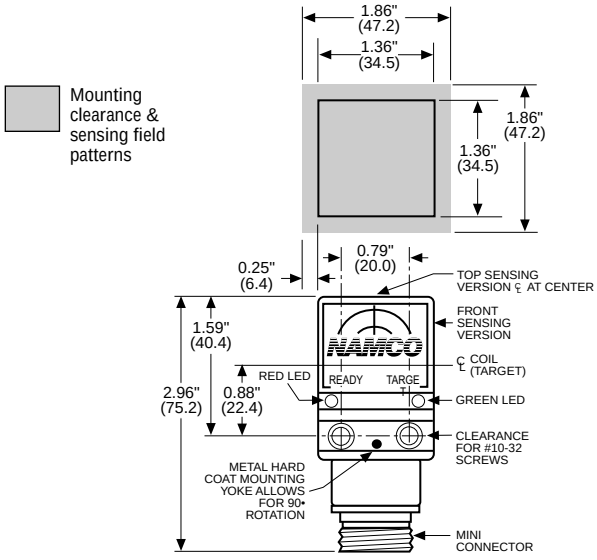


2 Wire AC/DC N.O.



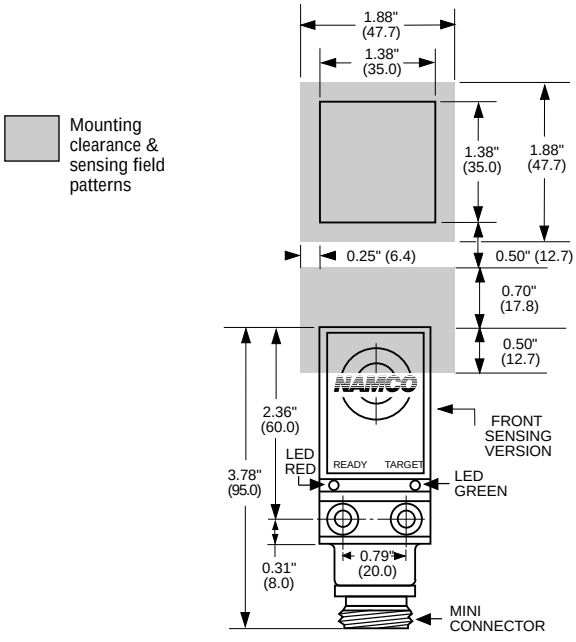
Dimensional Drawings

ROTATABLE SENSORS – SHORT HOUSING



ROTATABLE SENSORS – LONG HOUSING

Rectangular/Ultra Long Range models



Proximity Sensors

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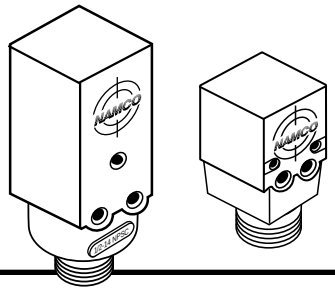
Weld Field Immune

Inductive Thermoset Rectangular

DC AC/DC



Proximity Sensors

- **Weld Field and Electrical Noise Immunity**
- **Predictable, Consistent Electrical Performance**
- **100% Tested and Burned-in**
- **Weld Spatter Resistant Housings Will Not Support Combustion**
- **Standard Latching Short Circuit Protection (SCP), Non-Latching SCP Available for DC Models only**

These sensors are specifically designed for extreme duty use in harsh applications such as automotive fabrication and assembly plants. The rectangular series has been the standard of the automotive industry for over 25 years. In that time several different versions, all with a common mounting, have been developed for use as part present and machine location sensors. In addition, specific accessories have been developed to make these sensors even more reliable in your application.

0.5" Range (Unshielded) Thermoset Sensors

Connector Type	Circuit Description	Front Sense Model No.	Left Sense Model No.	Right Sense Model No.	Top Sense Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Short Circuit Protected	Inrush Current
SHORT HOUSING DC 10-30V										
4-pin Euro	3W, PNP, NO	**EE510-55440**	**EE510-56440**	**EE510-58440**	**EE510-59440**	200mA	10µA	2.0V @ 100mA	Latching	N/A
4-pin Euro	3W, PNP, NO	**EE510-55040**	**EE510-56040**	**EE510-58040**	**EE510-59040**	200mA	10µA	2.0V @ 100mA	Non-Latching	N/A
SHORT HOUSING AC/DC 20-230V										
3-pin Mini	2W, NO, LL	**EE530-55400**	**EE530-56400**	**EE530-58400**	**EE530-59400**	500mA	1.7mA	<10V	Latching	3A (20ms)
3-pin Mini	2W, NO, HL	**EE560-55400**	**EE560-56400**	**EE560-58400**	**EE560-59400**	500mA	4.5mA	<10V	Latching	3A (20ms)
LONG HOUSING DC 10-30V										
4-pin Mini	3W, PNP, NO	**EE510-50400**	**EE510-51400**	**EE510-53400**	**EE510-54400**	200mA	10µA	2.0V @ 100mA	Latching	N/A
4-pin Mini	3W, PNP, NO	**EE510-50000**	**EE510-51000**	**EE510-53000**	**EE510-54000**	200mA	10µA	2.0V @ 100mA	Non-Latching	N/A
4-pin Euro	3W, PNP, NO	**EE510-50440**	**EE510-51440**	**EE510-53440**	**EE510-54440**	200mA	10µA	2.0V @ 100mA	Latching	N/A
4-pin Euro	3W, PNP, NO	**EE510-50040**	**EE510-51040**	**EE510-53040**	**EE510-54040**	200mA	10µA	2.0V @ 100mA	Non-Latching	N/A
LONG HOUSING AC/DC 20-230V										
3-pin Mini	2W, NO, LL	**EE530-50400**	**EE530-51400**	**EE530-53400**	**EE530-54400**	500mA	1.7mA	<10V	Latching	3A (20ms)
3-pin Mini	2W, NO, HL	**EE560-50400**	**EE560-51400**	**EE560-53400**	**EE560-54400**	500mA	4.5mA	<10V	Latching	3A (20ms)
8' Cable	2W, NO, HL	**EE560-50415**	**EE560-51415**	**EE560-53415**	**EE560-54415**	500mA	4.5mA	<10V	Latching	3A (20ms)
LONG HOUSING AC/DC 20-230V DUAL SENSING										
5-pin Mini	2W, NO, LL	**EE530-65500**	–	–	–	500mA	1.7mA	<10V	Latching	3A (20ms)
5-pin Mini	2W, NO, HL	**EE560-65500**	–	–	–	500mA	4.5mA	<10V	Latching	3A (20ms)

* Across conducting sensor

▶ "LL" indicates *Low Leakage* and "HL" indicates *High Leakage*.

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

Common Sensor Characteristics

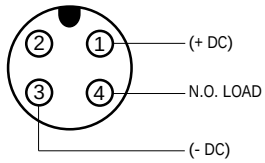
THERMOSET INDUCTIVE RECTANGULAR SENSORS	
Nominal Sensing Range (±10%)	0.5"
Short Circuit Protection	yes
Repeatability	<±1%
Hysteresis	3-10%
Temperature Drift (max.)	±10%
Ambient Temperature Range	-4°F to +158°F
Reverse Polarity Protected	yes
Current Consumption (3-wire DC only)	10mA
LED Indicator (AC/DC)	red = pwr, green = target
LED Indicator (DC)	green = pwr, amber = target
Housing	Weld Flash Proof
Cable Type	PVC
Shipping Weight	6 oz.
Maximum Switching Frequency	16Hz

Circuit Drawings

EURO CONNECTOR MODELS

Male view shown

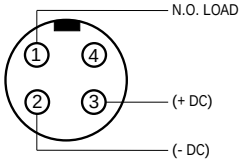
3 Wire DC N.O.



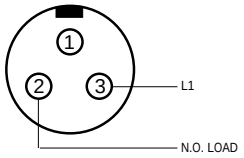
MINI CONNECTOR MODELS

Male views shown

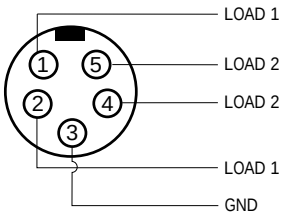
3 Wire DC N.O.



2 Wire AC/DC N.O.

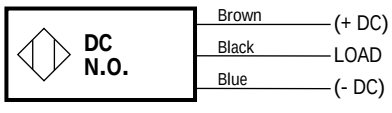


5 Wire AC/DC N.O.

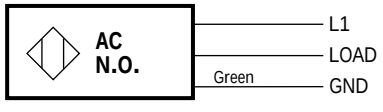


CABLE MODELS

3 Wire DC N.O.

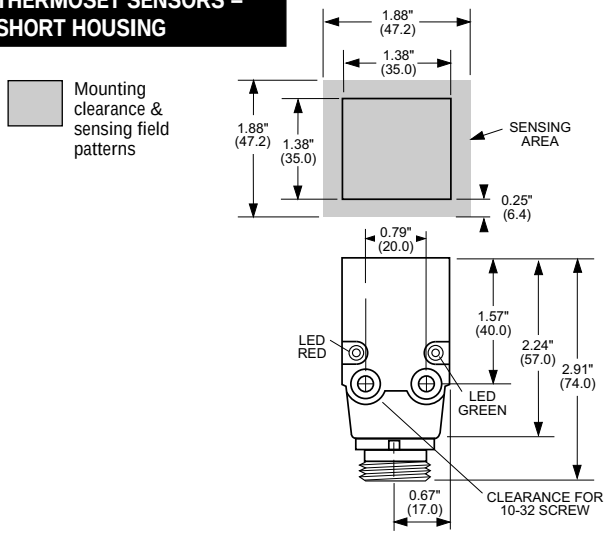


2 Wire AC/DC N.O.

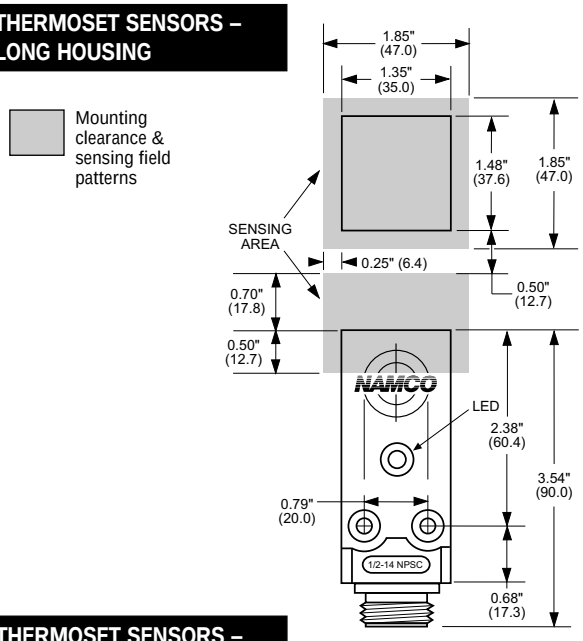


Dimensional Drawings

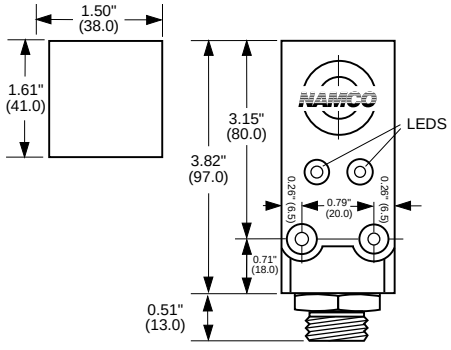
THERMOSET SENSORS – SHORT HOUSING



THERMOSET SENSORS – LONG HOUSING



THERMOSET SENSORS – DUAL SENSING



Proximity Sensors

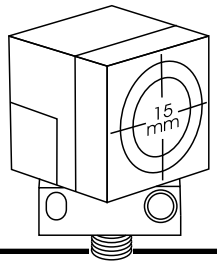
NAMCO

Namco Controls Corporation
Mayfield Village, OH 44143
(440) 460-1360 • FAX (440) 460-3800 • namcocontrols.com

Weld Field Immune

HammerHead™ Proximity Sensor

DC AC/DC



Proximity Sensors

Introducing the Namco HammerHead™ Proximity Sensor: Evolution Means Survival of the Fittest.

All Metal Body Stands up to Abuse

To evolve means to adapt to your surroundings. The HammerHead sensor is completely enclosed in a rugged die-cast body. All metal means more strength in the face of abuse.

9-Way Position Flexibility

Eight-point indexed side-sense, plus top sense configuration make the HammerHead sensor "9-sensors-in-one."

Positive Grip Compression Clamp Bracket

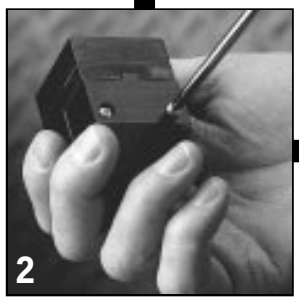
Provides superior mounting strength.

HAMMERHEAD

"Show us your metal!" The HammerHead sensor has an all-metal body so it is not prone to mechanical breakage like other user-configurable sensors with plastic housings.

Streamlined Design Shakes off Weld Slag . . . Without Protective "Boots"

The HammerHead sensor's face is weld slag resistant, so even heavy deposits roll right off. Plus, because it has no nooks or crevices for slag to accumulate, you'll never have to worry about "false triggering" from slag build-up.



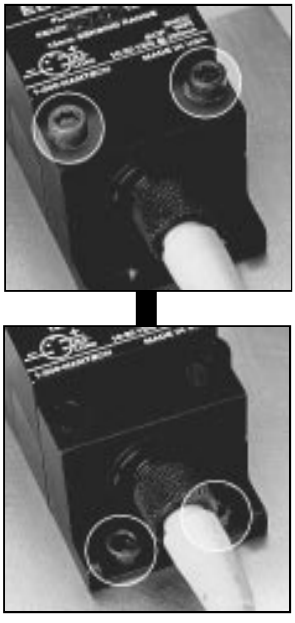
Adjustment screws go straight in . . . no difficult angles to slow things down.

Configuring is as easy as "1-2-3"

The HammerHead sensor is field-adaptable to positions for top, front, left or right sensing. This means you can site-adapt sensors to changing application conditions.

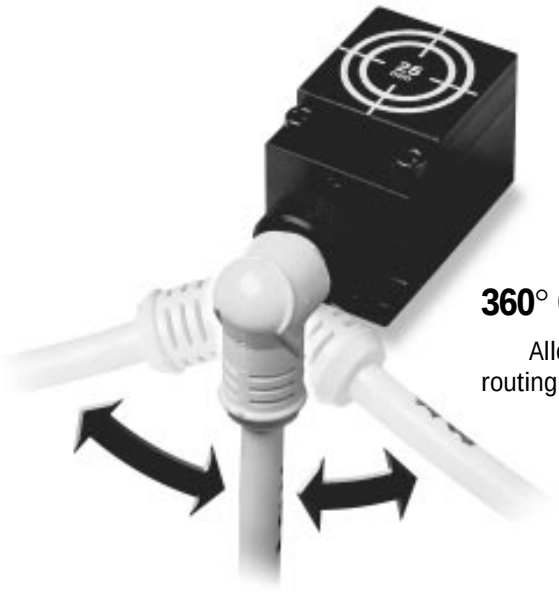
An Easy Upgrade. Directly Replaces Other Configurable Sensors

Two sets of mounting holes on bracket allow easy retrofit of traditional rectangular sensors (using lower pair of holes), or retrofit of limit switch-style sensors (using the upper pair).



Simplifies Ordering

Because it is "9-sensors-in-one," the HammerHead sensor makes things easy for your Purchasing Department. A single part number replaces as many as five conventional rectangular proximity sensors.



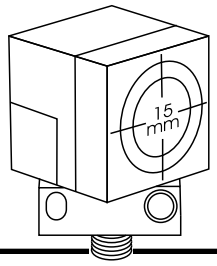
360° Connector Swivel

Allows for convenient cordset routing, especially with 90° cordsets.

Weld Field Immune

HammerHead™ Proximity Sensor

DC AC/DC



- **Nine-way position flexibility**
- **Weld Field Immune circuitry is designed to operate within 1" of a resistance welding electrode carrying 20,000 Amperes RMS (45,000 Amperes peak) without changing state**
- **Will not exhibit false turn-ons from walkie-talkies or other in-plant sources of RF noise**
- **Patented Short Circuit Protection**
- **Covered by Namco Lifetime Replacement Program**
- **Rugged metal body and clamp bracket**

The HammerHead sensor is field-configurable to sense in nine different positions: top, front, back, left, right, and four 45° side sense positions.

The HammerHead sensor features Namco's famous weld field immune circuit proven reliable the world over in the harshest conditions. Totally epoxy encapsulated, the electronics are truly "automotive grade."

Protected by the NAMCO Lifetime Replacement Program

9-Way Configurable Proximity Sensors

Connector Type	Circuit Description	Housing Dimensions	Non-latching SCP Model No.	Latching SCP Model No.	Maximum Load Current	Leakage Current	Voltage Drop	Short Circuit Protected
15mm SENSING RANGE DC 10-30V (SHIELDED)								
4-pin Mini	3W, PNP, NO	40x40x68.5mm	**EE510-90000**	**EE510-90400**	200mA	< 10µA	2.5V	Yes
4-pin Euro	3W, PNP, NO	40x40x68.5mm	**EE510-90040**	**EE510-90440**	200mA	< 10µA	2.5V	Yes
20mm SENSING RANGE DC 10-30V (SHIELDED)								
4-pin Mini	3W, PNP, NO	40x40x68.5mm	**EE510-91000**	**EE510-91400**	200mA	< 10µA	2.5V	Yes
4-pin Euro	3W, PNP, NO	40x40x68.5mm	**EE510-91040**	**EE510-91440**	200mA	< 10µA	2.5V	Yes
25mm SENSING RANGE DC 10-30V (UNSHIELDED)								
4-pin Mini	3W, PNP, NO	40x40x68.5mm	**EE510-92000**	**EE510-92400**	200mA	< 10µA	2.5V	Yes
4-pin Euro	3W, PNP, NO	40x40x68.5mm	**EE510-92040**	**EE510-92440**	200mA	< 10µA	2.5V	Yes
15mm SENSING RANGE AC/DC 20-150V (SHIELDED)								
3-pin Mini	2W, NO, LL	40x40x68.5mm		**EE530-90400**	200mA	1.7mA	10V	Yes
3-pin Micro[3]	2W, NO, LL	40x40x68.5mm		**EE530-90420**	200mA	1.7mA	10V	Yes
20mm SENSING RANGE AC/DC 20-150V (SHIELDED)								
3-pin Mini	2W, NO, LL	40x40x68.5mm		**EE530-91400**	200mA	1.7mA	10V	Yes
3-pin Micro[3]	2W, NO, LL	40x40x68.5mm		**EE530-91420**	200mA	1.7mA	10V	Yes
25mm SENSING RANGE AC/DC 20-150V (UNSHIELDED)								
3-pin Mini	2W, NO, LL	40x40x68.5mm		**EE530-92400**	200mA	1.7mA	10V	Yes
3-pin Micro[3]	2W, NO, LL	40x40x68.5mm		**EE530-92420**	200mA	1.7mA	10V	Yes

[3]Consult factory for availability.

▶ "LL" indicates *Low Leakage* and "HL" indicates *High Leakage*.

▶ Consult factory for normally closed model availability.

Common Sensor Characteristics

HAMMERHEAD SENSORS	2 Wire AC/DC	3 Wire DC
Supply Voltage	20-150V	10-30V
Voltage Drop	10V	2.5V
Max. Load Current	200mA	200mA
Current Consumption	N/A	11mA
Leakage Current	1.7mA	< 10µA
Mis-wiring Protected	Yes[1]	Yes[2]
Response Time	30ms	30ms
Output Circuit	2 Wire	Sourcing
Ambient Temperature Range	-25°C to 70°C (-13°F to 158°F)	

LED Functions

	2 Wire AC/DC		3 Wire DC	
	Red	Green	Green	Amber
Power Off	Off	Off	Off	Off
Power On Load De-energized	On	Off	On	Off
Power On Load Energized	Off	On	On	On
*SCP Mode Activated	Both Flashing		Both Flashing	

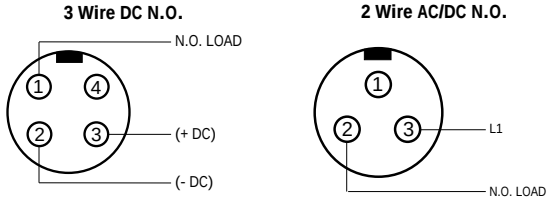
**Short Circuit Protection: If the sensor is shorted, the sensor's Short Circuit Protection (SCP) will be activated. When this occurs, both LEDs will flash and the sensor will limit current flow to about 2.0mA.*

[1] Namco 2-wire AC/DC sensors are bipolar by design - they cannot be mis-wired.

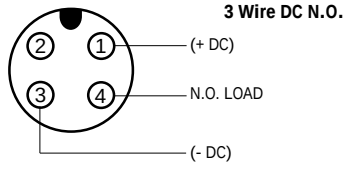
[2] Namco 3-wire DC sensors incorporate reverse polarity protection.

Wiring Diagrams

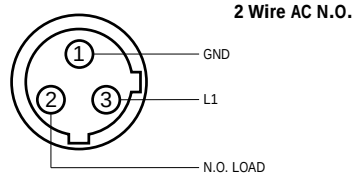
MINI CONNECTOR MODELS Male views shown



EURO CONNECTOR MODELS Male view shown

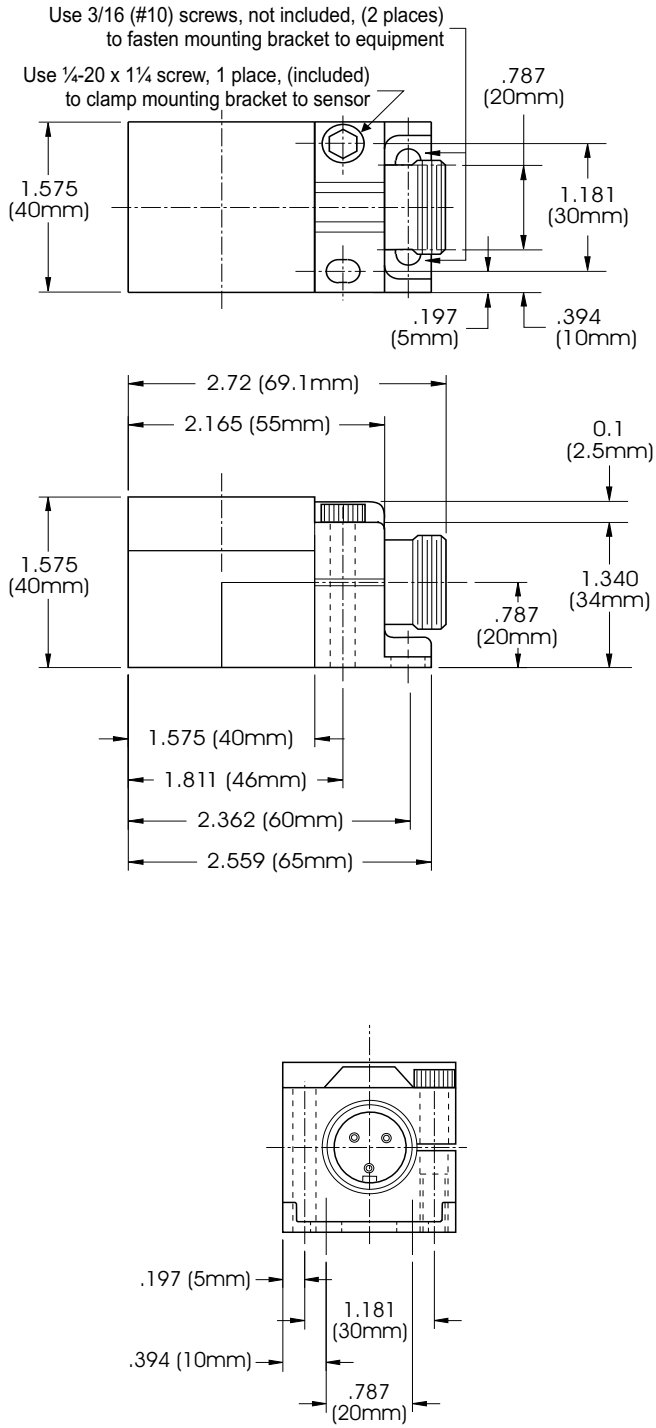


MICRO CONNECTOR MODELS Male view shown



Dimensional Drawings

HAMMERHEAD SENSORS - MINI CONNECTORS



Proximity Sensors

NAMCO

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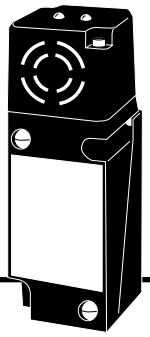
Inductive Limit Switch Style

AC/DC



Proximity Sensors

AC/DC 20-230V 13mm (Unshielded) Sensing Range

Connector Type	Circuit Description	Sensing Face	Housing Dimensions	Shielded Model No.	Unshielded Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency	Short Circuit Protected
COMPLETE ASSEMBLIES										
Terminal	2W, AC/DC, NO	Side	43x41x117mm	—	**EE630-50510**	500mA	1.7mA	<10V	15Hz	yes
Terminal	2W, AC/DC, NC	Side	43x41x117mm	—	**EE630-50610**	500mA	1.7mA	<10V	15Hz	yes
Terminal	2W, AC/DC, NO	Top	43x41x117mm	—	**EE630-54510**	500mA	1.7mA	<10V	15Hz	yes
Terminal	2W, AC/DC, NC	Top	43x41x117mm	—	**EE630-54610**	500mA	1.7mA	<10V	15Hz	yes
SENSING HEADS										
—	2W, AC/DC, NO	Side	N/A	—	**EE631-00510**	500mA	1.7mA	<10V	15Hz	yes
—	2W, AC/DC, NC	Side	N/A	—	**EE631-00610**	500mA	1.7mA	<10V	15Hz	yes
—	2W, AC/DC, NO	Top	N/A	—	**EE631-04510**	500mA	1.7mA	<10V	15Hz	yes
—	2W, AC/DC, NC	Top	N/A	—	**EE631-04610**	500mA	1.7mA	<10V	15Hz	yes
BASE ASSEMBLY										
Terminal	—	—	N/A	—	**EE631-51000**	500mA	1.7mA	<10V	15Hz	yes

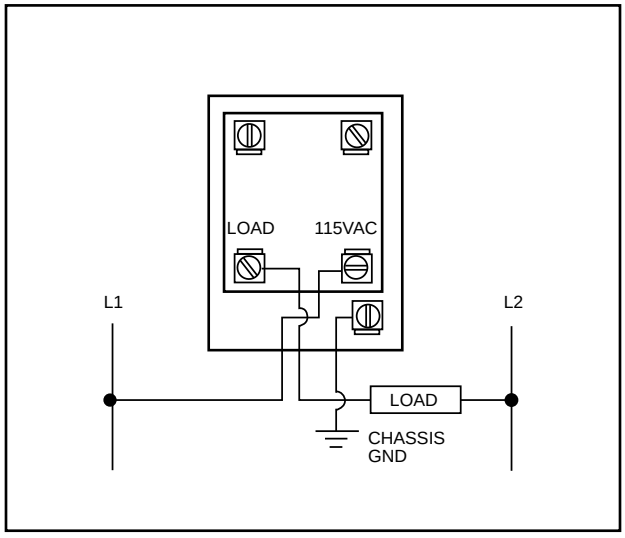
* Across conducting sensor

Protected by the NAMCO Lifetime Replacement Program

Common Sensor Characteristics

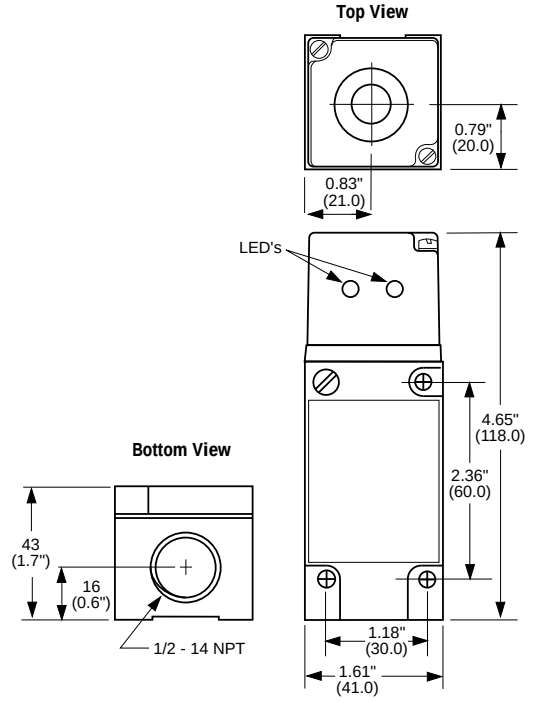
LIMIT SWITCH STYLE SENSORS	
Sensing Distance	0.5" ±10%
Repeatability	<±1%
Hysteresis	10%
Ambient Temperature Range	-4°F to +158°F
Reverse Polarity Protected	yes
NEMA Enclosure Type	1, 12, 13
Operating Temperature Range	-20°C to +70°C
LED Indicators	red = power green = target
Shipping Weight	14 oz.

Wiring Diagram

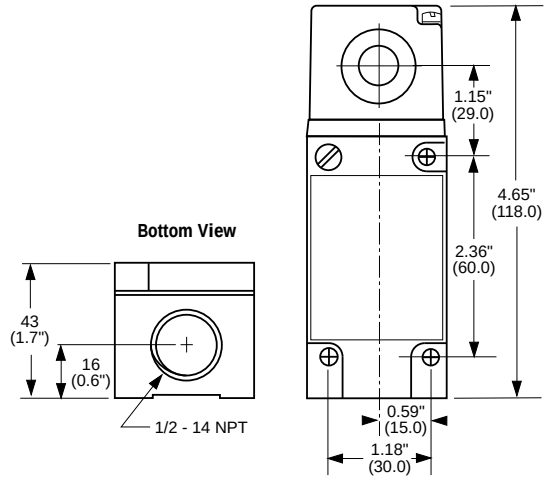


Dimensional Drawings

TOP SENSE MODELS



SIDE SENSE MODELS



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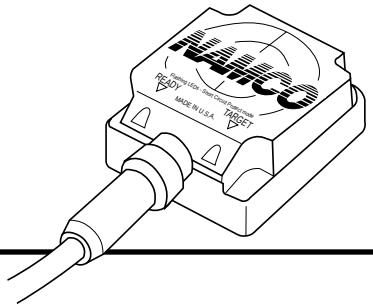
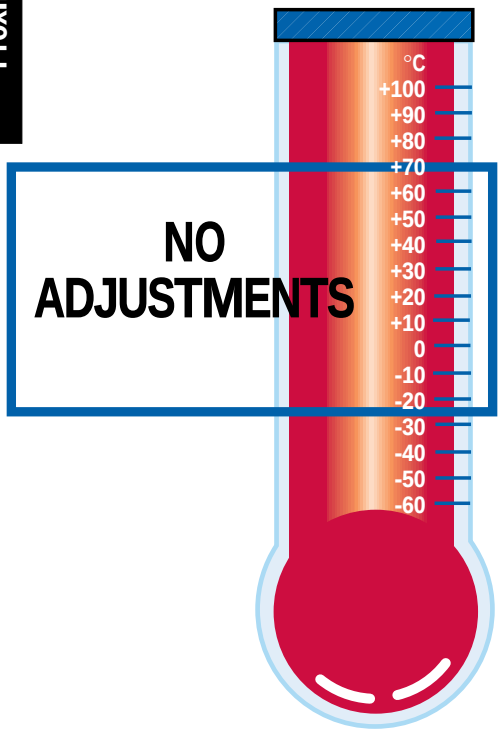
Weld Field Immune

Focused Field Long Range Sensors



Proximity Sensors

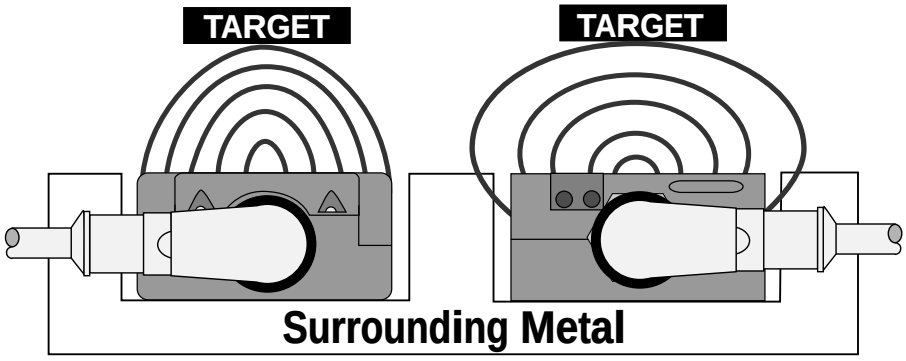
Focused Field FlatPak™ Sensor: Range Stable to 70°C, Never Needs Range Adjustments



The Namco Focused Field FlatPak™ Proximity Sensor is a Super Heavy Duty, completely encapsulated sensor designed to sense large metal objects at long ranges. It is the first sensor of this body style to offer a focused sensing field.

The focused sensing field allows this sensor to be mounted flush with surrounding metal with only a .25 inch gap between the sensor and the metal surface. This sensor will operate reliably in this setting without sensing range adjustments all year round regardless of changes in ambient temperature.

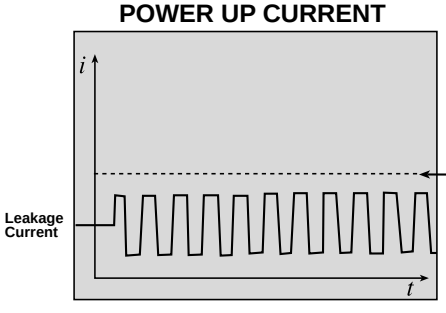
Competitive sensors have traditionally included a trim pot to enable the user to revise the sensing distance when ambient conditions changed. These sensors were susceptible to substantial growth in sensing range when ambient temperature changed from season to season. They would eventually "lock on" to surrounding metal due to this growth in range and to the un-focused nature of their sensing fields. Only a .25 inch clearance is necessary to insure that the Focused Field FlatPak will never lock on to surrounding metal.



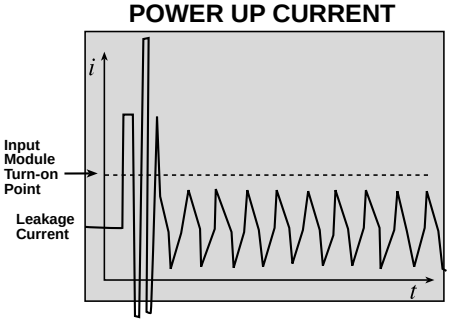
Namco FlatPak *Other Extended Range Sensors*

No TRANSIENTS at Power-Up

The Namco FlatPak sensor has the most noise resistant circuitry in the business, **Namco's patented Weld Field Immune (WFI) circuitry.** Not only will the sensor operate reliably in the presence of 20,000 amp weld fields, it also powers-up glitch-free and is extremely resistant to radio frequency interference and other forms of electrical noise. Problems such as "false detection" and "dropping out" are non-existent, further minimizing programming and maintenance requirements.



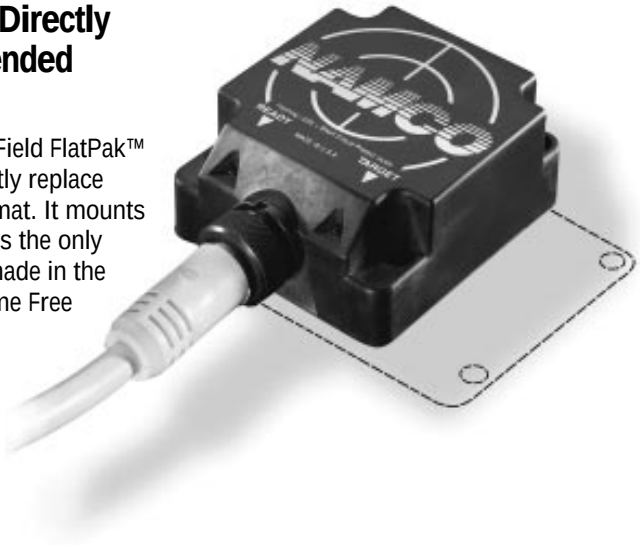
Namco Focused Field FlatPak Sensor. A clean wave means predictable performance.



Power-up current draw of competitive sensor will turn on PLC inputs.

An Easy Upgrade… Directly Replaces Other Extended Range Sensors

The Namco Focused Field FlatPak™ Sensor is designed to directly replace existing sensors of this format. It mounts on 65mm bolt centers and is the only sensor of this type that is made in the USA. It comes with a Lifetime Free Replacement Warranty.



Assists in Troubleshooting

Namco's WFI circuit includes latching Short Circuit Protection (SCP). If the sensor detects excessive current, it reverts to a sleep state with LEDs alternately flashing. This provides a clear indication of a problem in the circuit, simplifying the troubleshooting task. The sensor draws minimal current (2mA) and can remain in this state indefinitely.

No sensing range adjustments, ever.

Namco Weld Field Immune circuitry is designed to operate in presence of resistance welding electrodes carrying 20,000 Amperes RMS (45,000 Amperes peak).

Weld-splatter resistant housing.

Super Reliable– Covered by Namco Lifetime Replacement Program.

Built-in connector available.

Available with either 40mm or 50mm sensing range.

You can mount flush with metal floors or within metal channel.

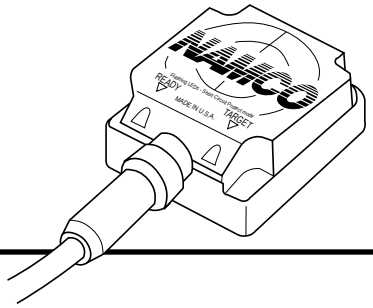
Namco's patented latching short circuit protection is very fast acting. Prolonged shorts will not damage electronics; latching feature aids in the diagnosis of troublesome intermittent faults.

Only extended range sensor made in the USA.

Available in either 20-150 VAC/DC or 10-30 VDC styles.

Weld Field Immune

Focused Field Long Range Sensors



Proximity Sensors

- **40mm or 50mm Sensing Range**
- **"No Adjustment" Sensor**
- **Focused Field Will not Lock on Surrounding Metal**
- **Easy Upgrade/Direct Replacement**
- **Sensing Range - Stable From -25°C to 70°C**
- **Namco Weld Field Immune Circuit**
- **Clean PowerUp - No Turn-on Transients**
- **Latching SCP - Simplifies Troubleshooting**
- **Super Reliable, Fully Epoxy-Encapsulated: Covered by Lifetime Free Replacement Program**
- **Non-Latching SCP Available for DC Modes Only**
- **ONLY SENSOR OF ITS TYPE MADE IN USA**

Protected by the NAMCO Lifetime Replacement Program

The NAMCO Focused Field FlatPak™ Proximity Sensor is a Super Heavy Duty, completely encapsulated sensor designed to sense large metal objects at long ranges in tough environments. It is the first sensor of this body style to offer a focused sensing field.

The focused sensing field allows this sensor to be mounted flush with surrounding metal with only a .25 inch gap between the sensor and the metal surface. This sensor will operate reliably in this setting without adjustment all year round regardless of changes in ambient temperature.

Competitive sensors have traditionally included a trim pot to enable the user to revise the sensing distance when ambient conditions change. These sensors are susceptible to substantial growth in sensing range when ambient temperatures change from season to season. They eventually "lock on" to surrounding metal due to this growth in range and to the unfocused nature of their sensing fields.

The Namco Focused Field FlatPak™ Sensor has two advantages over competitive products that eliminate the need for constant adjustment. **In fact, there are no sensitivity adjustments to be made, ever!!!**

The first advantage is the focused field. The shape of this field minimizes sensing of surrounding metal. When mounted in an identical setting to the competitive switch, the Focused Field FlatPak's sensing range changes less than 10%, and the shape of the field stays focused forward of the switch.

The second advantage is exceptional stability over temperature. The Namco FlatPak's range will increase a maximum of 10% even at the maximum ambient temperature, and the shape of the field will continue in a non-side-sensing focused field.

The Namco Focused Field FlatPak™ proximity sensor requires only a .25 inch clearance to surrounding metal. Once installed with this clearance, the sensor will never lock on to surrounding metal.

This Namco FlatPak also includes the most noise resistant circuitry in the business, Namco's patented Weld Field Immune (WFI) circuitry. Not only will the sensor operate reliably in the presence of 20,000 amp weld fields, it also powers up glitch-free and is extremely resistant to radio frequency interference and other forms of electrical noise. Problems such as "false detection" and "dropping out" are non-existent, further minimizing programming and maintenance requirements.

Namco's WFI circuit includes latching Short Circuit Protection (SCP). If the sensor detects excessive current, it reverts to a sleep state with LEDs flashing. This provides a clear indication of a problem in the circuit, simplifying the troubleshooting task. The sensor draws minimal current (2 mA) and can remain in this state indefinitely.

The Namco Focused Field FlatPak™ Sensor is designed to directly replace existing sensors of this format. It mounts on 65mm bolt centers and is **the only sensor of this type that is Made in the USA.** It comes with a Lifetime Free Replacement Warranty.

Connector Type	Circuit Description	Housing Material	Housing Dimensions	Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency	Short Circuit Protected
40mm SENSING RANGE DC 10-30V									
4-pin Euro	3W, PNP, NO	Fortron	79x92x40mm	**EE510-86440**	200mA	<10µA	<2.5V @ 200mA	15Hz	Latching
4-pin Euro	3W, PNP, NO	Fortron	79x92x40mm	**EE510-86040**	200mA	<10µA	<2.5V @ 200mA	15Hz	Non-latching
4-pin Mini	3W, PNP, NO	Fortron	79x92x40mm	**EE510-86400**	200mA	<10µA	<2.0V @ 200mA	15Hz	Latching
4-pin Mini	3W, PNP, NO	Fortron	79x92x40mm	**EE510-86000**	200mA	<10µA	<2.0V @ 200mA	15Hz	Non-latching
40mm SENSING RANGE AC/DC 20-150V									
3-pin Micro	2W, NO, LL	Fortron	79x92x40mm	**EE530-86420**	200mA	1.7mA	≤10V	15Hz	Latching
3-pin Mini	2W, NO, LL	Fortron	79x92x40mm	**EE530-86400**	200mA	1.7mA	≤10V	15Hz	Latching
50mm SENSING RANGE DC 10-30V									
4-pin Euro	3W, PNP, NO	Fortron	79x92x40mm	**EE510-88440**	200mA	<10µA	<2.5V @ 200mA	15Hz	Latching
4-pin Euro	3W, PNP, NO	Fortron	79x92x40mm	**EE510-88040**	200mA	<10µA	<2.5V @ 200mA	15Hz	Non-latching
4-pin Mini	3W, PNP, NO	Fortron	79x92x40mm	**EE510-88400**	200mA	<10µA	<2.0V @ 200mA	15Hz	Latching
4-pin Mini	3W, PNP, NO	Fortron	79x92x40mm	**EE510-88000**	200mA	<10µA	<2.0V @ 200mA	15Hz	Non-latching
50mm SENSING RANGE AC/DC 20-150V									
3-pin Micro	2W, NO, LL	Fortron	79x92x40mm	**EE530-88420**	200mA	1.7mA	≤10V	15Hz	Latching
3-pin Mini	2W, NO, LL	Fortron	79x92x40mm	**EE530-88400**	200mA	1.7mA	≤10V	15Hz	Latching

Common Sensor Characteristics

FLATPAK PROXIMITY SENSORS		
Supply Voltage	10-30V DC	20-150V AC/DC
Voltage Drop	≤ 2.5V @ 200mA	≤ 10V
	≤ 2.0V @ ≤ 100mA	
Max. Load Current @ 25°C	200mA	
Inrush Current (rms 1Hz)	-	1.5A
Leakage Current	10µA	1.7mA
Sensing Range	40mm/50mm	
Response Time	30ms	
Power-up Time	70ms	
Max. Switching Frequency	15Hz	
Ambient Temp. Range	-25°C to 70°C (-13°F to 158°F)	

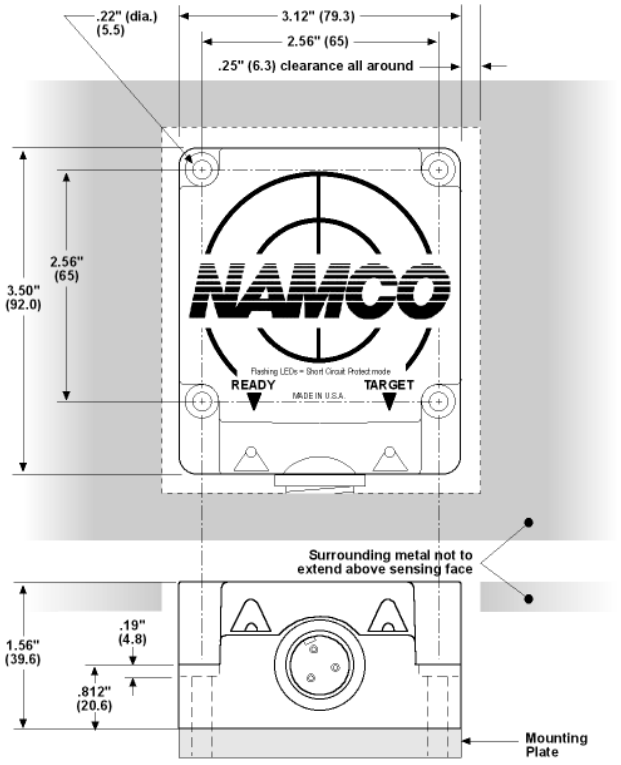
LED Functions

	10-30V DC		20-150V AC/DC	
	Green	Amber	Red	Green
Power Off	Off	Off	Off	Off
Power On Load De-energized	On	Off	On	Off
Power On Load Energized	On	On	Off	On
*SCP Mode Activated	Flashing		Flashing	

**Short Circuit Protection: If the sensor is shorted, the sensor's Short Circuit Protection (SCP) will be activated. When this occurs, both LEDs will flash and the sensor will limit current flow to about 2.0mA.*

Dimensional Drawings

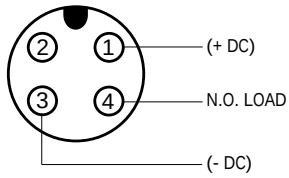
FOCUS FIELD FLATPAK



Circuit Drawings

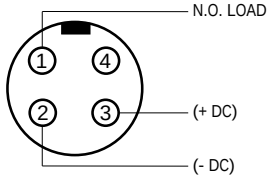
EURO CONNECTOR MODELS

3 Wire DC N.O.

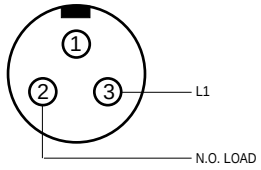


MINI CONNECTOR MODELS

3 Wire DC N.O.

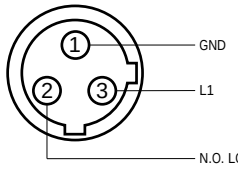


2 Wire AC/DC N.O.



MICRO CONNECTOR MODELS

2 Wire AC N.O.



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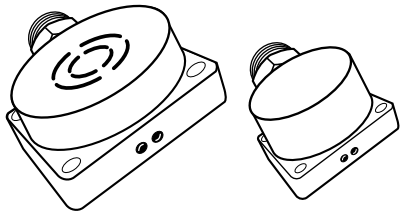
Weld Field Immune

Extended Range Sensors

DC AC/DC



- **Weld Field and Electrical Noise Immunity**
- **Standard Latching Short Circuit Protection (SCP), Non-Latching SCP Available for DC Models Only**
- **Predictable, Consistent Electrical Performance**
- **100% Tested and Burned-in**

These sensors are specifically designed for extreme duty use in harsh applications such as automotive fabrication and assembly plants. Our Extended Range sensors have been designed primarily for use as part present sensors for sheet metal operations, or other applications where target to sensor relationship cannot be guaranteed during operation. For the 25mm range unit, a special cover is available to protect the thermoset housing from damage caused by extreme weld expulsion.

Connector Type	Circuit Description	Housing Material	Housing Dimensions	Model No. (Unshielded)	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency	Short Circuit Protected
25mm SENSING RANGE DC 10-30V									
4-pin Euro	3W, PNP, NO	Thermoset	74x50x41mm	**EE510-83441**	200mA	10µA	2.0V @ 100mA	16Hz	Latching
4-pin Euro	3W, PNP, NO	Thermoset	74x50x41mm	**EE510-83041**	200mA	10µA	2.0V @ 100mA	16Hz	Non-Latching
4-pin Mini	3W, PNP, NO	Thermoset	74x50x41mm	**EE510-83401**	200mA	10µA	2.0V @ 100mA	16Hz	Latching
4-pin Mini	3W, PNP, NO	Thermoset	74x50x41mm	**EE510-83001**	200mA	10µA	2.0V @ 100mA	16Hz	Non-Latching
8' Cable	3W, PNP, NO	Thermoset	74x50x41mm	**EE510-83411**	200mA	10µA	2.0V @ 100mA	16Hz	Latching
8' Cable	3W, PNP, NO	Thermoset	74x50x41mm	**EE510-83011**	200mA	10µA	2.0V @ 100mA	16Hz	Non-Latching
25mm SENSING RANGE AC/DC 20-230V									
3-pin Micro	2W, NO, LL	Thermoset	74x50x41mm	**EE530-83421**	500mA	1.7mA	<10V	16Hz	Latching
3-pin Micro	2W, NO, HL	Thermoset	74x50x41mm	**EE560-83421**	500mA	4.5mA	<10V	16Hz	Latching
3-pin Mini	2W, NO, LL	Thermoset	74x50x41mm	**EE530-83401**	500mA	1.7mA	<10V	16Hz	Latching
3-pin Mini	2W, NO, HL	Thermoset	74x50x41mm	**EE560-83401**	500mA	4.5mA	<10V	16Hz	Latching
8' Cable	2W, NO, HL	Thermoset	74x50x41mm	**EE560-83411**	500mA	4.5mA	<10V	16Hz	Latching
50mm SENSING RANGE DC 10-30V									
4-pin Euro	3W, PNP, NO	Thermoplastic	117x101x50mm	**EE510-84440**	200mA	10µA	2.0V @ 100mA	16Hz	Latching
4-pin Euro	3W, PNP, NO	Thermoplastic	117x101x50mm	**EE510-84040**	200mA	10µA	2.0V @ 100mA	16Hz	Non-Latching
4-pin Mini	3W, PNP, NO	Thermoplastic	117x101x50mm	**EE510-84400**	200mA	10µA	2.0V @ 100mA	16Hz	Latching
4-pin Mini	3W, PNP, NO	Thermoplastic	117x101x50mm	**EE510-84000**	200mA	10µA	2.0V @ 100mA	16Hz	Non-Latching
8' Cable	3W, PNP, NO	Thermoplastic	117x101x50mm	**EE510-84410**	200mA	10µA	2.0V @ 100mA	16Hz	Latching
8' Cable	3W, PNP, NO	Thermoplastic	117x101x50mm	**EE510-84010**	200mA	10µA	2.0V @ 100mA	16Hz	Non-Latching
50mm SENSING RANGE AC/DC 20-230V									
3-pin Micro	2W, NO, LL	Thermoplastic	117x101x50mm	**EE530-84420**	500mA	1.7mA	<10V	16Hz	Latching
3-pin Micro	2W, NO, HL	Thermoplastic	117x101x50mm	**EE560-84420**	500mA	4.5mA	<10V	16Hz	Latching
3-pin Mini	2W, NO, LL	Thermoplastic	117x101x50mm	**EE530-84400**	500mA	1.7mA	<10V	16Hz	Latching
3-pin Mini	2W, NO, HL	Thermoplastic	117x101x50mm	**EE560-84400**	500mA	4.5mA	<10V	16Hz	Latching
8' Cable	2W, NO, HL	Thermoplastic	117x101x50mm	**EE560-84410**	500mA	4.5mA	<10V	16Hz	Latching

* Across conducting sensor

▶ "LL" indicates *Low Leakage* and "HL" indicates *High Leakage*.

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

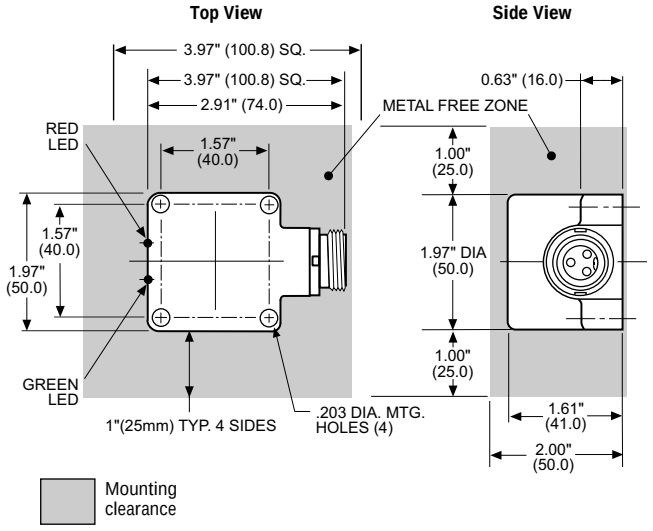
Common Sensor Characteristics

EXTENDED RANGE SENSORS		
	2W AC/DC	**3W DC**
Nominal Sensing Range (±10%)	25mm & 50mm	
Current Consumption	N/A	10mA
Short Circuit Protection	yes	
Reverse Polarity Protected	yes	
Temperature Drift (Max.)	±10%	
Ambient Temperature Range	25mm: -4°F to +158°F 50mm: -4°F to +122°F	
Cable Type	PVC	
Hysteresis	3-10%	
Repeatability	<±1%	
LED Indicator	red = power green = target	grn = power amber = target
Shipping Weight	25mm	50mm
Connector model: Cable model:	10 oz. 15 oz.	2 lb. 2 lb. 5 oz.

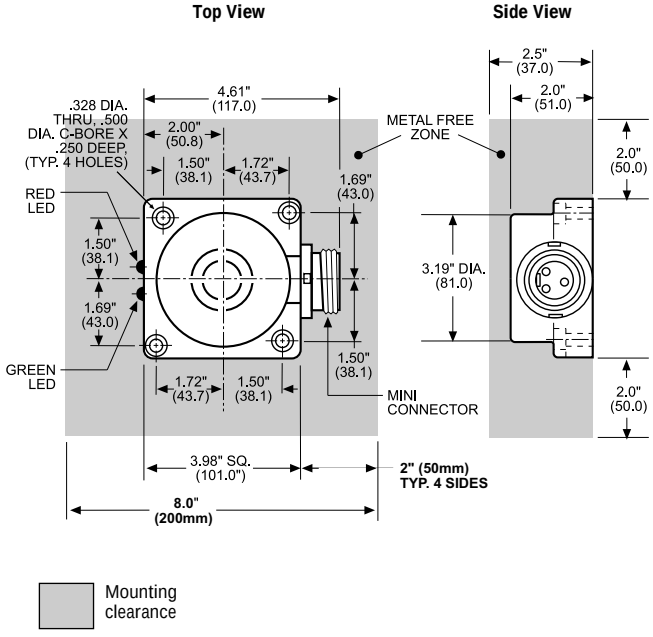
* See Proximity Reference Information Secion for details on mounting clearances for extended range sensors.

Dimensional Drawings

25mm SENSING RANGE



50mm SENSING RANGE

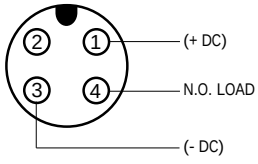


Circuit Drawings

EURO CONNECTOR MODELS

Male view shown

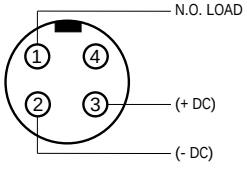
3 Wire DC N.O.



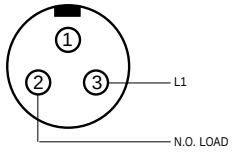
MINI CONNECTOR MODELS

Male views shown

3 Wire DC N.O.

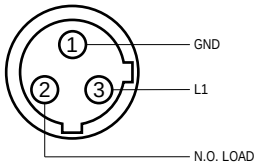


2 Wire AC/DC N.O.



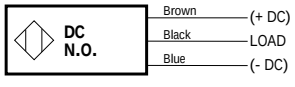
MICRO CONNECTOR MODELS

2 Wire AC N.O.

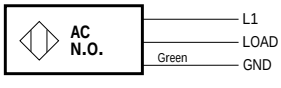


CABLE MODELS

3 Wire DC N.O.



2 Wire AC N.O.



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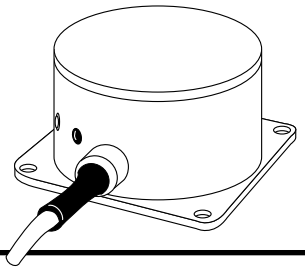
Round Metal | Inductive Flat Pack | DC AC



These long range sensors are shielded and not susceptible to side sensing of surrounding metal.

20-90mm (Shielded) Sensing Ranges

Connector Type	Circuit Description	Housing Material	Shielded Model No.	Unshielded Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency	Short Circuit Protected
20mm Sensing Range DC 10-30V									
6.6' Cable	3W, NPN, NO	Metal	**ER510-80130**	—	400mA	<10µA	<2.5 VDC	30Hz	yes
6.6' Cable	3W, PNP, NO	Metal	**ER511-80130**	—	400mA	<10µA	<2.5 VDC	30Hz	yes
20mm Sensing Range AC 20-250V									
6.6' Cable	2W, AC, NO	Metal	**ER520-80430****	—	400mA	<1.5mA @220 VAC	<8 VAC @400mA	25Hz	no
20-45mm Adjustable Sensing Range DC 10-55V									
4-pin Mini	3W, NPN, NO	Metal	**ER510-81120**	—	400mA	<10µA	<2.5 VDC @400mA	30Hz	yes
4-pin Mini	3W, PNP, NO	Metal	**ER511-81120**	—	400mA	<10µA	<2.5 VDC @400mA	30Hz	yes
6.6' Cable	3W, NPN, NO	Metal	**ER510-81130**	—	400mA	<10µA	<2.5 VDC @400mA	30Hz	yes
6.6' Cable	3W, PNP, NO	Metal	**ER511-81130**	—	400mA	<10µA	<2.5 VDC @400mA	30Hz	yes
20-45mm Adjustable Sensing Range AC 80-250V									
3-pin Mini	2W, AC, NO	Metal	**ER520-81420****	—	400mA	<2mA	<8 VAC @400mA	10Hz	no
6.6' Cable	2W, AC, NO	Metal	**ER520-81430****	—	400mA	<2mA	<8 VAC @400mA	10Hz	no
45-90mm Adjustable Sensing Range DC 10-55V									
4-pin Mini	3W, NPN, NO	Metal	**ER510-82120**	—	400mA	<10µA	<2.5 VDC @400mA	30Hz	yes
4-pin Mini	3W, PNP, NO	Metal	**ER511-82120**	—	400mA	<10µA	<2.5 VDC @400mA	30Hz	yes
6.6' Cable	3W, NPN, NO	Metal	**ER510-82130**	—	400mA	<10µA	<2.5 VDC @400mA	30Hz	yes
6.6' Cable	3W, PNP, NO	Metal	**ER511-82130**	—	400mA	<10µA	<2.5 VDC @400mA	30Hz	yes
45-90mm Adjustable Sensing Range AC 80-250V									
3-pin Mini	2W, AC, NO	Metal	**ER520-82420****	—	400mA	<2.5mA @220 VAC	<8 VAC @400mA	10Hz	no
6.6' Cable	2W, AC, NO	Metal	**ER520-82430****	—	400mA	<2.5mA @220 VAC	<8 VAC @400mA	10Hz	no

* Across conducting sensor

** Without Mounting Plate

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

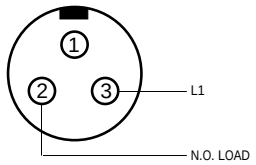
Common Sensor Characteristics

ROUND METAL FLAT PACK DC & AC SENSORS	
Shielded Sensing Range	20-90mm
Standard Target (mm) (mild steel)	60x60x1 (20mm Range) 135x135x1 (20-45mm Range) 270x270x1 (45-90mm Range)
Repeatability	± 2%
Hysteresis	3-8% (typ.); 15% (max.)
Temperature Drift (max.)	±15%
Ambient Temperature Range	-13°F to +158°F
Reverse Polarity Protected	yes
Current Consumption	<1.5mA
NEMA Enclosure Type	1, 3, 4, 4x
LED Indicator	red = target
Metal Housings	Aluminum
Shipping Weight	Connector model: 2 lb. Cable model: 2 lb. 5 oz.

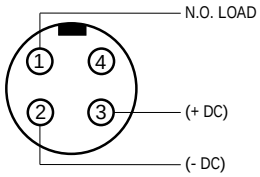
Circuit Drawings

MINI CONNECTOR MODELS Male views shown

2 Wire AC N.O.

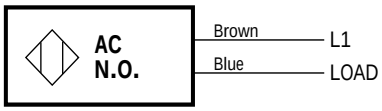


3 Wire DC N.O.

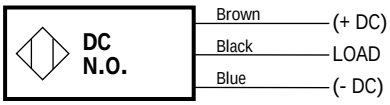


CABLE MODELS

2 Wire AC N.O.

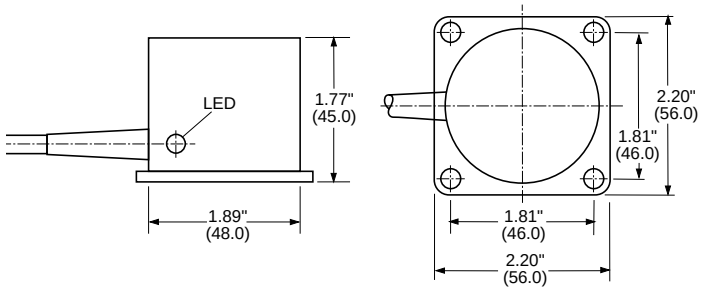


3 Wire DC N.O.

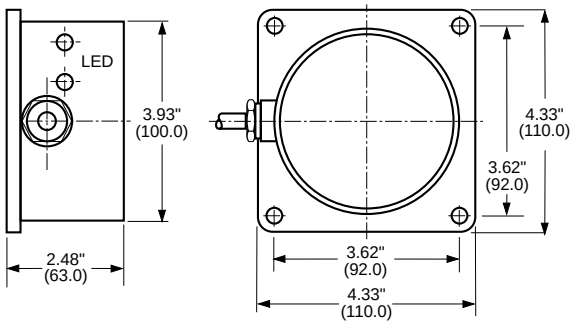


Dimensional Drawings

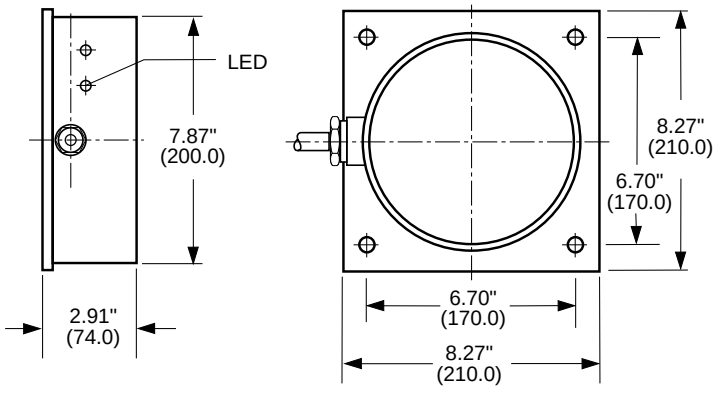
20mm SENSING RANGE



20-45mm ADJUSTABLE



45-90mm ADJUSTABLE



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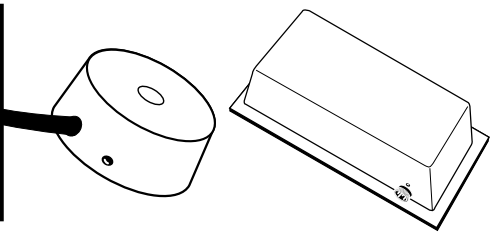
Plastic Inductive Flat Pack DC AC



These ultra long range sensors are ideal when exact positioning of large objects is not possible.

20-250mm Adjustable (Unshielded) Sensing Ranges

Connector Type	Circuit Description	Housing Material	Shielded Model No.	Unshielded Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency	Short Circuit Protected
Round 20-50mm Adjustable DC 10-55V									
6.6' Cable	3W, NPN, NO	Plastic	—	**ER510-25121**	400mA	<10µA	<2.5 VDC @ 400mA	30Hz	yes
6.6' Cable	3W, PNP, NO	Plastic	—	**ER510-25123**	400mA	<10µA	<2.5 VDC @ 400mA	30Hz	yes
Round 20-50mm Adjustable AC 80-250V									
6.6' Cable	2W, AC, NO	Plastic	—	**ER520-25165**	400mA	<2mA @ 220 VAC	<8 VAC @ 400mA	8Hz	no
Round 30-70mm Adjustable DC 10-30V									
6.6' Cable	3W, NPN, NO	Plastic	—	**ER510-27021**	400mA	<10µA	<2.5 VDC @ 400mA	30Hz	yes
6.6' Cable	3W, PNP, NO	Plastic	—	**ER510-27023**	400mA	<10µA	<2.5 VDC @ 400mA	30Hz	yes
Round 30-70mm Adjustable AC 80-250V									
6.6' Cable	2W, AC, NO	Plastic	—	**ER520-27065****	400mA	<2mA @ 220 VAC	<8 VAC @ 400mA	8Hz	no
Round 40-100mm Adjustable DC 10-30V									
4-pin Mini	3W, NPN, NO	Plastic	—	**ER510-21221**	400mA	<10µA	<2.5 VDC @ 400mA	20Hz	yes
4-pin Mini	3W, PNP, NO	Plastic	—	**ER510-21223**	400mA	<10µA	<2.5 VDC @ 400mA	20Hz	yes
6.6' Cable	3W, NPN, NO	Plastic	—	**ER510-21021**	400mA	<10µA	<2.5 VDC @ 400mA	20Hz	yes
6.6' Cable	3W, PNP, NO	Plastic	—	**ER510-21023**	400mA	<10µA	<2.5 VDC @ 400mA	20Hz	yes
Round 40-100mm Adjustable AC 80-250V									
3-pin Mini	2W, AC, NO	Plastic	—	**ER520-21265****	400mA	<2mA @ 220 VAC	<8 VAC @ 400mA	8Hz	no
6.6' Cable	2W, AC, NO	Plastic	—	**ER520-21065****	400mA	<2mA @ 220 VAC	<8 VAC @ 400mA	8Hz	no
Rectangular 70-150mm Adjustable AC/DC 38-250V									
3-pin Mini	2W, AC/DC, NO	Plastic	—	**ER520-86401****	400mA	<2mA @ 220 VAC	<11 VAC	10Hz	yes
6.6' Cable	2W, AC/DC, NO	Plastic	—	**ER520-86411****	400mA	<2mA @ 220 VAC	<11 VAC	10Hz	yes
Rectangular 100-250mm Adjustable AC/DC 38-250V									
3-pin Mini	2W, AC/DC, NO	Plastic	—	**ER520-87401****	400mA	<2mA @ 220 VAC	<11 VAC	5Hz	yes
6.6' Cable	2W, AC/DC, NO	Plastic	—	**ER520-87411****	400mA	<2mA @ 220 VAC	<11 VAC	5Hz	yes

* Across conducting sensor

** Without Mounting Plate

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

Common Sensor Characteristics

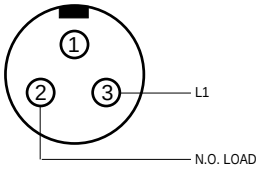
PLASTIC FLAT PACK DC & AC SENSORS	
Unshielded Sensing Range	20-250mm Adjustable
Standard Target (mm) (mild steel)	150x150x1 (20-50mm range) 210x210x1 (30-70mm range) 300x300x1 (40-100mm range) 450x450x1 (70-150mm range) 600x600x1 (100-250mm range)
Repeatability	± 2%
Hysteresis	3-8% (typ.); 15% (max.)
Temperature Drift (max.)	±15%
Ambient Temperature Range	-13°F to +158°F
Reverse Polarity Protected	yes
Current Consumption	<6mA (DC)
NEMA Enclosure Type	1, 12, 13
LED Indicator	red = target
Plastic Housings	Noryl®
Shipping Weight	Connector model: 5 lb. Cable model: 5 lb. 5 oz.

Circuit Drawings

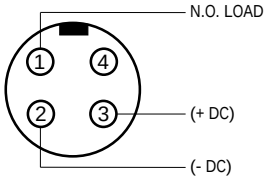
MINI CONNECTOR MODELS

Male views shown

2 Wire AC N.O.

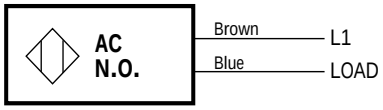


3 Wire DC N.O.

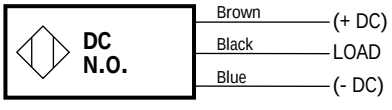


CABLE MODELS

2 Wire AC N.O.



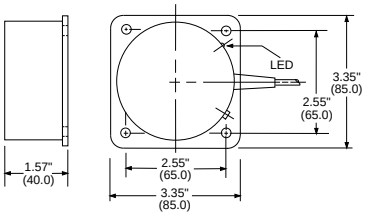
3 Wire DC N.O.



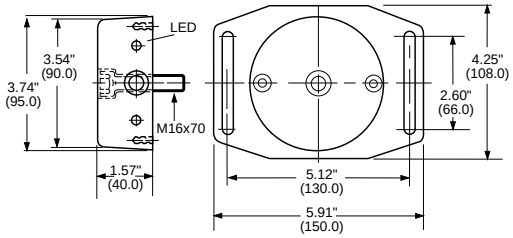
Dimensional Drawings

ROUND MODELS

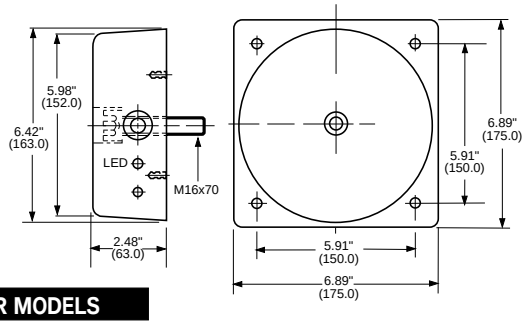
20-50mm Adjustable



30-70mm Adjustable

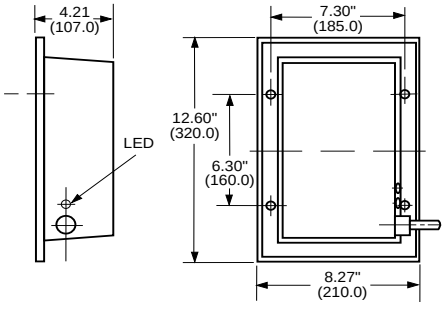


40-100mm Adjustable

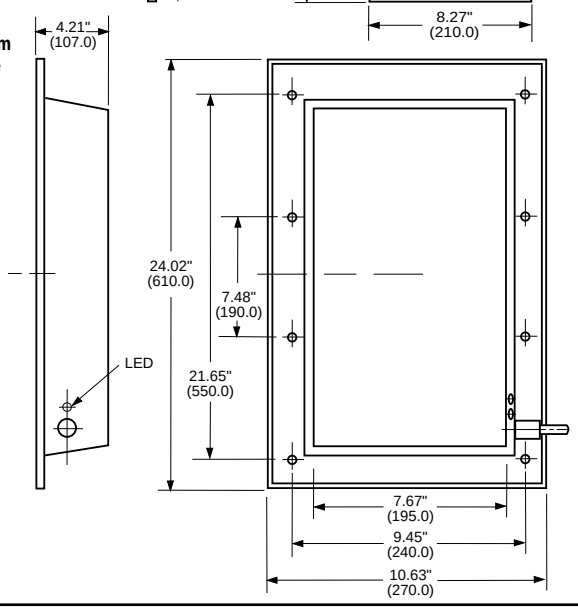


RECTANGULAR MODELS

70-150mm Adjustable



100-250mm Adjustable



Proximity Sensors

NAMCO

Namco Controls Corporation
Mayfield Village, OH 44143
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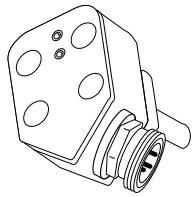
Weld Field Immune

90° Rotatable Cylindicator® Sensors

DC AC/DC



Proximity Sensors

- **Weld Field and Electrical Noise Immunity**
- **3000 PSI Pressure Rating**
- **Standard Latching Short Circuit Protection (SCP), Non-Latching Available in DC Models**
- **Predictable, Consistent Electrical Performance**
- **100% Tested and Burned-in**
- **Purpose-Designed Housings and Materials**

For over 25 years, the Cylindicator sensor has been the standard for industrial applications that require end-of-stroke indication on Hydraulic and Pneumatic Cylinders. Available in several styles, they are the standard for many OEM cylinder manufacturers. All Cylindicators are completely PLC compatible with many output configurations, including a UL Listed Intrinsically Safe version (see EE931 series for details).

Protected by the NAMCO Lifetime Replacement Program

	3-Pin Mini 2-W, 20-230V AC/DC, N.O.		4-Pin Mini* 3-Wire, 10-30V DC, N.O., 10μA Leakage Current				
	Latching SCP		Non-Latching SCP		Latching SCP		
	1.7mA Leakage Current	4.5mA Leakage Current	SI (NPN)	SO (PNP)	SI (NPN)	SO (PNP)	SI/SO*
Probe Length	EE230	EE260	EE210-	EE210-	EE210-	EE210-	EE210-
0.915	—	—	EE210-38820	EE210-38800	EE210-38860	EE210-38840	EE210-38880
0.950	EE230-30120	EE260-30120	EE210-30120	EE210-30100	EE210-30160	EE210-30140	EE210-30180
1.025	EE230-30420	EE260-30420	EE210-30420	EE210-30400	EE210-30460	EE210-30440	EE210-30480
1.050	EE230-30520	EE260-30520	EE210-30520	EE210-30500	—	EE210-30540	—
1.125	EE230-30820	EE260-30820	EE210-30820	EE210-30800	EE210-30860	EE210-30840	EE210-30880
1.150	EE230-30920	EE260-30920	—	—	—	—	—
1.225	EE230-31220	—	—	EE210-31200	—	EE210-31240	—
1.250	EE230-31320	EE260-31320	EE210-31320	EE210-31300	EE210-31360	EE210-31340	EE210-31380
1.275	EE230-31420	EE260-31420	—	—	—	—	—
1.295	EE230-31520	EE260-31520	EE210-31520	EE210-31500	EE210-31560	EE210-31540	EE210-31580
1.350	EE230-31720	EE260-31720	—	—	—	EE210-31740	—
1.400	EE230-31920	—	EE210-31920	—	EE210-31960	EE210-31940	EE210-31980
1.475	EE230-32220	EE260-32220	—	—	—	—	—
1.500	EE230-32320	EE260-32320	EE210-32320	EE210-32300	—	EE210-32340	EE210-32380
1.525	EE230-32420	—	—	—	—	—	—
1.625	EE230-32820	—	—	—	—	—	—
1.725	EE230-33220	EE260-33220	EE210-33220	EE210-33200	EE210-33260	EE210-33240	EE210-33280
1.750	EE230-33320	EE260-33320	—	EE210-33300	—	EE210-33340	EE210-33380
1.875	EE230-33820	EE260-33820	EE210-33820	EE210-33800	EE210-33860	EE210-33840	EE210-33880
2.062	EE230-38720	EE260-38720	EE210-38720	EE210-38700	EE210-38760	EE210-38740	EE210-38780
2.125	EE230-34820	EE260-34820	EE210-34820	EE210-34800	EE210-34860	EE210-34840	EE210-34880
2.275	EE230-35420	EE260-35420	EE210-35420	EE210-35400	EE210-35460	EE210-35440	EE210-35480
2.375	EE230-35820	—	—	—	—	—	—
2.775	EE230-37420	EE260-37420	—	—	—	—	—
2.875	EE230-37820	EE260-37820	EE210-037820	EE210-37800	EE210-37860	EE210-37840	EE210-37880
3.750	EE230-39120	—	—	—	—	—	—
3.775	EE230-39020	EE260-39020	—	EE210-39000	—	EE210-39040	—
4.560	EE230-38620	EE260-38620	EE210-38620	—	EE210-38660	EE210-38640	EE210-38680
4.850	EE230-38920	EE260-38920	EE210-38920	EE210-38900	EE210-38960	—	EE210-38980
4.990	EE230-38520	—	EE210-38520	EE210-38500	EE210-38560	—	EE210-38580

* Sink/Source Combination Devices Use a 5-Pin, 4-Wire Connector!

▶ Consult factory for Normally Closed, DC Sinking, and Cable model availability.

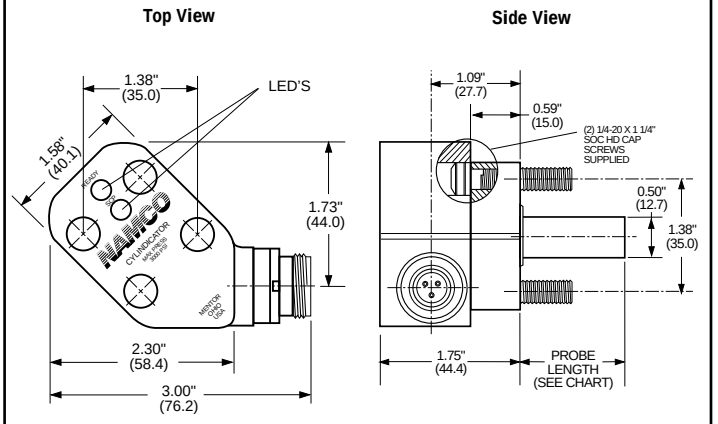
Common Sensor Characteristics

CYLINDICATOR® SENSORS		
	AC/DC	DC
Nominal Sensing Range (±10%)	0.080"	
Current Consumption	1.7 or 4.5mA	10µA
Voltage Drop	≈10 VAC	2.0V@100mA
Temperature Drift (Max.)	±10%	
Short Circuit Protection	yes	
Reverse Polarity Protected	yes	
Ambient Temperature Range	-4°F to +158°F	
Maximum Switching Frequency	16Hz	
Hysteresis	3-10%	
Repeatability	<±1.25%	
Designed to meet NEMA Enclosure Type	4, 6, 12 & 13	
Load Current	5mA to 500mA	200mA max.
LED Indicator	red = power green = target	green = power amber = target
Shipping Weight	12 oz.	

See Cylindicator® Sensor Design Guide Section for details.

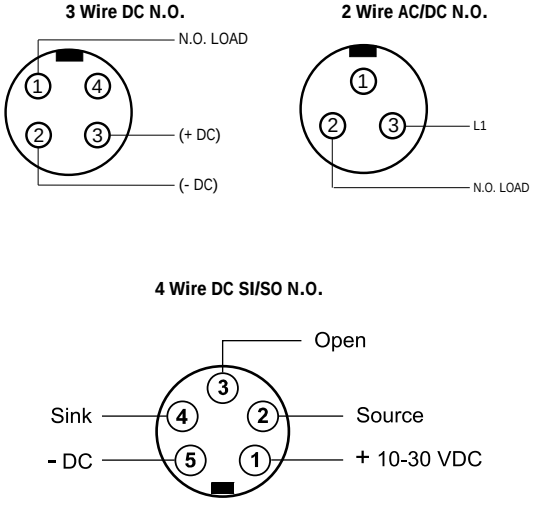
Dimensional Drawings

90° ROTATABLE



Circuit Drawings

MINI CONNECTORS (Male views shown)



Proximity Sensors

NAMCO

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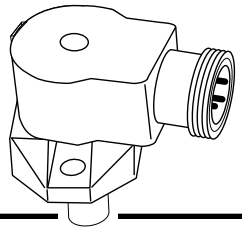
Weld Field Immune

LPR Cylindicator® Sensors

DC AC/DC



Proximity Sensors

- **Both 3,000 and 5,000 PSI Pressure Ratings**
- **Weld Field and Electrical Noise Immunity**
- **Standard Latching Short Circuit Protection (SCP) — Non-latching Avialable in DC Models**
- **Predictable, Consistent Electrical Performance**
- **100% Tested and Burned-in**
- **Purpose-Designed Housings and Materials**

For over 25 years, the Cylindicator sensor has been the standard for industrial applications that require end-of-stroke indication on Hydraulic and Pneumatic Cylinders. Available in both 3,000 and 5,000 PSI pressure ratings, they are the standard for many OEM cylinder manufacturers. All Cylindicators are completely PLC compatible with many output configurations, including a UL Listed Intrinsically Safe version (see EE931 series for details).

LPR 3000 (3,000 PSI)

	3-pin Micro, N.O.	3-pin Mini, N.O.		4-pin Mini, N.O.		4-pin Euro, N.O.	
Probe Length	2-wire, 20-230V, AC/DC Latching SCP 1.7mA leakage current	2-wire, 20-230V, AC/DC Latching SCP 1.7mA leakage current	2-wire, 20-230V, AC/DC Latching SCP 4.5mA leakage current	3-wire, 10-30V DC, Sourcing (PNP) 10μA leakage current Latching SCP	3-wire, 10-30V DC, Sourcing (PNP) 10μA leakage current Non-Latching SCP	3-wire, 10-30V DC Sourcing (PNP) 10μA leakage current Latching SCP	3-wire, 10-30V DC Sourcing (PNP) 10μA leakage current Non-Latching SCP
	EE230-	EE230-	EE260-	EE210-	EE210-	EE210-	EE210-
1.025	EE230-10423	EE230-10420	EE260-10420	EE210-10440	EE210-10400	EE210-10444	EE210-10404
1.250	EE230-11323	EE230-11320	EE260-11320	EE210-11340	EE210-11300	EE210-11344	EE210-11304
1.500	EE230-12323	EE230-12320	EE260-12320	EE210-12340	EE210-12300	EE210-12344	EE210-12304
1.750	EE230-13323	EE230-13320	EE260-13320	EE210-13340	EE210-13300	EE210-13344	EE210-13304
2.062	EE230-18723	EE230-18720	EE260-18720	EE210-18740	EE210-18700	EE210-18744	EE210-18704
2.875	EE230-17823	EE230-17820	EE260-17820	EE210-17840	EE210-17800	EE210-17844	EE210-17804
3.775	EE230-19023	EE230-19020	EE260-19020	EE210-19040	EE210-19000	EE210-19044	EE210-19004
4.560	EE230-18623	EE230-18620	EE260-18620	EE210-18640	EE210-18600	EE210-18644	EE210-18604

LPR 5000 (5,000 PSI)

	3-pin Micro, N.O.	3-pin Mini, N.O.		4-pin Mini, N.O.		4-pin Euro, N.O.	
Probe Length	2-wire, 20-230V, AC/DC Latching SCP 1.7mA leakage current	2-wire, 20-230V, AC/DC Latching SCP 1.7mA leakage current	2-wire, 20-230V, AC/DC Latching SCP 4.5mA leakage current	3-wire, 10-30V DC, Sourcing (PNP) 10μA leakage current Latching SCP	3-wire, 10-30V DC, Sourcing (PNP) 10μA leakage current Non-Latching SCP	3-wire, 10-30V DC Sourcing (PNP) 10μA leakage current Latching SCP	3-wire, 10-30V DC Sourcing (PNP) 10μA leakage current Non-Latching SCP
	EE230-	EE230-	EE260-	EE210-	EE210-	EE210-	EE210-
1.025	EE230-10427	EE230-10425	EE260-10425	EE210-10445	EE210-10405	EE210-10446	EE210-10406
1.250	EE230-11327	EE230-11325	EE260-11325	EE210-11345	EE210-11305	EE210-11346	EE210-11306
1.500	EE230-12327	EE230-12325	EE260-12325	EE210-12345	EE210-12305	EE210-12346	EE210-12306
1.750	EE230-13327	EE230-13325	EE260-13325	EE210-13345	EE210-13305	EE210-13346	EE210-13306
2.062	EE230-18727	EE230-18725	EE260-18725	EE210-18745	EE210-18705	EE210-18746	EE210-18706
2.875	EE230-17827	EE230-17825	EE260-17825	EE210-17845	EE210-17805	EE210-17846	EE210-17806
3.775	EE230-19027	EE230-19025	EE260-19025	EE210-19045	EE210-19005	EE210-19046	EE210-19006
4.560	EE230-18627	EE230-18625	EE260-18625	EE210-18645	EE210-18605	EE210-18646	EE210-18606

▶ Consult factory for Normally Closed and DC Sinking model availability.

Protected by the NAMCO Lifetime Replacement Program

Common Sensor Characteristics

CYLINDICATOR® SENSORS		
	AC/DC	DC
Nominal Sensing Range (±10%)	0.080"	
Current Consumption	1.7 or 4.5mA	10µA
Voltage Drop	≈10 VAC	2.0V@100mA
Temperature Drift (Max.)	±10%	
Short Circuit Protection	yes	
Reverse Polarity Protected	yes	
Ambient Temperature Range	-4°F to +158°F	
Maximum Switching Frequency	16Hz	
Hysteresis	3-10%	
Repeatability	<±1.25%	
Designed to meet NEMA Enclosure Type	4, 6, 12 & 13	
Load Current	5mA to 500mA	200mA max.
LED Indicator	red = power green = target	green = power amber = target
Shipping Weight	12 oz.	

See Cylindicator® Sensor Design Guide Section for details.

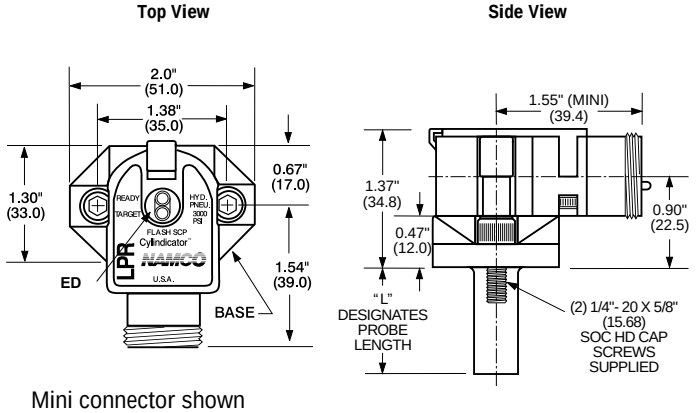
LED Functions

	10-30V DC		20-230V AC/DC	
	Green	Amber	Red	Green
Power Off	Off	Off	Off	Off
Power On Load De-energized	On	Off	On	Off
Power On Load Energized	On	On	Off	On
*SCP Mode Activated	Both Flashing		Both Flashing	

**Short Circuit Protection: If the sensor is shorted, the sensor's Short Circuit Protection (SCP) will be activated. When this occurs, both LEDs will flash and the sensor will limit current flow to about 2.0mA.*

Dimensional Drawings

LOW PROFILE ROTATABLE

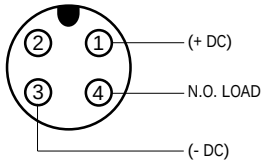


Mini connector shown

Circuit Drawings

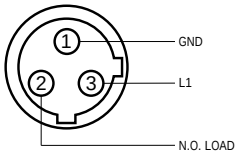
EURO CONNECTOR MODELS Male view shown

3 Wire DC N.O.



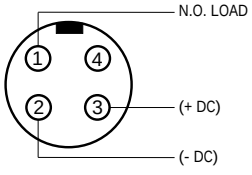
MICRO CONNECTOR MODELS Male view shown

2 Wire AC/DC N.O.

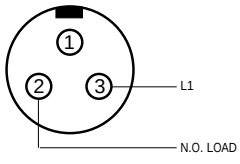


MINI CONNECTOR MODELS Male views shown

3 Wire DC N.O.



2 Wire AC/DC N.O.



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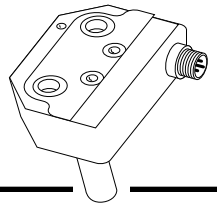
Weld Field Immune

Low-Profile Cylindicator® Sensors

DC AC/DC



Proximity Sensors

- **Weld Field and Electrical Noise Immunity**
- **1500 PSI Continuous Pressure Rating**
- **Standard Latching Short Circuit Protection (SCP), Non-Latching Available in DC Models**
- **Predictable, Consistent Electrical Performance**
- **100% Tested and Burned-in**
- **Purpose-Designed Housings and Materials**

For over 25 years, the Cylindicator sensor has been the standard for industrial applications that require end-of-stroke indication on Hydraulic and Pneumatic Cylinders. Available in several styles, they are the standard for many OEM cylinder manufacturers. All Cylindicators are completely PLC compatible with many output configurations, including a UL Listed Intrinsically Safe version (see EE931 series for details).

	3-Pin Micro Connector 2-W, 20-230V, AC/DC, N.O.		4-Pin Euro Connector 3-W, 10-30V, DC Sourcing (PNP), N.O.	
	Latching Short-Circuit Protection (SCP)			Non-Latching SCP
	1.7mA Leakage Current	4.5mA Leakage Current	10µA Leakage Current	
Probe Length	EE230-	EE260-	EE210-	EE210-
0.915”	EE230-28820	EE260-28820	EE210-28844	EE210-28804
0.950”	EE230-20120	EE260-20120	EE210-20144	EE210-20104
1.025”	EE230-20420	EE260-20420	EE210-20444	EE210-20404
1.130”	EE230-20320	EE260-20320	EE210-20344	EE210-20304
1.250”	EE230-21320	EE260-21320	EE210-21344	EE210-21304
1.350”	EE230-21720	EE260-21720	EE210-21744	EE210-21704
2.062”	EE230-28720	EE260-28720	EE210-28744	EE210-28704
2.775”	EE230-27420	EE260-27420	EE210-27444	EE210-27404
2.875”	EE230-27820	EE260-27820	EE210-27844	EE210-27804
3.775”	EE230-29020	EE260-29020	EE210-29044	EE210-29004
4.560”	EE230-28620	EE260-28620	EE210-28644	EE210-28604

Protected by the NAMCO Lifetime Replacement Program

▶ Consult factory for Normally Closed, DC Sinking, and Cable model availability.

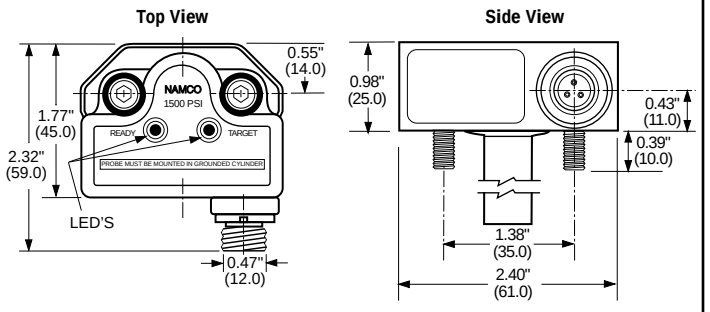
Common Sensor Characteristics

CYLINDICATOR® SENSORS		
	AC/DC	**DC**
Nominal Sensing Range (±10%)	0.080"	
Current Consumption	1.7 or 4.5mA	10µA
Voltage Drop	≈10 VAC	2.0V@100mA
Temperature Drift (Max.)	±10%	
Short Circuit Protection	yes	
Reverse Polarity Protected	yes	
Ambient Temperature Range	-4°F to +158°F	
Maximum Switching Frequency	16Hz	
Hysteresis	3-10%	
Repeatability	<±1.25%	
Designed to meet NEMA Enclosure Type	4, 6, 12 & 13	
Load Current	5mA to 500mA	200mA max.
LED Indicator	red = power green = target	green = power amber = target
Shipping Weight	12 oz.	

See Cylindicator® Sensor Design Guide Section for details.

Dimensional Drawings

LOW PROFILE



LED Functions

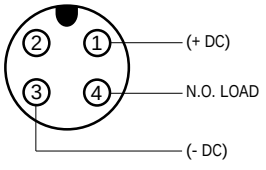
	10-30V DC		**20-230V AC/DC**	
	Green	**Amber**	**Red**	**Green**
Power Off	Off	Off	Off	Off
Power On Load De-energized	On	Off	On	Off
Power On Load Energized	On	On	Off	On
*SCP Mode Activated	Both Flashing		Both Flashing	

**Short Circuit Protection: If the sensor is shorted, the sensor's Short Circuit Protection (SCP) will be activated. When this occurs, both LEDs will flash and the sensor will limit current flow to about 2.0mA.*

Circuit Drawings

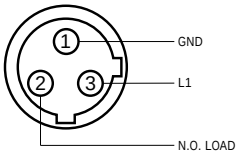
EURO CONNECTOR MODELS Male view shown

3 Wire DC N.O.



MICRO CONNECTOR MODELS Male view shown

2 Wire AC/DC N.O.



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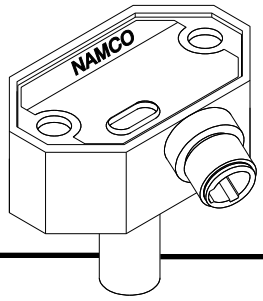
Weld Field Immune

C2™ Cylindicator® Sensors

DC AC/DC



Proximity Sensors

- **Low Mass - Less Susceptible to Damage from Shock and Vibration**
- **Lowest Profile Cylinder Sensor on the Market**
- **Weld Field and Electrical Noise Immunity**
- **300 PSI Continuous Pressure Rating**
- **Single Piece Rugged Die-Cast Housing**
- **Tested to over 20 Million Switching Cycles**
- **Purpose-Designed Housings and Materials**
- **Standard Latching Short Circuit Protection (SCP), Non-Latching Available in DC Models**

As the leader in end-of-stroke cylinder position sensing for over 18 years, Namco is proud to introduce the newest member of the Namco Cylindicator series: the C2™ Cylindicator® sensor.

Many developments in cylinder position sensing have resulted in sophisticated, overly-complicated sensors. The C2 sensor, on the other hand, is a "back to basics" design. This new design capitalizes on the real needs of the pneumatic power clamp cylinder user.

	3-Pin Micro	4-Pin Euro	
	2-W, 20-150V AC/DC, N.O. 1.7mA Leakage Current Latching SCP	3-W, 10-30V DC, N.O., Sourcing (PNP) 10μA Leakage Current Latching SCP	 Non-Latching SCP
Probe Length	**EE230-**	**EE210-**	**EE210-**
1.025"	EE230-60420	EE210-60444	EE210-60404
1.250"	EE230-61320	EE210-61344	EE210-61304
1.500"	EE230-62320	EE210-62344	EE210-62304
1.750"	EE230-63320	EE210-63344	EE210-63304
2.062	EE230-68720	EE210-68744	EE210-68704
2.875"	EE230-67820	EE210-67844	EE210-67804
3.775"	EE230-69020	EE210-69044	EE210-69004
4.560"	EE230-68620	EE210-68644	EE210-68604

Protected by the NAMCO Lifetime Replacement Program

Common Sensor Characteristics

C2 CYLINDICATOR® SENSORS		
Nominal Sensing Range (±10%)	0.080"	
Supply Voltage	10-30V DC	20-150V AC/DC
Voltage Drop	≤ 2.5V @ 200mA	≤ 10V
	≤ 2.0V @ ≤ 100mA	
Max. Load Current @ 25°C	200mA	
Inrush Current (rms 1Hz)	-	1.5A
Leakage Current	10µA	1.7mA
Max. Continuous Pressure	300 psi	
Response Time	30ms	
Power-up Time	35ms to 45ms	
Max. Switching Frequency	15Hz	
Ambient Temp. Range	-25°C to 70°C (-13°F to 158°F)	

LED Functions

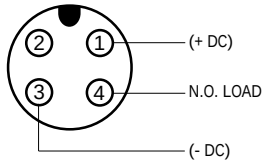
	10-30V DC		20-150V AC/DC	
	Green	Amber	Red	Green
Power Off	Off	Off	Off	Off
Power On Load De-energized	On	Off	On	Off
Power On Load Energized	On	On	Off	On
*SCP Mode Activated	Both Flashing		Both Flashing	

**Short Circuit Protection: If the sensor is shorted, the sensor's Short Circuit Protection (SCP) will be activated. When this occurs, both LEDs will flash and the sensor will limit current flow to about 2.0mA.*

Circuit Drawings

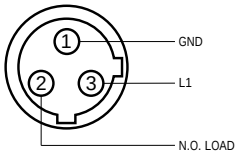
EURO CONNECTOR MODELS Male view shown

3 Wire DC N.O.



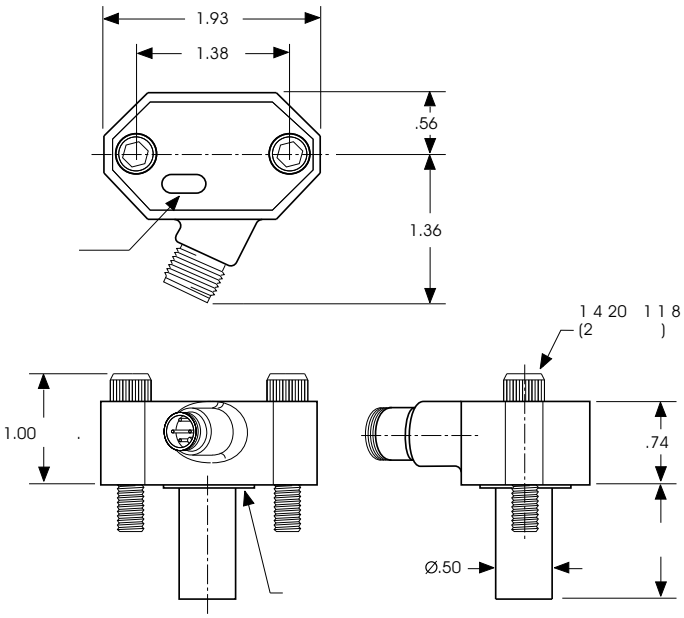
MICRO CONNECTOR MODELS Male view shown

2 Wire AC/DC N.O.

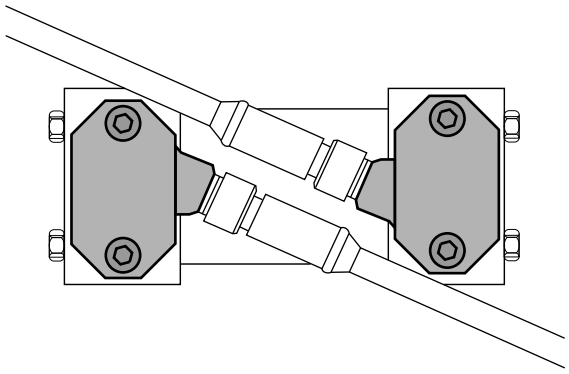


Dimensional Drawings

C2 LOW PROFILE



TYPICAL INSTALLATION



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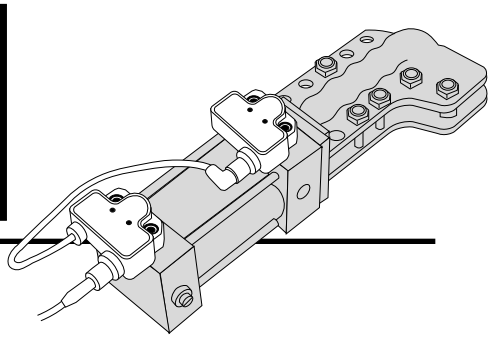
Weld Field Immune

Tandem Low Profile - Power Clamp Sensor Kit



Proximity Sensors

- **Cabling is Reduced 50%**
- **Cabling is Industry-Standard Micro Style**
- **Outputs Remain Independent - Power and Ground Connectors are Factory Interconnected**
- **Cable Terminations Reduced for Installer**
- **Cable Bundle Density Reduced**
- **Reduces Junction Box Size**
- **Reduces Fitting Size**
- **Reduces Panel Size**

The new Namco LP2™ Tandem Low Profile Power Clamp Sensor Kit is an adaptation of our successful Low Profile Cylindicator® sensor.

This new version reduces the cabling necessary by 50% when two sensors are required on an air or hydraulic cylinder.

The system consists of a new Low Profile Cylindicator sensor specially constructed as a common wiring point. Cabling is brought to the Master unit, then the built-in cable from the Master unit is connected to a standard Low Profile Cylindicator sensor. This eliminates 50% of the wiring density and labor required as compared to "conventional" practices.

The LP2™ sensor kit is the most cost effective, highest reliability solution for reducing sensor wiring complexity and cost in power clamp applications.

Applications:

Patented Weld Field Immune circuitry permits application within one inch of resistance welder tips carrying 20,000 Amperes. This system is ideal for end-of-stroke detection on hydraulic or pneumatic clamping cylinders in automotive assembly, metal fabricating, and general automated welding applications.

Cylindicator is a registered trademark of Namco Controls Corporation.

LP2 is a trademark of Namco Controls Corporation.

Ordering Information

Description	Part No.	Part No.
	2-wire AC/DC	**3-wire DC**
Standard LP2 Kit, 1.025" Probe	**EE270-20420**	**EE280-20446**
Kit includes:		
1 Master Low Profile Cylindicator® Sensor with "pigtail" interconnect	**EE270-20421**	**EE280-20447**
1 Standard Low Profile Cylindicator® Sensor	**EE230-20420**	**EE210-20444**

Protected by the NAMCO Lifetime Replacement Program

Specifications

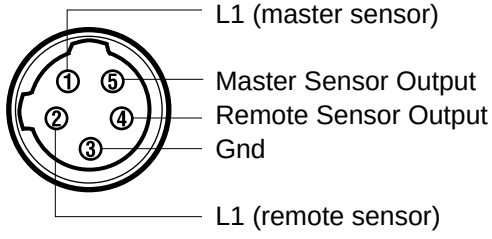
LP2 POWER CLAMP SENSOR KIT		
Supply Voltage	10-30V DC	20-230V AC/DC
Voltage drop	≤2.5V @ 200mA ≤2.0V@≤100mA	≤10V
Max. Load Current @ 25°C	200mA	500mA
Inrush Current (rms 1Hz)	—	3A
Leakage Current	10µA	1.7mA
Response Time	30ms	
Power-up Time	35ms to 45ms	
Max. Switching Frequency	15 Hz	
Ambient Temp. Range	-20°C to 70°C	
Max. Continuous Pressure	1500 PSI	

LED Functions				
	10-30V DC		20-230V AC/DC	
	Green	Amber	Red	Green
Power Off	Off	Off	Off	Off
Power On Load De-energized	On	Off	On	Off
Power On Load Energized	On	On	Off	On
*SCP Mode Activated	Both Flashing		Both Flashing	

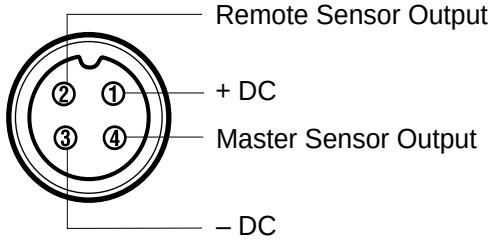
* Short Circuit Protection: If the sensor is shorted, the sensor's Short Circuit Protection (SCP) will be activated. When this occurs, both LED's will flash and the sensor will limit current flow to about 2.0mA.

Wiring Diagram

2WAC/DC

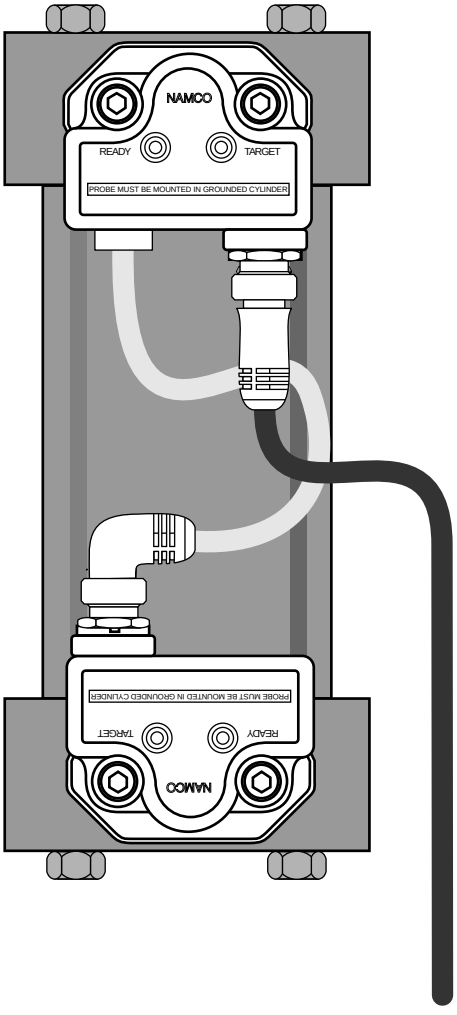


3WDC



Tandem Low Profile - Power Clamp Sensor Kit

EE270-2



Proximity Sensors

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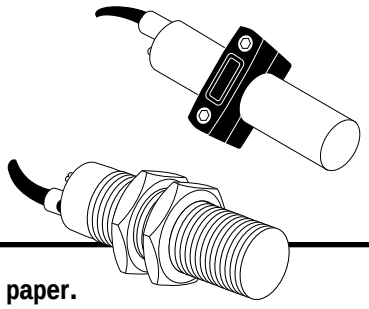
Capacitive Sensors

DC AC



For sensing metallic and non-metallic objects such as liquids, glass, plastic, powders, or paper.

0-70mm (Unshielded) and 3-10mm (Shielded) Adjustable Sensing Ranges

Connector Type	Circuit Description	Housing Material	Shielded Model No.	Unshielded Model No.	Maximum Load Current @ 140°F	Maximum Load Current @ 176°F	Leakage Current	Voltage Drop*	Maximum Switching Frequency	Short Circuit Protected
18mm Threaded Tubular 2-8mm Adjustable DC 10-55V										
6.6' Cable	3W, NPN, NO	Plastic	—	**ET710-33110**	200mA	100mA	<10µA	<2.5 VDC	300Hz	yes
6.6' Cable	3W, PNP, NO	Plastic	—	**ET711-33110**	200mA	100mA	<10µA	<2.5 VDC	300Hz	yes
18mm Threaded Tubular 2-8mm Adjustable AC 20-250V										
6.6' Cable	2W, AC, NO	Plastic	—	**ET720-33410**	200mA	100mA	<2mA @250VAC	<8 VAC	15Hz	no
30mm Threaded Tubular 5-15mm Adjustable DC 10-55V										
6.6' Cable	3W, NPN, NO	Metal	**ET710-42110**	—	200mA	100mA	<10µA	<2.5 VDC	100Hz	yes
6.6' Cable	3W, PNP, NO	Metal	**ET711-42110**	—	200mA	100mA	<10µA	<2.5 VDC	100Hz	yes
30mm Threaded Tubular 5-15mm Adjustable AC 20-250V										
6.6' Cable	2W, AC, NO	Metal	**ET720-42410**	—	200mA	100mA	<2mA @250VAC	<8 VAC	15Hz	no
30mm Threaded Tubular 8-20mm Adjustable DC 10-55V										
6.6' Cable	3W, NPN, NO	Metal	—	**ET710-43110**	200mA	100mA	<10µA	<2.5 VDC	100Hz	yes
6.6' Cable	3W, PNP, NO	Metal	—	**ET711-43110**	200mA	100mA	<10µA	<2.5 VDC	100Hz	yes
6.6' Cable	3W, NPN, NO	Plastic	—	**ET710-53110**	200mA	100mA	<10µA	<2.5 VDC	100Hz	yes
6.6' Cable	3W, PNP, NO	Plastic	—	**ET711-53110**	200mA	100mA	<10µA	<2.5 VDC	100Hz	yes
30mm Threaded Tubular 8-20mm Adjustable AC 20-250V										
6.6' Cable	2W, AC, NO	Metal	—	**ET720-43410**	200mA	100mA	<2mA @250VAC	<8 VAC	15Hz	no
6.6' Cable	2W, AC, NO	Plastic	—	**ET720-53410**	200mA	100mA	<2mA @250VAC	<8 VAC	15Hz	no
34mm Smooth Tubular 0-20mm Adjustable DC 10-55V										
6.6' Cable	3W, NPN, NO	Plastic	**ET710-82110**	**ET710-83110**	200mA	100mA	<10µA	<3 VDC	100Hz	yes
6.6' Cable	3W, PNP, NO	Plastic	—	**ET711-83110**	200mA	100mA	<10µA	<3 VDC	100Hz	yes
34mm Smooth Tubular 0-20mm Adjustable AC 20-250V										
6.6' Cable	2W, AC, NO	Plastic	—	**ET720-83410**	200mA	100mA	<2mA @250VAC	<8 VAC	15Hz	no

* Across conducting sensor

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

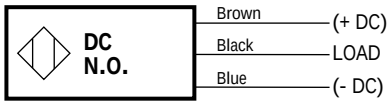
Common Sensor Characteristics

CAPACITIVE SENSORS	
Shielded Sensing Range	3-10mm
Unshielded Sensing Range	0-70mm
Standard Target (mm) (mild steel)	24x24x1 (2-8 Unshielded Range) 45x45x1 (3-10mm Shielded Range) 60x60x1 (0-20mm Unshielded Range) 210x210x1 (20-70mm Unshielded Range)
Repeatability	±5%
Hysteresis	3-20%
Temperature Drift (max.)	± 20%
Ambient Temperature Range	-13°F to +176°F (18mm & 34mm) -13°F to +140°F (30mm & Flat Pack)
Reverse Polarity Protected	yes
Current Consumption	18mm & 34mm DC: <7mA 30mm & 34mm AC: <2mA 30mm & Flat Pack DC: <10mA
NEMA Enclosure Type	Metal: 1, 12, 13 Plastic: 1, 4, indoor, 12, 13
LED Indicator	red = target
Metal Housings	Chrome Plated Brass
Plastic Housings	Ultradur®
Shipping Weight	18mm: 8 oz. 30mm: 10 oz. 34mm: 11 oz. (Add 5 oz. for 6' Cable)

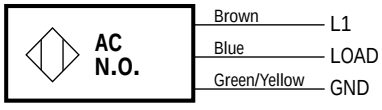
Circuit Drawings

CABLE MODELS

3 Wire DC N.O.



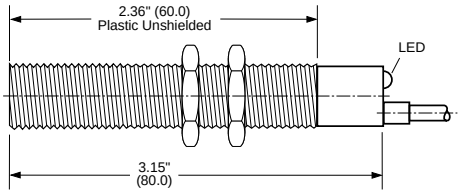
2 Wire AC N.O.



Dimensional Drawings

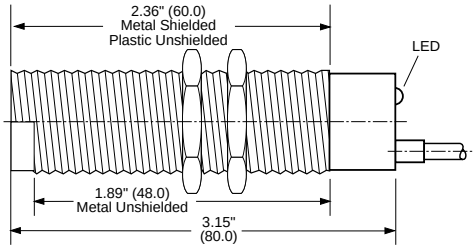
18mm MODELS

Body threads = M18x1

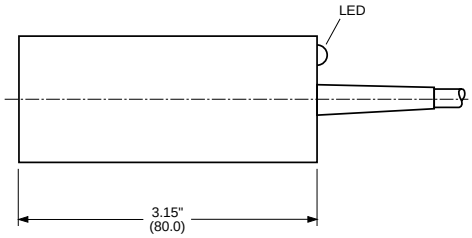


30mm MODELS

Body threads = M30x1.5



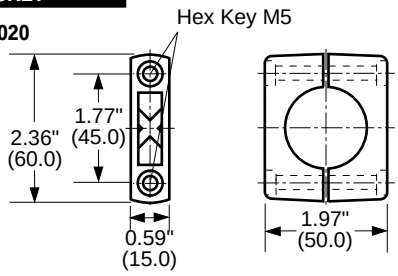
34mm MODELS



MOUNTING BRACKET

Part No. ET018-20020

Included with sensors



Proximity Sensors

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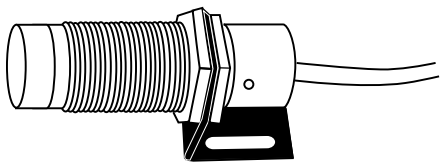
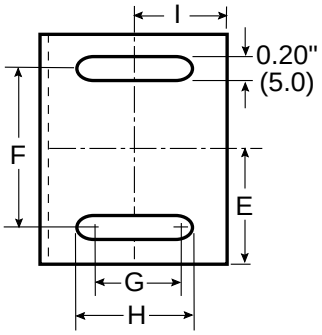
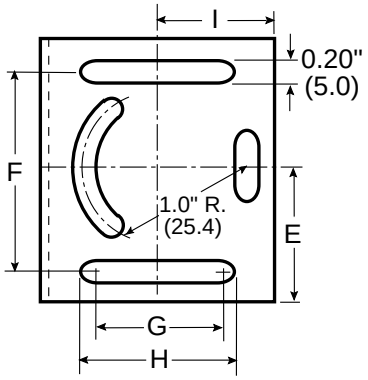
Proximity Sensor Accessories



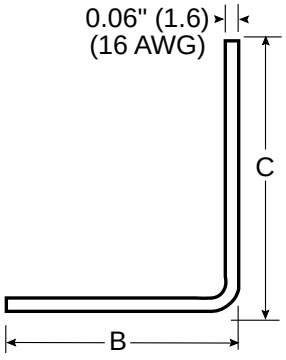
12-47mm TUBULAR MOUNTING BRACKETS

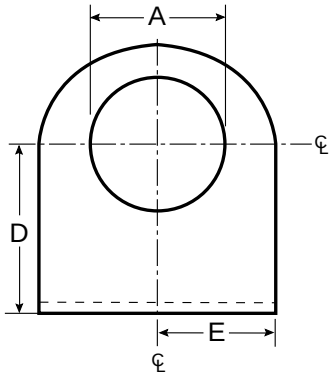


12-30mm Base



47mm Base





12-47mm Side and Front

Model No.	Sensor Diameter	Hole Diameter A	Depth B	Height C	Height to Center D	Width to Center E	Slot Centers F	Drill Centers G	Slot Length H	Depth Center I	Material
EE972-01803	8mm	0.38" (9.6)	1.00" (25.4)	1.25" (31.8)	0.75" (19.1)	0.50" (12.7)	0.51" (13.0)	0.36" (9.1)	0.56" (14.2)	0.50" (12.7)	C. F. Steel
EE972-01804	12mm	0.50" (12.7)	1.00" (25.4)	1.25" (31.8)	0.75" (19.1)	0.50" (12.7)	0.51" (13.0)	0.36" (9.1)	0.56" (14.2)	0.50" (12.7)	C. F. Steel
EE972-01835	18mm	0.76" (19.5)	1.00" (25.4)	1.51" (38.2)	0.88" (22.3)	0.63" (15.8)	0.80" (20.3)	0.46" (11.6)	0.66" (16.7)	0.56" (14.2)	C. F. Steel
EE972-01807	30mm	1.25" (31.8)	1.50" (38.1)	1.92" (48.6)	1.09" (27.6)	0.83" (20.9)	1.16" (29.3)	0.80" (20.3)	1.00" (25.4)	0.75" (19.0)	C. F. Steel
EE972-02001	47mm	1.86" (47.2)	1.50" (38.1)	2.84" (72.0)	1.59" (40.3)	1.25" (31.8)	2.00" (50.8)	0.80" (20.3)	1.00" (25.4)	0.75" (19.0)	C. F. Steel

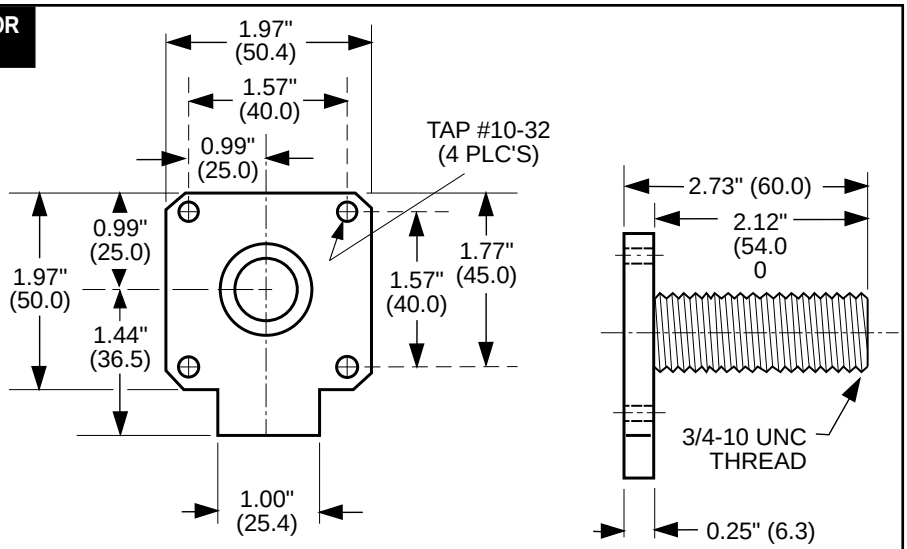
25mm ADJUSTABLE EXTENDED RANGE SENSOR MOUNTING BRACKET KIT

Part No. EE972-01860

Allows 25mm Proximity Sensors to be adjusted similarly to a standard tubular sensor. Kit includes (4) #10-32 socket head cap screws and (2) hex jam nuts.

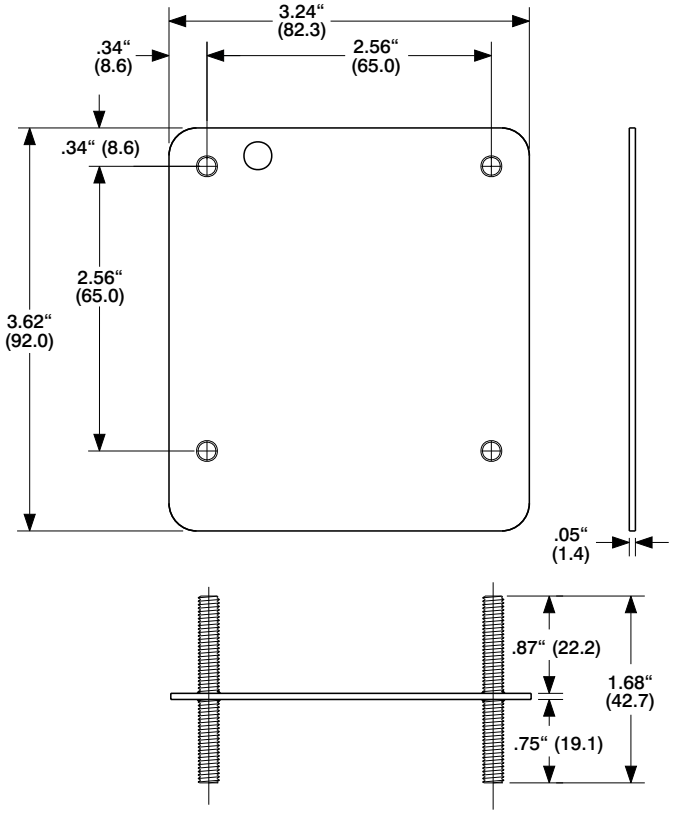
Part No. EE972-01861

Bracket only.



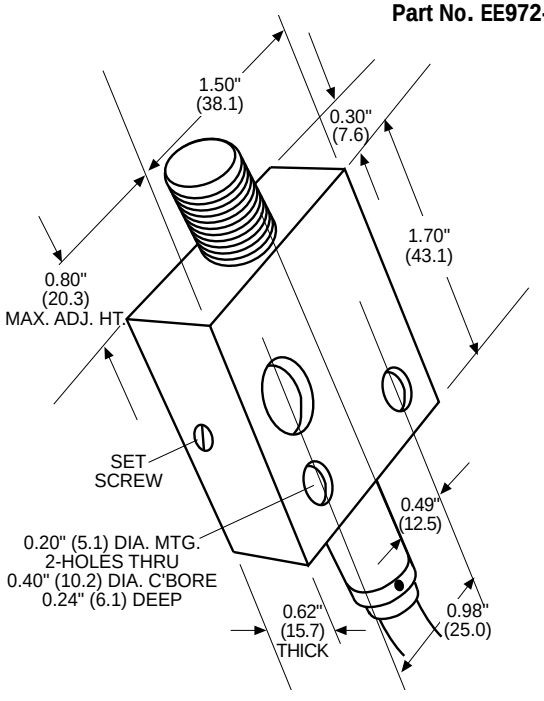
40mm FLATPAK BRACKET

Part No. EE972-01859



12mm TUBULAR BRACKET

Part No. EE972-01834



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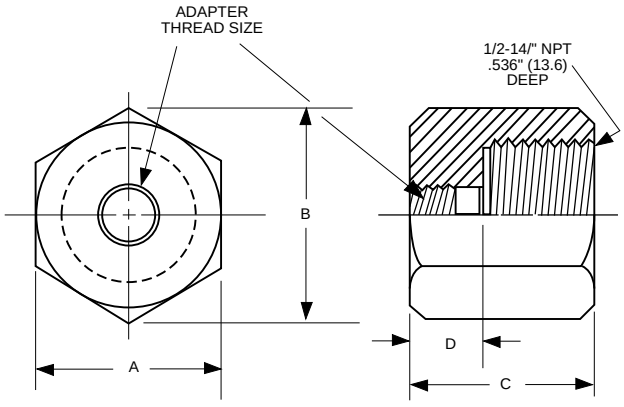
Proximity Sensor Accessories

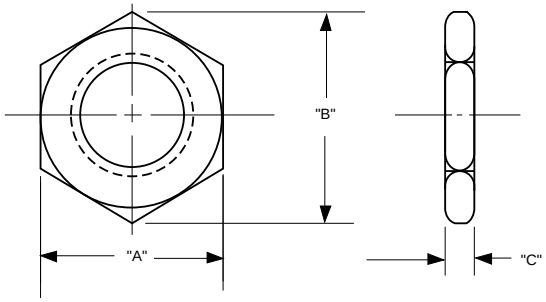
CONDUIT ADAPTERS



Adapter Thread Size (mm)	HEX SIZE				Model No.
	Flats	Corners	Length	Depth	
	A	B	C	D	
8	1.00" (25.4)	1.15" (29.2)	1.00" (25.4)	0.25" (6.3)	**EE014-20009**
12	1.00" (25.4)	1.15" (29.2)	1.50" (38.1)	0.25" (6.3)	**EE014-20010**
18	1.00" (25.4)	1.15" (29.2)	2.00" (50.8)	0.25" (6.3)	**EE014-20011**
30	1.50" (38.1)	1.73" (43.9)	2.25" (57.1)	0.38" (9.6)	**EE014-20012**
47	2.00" (50.8)	2.31" (58.7)	2.50" (63.5)	0.38" (9.6)	**EE014-20013**

Material: Aluminum 2024
Stainless Steel version available on special order.
Consult factory.

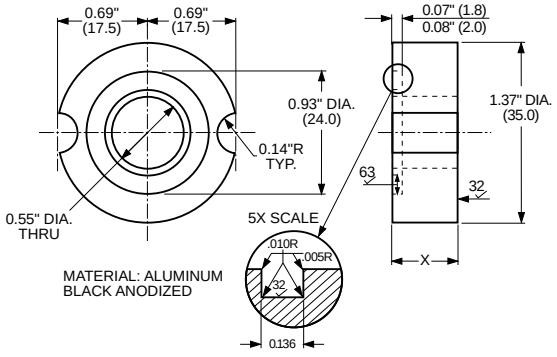
MOUNTING NUTS



	Mounting Nuts					Lock Washer
	Dimensions			Model No.		
I.D.	A	B	C	Metal	Plastic	Black, Serrated
3/4-20	1.06" (26.9)	1.22" (30.9)	0.16" (4.1)	**EE154-80001***	–	–
8mm	0.51" (13.0)	0.58" (14.7)	0.16" (4.1)	**EE013-80011**	**EE013-80000**	–
12mm	0.67" (17.0)	0.77" (19.5)	0.22" (5.6)	**EE013-80003**	**EE013-81003**	**EE100-00139**
18mm	0.94" (23.8)	1.06" (26.9)	0.16" (4.1)	**EE013-80002***	**EE013-81002**	**EE100-00137**
30mm	1.44" (36.6)	1.66" (42.2)	0.19" (4.8)	**EE013-80001***	**EE013-81001**	**EE100-00138**
47mm	2.00" (50.8)	2.20" (55.9)	0.20" (5.1)	**EE013-80004**	–	–

**Quantity one (1) per package; all others are shipped two (2) per package.*

CYLINDICATOR® SENSOR SPACER KITS



Kits include two mounting bolts and O-Ring. Replacement O-Ring is EE972-19306 (Equivalent to Parker # 2-116V709-90). Specify spacer height.

NOTE: Please consult factory before using spacer kits with LPR Cylindicator® sensors.

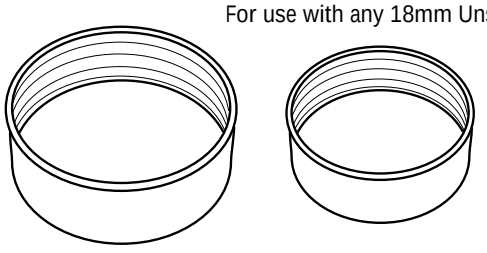
Dimension "X"	Model No.
0.19"	**EE972-01827**
0.25"	**EE972-01822**
0.31"	**EE972-01829**
0.38"	**EE972-01831**
0.50"	**EE972-01820**

TEFLON® CAPS

Repel weld slag; increase sensor life.

Part No. EE505-60002
For use with any 18mm Shielded Sensor

Part No. EE505-60004
For use with any 18mm Unshielded Sensor

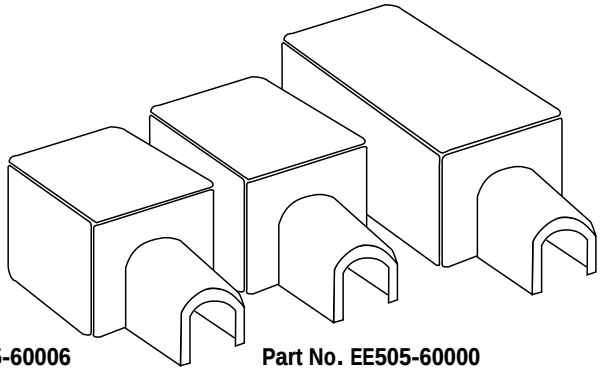


Part No. EE505-60003
For use with any 30mm Shielded Sensor

Part No. EE505-60005
For use with any 30mm Unshielded Sensor

WELD-SPLATTER RESISTANT COVERS

Part No. EE505-60001
For use with EE500-1 Rotatable Rectangular Sensors



Part No. EE505-60006
For use with EE500-9 HammerHead Sensors

Part No. EE505-60000
For use with EE500-8 25mm Extended Range Sensors

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Buying the Proper Proximity Sensor

Not All Proximity Sensors Are Created Equal…

Namco makes two grades of proximity sensors:

- Tough - Our “Standard Industrial Grade” line
- Incredibly Tough - Our WFI Automotive-Grade Line

Most industrial applications require a pretty rugged sensor; for example, a packaging machine or material handling application. For these jobs, Namco’s Standard Industrial Grade products are well-suited. However, there are some applications where nothing but the most durable will do. For example, if you have lots of welding activity nearby, both physical and electronic characteristics must be upgraded.

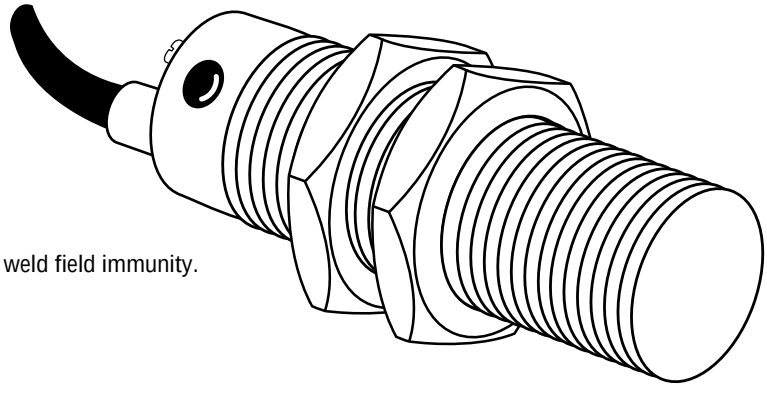
To make sure you match your sensor selection to your application, call 1-800-NAMTECH.

Namco Standard Industrial Grade Sensor

Liquid polyurethane used as encapsulant.

Single LED - on with target present.

Thermoplastic sensing face.



Value priced.

No weld field immunity.

Housings of either thermoplastic or chrome plated brass.

Current-limit type short circuit protection on some models (as indicated in selector chart).

Protected by the NAMCO Lifetime Replacement Program

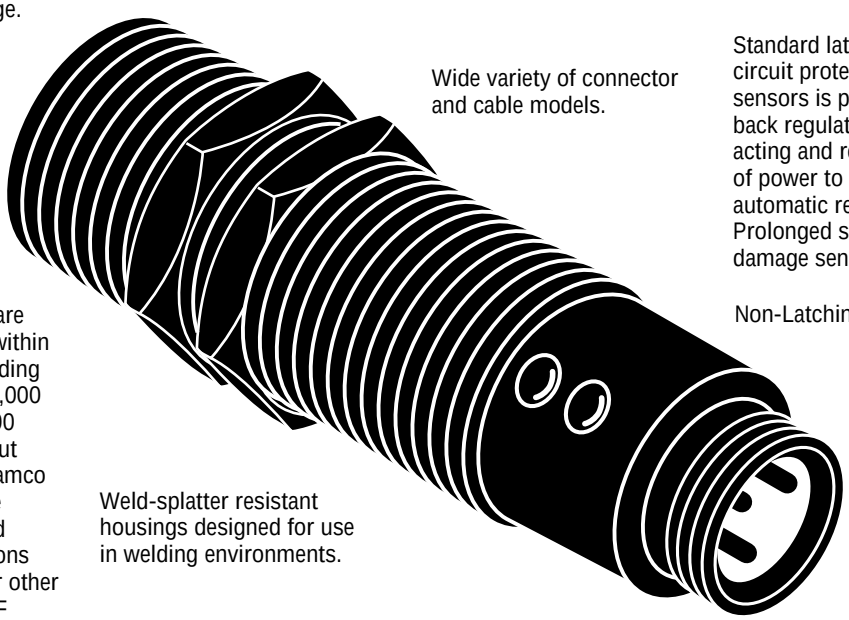
Namco Weld Field Immune (WFI) Sensor

Circuitry to accept a broad range of input voltages. Predictable, consistent electrical performance independent of input impedance and voltage.

Housing must withstand 300 pound step test and/or 250 pound cantilevered load test per UL 508.

Special epoxy encapsulants are mechanically strong while maintaining electrical insulative properties.

Meets UL 508 requirements. Connectors, cables, and sensor tested for strength, flammability, insulation, torque, and pull out.



Wide variety of connector and cable models.

Standard latching short circuit protection in Namco sensors is patented fold-back regulator type; fast-acting and requires removal of power to prevent automatic restart. Prolonged shorts will not damage sensor electronics.

Non-Latching.

Namco WFI sensors are designed to operate within 1" of a resistance welding electrode carrying 20,000 Amperes RMS (45,000 Amperes peak) without changing state. All Namco WFI sensors pass the NEMA noise tests and exhibit no false turn-ons from walkie-talkies or other in-plant sources of RF Noise.

Weld-splatter resistant housings designed for use in welding environments.

Every Namco WFI sensor:
1) goes through 52 automatic testing steps;
2) is thermocycled between -20°C to + 70°C;
3) is 100% functionally tested.

Two LED's: Green for "target sensed" and red for "power available" (AC/DC versions); Green for "power available" and amber for "target sensed" (DC versions).

Molded thermoset plastics for rectangular and extended range, hard coat for tubulars.

Protected by the NAMCO Lifetime Replacement Program

NAMCO

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Proximity Sensors

Principles of Operation

Inductive

Proximity sensors are generally constructed with four main elements: (1) a coil and ferrite core assembly; (2) an oscillator; (3) a convertor/trigger circuit (detector) and; (4) an output device.

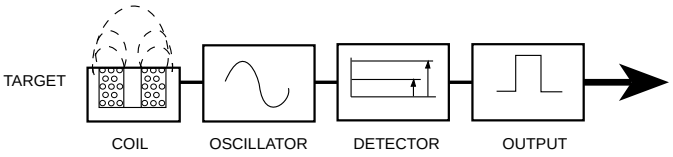

Figure 1

The oscillator creates a radio frequency field that is shaped and defined by the coil and core. As a target is placed in this field, eddy currents are set up in the surface of the target. The oscillator, being a limited power device, will lower its amplitude as the eddy currents are produced. The convertor/trigger circuit rectifies the AC sine wave signal to DC, compares the level against a preset reference, and actuates the sensor output if a target is present. Switching is clean, with none of the bounce of mechanical switches.

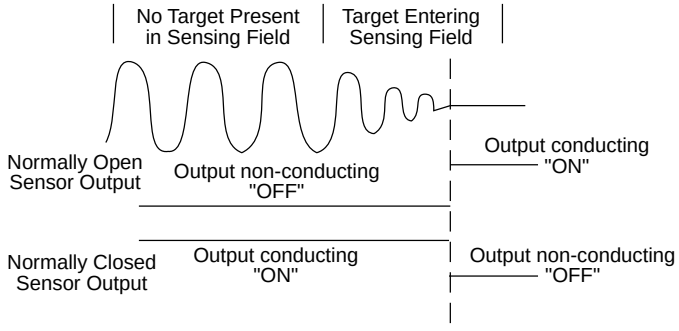

Figure 2

Capacitive

Essentially similar except that the coil is replaced by a sensing plate, and the oscillator is not running until the object to be detected is within range.

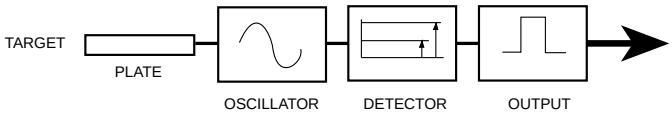

Figure 3

Capacitive sensors depend on the coupling between the sensing plate and earth ground. If a target is placed within range, the capacitance level will vary depending on target density, conductivity, and relative humidity. If the adjustment potentiometer is correctly set, the oscillator will be turned on when a target is within range.

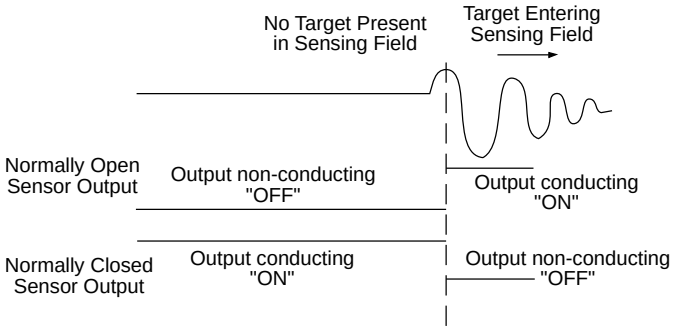

Figure 4

Important Note: Never use a metal body capacitive sensor in wet environments. Moisture between the sensing plate and the metal body will cause the sensor to “lock on.” For wet environments, always use a plastic bodied sensor.

Inductive Sensor Selection

1. Target Identification

This is the most critical step in proper application of inductive and capacitive sensors. Most application problems stem from improper selection of a sensor for a particular target. This usually comes from a desire to "standardize" a design. Generally the following rules apply to all inductive sensors:

The sensor face should equal or be smaller than the target surface area. All manufacturers calibrate the range of a particular sensor with a "standard target." This standard target is always larger than the diameter of the sensor face. Although it is possible to sense targets smaller than the sensor face diameter, rated range cannot be achieved using a target that is smaller than the sensor face. The following changes in the sensing range will occur if the dimensions of the target are larger or smaller than the standard target specified.

Target size in %	150	125	100 (Standard Target)	75	50	25	12.5
Deviation from Sn in %	+10	+7	0	-7	-14	-27	-45

Figure 5

2. Air Gap Determination

When examining your application, remember that most shielded inductive sensors (Fig. 6) will have a maximum range that is approximately one third of the diameter of the sensing face.

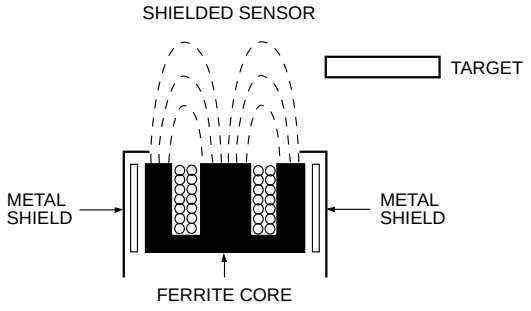

Figure 6

It is often necessary to allow a rather large air gap between the target and the sensor. When this is required, an unshielded sensor (Fig. 7) will be required. The unshielded sensor will generally have the plastic "nose" of the sensor projecting out of the metal barrel, or (plastic bodied types) it will not have a shielding ring around the core. These unshielded sensors will typically sense at ranges 3 to 50 percent greater than shielded types. A penalty is paid, however, as it is necessary to provide a metal-free area around the sensor that is much larger than the shielded types.

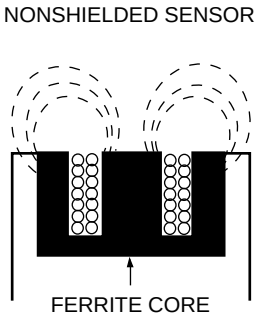

Figure 7

(See **3. Mounting Clearances**)

Positioning of the sensor should allow the target to penetrate approximately 30% into the field to allow for manufacturing tolerances, resistance to vibration, and inaccuracies that are common to all initial start-ups.

When determining the air gap (sensing distance) required, it should be noted that an inductive sensor will produce its rated range only against a standard target of mild steel. Other materials will reduce the sensing range (SN) as follows:

Mild Steel SN x 1.0
Aluminum Foil SN x 1.0
Stainless Steel SN x 0.85
Brass SN x 0.5
Copper SN x 0.46
Aluminum SN x 0.4

Continued on next page.

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Example: If a sensor with a 5mm sensing range is used to sense a standard target made of copper, the sensing range of the sensor is reduced as indicated below:

5mm (0.46) = 2.3mm (maximum)

When mounting a sensor it is always preferred to position the target so that it "slides by" the sensor face. This type of mounting will ensure that the sensor face is not damaged by contact with the target. If your application dictates a "head on" approach, it is essential that the target does not use the sensor face as a physical stop. Failure to provide clearance in either the slide-by or head-on modes will result in damage to the sensor and possible failure of the device.

Hysteresis (Fig. 8) must be allowed for as the target must move far enough away from the sensing field so that the sensor cannot detect it. If a target is placed within the hysteresis band, vibration of the target can cause the switch to turn on and off rapidly ("chatter"). All sensor manufacturers build in a certain amount of hysteresis to minimize chatter.

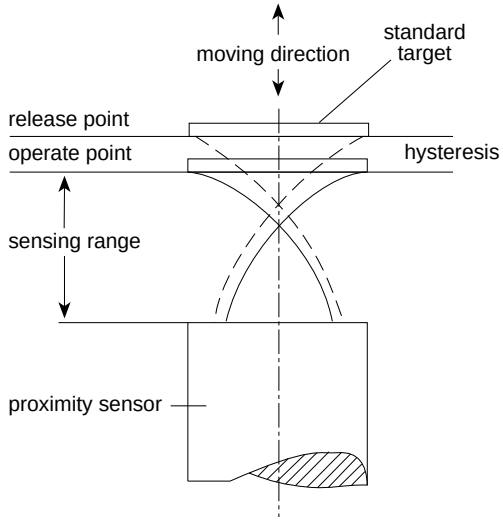
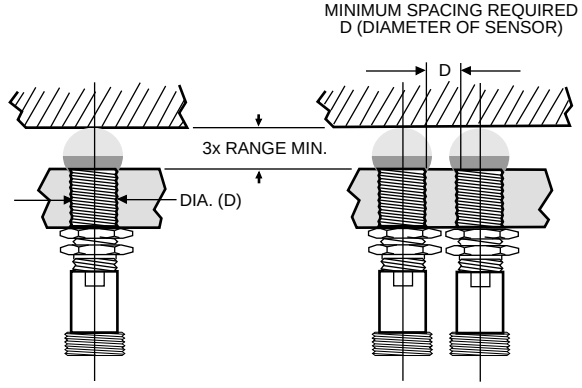


Figure 8

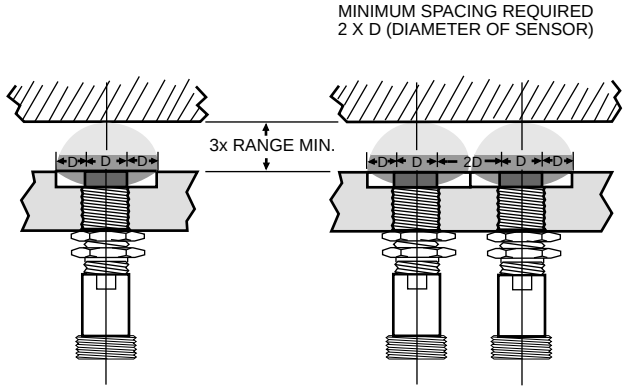
3. Mounting Clearances

Mounting of sensors should follow industry accepted practices as shown. Failure to properly position the sensor is the single largest cause of field problems.

SHIELDED SENSORS
(FLUSH MOUNTABLE)



UNSHIELDED SENSORS
REQUIRE METAL-FREE AREA



SENSORS MUST BE MOUNTED SUCH THAT SURROUNDING METAL IS NOT IN THE SENSING AREA.

OPPOSING SENSORS

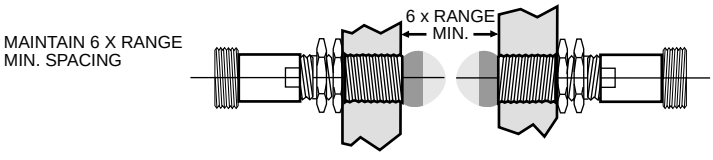


Figure 9

4. Housing Selection

After you have determined the target and air gap, it is then possible to select the style of housing for the application. Sensors are typically grouped according to range against a standard target. The most often used types are the metal barrel styles. These are great for general purpose uses but should not be used in areas where liquids are present. For wet environments, the all-plastic types are preferred. To determine your best specific type, consult the Enclosure Types below.

Various accessories are available for sealing, conduit, and mounting. Also, many sensors are available with quick disconnects. This is more expensive initially but can be justified if the sensor is placed on moving equipment where the cable is flexed often. The weak link then becomes the entry point of the cable to the housing. When failure occurs, it is necessary to replace the complete assembly because the cable failed. It's also easier to position the sensor mechanically, then complete the electrical wiring.

Industrial Control Equipment - UL 508
Table 6.1 – Enclosure Designations

Designation	Intended Use and Description	Designation	Intended Use and Description
1	Indoor use primarily to provide protection against contact with the enclosed equipment and against a limited amount of falling dirt.	**4X**	Either indoor or outdoor use to provide a degree of protection against falling rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure; resists corrosion.
2	Indoor use to provide a degree of protection against limited amounts of falling water and dirt.	**6**	Indoor or outdoor use to provide against the entry of water during temporary, limited submersion; undamaged by the formation of ice on the enclosure.
3	Outdoor use to provide a degree of protection against windblown dust and windblown rain; undamaged by the formation of ice on the enclosure.	**6P**	Indoor and outdoor use to provide a degree of protection against the entry of water during prolonged submersion at limited depths.
3R	Outdoor use to provide a degree of protection against falling rain; undamaged by the formation of ice on the enclosure.	**11**	Indoor use to provide by oil immersion a degree of protection of the enclosed equipment against the corrosion effects of corrosive liquids and gases.
3S	Outdoor use to provide a degree of protection against windblown dust, windblown rain, and sleet; external mechanisms remain operable while ice laden.	**12, 12K**	Indoor use to provide a degree of protection against dust, dirt, fiber flyings, dripping water, and external condensation of noncorrosive liquids.
4	Either indoor or outdoor use to provide a degree of protection against falling rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.	**13**	Indoor use to provide a degree of protection against lint, dust seepage, external condensation, and spraying of water, oil, and noncorrosive liquids.

Table 6.1 revised December 5, 1986

Continued on next page.

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Proximity Sensor Information

Electrical Considerations

Namco offers sensors that are suitable for direct connection to most common types of control systems. The most common types are listed below:

1. Relay Systems
2. Programmable Controllers
3.Custom Microprocessors
4. Output Devices (Solenoids)

When specifying a particular output type, at no time should the appropriate specifications of the particular sensor be exceeded or sensor failure may result.

A switch in a protective interlocking circuit should be used with at least one other device that will provide a redundant protective function, and the circuit should be so arranged that either device will interrupt the intended operation of the controlled equipment. (Proposed NEMA ICS 2-225.95 std.)

Namur Sensors

Namur refers to the standards committee of measurement and control of the chemical industry of Europe. Namco sensors comply with DIN 19234, and therefore are compatible with the Namur requirements.

This type of sensor contains only the “front end” of the typical proximity sensor coupled to an output transistor that will vary the current (not voltage) in proportion to the target distance (Fig. 10). This type of sensor is normally connected to an external amplifier which will provide the switch closure to an external control system. It is possible to interface these sensors to either custom external solid state relays or PLC (Programmable Logic Control) systems with the appropriate input card. When used with an approved intrinsically-safe control amplifier, Namur sensors can be used in hazardous areas. Please consult factory for application details.

When the target is not present, the sensor passes a small amount of current ($\geq$ 2.2mA). The current decreases in a non-linear fashion as the target enters the sensing field. This action is similar to a variable resistor. (See Figure 10.)

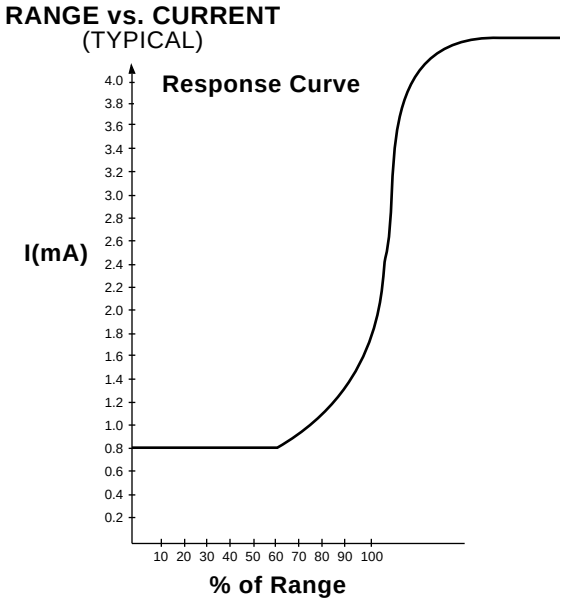
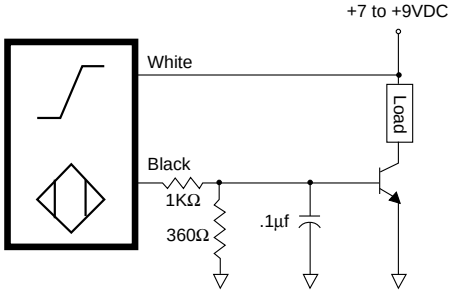
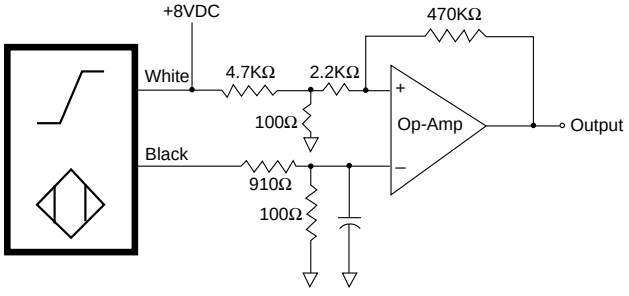


Figure 10

Suggested On/Off Output Circuits for NAMUR Sensors





DC Sensors

Available as either current sinking (NPN) or current sourcing (PNP), this type of sensor will provide the fastest output switching available.

The voltage range is typically 10-30 VDC with minimal drop across the output transistor for easy connection to programmable controllers. Most DC sensors include reverse polarity and short circuit protection as standard features.

Normally open output sensors are used in most applications. Normally closed output sensors can be made to order. Complimentary (one output "on," one output "off") output sensors (Fig. 11) can be used as a normally open and normally closed sensor at the same time. This convenient sensor can be used to replace a normally open sensor or a normally closed sensor. Simply hook up the desired output and either tape or cut off the load lead that is not being used.

NPN (SINKING) N.O. & N.C.

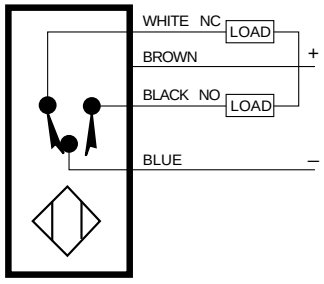


Figure 11

Dual output (NPN & PNP) sensors (Fig. 12) can have either output connected to a load, or each output connected to its own load, but not both to the same load. If the two outputs are each connected to separate loads as shown in Figure 12, the sum of the two load currents must not exceed the maximum load current of sensor (typically 200mA). This particular sensor output configuration is designed to minimize replacement inventories. It does not have complementary switching capabilities, i.e., both of the outputs switch either "on" or "off" at the same time.

NPN (SINKING) & PNP (SOURCING)

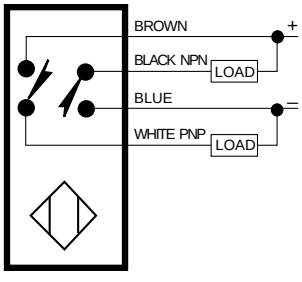


Figure 12

When connecting DC sensors to inductive loads, it is suggested that a diode be placed in the circuit to cancel any kickback that may damage the output of the sensor. (See Figure 13.)

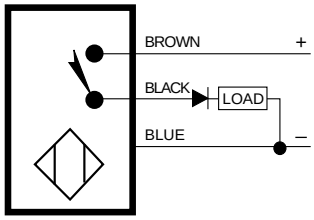


Figure 13

Series Connection:

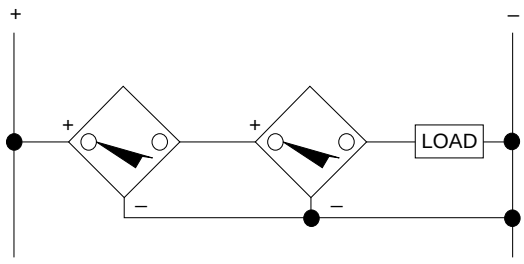
AND circuits can be made by series connection of normally open output sensors.

NAND circuits can be made by series connection of normally closed output sensors.

The maximum number of sensors that may be wired in series is equal to the lowest number of the following two equations:

$$\#\ \text{Sensors} = \frac{\text{Supply Voltage - Min. Operating Voltage of Load}}{\text{Voltage Drop Across Each Sensor}}$$

$$\#\ \text{Sensors} = \frac{\text{Max. Sensor Output Current - Load Current}}{\text{No Load Current of Sensor}}$$



PNP Output shown - for NPN Output reverse V_{supply} and sensor polarities.

Continued on next page.

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Proximity Sensors

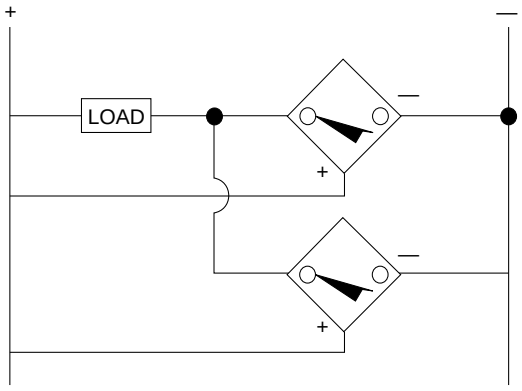
In a long series string, it is possible to exceed the current handling capacity of the last or first sensor due to the sensor current requirements plus the load. This problem can be circumvented by alternating types; i.e., PNP, NPN, PNP, etc. Wiring the sensors in this manner will allow an infinite number to be wired in series.

Parallel Connection:

OR circuits can be made by parallel connection of normally open output sensors.

NOR circuits can be made by parallel connection of normally closed output sensors.

The maximum number of sensors that may be wired in parallel is equal to the current capacity of the voltage supply used.



NPN Output shown - For PNP Output reverse V_{supply} and sensor polarities.

AC Sensors

AC sensors can also be connected to the same types of control systems as the DC types but are typically load powered. This configuration is a result of user demands for the high reliability of solid state sensors coupled to the requirement for minimal wiring.

In operation, the AC sensor will draw a small amount of current through the load with no target present. This current typically is less than 1.7mA allowing direct connection to programmable controller input cards with no shunt resistor required. This current must be allowed for when designing parallel logic circuits as the leakage currents may become large enough to actuate the load. This can be overcome by application of a properly sized shunt resistor.

Series Connection:

Note:

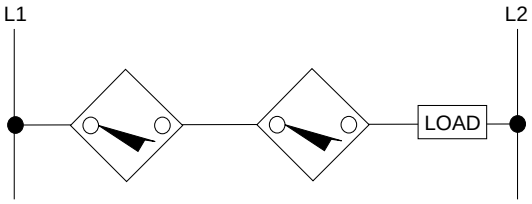
Connection of more than two AC sensors in series, is NOT recommended

AND circuits can be made by series connection of normally open output sensors.

NAND circuits can be made by series connection of normally closed output sensors.

The maximum number of sensors that may be wired in series:

$$\#\ \text{Sensors} = \frac{\text{Supply Voltage - Min. Operating Voltage of Load}}{\text{Voltage Drop Across Each Sensor}}$$



When a target is placed in the field and the sensor actuates, the amount of voltage available to the load will be reduced by approximately 8-10 volts. This value is critical in series circuits. Calculations for each series circuit must be made to ensure that enough voltage is available to actuate the load. The same problem exists when attempting to use a two-wire AC sensor at low AC voltages. For instance, if a 20-250 VAC sensor is used at 24VAC, the voltage available to the load will be between 14-18 VAC.

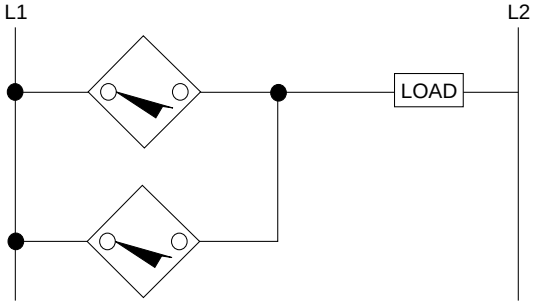
Parallel Connection:

OR circuits can be made by parallel connection of normally open output sensors.

NOR circuits can be made by parallel connection of normally closed output sensors.

The maximum number of sensors that may be wired in parallel is

$$\#\ \text{Sensors} = \frac{\text{Holding Current of Load}}{\text{Leakage Current of Each Sensor}}$$



All AC sensors have switching speeds that are much lower than their DC counterparts. Typical switching speeds are 20 to 30 Hz.

Short circuit protection is a feature of many types of Namco sensors. This internal circuit will protect the sensor if the load inrush current exceeds 3 amperes. In the event of a large inrush current, the sensor will trip into “short circuit” mode. On standard ET/ER series sensors the LED does not illuminate. On WFI sensors both LEDs will flash, and the output current will be limited to approximately 2.5 mA. To restore the sensor it is necessary to remove power for approximately one second. The sensor will not function in SCP mode.

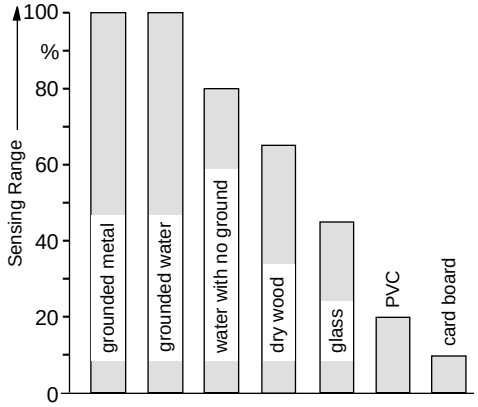
The short circuit protection feature is designed to protect the sensor and not the external circuit. The short circuit protection feature does not eliminate the need for branch circuit fusing.

Capacitive Sensors

Capacitive sensors are unique in that they will sense most materials including non-metallics. The actual sensing is performed by a circuit containing an oscillator, detector stage, and an output stage similar to the inductive type sensor. The differences are (1) the oscillator is not running when a target is not present, and (2) the sensing portion of the sensor is a special plate in the sensing surface of the sensor. This plate also has an opposing connection-to-earth ground through the detection circuit. When an object is placed near the sensing plate, the dielectric constant of the material will allow coupling from the sensing plate through the air-to-earth ground thus starting the oscillator. To provide adjustment for the various types of materials and their different dielectric constants, an adjustment potentiometer is typically provided.

This change in dielectric constant is a requirement for accurate sensing. If a material has a very low dielectric constant, the sensor must be in very close proximity to the material being sensed. Conversely, a material with a high dielectric constant can be sensed at a greater distance.

The diagram below shows the reduction created by different materials.



Materials with a high dielectric constant can be sensed through the walls of a container with a lower dielectric constant. Example: sensing water level in a boiler sight glass tube.

Application Cautions

1. The adjustment potentiometer is a non-linear device. Do not attempt to adjust the sensor beyond 2/3 of the maximum range obtained on a given material.

2. Never use a sensor with a metal housing in a damp environment. If the face of the metal housing sensor is splashed, the sensor will turn “On” and will not turn “Off” until the water is removed.

3. Because the capacitive sensor depends on coupling through the air, maximum range will be greater on hot, humid days. It may be possible to sense a particular material only on days when the humidity is high.

4. To determine if the material you wish to sense can be sensed reliably, Namco recommends actual testing. If this is not practical, consult our Applications Engineering Department.

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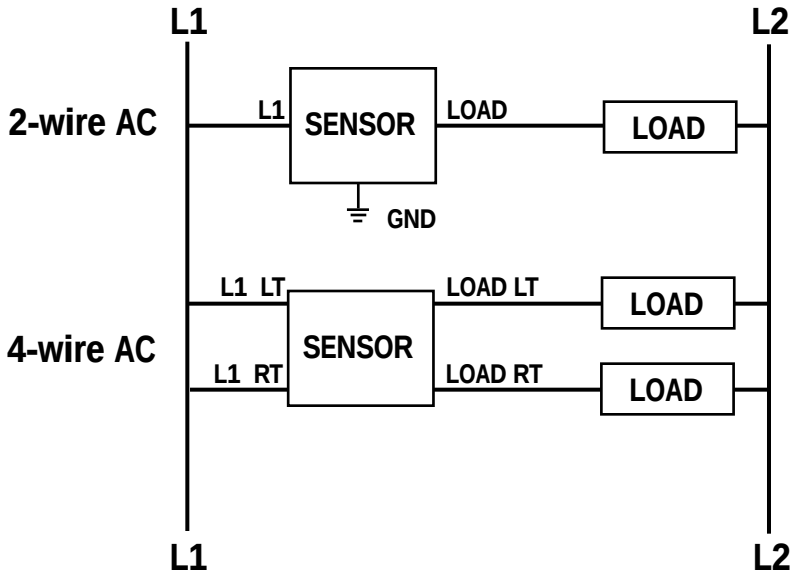
Typical Wiring Diagrams

Proximity Sensors

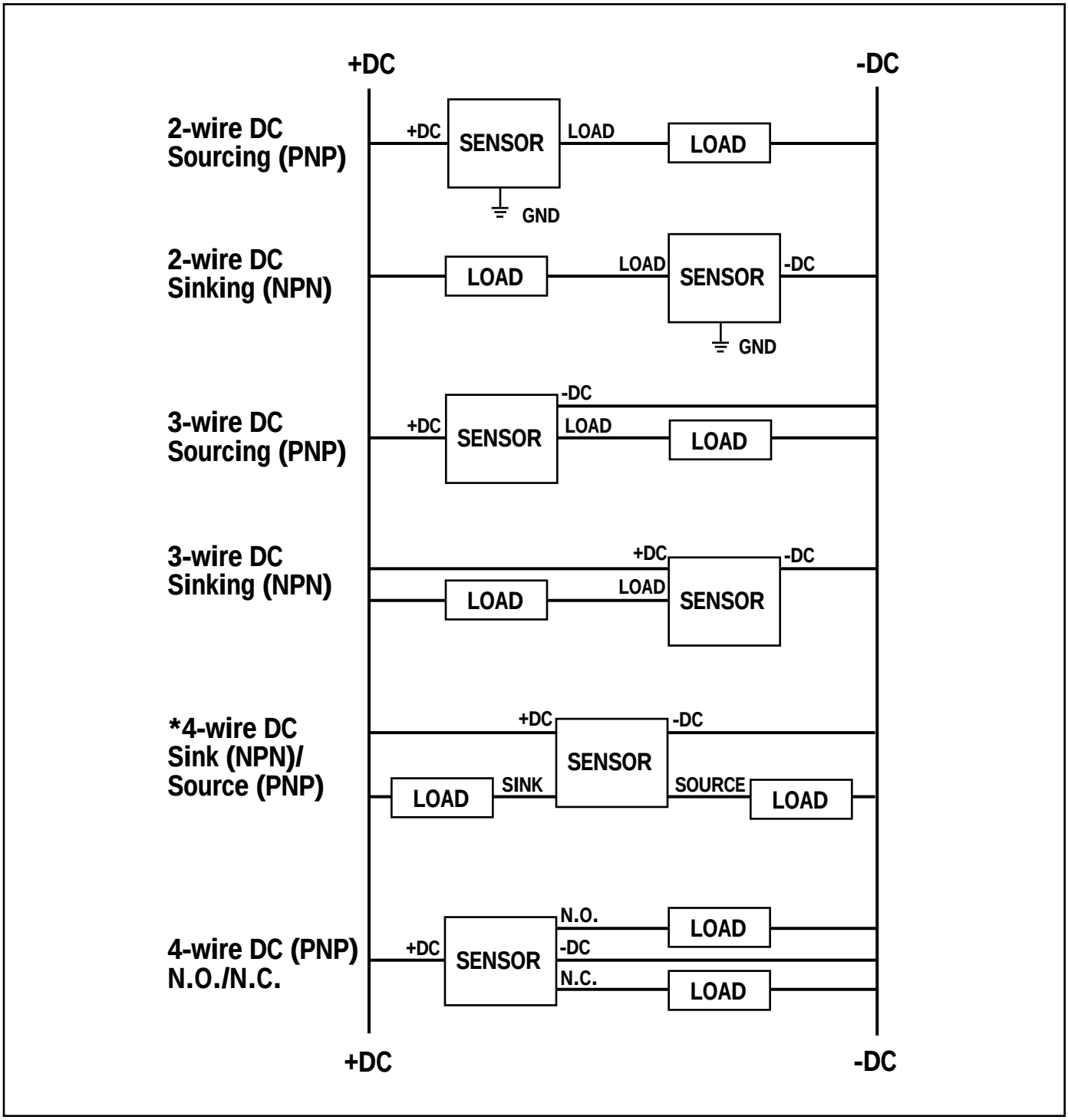
Notes:

1. These diagrams are valid for sensors with cables and connectors.
2. Sensors may or may not have ground connections or grounded housings. Refer to the specific connector or cable diagram for your particular sensor's model number to determine if it is grounded.
3. The markings on these wiring diagrams (L1, Load, etc.) are identical to those on the connector diagrams.
4. All switches are Normally Opened (N.O.) unless specifically marked Normally Closed (N.C.).
5. All switch outputs are Sourcing unless specifically marked Sink.

AC Wiring Diagrams



DC Wiring Diagrams



* Can be used as a single sink or source switch. When both outputs are used simultaneously, the sum of the load currents must not exceed maximum rating of sensor!

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Reference Information

Cylindicator® Sensor Design Guide

Cylindicator Sensor Installation

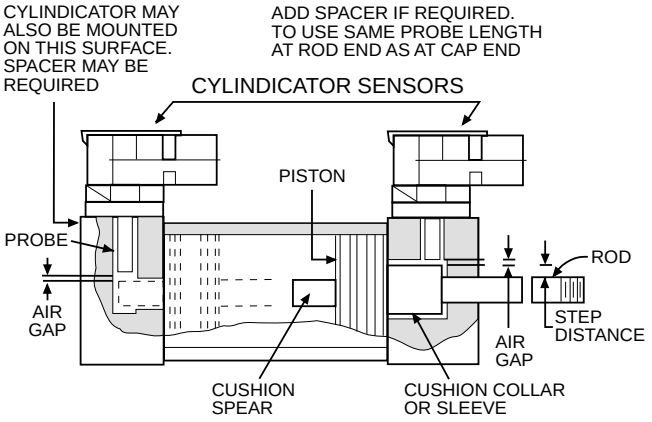


Figure 1

Proper operation of your Namco Cylindicator depends in large part on these factors:

Establishment of a proper air gap between the probe face and the target.

The air gap is the actual distance between the tip of the probe and the part of the piston which is the "target." The target can be the collar or cushion sleeve, cushion spear, or the end of the rod inside the cylinder. **This target must be close enough to actuate the Cylindicator Sensor but not so close as to actually contact the probe.**

Experience has shown an air gap of 0.025 inches to be optimum in most applications. The air gap should always be greater than 0.015 inches and less than 0.045 inches, including worst case tolerances. Gaps in excess of 0.045 inches are not recommended and could result in inconsistent operation.

Assuring a minimum "step distance" between the cushion collar and the piston rod.

Standard Namco Cylindicator Sensors have a nominal sensing range of 0.080 inches beyond the stated probe length. The minimum step distance (cushion to rod) must be greater than 0.095 inches to guarantee that the sensor will "drop out" when the target is no longer present. This minimum step distance accounts for mechanical tolerances, temperature effects, and hysteresis effects.

Sensing a known metallic target.

In all applications referred to in this publication, the target is assumed to be of a ferrous metal. Consult Namco if a different metal such as aluminum, brass, or stainless steel must be used as the sensing range is reduced.

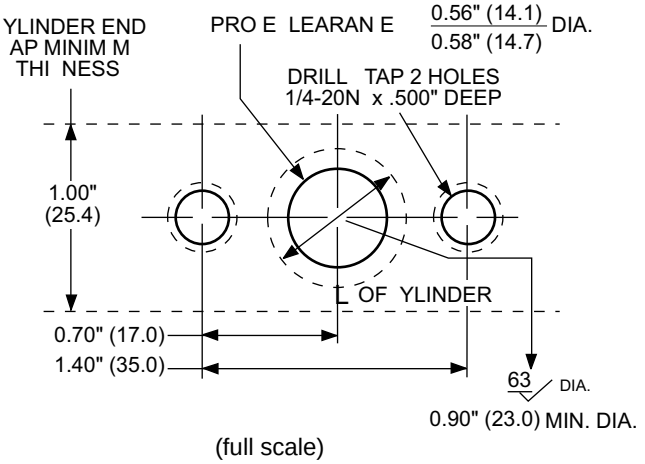
Mounting to a proper cylinder endcap.

The clearance hole for the sensing probe must be 0.560" diameter minimum/0.580" diameter maximum. The end block must be designed so that the probe tip is flush to 0.04" extended beyond surrounding metal within 0.5" of the probe side walls.

Other Tips:

- Never operate the cylinder at pressures which exceed the Cylindicator sensor's ratings.
- Do not exceed ambient temperature range.
- The Cylindicator Sensor must be positioned so that the target area (cushion spear, cushion collar, etc.) will completely cover the probe sensing face when the sensor is operated.
- Do not mount the Cylindicator Sensor on the bottom of the cylinder. Debris could accumulate around the probe which might cause damage or inconsistent operation.
- All Cylindicator Sensors are completely epoxy potted and as such contain no serviceable parts inside. Do not remove the cover or tamper with the cable or connector.
- Cylindicator Sensors must have the O-Ring probe seal that is supplied with each unit installed around the probe before mounting.
- **Do not attempt to modify the probe by cutting, grinding, filing, etc.**

Mounting Dimensions and Template



(full scale)

"Stroke To Go" vs. "Air Gap"

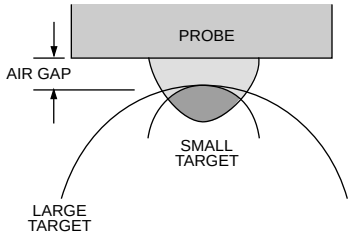
"Stroke To Go"

The amount of stroke remaining in the cylinder after the Cylindicator Sensor activates.

NOTE: If a cylinder is mechanically restrained from going full stroke — no target will be present for the switch to detect (no switch output).

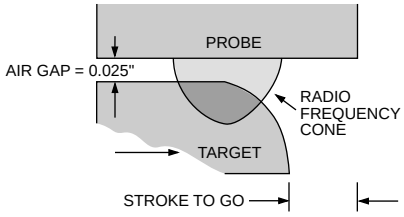
Target End View

Smaller diameter targets have less metal in the sensing field at a constant air gap. Loss of stroke-to-go is more pronounced on smaller bore cylinders as air gap increases.



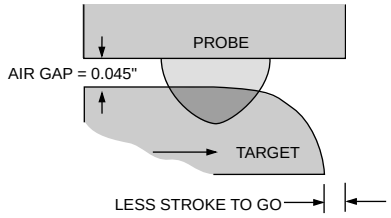
Switch Actuated

Recommended nominal air gap distance provides the stated maximum stroke to go.



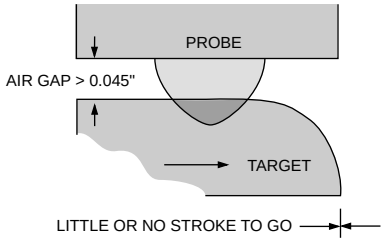
Switch Actuated

Variations from the recommended nominal air gap distance results in loss of stroke to go.



Switch Probably Not Actuated

Increased variations from the recommended nominal air gap distance results in little or no stroke to go and possible erratic operation.



**Loss of stated maximum stroke to go can prevent the proximity sensor from activating in plant equipment and tools with positive stops.*

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Reference Information

Capacitive Sensor Applications

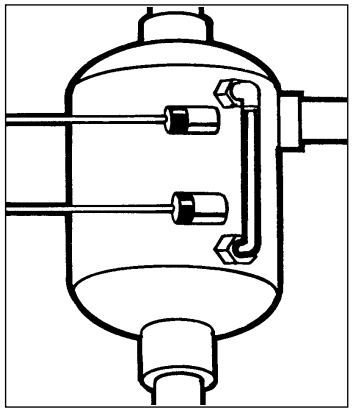
Namco offers a full line of capacitive sensors designed to sense non-metallic products. Capacitive proximity sensors can be adjusted so that they will ignore or “see through” an object in order to detect a second object behind it. As long as the object in the foreground is not metallic, the sensor will actually be able to sense products such as powders, granular material, and liquids even when they are hidden from view.

Capacitive sensors operate by detecting the change in capacitance between the capacitive sensor and the intended target. Capacitance is an electrical property between two separate materials, and its strength varies with distance and the properties of the materials. Namco's capacitive sensors have sensing ranges up to 70mm.

Namco capacitive proximity sensors are available in three housing styles and can detect many different liquid and solid materials including oil, water, soaps, beverages, chemicals, powders, and grains. Their versatility and range make them ideal for a variety of food industry applications. Detecting product level inside a hopper or storage tank is an easy task for the sensor as is sensing the contents of a sealed package to make sure it contains the proper amount of product. At the end of the production line Namco’s capacitive sensors can be used to make sure cases are full of packaged product and to detect shipping pallets for automatic case loading applications.

How do I control liquid level in a tank?

Use a sight glass and two capacitive proximity sensors. The sight glass can be clear glass or any non-metallic material like PVC. The sensors detect the high and low liquid level through the wall of the sight glass or pipe. Whether the liquid is clear or not does not affect sensing.



Should I use a capacitive sensor with a metal or plastic body?

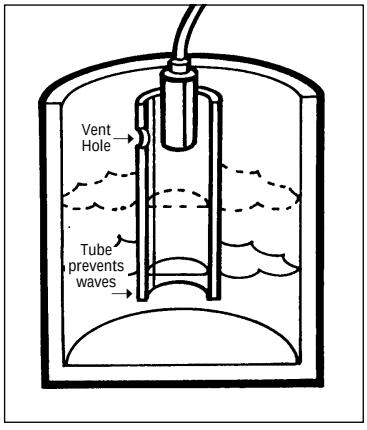
Generally, plastic body capacitive sensors are more suitable for applications where chemical or water resistance is desired. This would include food applications.

Metal body sensors are more appropriate where physical strength and rigidity are needed as well as in high vibration applications.

What if I have a metallic tank and no sight glass?

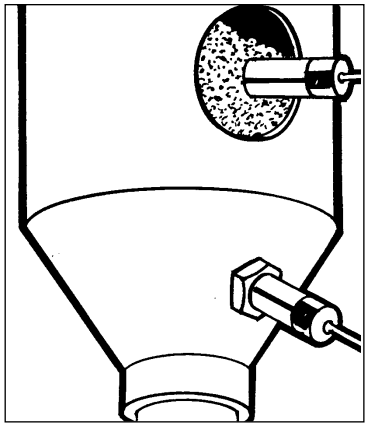
To sense liquid level in a metal tank, you’ll need two capacitive sensors and mounting wells which project through the tank walls. The wells allow the sensors to project far enough into the tank to avoid side sensing of the tank walls. (Capacitive sensors do sense metal as well as non-metallic objects.)

Another common "high-level" or "tank full" application technique involves mounting the sensor inside a tube to prevent splashing and "waves" from falsely tripping the sensor. This technique is also used when a hole or sight glass is not possible.



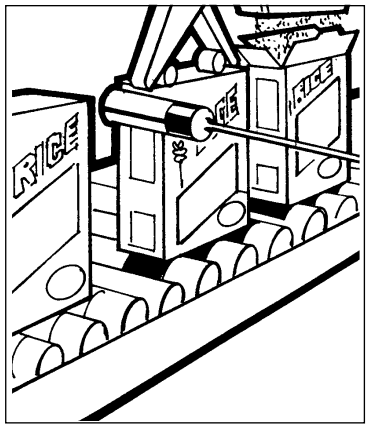
How can I sense dry bulk material in a hopper?

Again, you'll need two capacitive sensors--one for "high" level, one for "low" level. These can be mounted either of two ways: through a plastic window, or by mounting through the wall using the sensor's jam nuts.



Can sensors be used to insure my product is in its package?

Of course! Commonly found uses are for full-case detection as well as individual package checking. Detection is easy because the sensor "sees" through plastic, paper, or even cardboard boxes.



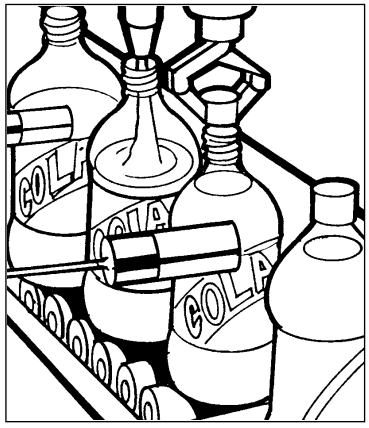
What about checking to make sure bottles have been filled?

Capacitive sensors have a number of uses in bottle filling and capping.

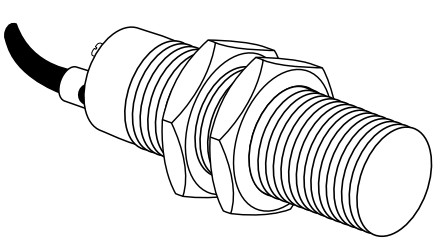
They can make sure empty bottles are continuously supplied to the filler. The line is shut down if there is no supply.

They can be used as a liquid level sensor to control the filling equipment.

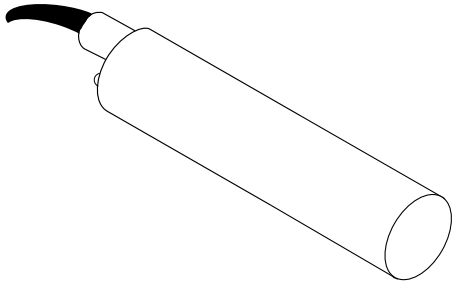
They can also be used to check that all containers have been capped.



Capacitive Proximity Sensors



Threaded Tubular Sensor



Smooth Tubular Sensor

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Glossary

Proximity Sensor Information

Axial Approach: The approach path of a target whose center is the same as the centerline of the sensing field.

Capacitive Sensor: A solid state switch which senses a changing dielectric mass. Usually adjustable and able to sense most materials.

Complementary Output: A form "C" type output (normally open and normally closed) which changes state simultaneously when the sensor is actuated.

Current Consumption (No Load Current): This is the current consumption of a proximity sensor when the output transistor is in the off state. It is indicated at the maximum voltage rate.

Current Sinking (NPN): A negative switching output in which the load current passes through the load first, then "sinks" through the sensor.

Current Sourcing (PNP): A positive switching output in which the current for the load is "sourced" through the sensor.

Differential: The difference between the operating point and the release point of a sensor.

Dwell Time: The minimum time needed for a particular target to be in the sensing field for the output to be energized or de-energized.

Eddy Currents: Small circular currents induced on the surface of a metallic target by an inductive sensor.

Hysteresis: The difference between the operating point and the release point of a sensor. (See Fig. 1)

Inductive Sensor: A solid state switch which emits a small directional radio frequency field. When a metallic target enters the field, eddy current losses are created thereby loading the oscillator. If this loading exceeds an internal setpoint, the output of the sensor is energized.

Interference Protection: All Namco proximity sensors feature an interference protection circuitry. This feature assures that voltage peaks or release interference caused by relays does not destroy the proximity sensor.

Leakage Current: The current which flows through the load when the sensor is non-energized. Also called burden or residual current.

LED: Namco proximity sensors feature a light emitting diode to indicate with a red LED that the sensor output is conducting. WFI proximity sensors have a red LED to show unit is powered up and a green LED to indicate target is present.

Maximum Load Current: This is the maximum load at which a proximity sensor may be operated continuously.

Minimum Load Current: The minimum current necessary to assure proper output operation.

Operate Point: The point at which a target is sensed. (See Fig. 1)

Release Point: The point at which the sensor returns to a non-energized state as the target leaves the sensing field. (See Fig. 1)

Repeatability: The relative variation in effective operating distance measured repeatedly over an established period of time during which environmental and electrical conditions, (i.e., applied voltage, temperature, relative humidity, mounting, etc.) are held constant.

Response Time: The time delay between when the target

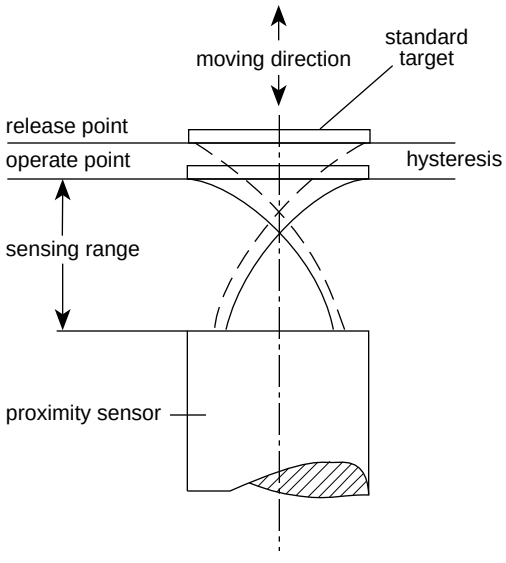

Figure 1

appears at the operate point and the output is energized.

Reverse Polarity Protection: Usually a diode inserted in one of the power leads of a D.C. Switch. This protects the internal circuitry if connections are accidentally reversed.

Sensing Range: The distance from the sensing face to a standard target at a specific temperature (usually 77°F). Most industrial type sensors usually will hold this range +/- 10% of rated sensing range. (See Fig. 1)

Shielded Sensor: A sensor which has a very directional sensing field. This allows the sensing face to be flush mounted in metal.

Short Circuit Protection (SCP): Internal circuitry which protects the sensor against accidental short circuits. SCP is not intended to protect other control circuit components or interconnecting wiring.

Standard Target: A mild steel plate 1mm thick, with sides equal to the diameter of the sensing face or 3 times rated sensing range, whichever is greater. (See Fig. 1)

Switching Frequency: The maximum speed at which a sensor will deliver discrete individual pulses as the target(s) enter and leave the sensing field. This value is always dependent on target size, distance from sensing face, speed of target and switch type. The catalog values given are obtained using a standard target.

Temperature Drift: The temperature drift indicates the change of the switching point caused by ambient temperature variations within the range of -13°F to +158°F. The temperature of the measuring plate does not influence the switching point. The switching point at -13°F to +158°F may vary up to 10% compared to the point measured at +68°F. (See Figure 2.)

Unshielded Sensor: A sensor which has an extended sensing range for its size. **Must not be flush mounted in metal unless a counterbore is cut such that the sensor is not influenced by the surrounding metal.**

Voltage Drop: The difference in voltage at the load measured with and without the sensor in a circuit. Must be taken into account when designing with any 2-wire device.

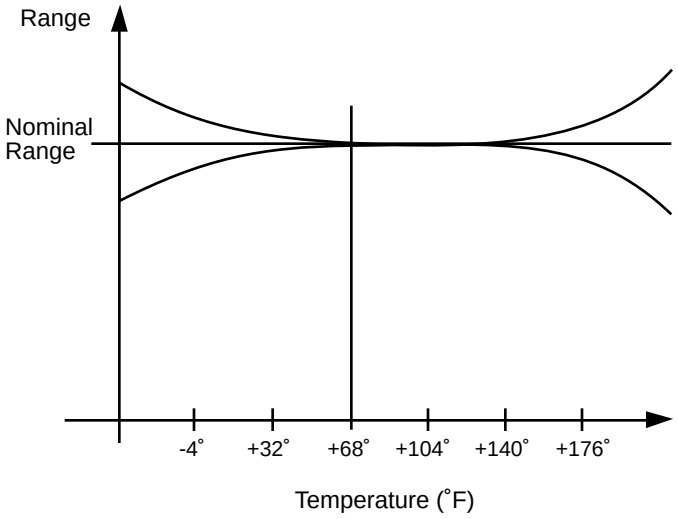

Figure 2

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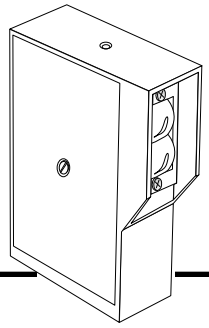
Heavy Duty Photoelectric Sensors Retro-Reflective



- **Non-Polarized**
- **Modulated LED**
- **Choice of Outputs**
- **Diecast Aluminum Housing Epoxy Coated**
- **Tri-Color LED Indicator**
- **Optional Plug-In Time Delays**
- **NEMA 3, 4, 12 & 13 Design**
- **-20°C to +70°C**

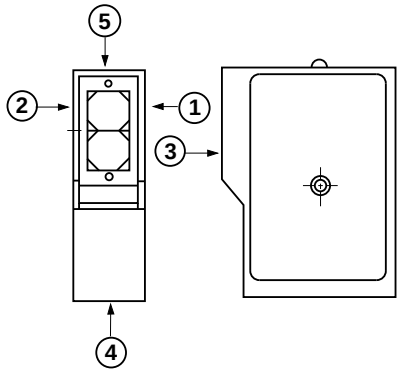
These beefed-up sensors are smart as well as tough. Die cast aluminum housings and totally sealed optics help make them ideal for severe environments. All models use a modulated infrared LED emitter and receiver to ignore ambient light. Plug-in time delay modules offer wide flexibility in application options.

Designed for harsh industrial environments, the EP100 Series is especially equipped to alert you to potential problems. When other sensors run into alignment or dirty optic problems, you don't know about it until they fail. The EP100 uses a unique "tri-color" LED to indicate impending problems. When the LED glows:

- Green — stable operation *>70% reflected signal strength*
- Yellow — marginal operation *40-70% reflected signal strength*
- Red — insufficient reflected signal

Target Repeatability

For best repeatability, it is recommended to have target travel in direction (1) or (2). Traveling toward lens (3) will result in slightly higher tolerance on switch point. It is not recommended to have target travel in direction (4) and (5).



Supply Voltage	Power Consumption	Output Circuit Type	Model No.	Output Rating	Response Time On/Off	Maximum Switching Frequency	Leakage Current
RELAY OUTPUTS							
120 VAC	1.0 VA	DPDT	**EP110-12001***	5A Resistive @ 250 VAC or 30 VDC	15mS/20ms	25 Hz	—
11-30 VDC	70 mA	DPDT	**EP110-15001**	5A Resistive @ 250 VAC or 30 VDC	15mS/20ms	25 Hz	—
TRANSISTOR OUTPUTS							
120 VAC	1.0 VA	NPN	**EP110-12201***	25 mA @ 40 VDC	2mS/2ms	250 Hz	—
11-30 VDC	70 mA	NPN	**EP110-15201**	25 mA @ 40 VDC	2mS/2ms	250 Hz	—

* UL Listed and CSA Approved

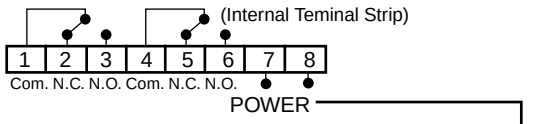
Common Sensor Characteristics

RETROREFLECTIVE HEAVY DUTY SENSORS	
Sensing Range	0-30 ft.*
Standard Retroreflector Target	4" x 4" square reflector
Lens	Glass
Light Source	Modulated Infrared LED
Light/Dark Operate — Selectable	yes
Optional Plug-in Timers	yes
NEMA Enclosure Types	3, 4, 12 & 13
Temperature Range	-20˚C to +70˚C
UL/CSA Certifications	yes
Sensitivity Adjustment	yes
Optic Heater	no
Cable Entry	1/2" - 14 NPT Conduit
Shipping Weight	18 oz.

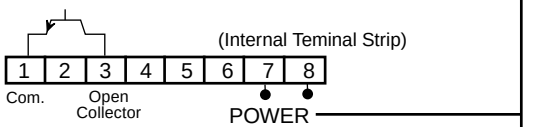
* Using EP175-13900, 4" x 4" square reflector

Circuit Drawings

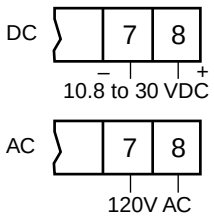
RELAY (DPDT) OUTPUTS



TRANSISTOR (NPN) OUTPUTS

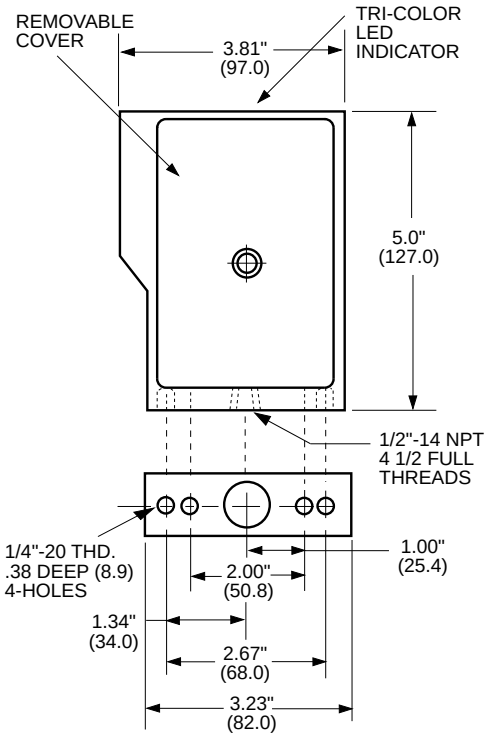


POWER INPUT:

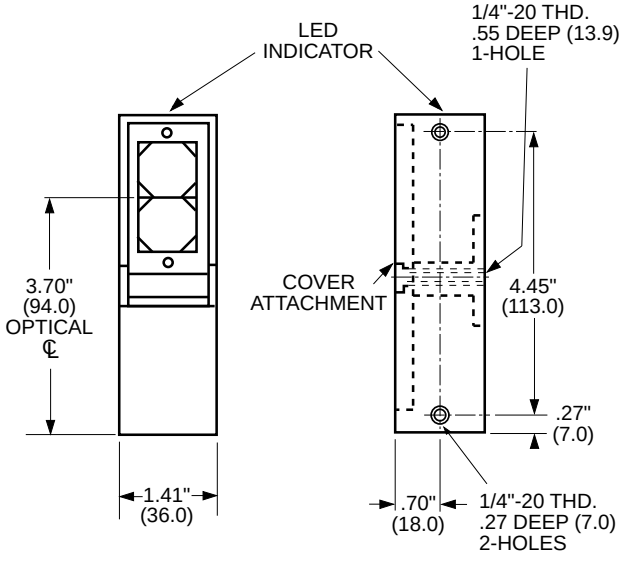


Dimensional Drawings

SIDE & BOTTOM VIEW



FRONT & REAR VIEW



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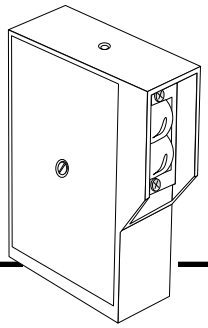
Heavy Duty Photoelectric Sensors

Diffuse Proximity



- **Modulated LED**
- **Choice of Outputs**
- **Diecast Aluminum Housing Epoxy Coated**
- **Tri-Color LED Indicator**
- **Optional Plug-In Time Delays**
- **NEMA 3, 4, 12 & 13 Design**
- **-20°C to +70°C**

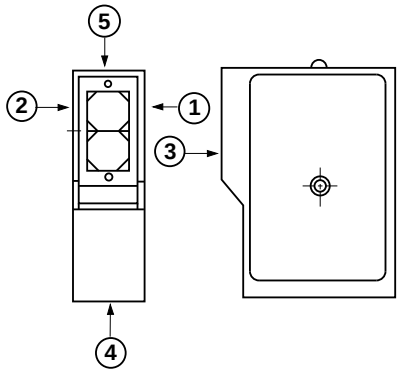
These beefed-up sensors are smart as well as tough. Die cast aluminum housings and totally sealed optics help make them ideal for severe environments. All models use a modulated infrared LED emitter and receiver to ignore ambient light. Plug-in time delay modules offer wide flexibility in application options.

Designed for harsh industrial environments, the EP100 Series is especially equipped to alert you to potential problems. When other sensors run into alignment or dirty optic problems, you don't know about it until they fail. The EP100 uses a unique "tri-color" LED to indicate impending problems. When the LED glows

- Green — stable operation *>70% reflected signal strength*
- Yellow — marginal operation *40-70% reflected signal strength*
- Red — insufficient reflected signal

Target Repeatability

For best repeatability, it is recommended to have target travel in direction (1) or (2). Traveling toward lens (3) will result in slightly higher tolerance on switch point. It is not recommended to have target travel in direction (4) and (5).



Supply Voltage	Power Consumption	Output Circuit Type	Fixed Range			Adjustable Range	Output Rating	Response Time (On/Off)	Maximum Switching Frequency	Leakage Current
			1.0'	2.5'	6.5'					
RELAY OUTPUTS										
120 VAC	1.0 VA	DPDT	**EP130-12003***	**EP130-12002***	**EP130-12001***	—	5A Resistive @ 250 VAC or 30 VDC	20ms/25ms	25 Hz	—
11-30 VDC	70 mA	DPDT	**EP130-15003**	**EP130-15002**	**EP130-15001**	—	5A Resistive @ 250 VAC or 30 VDC	20ms/25ms	25 Hz	—
110/220 VAC	4.0 VA	SPDT	—	—	—	**EP130-12004**	50 W - 250 VDC 60 VA - 250 VAC	70ms	7 Hz	—
11-30 VDC ± 10%	90 mA	SPDT**	—	—	—	**EP130-15004**	50 W-250 VDC 60 VA - 250 VAC	70ms	7 Hz	—
TRANSISTOR OUTPUTS										
120 VAC	1.0 VA	NPN	**EP130-12203***	**EP130-12202***	**EP130-12201***	—	25 mA @ 40 VDC	60ms/10ms	60 Hz	—
11-30 VDC	70 mA	NPN	**EP130-15203**	**EP130-15202**	**EP130-15201**	—	25 mA @ 40 VDC	60ms/10ms	60 Hz	—
11-30 VDC ± 10%	90 mA	PNP**	—	—	—	**EP130-15004**	100mA	70ms	7 Hz	—

* UL Listed and CSA Approved

** Relay/Transistor (PNP) outputs on EP130-15004.

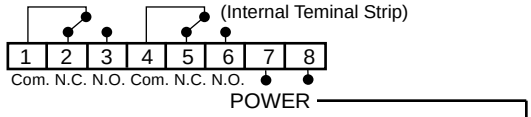
Common Sensor Characteristics

DIFFUSE PROXIMITY HEAVY DUTY SENSORS		
	Fixed Range	**Adjustable Range**
Sensing Ranges	1.0, 2.5, 6.5 ft.*	100-800 mm Adjustable*
Standard Target	White Bond Paper	
Lens	Glass	
Light Source	Modulated Infrared LED	
Light/Dark Operate — Selectable	yes	
Optional Plug-in Timers	yes	
NEMA Enclosure Type	3, 4, 12 & 13	
Temperature Range	-20˚C to +70˚C	-20˚C to +60˚C
UL/CSA Certifications	yes	
Sensitivity Adjustment	yes	
Optic Heater	no	
Cable Entry	1/2" - 14 NPT Conduit	
Shipping Weight	16 oz.	18 oz.

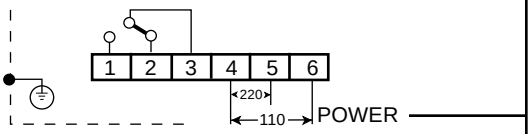
*Using White Bond Paper

Circuit Drawings

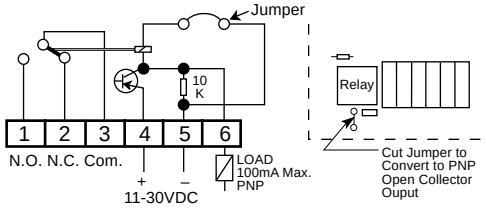
RELAY (DPDT) OUTPUTS



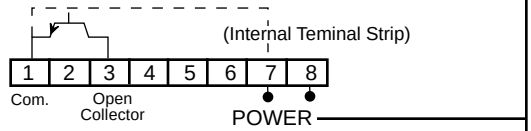
AC OUTPUTS ADJUSTABLE RANGE (SPDT)/AC POWER



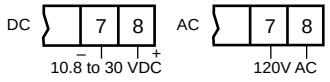
DC OUTPUTS ADJUSTABLE RANGE (SPDT/PNP)/DC POWER



TRANSISTOR (NPN) OUTPUTS

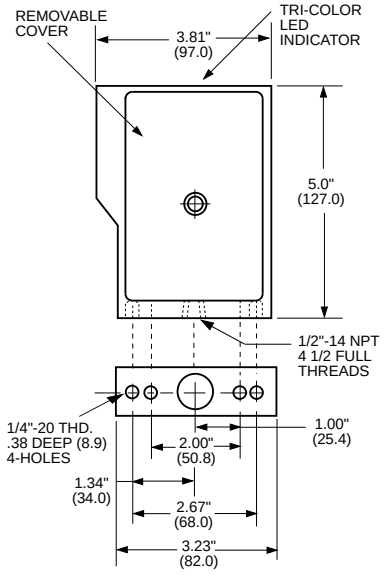


POWER INPUT:

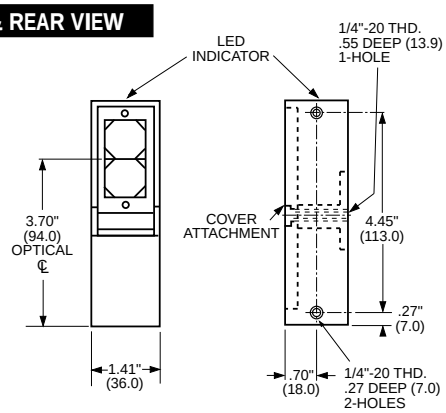


Dimensional Drawings

SIDE & BOTTOM VIEW



FRONT & REAR VIEW



Tolerance vs. Range

For Adjusted Range Diffuse Scanner EP130-12004 & EP130-15004

Adjusted Range	Total Sensing Range From:	Max. Range of White Target When Range is Set On Black Target	
		Black Paper	White Paper
3.94" (100mm)	1.97" to 3.94" (50mm to 100mm)	3.94" (100mm)	4.02" (102mm)
11.80" (300mm)	3.94" to 11.80" (100mm to 300mm)	11.80" (300mm)	12.20" (310mm)
19.68" (500mm)	4.72" to 19.68" (120mm to 500mm)	19.68" (500mm)	21.26" (540mm)
31.50" (800mm)	5.90" to 31.50" (150mm to 800mm)	31.50" (800mm)	31.50" (800mm)

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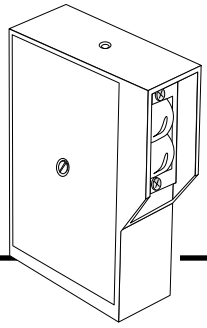
Heavy Duty Photoelectric Sensors

Thru-Beam & Fiber Optic



- **Modulated LED**
- **Choice of Outputs**
- **Diecast Aluminum Housing Epoxy Coated**
- **Tri-Color LED Indicator**
- **Optional Plug-In Time Delays**
- **400 Ft. Range Thru-Beam**
- **Sealed Heated Optics Thru-Beam**
- **NEMA 3, 4, 12 & 13 Design**
- **-20°C to +70°C**

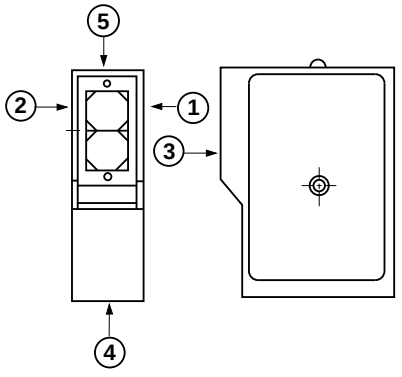
These beefed-up sensors are smart as well as tough. Die cast aluminum housings and totally sealed optics help make them ideal for severe environments. All models use a modulated infrared LED emitter and receiver to ignore ambient light. Plug-in time delay modules offer wide flexibility in application options.

Designed for harsh industrial environments, the EP100 Series is especially equipped to alert you to potential problems. When other sensors run into alignment or dirty optic problems, you don't know about it until they fail. The EP100 uses a unique "tri-color" LED to indicate impending problems. When the LED glows

- Green — stable operation *>70% reflected signal strength*
- Yellow — marginal operation *40-70% reflected signal strength*
- Red — insufficient reflected signal

Target Repeatability

For best repeatability, it is recommended to have target travel in direction (1) or (2). Traveling toward lens (3) will result in slightly higher tolerance on switch point. It is not recommended to have target travel in direction (4) and (5).



Supply Voltage	Power Consumption	Output Circuit Type	Thru-Beam Emitter	Thru-Beam Receiver	Fiber Optic	Output Rating	Response Time On/Off	Maximum Switching Frequency	Leakage Current
110/220 VAC	3.5 VA	—	**EP120-12501**	—	—	—	—	—	—
24 VDC ± 10%	35 mA	—	**EP120-15501**	—	—	—	—	—	—
RELAY OUTPUTS									
120 VAC	1.0 VA	DPDT	—	—	**EP140-12001**	5A Resistive @ 250 VAC or 30 VDC	20mS/25ms	25 Hz	—
110/220 VAC	4.5 VA	SPDT	—	**EP120-12701**	—	50W - 250 VDC 60 VA - 250 VAC	30mS/150ms	6 Hz	—
11-30 VDC	70 mA	DPDT	—	—	**EP140-15001**	5A Resistive @ 250 VAC or 30 VDC	20mS/25ms	20 Hz	—
24 VDC ± 10%	100 mA	SPDT**	—	**EP120-15701**	—	50W - 250 VDC 60 VA - 250 VAC	—	20 Hz	—
TRANSISTOR OUTPUTS									
11-30 VDC	70 mA	NPN	—	—	**EP140-15201**	25 mA @ 40 VDC	6mS/10ms	60 Hz	—
24 VDC ± 10%	100 mA	PNP**	—	**EP120-15701**	—	100 mA	—	100 Hz	—

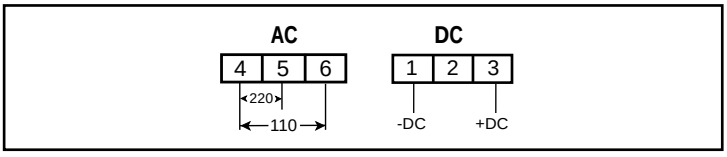
* UL Listed
** Relay/Transistor (PNP) outputs on EP120-15701

Common Sensor Characteristics

THRU-BEAM & FIBER OPTIC HEAVY DUTY SENSORS		
	Thru-Beam	**Fiber Optic**
Sensing Range	0-400 ft.	See Photoelectric Accessories section
Lens	Glass	
Light Source	Modulated Infrared LED	
Light/Dark Operate — Selectable	no	yes
Optional Plug-in Timers*	yes	
NEMA Enclosure Type	3, 4, 12 & 13	
Temperature Range	-30˚C to +60˚C	-20˚C to +70˚C
UL/CSA Certifications	no	yes
Sensitivity Adjustment	no	yes
Optic Heater	yes	no
Cable Entry	1/2" - 14 NPT Conduit	
Shipping Weight	18 oz.	20 oz.

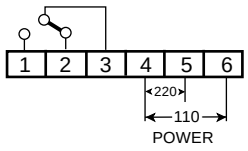
* Refer to Photoelectric Accessories section

Emitter Circuit Drawings

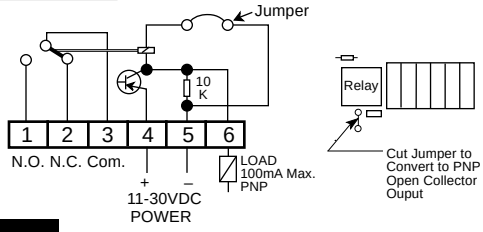


Receiver Circuit Drawings

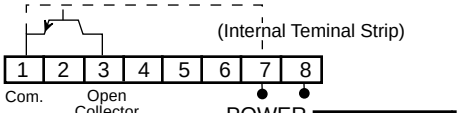
RELAY OUTPUT/AC POWER



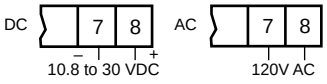
RELAY/TRANSISTOR (PNP) OUTPUT/DC POWER



TRANSISTOR OUTPUT (NPN)

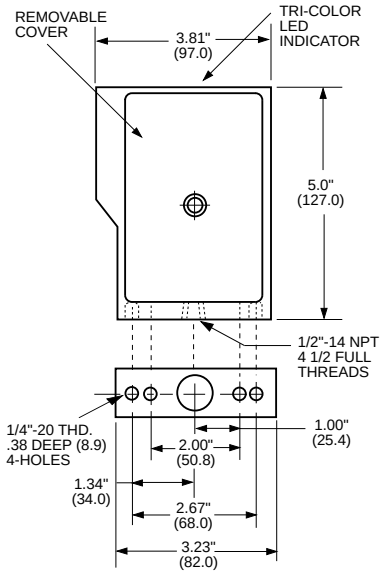


POWER INPUT:

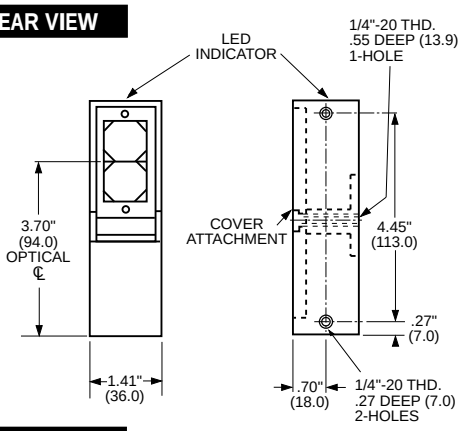


Dimensional Drawings

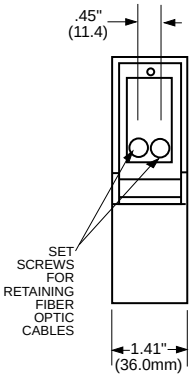
SIDE & BOTTOM VIEW



FRONT & REAR VIEW



FRONT VIEW, FIBER OPTIC MODEL



Photoelectric Sensors

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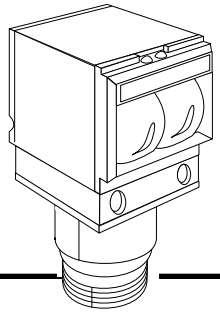
For technical assistance, call 1-800-NAMTECH

Compact Photoelectric Sensors Retro-Reflective



- **Programmable Controller Compatible**
- **NPN/PNP wire selectable**
- **Integral yoke bracket provides four 90°-indexed mounting positions**
- **Light/dark operate user selectable for optimum flexibility and minimum inventory**
- **Sensitivity gain adjust (all models)**
- **2 wire AC, 3 wire AC, or 4 wire DC circuit types**
- **Dual LED status indicators**

If you need a reliable photoelectric sensor, you can't do much better than the EP200. Only 2.45 inches high, it fits in the tightest spots. For easy installation, its U-shaped yoke slips off allowing you to rotate the sensor in 90° increments.

A Rynite® plastic housing holds the surface mount electronics which are themselves encapsulated in epoxy. A wide variety of configurations are available to fit your specific needs. In its retroreflective version, it is great for long range jobs...up to 30 feet. Polarized versions are immune from "proxing" or false signals from highly reflective objects like aluminum cans, shrink wrap, bottles, foil, etc.

The EP200 series of sensors is backed by Namco's Lifetime Replacement Program.

LED Functions

PHOTOELECTRIC SWITCH FUNCTION				
Type	Sensor Receiver Recognizes	Status Output	Status LED	
			Ready	Target
L.O.	DARK	OPEN	ON	OFF
L.O.	LIGHT	CLOSED	OFF	ON
D.O.	LIGHT	OPEN	ON	OFF
D.O.	DARK	CLOSED	OFF	ON

Protected by the NAMCO Lifetime Replacement Program

Termination Type	Power Consumption	Output Circuit Type	Non-Polarized Model No. (Plastic Lens)	Polarized Model No. (Glass Lens)	Output Rating	Leakage Current	Voltage Drop	Maximum Switching Frequency	Response Time On/Off
2-WIRE AC 20-150V									
3-pin Mini	0.3W @ 120V	2W	**EP210-24400**	**EP210-24401**	500mA	1.7mA	≤ 10V	15Hz	30ms
3-pin Micro	0.3W @ 120V	2W	**EP210-24420**	**EP210-24421**	500mA	1.7mA	≤ 10V	15Hz	30ms
6' Cable	0.3W @ 120V	2W	**EP210-24410**	**EP210-24411**	500mA	1.7mA	≤ 10V	15Hz	30ms
3-WIRE AC 85-132V									
3-pin Mini	0.7W @ 120 VAC	3W	**EP210-24600**	**EP210-24601**	500mA	—	≤ 2.5V	33Hz	15ms
4-pin Micro	0.7W @ 120 VAC	3W	**EP210-24620**	**EP210-24621**	500mA	—	≤ 2.5V	33Hz	15ms
6' Cable	0.7W @ 120 VAC	3W	**EP210-24610**	**EP210-24611**	500mA	—	≤ 2.5V	33Hz	15ms
4-WIRE DC 10-30V									
4-pin Mini	0.9W @ 30 VDC	4W, NPN & PNP	**EP210-24500**	**EP210-24501**	200mA	—	NPN @ 100mA: 0.8V PNP @ 100mA: 2.0V	250Hz	2ms
4-pin Euro	0.9W @ 30 VDC	4W, NPN & PNP	**EP210-24520**	**EP210-24521**	200mA	—	NPN @ 100mA: 0.8V PNP @ 100mA: 2.0V	250Hz	2ms
6' Cable	0.9W @ 30 VDC	4W, NPN & PNP	**EP210-24510**	**EP210-24511**	200mA	—	NPN @ 100mA: 0.8V PNP @ 100mA: 2.0V	250Hz	2ms

Common Sensor Characteristics

COMPACT RETRO-REFLECTIVE SENSORS		
	Polarized	**Non-Polarized**
Sensing Range	15 feet*	30 feet*
Standard Target	3.23" diameter reflector	
Light Source (LED)	Visible	Modulated Infrared
Light/Dark Operate — Selectable	yes	
Sensitivity Adjustment	yes	
Ambient Temperature Range	-20˚C to +70˚C	
Reverse Polarity Protected	4W DC only	
Short Circuit Protected	no	
NEMA Enclosure Type	3, 4, 5, 12, 13	
Dual LED Indicators	yes	
Plastic Housing Material	Rynite®	
Shipping Weight	16 oz.	

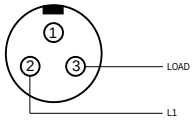
* Using EP175-23200, 3.23" dia. reflector.
® Thermal Plastic Polyester Resin, Registered Trademark of E.I. Dupont

Circuit Drawings

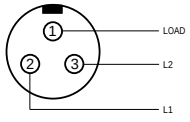
MINI CONNECTOR MODELS

Male views shown

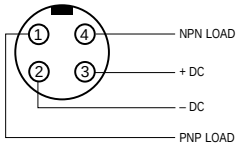
2 Wire AC



3 Wire AC



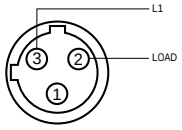
4 Wire DC



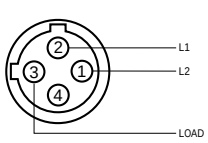
MICRO & EURO CONNECTOR MODELS

Male views shown

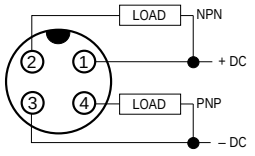
2 Wire AC



3 Wire AC

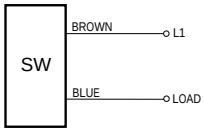


4 Wire DC (sinking and sourcing)

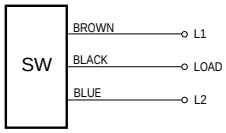


CABLE MODELS

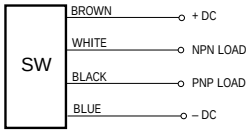
2 Wire AC



3 Wire AC



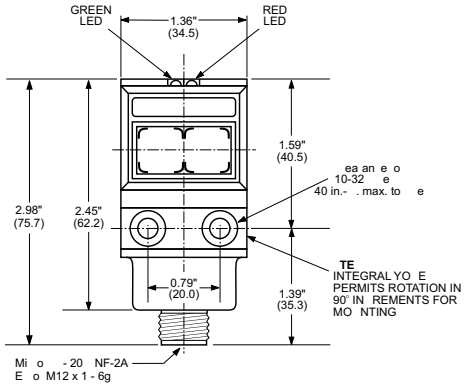
4 Wire DC



Dimensional Drawings

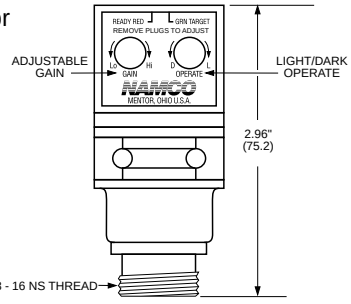
FRONT

Micro Connector style shown

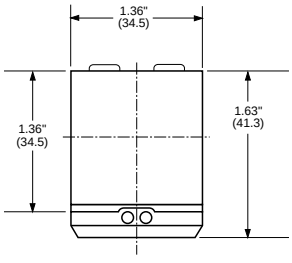


BACK

Mini Connector style shown

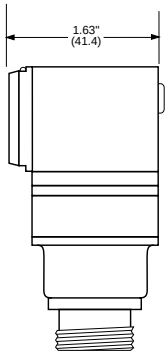


TOP



SIDE

Mini Connector style shown

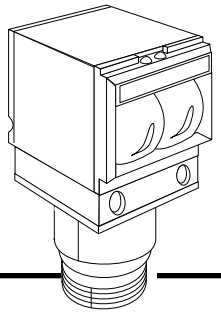


Photoelectric Sensors

Namco Controls Corporation
Mayfield Village, OH 44143
(440) 460-1360 • FAX (440) 460-3800 • namcocontrols.com

Compact Photoelectric Sensors

Diffuse Proximity



- **Programmable Controller Compatible**
- **NPN/PNP wire selectable**
- **Integral yoke bracket provides four 90°-indexed mounting positions**
- **Light/dark operate user selectable for optimum flexibility and minimum inventory**
- **Sensitivity gain adjust (all models)**
- **2 wire AC, 3 wire AC, or 4 wire DC circuit types**
- **Dual LED status indicators**

If you need a reliable photoelectric sensor, you can't do much better than the EP200. Only 2.45 inches high, it fits in the tightest spots. For easy installation, its "U"-shaped yoke slips off, allowing you to rotate the sensor in 90° increments.

A wide variety of configurations are available to fit your specific needs. Diffuse proximity sensing should be used when the following conditions exist: (1) the object itself is sufficiently reflective to return incident light to the receiver photodiode; (2) the installation of a reflector on the opposite side of the object is impractical.

The EP200 series of sensors is backed by Namco's Lifetime Replacement Program.

Protected by the NAMCO Lifetime Replacement Program

LED Functions

PHOTOELECTRIC SWITCH FUNCTION				
Type	Sensor Receiver Recognizes	Status Output	Status LED	
			Ready	Target
L.O.	DARK	OPEN	ON	OFF
L.O.	LIGHT	CLOSED	OFF	ON
D.O.	LIGHT	OPEN	ON	OFF
D.O.	DARK	CLOSED	OFF	ON

Termination Type	Power Consumption	Output Circuit Type	Model No.	Output Rating	Leakage Current	Voltage Drop	Response Time On/Off	Maximum Switching Frequency
2-WIRE AC 20-150V								
3-pin Mini	0.3W @ 120 VAC	2W	**EP230-24400**	500mA	1.7mA	≤10V	30ms	15 Hz
3-pin Micro	0.3W @ 120 VAC	2W	**EP230-24420**	500mA	1.7mA	≤10V	30ms	15 Hz
6' Cable	0.3W @ 120 VAC	2W	**EP230-24410**	500mA	1.7mA	≤10V	30ms	15 Hz
3-WIRE AC 85-132V								
3-pin Mini	0.7W @ 120 VAC	3W	**EP230-24600**	500mA	—	≤2.5V	15ms	33 Hz
4-pin Micro	0.7W @ 120 VAC	3W	**EP230-24620**	500mA	—	≤2.5V	15ms	33 Hz
6' Cable	0.7W @ 120 VAC	3W	**EP230-24610**	500mA	—	≤2.5V	15ms	33 Hz
4-WIRE DC 10-30V								
4-pin Mini	0.9W @ 30 VDC	4W, NPN & PNP	**EP230-24500**	200mA	—	0.8V: NPN @ 100mA 2.0V: PNP @ 100mA	2ms	250 Hz
4-pin Euro	0.9W @ 30 VDC	4W, NPN & PNP	**EP230-24520**	200mA	—	0.8V: NPN @ 100mA 2.0V: PNP @ 100mA	2ms	250 Hz
6' Cable	0.9W @ 30 VDC	4W, NPN & PNP	**EP230-24510**	200mA	—	0.8V: NPN @ 100mA 2.0V: PNP @ 100mA	2ms	250 Hz

Common Sensor Characteristics

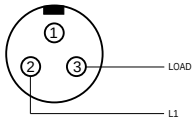
DIFFUSE PROXIMITY COMPACT SENSORS	
Sensing Range	30"*
Standard Target	White Bond Paper
Light Source	Modulated Infrared LED
Light/Dark Operate — Selectable	yes
Sensitivity Adjustment	yes
Ambient Temperature Range	-20˚C to +70˚C
Reverse Polarity Protected	4W DC only
Short Circuit Protected	no
NEMA Enclosure Type	3, 4, 5, 12, 13
Dual LED Indicators	yes
Plastic Housing Material	Rynite®
Shipping Weight	6 oz.

* Using White Bond Paper
® Thermal Plastic Polyester Resin, Registered Trademark of E.I. Dupont

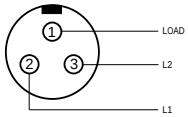
Circuit Drawings

MINI CONNECTOR MODELS

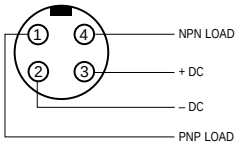
2 Wire AC



3 Wire AC

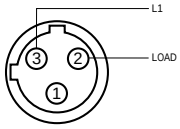


4 Wire DC

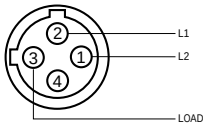


MICRO & EURO CONNECTOR MODELS

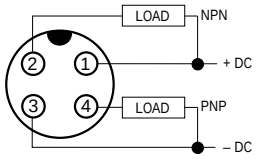
2 Wire AC



3 Wire AC

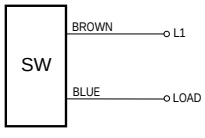


4 Wire DC (sinking and sourcing)

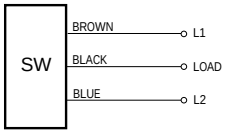


CABLE MODELS

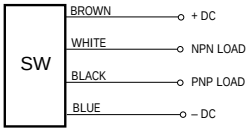
2 Wire AC



3 Wire AC



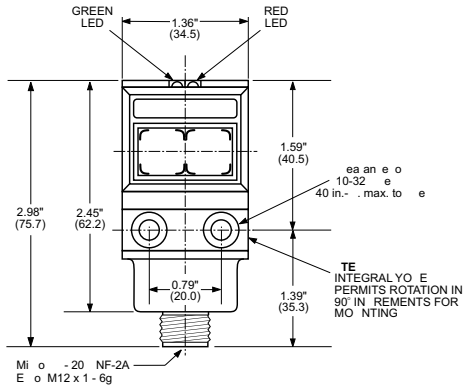
4 Wire DC



Dimensional Drawings

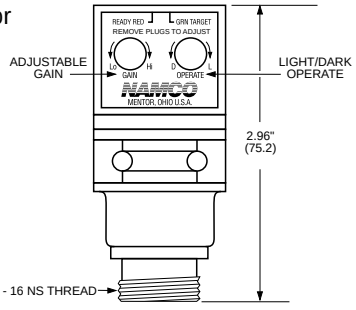
FRONT

Micro Connector style shown

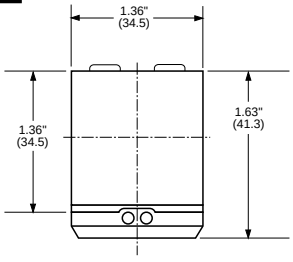


BACK

Mini Connector style shown

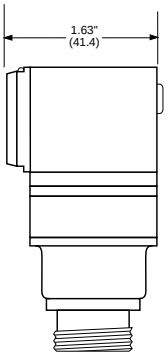


TOP



SIDE

Mini Connector style shown

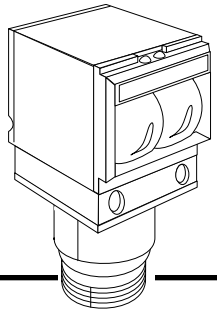


Photoelectric Sensors

Namco Controls Corporation
Mayfield Village, OH 44143
(440) 460-1360 • FAX (440) 460-3800 • namcocontrols.com

Compact Photoelectric Sensors

Thru-Beam & Fiber Optic



- **Programmable Controller Compatible**
- **NPN/PNP wire selectable**
- **Integral yoke bracket provides four 90°-indexed mounting positions**
- **Light/dark operate user selectable for optimum flexibility and minimum inventory**
- **Sensitivity gain adjust (all models)**
- **2 wire AC, 3 wire AC, or 4 wire DC circuit types**
- **Dual LED status indicators**

If you need a reliable photoelectric sensor, you can't do much better than the EP200. Only 2.45 inches high, it fits in the tightest spots. For easy installation, its U-shaped yoke slips off allowing you to rotate the sensor in 90° increments.

A Rynite® plastic housing holds the surface mount electronics which are themselves encapsulated in epoxy. A wide variety of configurations are available to fit your specific needs.

The EP200 series of sensors is backed by Namco's Lifetime Replacement Program.

LED Functions

PHOTOELECTRIC SWITCH FUNCTION				
	Sensor Receiver	Status	Status LED	
Type	Recognizes	Output	Ready	Target
L.O.	DARK	OPEN	ON	OFF
L.O.	LIGHT	CLOSED	OFF	ON
D.O.	LIGHT	OPEN	ON	OFF
D.O.	DARK	CLOSED	OFF	ON

Termination Type	Power Consumption	Output Circuit Type	Thru-Beam Emitter	Thru-Beam Receiver	Fiber Optic	Output Rating	Leakage Current	Voltage Drop	Response Time On/Off	Maximum Switching Frequency
2-WIRE AC/DC*										
3-pin Mini	0.9W @ 120 V	2W	**EP220-23400**	—	—	—	—	—		—
3-pin Micro	0.9W @ 120 V	2W	**EP220-23420**	—	—	—	—	—		—
6' Cable	0.9W @ 120 V	2W	**EP220-23410**	—	—	—	—	—		—
2-WIRE AC 20-150V										
3-pin Mini	0.3W @ 120 VAC	2W	—	**EP220-24400**	**EP240-24400**	500mA	1.7mA	≤10V	30ms	15 Hz
3-pin Micro	0.3W @ 120 VAC	2W	—	**EP220-24420**	**EP240-24420**	500mA	1.7mA	≤10V	30ms	15 Hz
6' Cable	0.3W @ 120 VAC	2W	—	**EP220-24410**	**EP240-24410**	500mA	1.7mA	≤10V	30ms	15 Hz
3-WIRE AC 85-132V										
3-pin Mini	0.7W @ 120 VAC	3W	—	**EP220-24600**	**EP240-24600**	500mA	—	≤2.5V	15ms	33 Hz
4-pin Micro	0.7W @ 120 VAC	3W	—	**EP220-24620**	**EP240-24620**	500mA	—	≤2.5V	15ms	33 Hz
6' Cable	0.7W @ 120 VAC	3W	—	**EP220-24610**	**EP240-24610**	500mA	—	≤2.5V	15ms	33 Hz
4-WIRE DC 10-30V										
4-pin Mini	0.9W @ 30 VDC	4W, NPN & PNP	—	**EP220-24500**	**EP240-24500**	200mA	—	0.8V: NPN @ 100mA 2.0V: PNP @ 100mA	2ms	250 Hz
4-pin Euro	0.9W @ 30 VDC	4W, NPN & PNP	—	**EP220-24520**	**EP240-24520**	200mA	—	0.8V: NPN @ 100mA 2.0V: PNP @ 100mA	2ms	250 Hz
6' Cable	0.9W @ 30 VDC	4W, NPN & PNP	—	**EP220-24510**	**EP240-24510**	200mA	—	0.8V: NPN @ 100mA 2.0V: PNP @ 100mA	2ms	250 Hz

* 20-150 VAC / 10-180 VDC

▶ Fiber optic cables not included with fiber optic sensors.

Common Sensor Characteristics

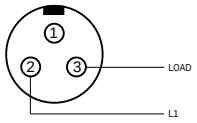
THRU-BEAM & FIBER OPTIC SENSORS		
	Thru-Beam	**Fiber Optic**
Sensing Range	200 feet	See Photoelectric Accessories section
Light/Dark Operate — Selectable	yes	
Light Source	Modulated Infrared LED	
Sensitivity Adjustment	yes	
Ambient Temperature Range	-20˚C to +70˚C	
Reverse Polarity Protected	4W DC only	
Short Circuit Protected	no	
NEMA Enclosure Type	3, 4, 5, 12, 13	
Dual LED Indicators	yes	
Plastic Housing Material	Rynite®	
Shipping Weight	6 oz.	

® Thermal Plastic Polyester Resin, Registered Trademark of E. I. Dupont

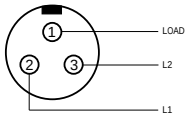
Circuit Drawings

MINI CONNECTOR MODELS

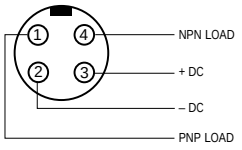
2 Wire AC



3 Wire AC

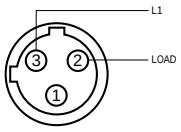


4 Wire DC

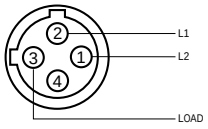


MICRO & EURO CONNECTOR MODELS

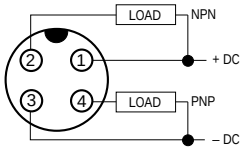
2 Wire AC



3 Wire AC

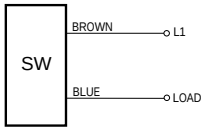


4 Wire DC (sinking and sourcing)

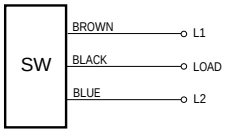


CABLE MODELS

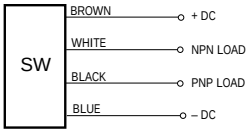
2 Wire AC



3 Wire AC



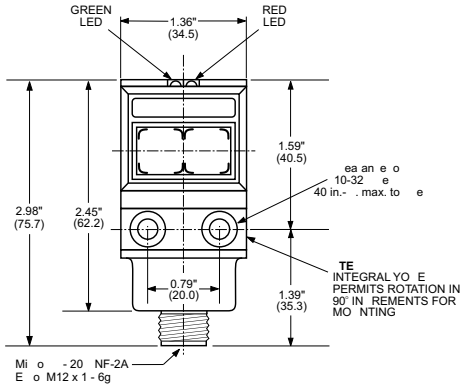
4 Wire DC



Dimensional Drawings

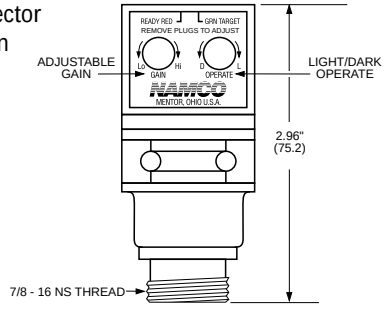
FRONT

Micro Connector style shown

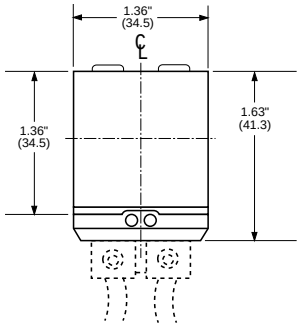


BACK

Mini Connector style shown

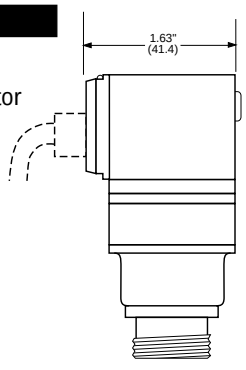


TOP



Dashed lines represent Fiber Optic version

SIDE



Mini Connector style shown

Dashed lines represent Fiber Optic version

Photoelectric Sensors

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Mayfield Village, OH 44143
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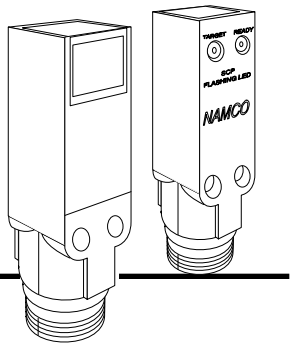
Weld Field Immune

Photoelectric Sensors

Diffuse Proximity



- **Side and end-sensing types available**
- **2-wire AC, 3-wire AC, or 3-wire DC circuit types**
- **Short circuit protected**
- **Dual LED indication**
- **Weld Field Immune**

The EP570 series sensor is an economical, reliable photoelectric sensor for nearly all applications. Programmable controller compatible, these are very good sensors for automotive body and assembly tooling or material handling tasks. Tough housing contains the latest in surface mount electronics technology for trouble-free use.

These sensors are appropriate for more demanding applications such as metal stamping. They use the same proven short circuit protected electronics found on Namco's Heavy Industry sensors.

Termination Type	Power Consumption	Output Circuit Type	Sensing Position	Model No.	Output Rating	Leakage Current	Voltage Drop	Response Time On/Off	Maximum Switching Frequency
2-WIRE AC/DC 20-230V									
3-pin Mini	0.44W @ 230V	2W	End	**EP570-11400**	4-400mA	≤1.7mA	≤10V	20ms	25 Hz
3-pin Mini	0.44W @ 230V	2W	Side	**EP570-21400**	4-400mA	≤1.7mA	≤10V	20ms	25 Hz
4-pin Mini	0.44W @ 230V	2W	End	**EP570-11410**	4-400mA	≤1.7mA	≤10V	20ms	25 Hz
4-pin Mini	0.44W @ 230V	2W	Side	**EP570-21410**	4-400mA	≤1.7mA	≤10V	20ms	25 Hz
3-pin Micro	0.44W @ 230V	2W	End	**EP570-11430**	4-400mA	≤1.7mA	≤10V	20ms	25 Hz
3-pin Micro	0.44W @ 230V	2W	Side	**EP570-21430**	4-400mA	≤1.7mA	≤10V	20ms	25 Hz
3-WIRE AC 85-132V									
4-pin Mini	≤ 1W @ 120V	3W	End	**EP570-11510**	200mA	—	≤3V	20ms	25 Hz
4-pin Mini	≤ 1W @ 120V	3W	Side	**EP570-21510**	200mA	—	≤3V	20ms	25 Hz
3-WIRE DC 10-30V									
4-pin Mini	0.9W @ 30V	3W, PNP	End	**EP570-11010**	200mA	—	≤3.5V	2.5ms	200 Hz
4-pin Mini	0.9W @ 30V	3W, PNP	Side	**EP570-21010**	200mA	—	≤3.5V	2.5ms	200 Hz
4-pin Micro	0.9W @ 30V	3W, PNP	End	**EP570-11040**	200mA	—	≤3.5V	2.5ms	200 Hz
4-pin Micro	0.9W @ 30V	3W, PNP	Side	**EP570-21040**	200mA	—	≤3.5V	2.5ms	200 Hz

Protected by the NAMCO Lifetime Replacement Program

Common Sensor Characteristics

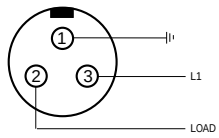
WELD FIELD IMMUNE DIFFUSE PROXIMITY SENSORS	
Sensing Range	2.8" ± 0.20"*
Standard Target	White Bond Paper
Light Source	Modulated Infrared LED
Light/Dark Operate	Light Operate Only
Sensitivity Adjustment	no
Ambient Temperature Range	-20° C to + 70° C
Reverse Polarity Protected	3W DC Only
Short Circuit Protected	yes
NEMA Enclosure Type	1, 12, 13
Dual LED Indicators	yes
Plastic Housing Material	Rynite®
Shipping Weight	5 oz.

*Using White Bond Paper
® Thermal Plastic Polyester Resin, Trademark of E. I. Dupont

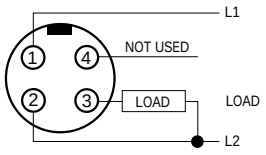
Circuit Drawings

MINI CONNECTOR MODELS

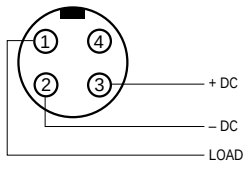
2-Wire AC



3-Wire AC

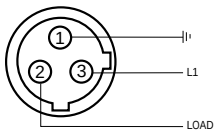


3-Wire DC

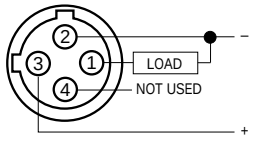


MICRO CONNECTOR MODEL

2-Wire AC

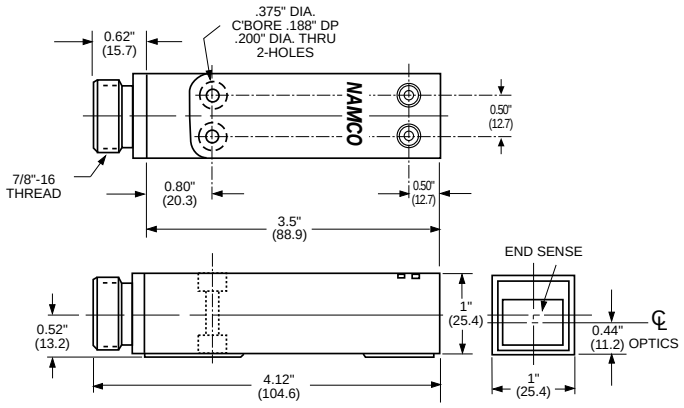


3-Wire DC

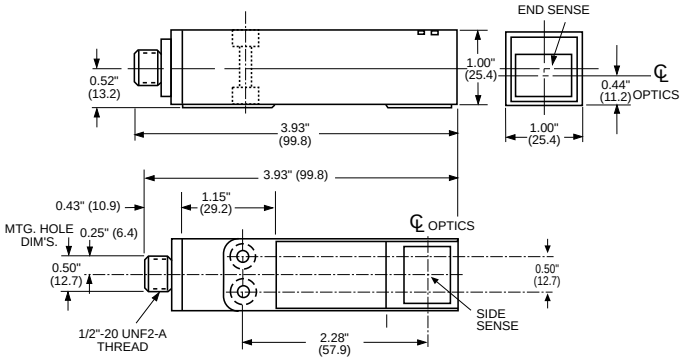


Dimensional Drawings

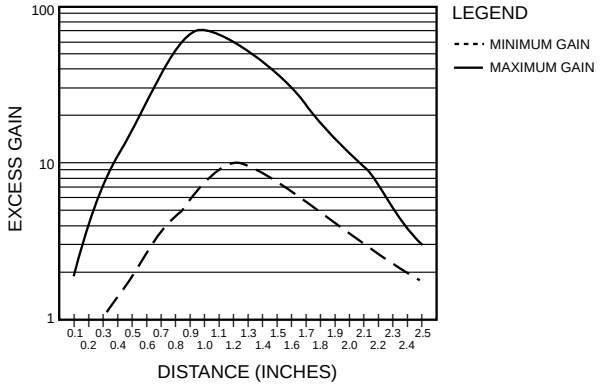
MINI CONNECTOR MODEL



MICRO CONNECTOR MODEL



EP570 Excess Gain



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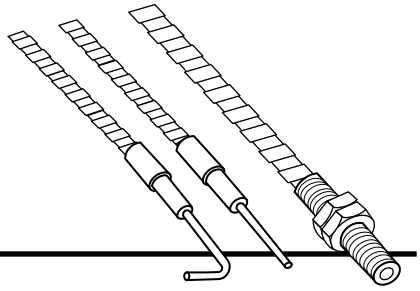
For technical assistance, call 1-800-NAMTECH

Fiber Optic Cables

Photoelectric Sensors Accessories



- **Choice of Sensor Head**
- **Glass**
- **PVC or Stainless Steel Jacket**
- **Sealed Construction**
- **3 or 6-Foot Lengths, Standard**

The addition of fiber optic cables greatly increases the flexibility of Namco's photoelectric sensors. These cables are used for EP140 and EP240 Series Switches.

Fiber optic cables transmit light from a control unit to an object and then return the reflected light back to the control unit producing an electrical signal. Because of their small size, fiber optic cables may be installed in areas that were inaccessible with other types of sensors. They are very flexible, vibration proof, submersible, and may be used in high temperature areas. Small part detection or counting is accomplished easily to replace unreliable methods such as weighing.

Special applications are easier to accomplish by specifying different tips rather than an entirely new photoelectric control.

Design Features

Optical glass fibers are encased in either a PVC jacket or, for added protection, a flexible armored stainless steel jacket to resist cuts or abrasion. The tips are constructed from stainless steel, brass, or aluminum for long life. The cables are sealed and may be used in "wash down" or submerged applications. Standard lengths are 3 feet and 6 feet. Consult factory for other lengths.

Jacketed Cables

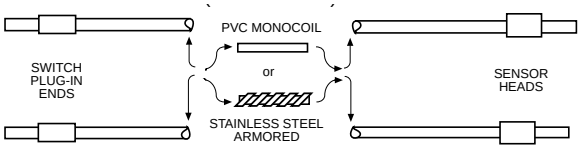
Sensor Head	Bundle Diameter	PVC		Stainless Steel		Approx. Range Sensitivity Adjustment	
		3' Cable Model No.	6' Cable Model No.	3' Cable Model No.	6' Cable Model No.	Minimum	Maximum
SINGLE CABLES							
Hypo Tip	.062	**EP181-11020**	**EP181-11021**	**EP181-12020**	**EP181-12021**	0.62"	3.00"
Hypo Tip 90˚	.062	**EP181-11030**	**EP181-11031**	**EP181-12030**	**EP181-12031**	0.62"	3.00"
Hypo Tip Bendable	.062	**EP181-11120**	**EP181-11121**	**EP181-12120**	**EP181-12121**	0.62"	3.00"
Flair Tip Narrow	.062	**EP181-11050**	**EP181-11051**	**EP181-12050**	**EP181-12051**	0.75"	3.50"
Tight 90˚ Tip	.094	**EP181-11060**	**EP181-11061**	**EP181-12060**	**EP181-12061**	4.00"	13.00"
Plain Tip	.125	**EP181-11000**	**EP181-11001**	**EP181-12000**	**EP181-12001**	5.00"	18.00"
Threaded Tip	.125	**EP181-11010**	**EP181-11011**	**EP181-12010**	**EP181-12011**	5.00"	18.00"
Flair Tip Wide	.125	**EP181-11040**	**EP181-11041**	**EP181-12040**	**EP181-12041**	3.25"	13.50"
Plain 90˚ Tip	.125	**EP181-11080**	**EP181-11081**	**EP181-12080**	**EP181-12081**	5.00"	18.00"
BIFURCATED CABLES							
Hypo Tip	.062	**EP181-21020**	**EP181-21021**	**EP181-22020**	**EP181-22021**	0.03"	0.53"
Hypo Tip 90˚	.062	**EP181-21030**	**EP181-21031**	**EP181-22030**	**EP181-22031**	0.03"	0.53"
Hypo Tip Bendable	.062	**EP181-21120**	**EP181-21121**	**EP181-22120**	**EP181-22121**	0.03"	0.53"
Flair Tip Narrow	.062	**EP181-21050**	**EP181-21051**	**EP181-22050**	**EP181-22051**	0.00"	0.25"
Tight 90˚ Tip	.094	**EP181-21060**	**EP181-21061**	**EP181-22060**	**EP181-22061**	0.28"	1.12"
Plain Tip	.125	**EP181-21000**	**EP181-21001**	**EP181-22000**	**EP181-22001**	0.38"	1.50"
Threaded Tip	.125	**EP181-21010**	**EP181-21011**	**EP181-22010**	**EP181-22011**	0.38"	1.50"
Flair Tip Wide	.125	**EP181-21040**	**EP181-21041**	**EP181-22040**	**EP181-22041**	0.28"	1.12"
Plain 90˚ Tip	.125	**EP181-21080**	**EP181-21081**	**EP181-22080**	**EP181-22081**	0.38"	1.50"

NOTE:

	PVC	Stainless Steel
Sheathing O.D.	0.238"	0.234"
Minimum Bend Radius:	0.595"	0.585"
Temperature Range:	-40°F to +235°F	-40°F to +525°F

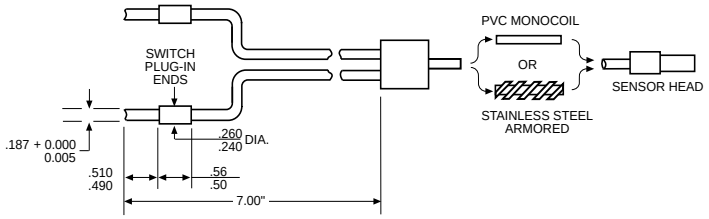
Cable Types

SINGLE CABLE (for Thru-Beam Sensing)



(Order Quantity of Two)

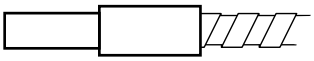
BIFURCATED CABLE (for Diffuse Sensing)



(Order Quantity of One)

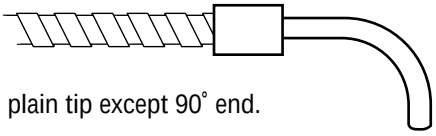
Common Cable Applications

PLAIN TIP



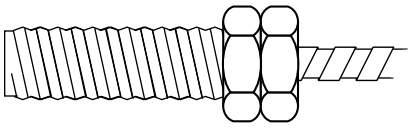
For general purpose use: may be fixed in-place with set screw; most common tip; furthest "Prox" thru-beam range.

PLAIN TIP 90˚



Same as plain tip except 90˚ end.

THREADED TIP

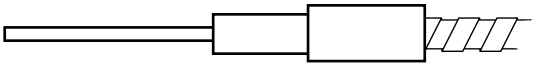


Same as Plain Tip but with brass threaded end; two jam nuts are furnished.

TIGHT TIP 90˚

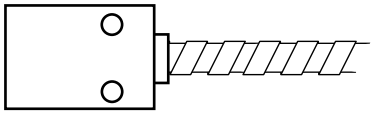
Tight 90˚ for use in close quarters; may be mounted on chute from vibrator feeder to monitor parts in automatic assembly operations.

HYPO TIP



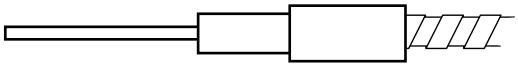
For very small parts or inaccessible areas: diffuse cable could "see" the edge of this page.

FLARE TIP WIDE



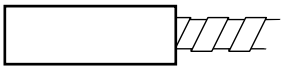
Used for edge control – detects very thin edges. With diffuse cable sensing, very small parts are detected when passed any place in front of the bundle height. Diffuse type also used for register marks detection.

HYPO TIP BENDABLE



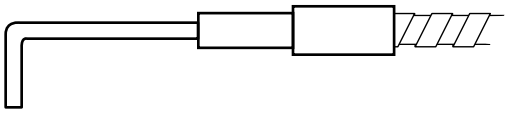
Same as standard hypo tip but tip may be bent to suit; min. bend 1/4"R. and not closer than 1/2" from either end.

FLARE TIP NARROW



Same as flare tip wide except smaller bundle height.

HYPO TIP 90˚



Same as standard hypo tip but with 90˚ bend. May be mounted very close along side narrow conveyor while viewing across it.

Photoelectric Sensors

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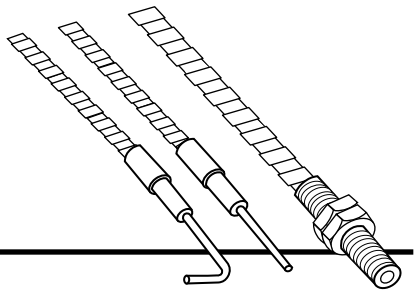
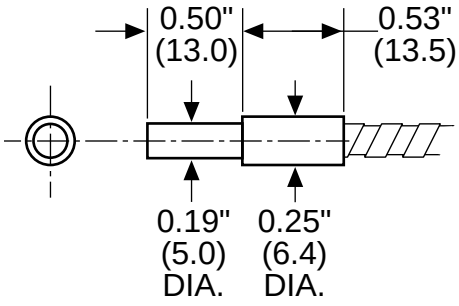
Photoelectric Sensors Accessories

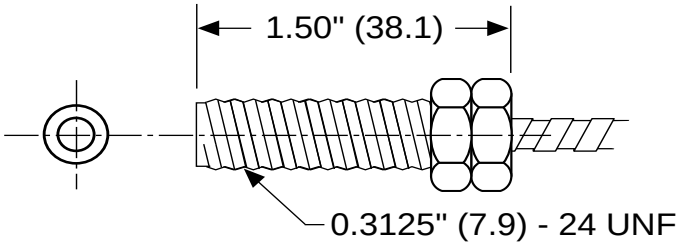


Dimensional Drawings

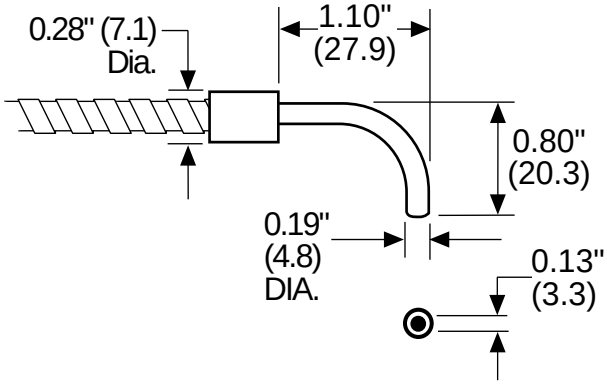
PLAIN TIP



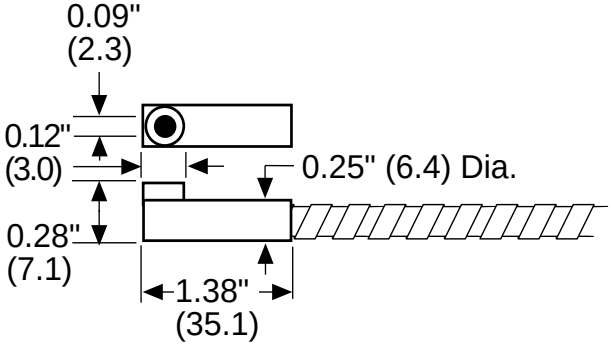
THREADED TIP



PLAIN TIP 90°

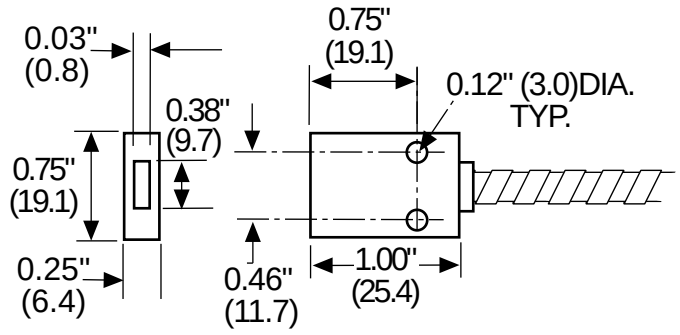


TIGHT TIP 90°

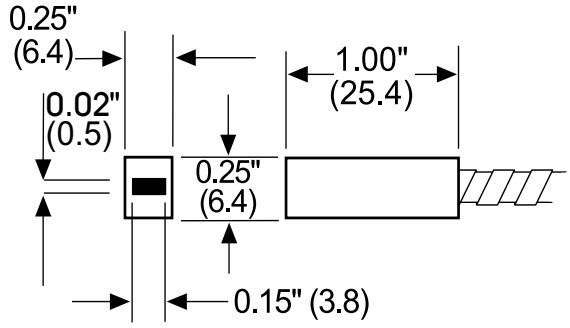


Dimensional Drawings

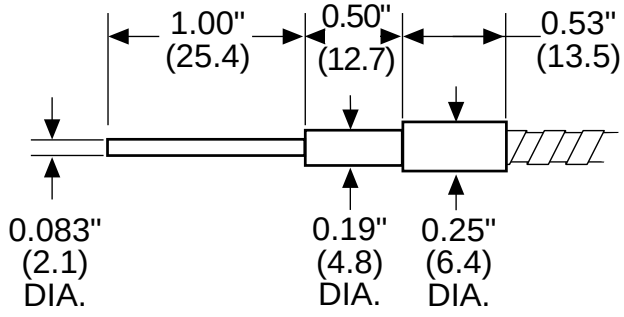
FLARE TIP WIDE



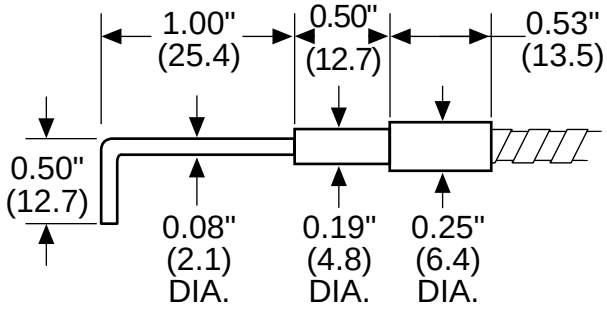
FLARE TIP NARROW



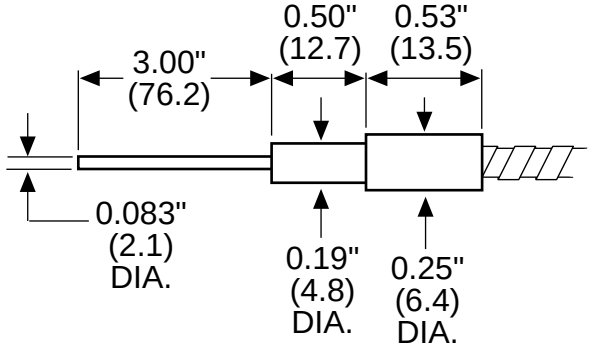
HYPO TIP



HYPO TIP 90°



HYPO TIP BENDABLE



Photoelectric Sensors

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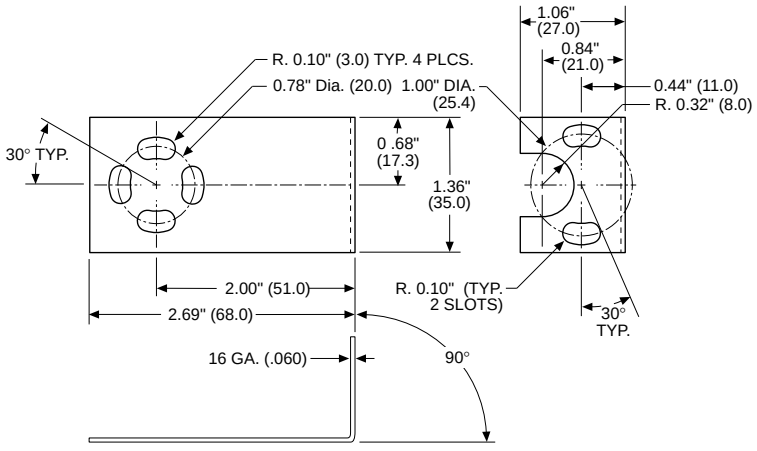
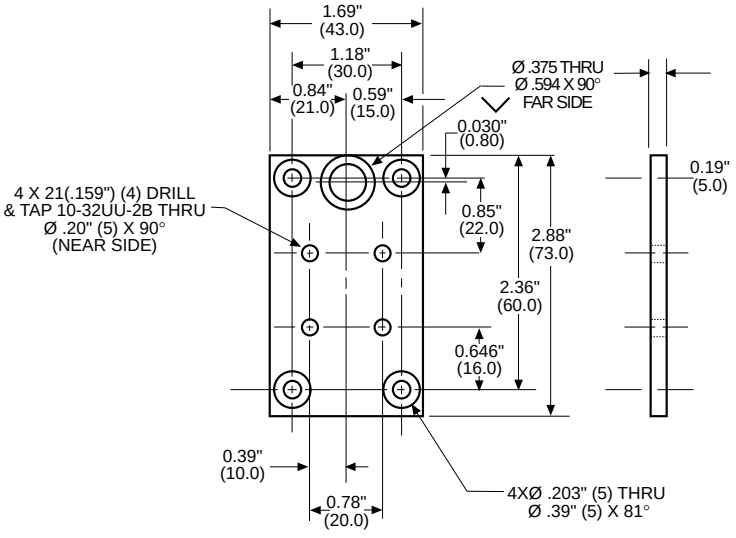
Photoelectric Sensor Accessories

BRACKETS FOR EP200 SERIES

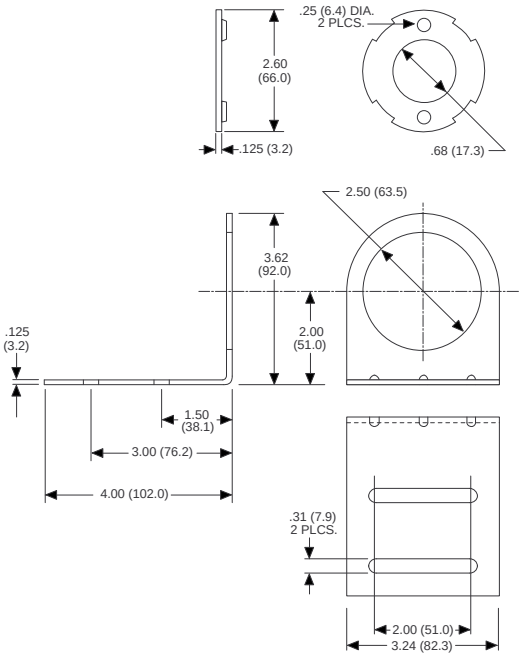


Part No. EP180-20010
Material: Cadmium Plated Steel



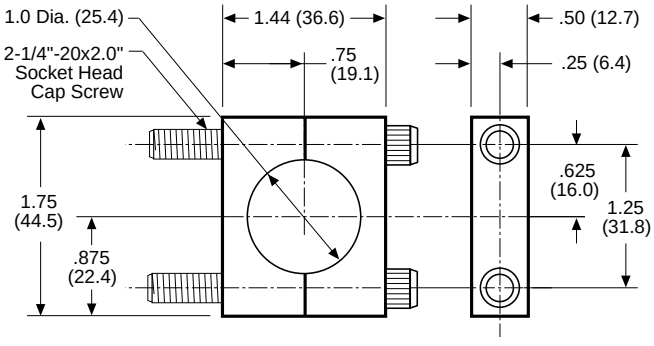
Part No. EP180-20011
Material: Aluminum Clear Anodized

BRACKET FOR TRI-COLOR UNITS



Part No. EP180-40000 (Swivel)
Material: Cadmium Plated Steel

BRACKET FOR EP570 SERIES



Part No. EP180-50000
(Used with EP570)
Material: Cadmium Plated Steel

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Reflectors

Photoelectric Sensor Accessories

The reflector is 50% of a retro-reflective system. Namco tests each reflector to insure its performance. Constructed from a sealed plexiglass assembly, they will operate in most environments. For harsh environments such as solvents or strong chemicals use glass reflectors on next page.

To reduce the effective area of a reflector, mask it with tape or metal shields - NEVER CUT A REFLECTOR. (Exception : EP175-31200 tape)

All Namco Retro-Reflective Units are rated with EP175-13900 (4" x 4") reflector. See chart for additional range information.

Namco High Temperature Reflectors are the same high quality as general purpose types but are designed to withstand environments beyond the norm such as applications requiring "wash down" or in areas where solvents such as toluene or trichloroethylene are present. Temperatures of up to 120˚C present no problem.

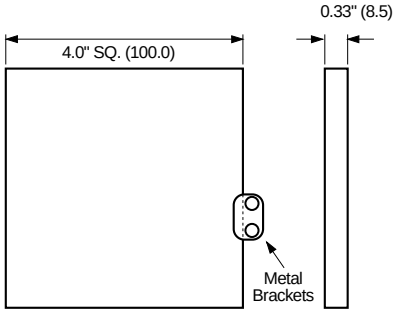
Namco also offers a metal reflector that will withstand a constant temperature of 480˚C (900˚F).

Recommended Ranges for Various Reflectors*

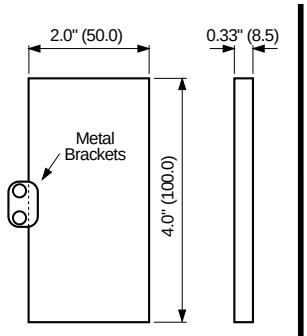
Reflector Model No.	SERIES	
	EP110	EP210
EP175-13900	0-30.0 ft.	0-10.0 ft.
EP175-31900	0-27.0 ft.	0-8.5 ft.
EP175-21000	1.5-9.0 ft.	0.3-3.0 ft.
EP175-23200	1.5-22.5 ft.	0.3-8.0 ft.
EP175-22400	0-20.0 ft.	0.3-6.0 ft.
EP175-31200	0.75-15.0 ft.	0.3-4.0 ft.
EP175-37100	0-20.0 ft.	0-7.0 ft.
EP175-32000	0-15.0 ft.	0-6.0 ft.
EP175-22600	0-15.0 ft.	0-6.0 ft.
EP175-23201	1.5-22.5 ft.	0.3-8.0 ft.
EP175-14000	0-12.0 ft.	0-4.0 ft.

* Rated with clean environment, lens & reflector.

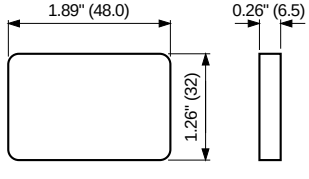
GENERAL PURPOSE REFLECTOR (Adhesive or Bracket mount)



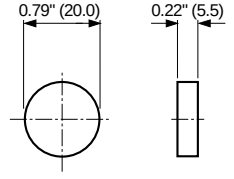
Reflector EP175-13900
(Supplied with 2 metal brackets)



Reflector EP175-31900
(Supplied with 2 metal brackets)



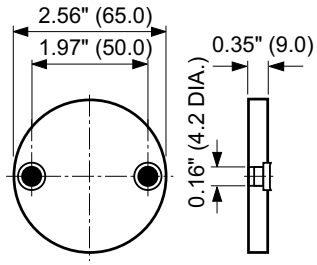
Reflector EP175-32000



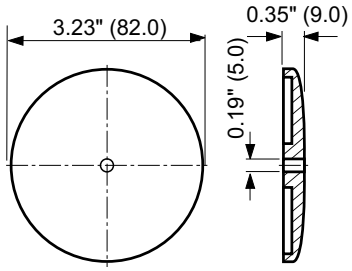
Reflector EP175-21000

Material: Plastic PMMA 8N (Plexiglass)
Temperature Range: -20˚C to +60˚C
Mounting: with glue, double face tape, or with brackets

GENERAL PURPOSE REFLECTOR (with Mounting Holes)



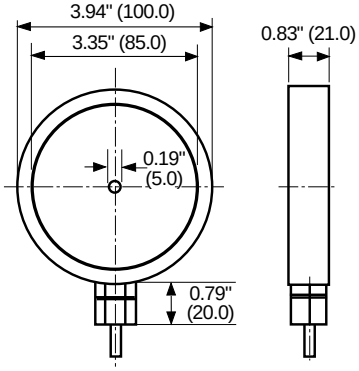
Reflector EP175-22600
Mounting holes for #6 screws



Reflector EP175-23200
Mounting hole for #8 screws

Material: Plastic PMMA 8N (Plexiglass)
Temperature Range: -20˚C to +60˚C
Mounting: with glue or screws

HEATED REFLECTOR



EP175-23201
Heated Reflector

Material: Plastic PMMA 8N (Plexiglass)
Temperature Range: -20˚C to +60˚C
Cable Length: 2M (6.6 ft.)
Input: 110VAC/2.0VA

Designed to operate in high humidity, fog, freezers, or outdoors and will keep reflective surface clear allowing proper performance. Shipped with EP175-23200 reflector. (Other voltages available.)

REFLECTIVE TAPE

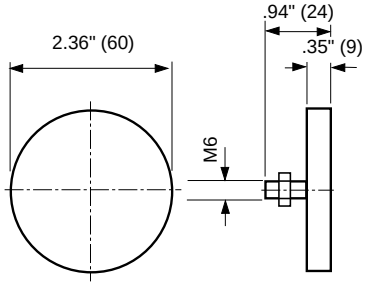
EP175-31200

•Adhesive backed reflective tape

• 1" x 12" mylar coated, honey combed sealed

Application Note: When cutting to size, allow for loss of reflective surface at cut edge.

HIGH TEMPERATURE GLASS



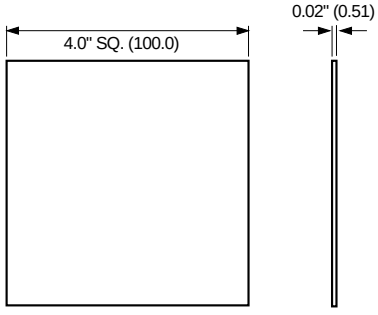
Reflector EP175-22400

Material: Glass
Temperature Range: -20˚C to +120˚C
Mounting: stud with nut

HIGH TEMPERATURE METAL

Namco High Temperature Reflectors are the same high quality as general purpose types but are designed to withstand environments beyond the norm. Applications requiring "wash down" or in areas where solvents such as toluene or trichloroethylene are present. Temperatures of 120˚C present no problem. Totally encased, glass corner-cube elements allow this type of performance.

Namco now offers a metal reflector that will withstand a constant temperature of 480˚C (900˚F).



Reflector EP175-14000

Material: Aluminum .020 thk. (51mm)
Temperature Range: -20˚C to +480˚C (900˚F) Intermittent to +540˚C (1000˚F)
Mounting: May be cut to size and attached with screws or clamps. May be cleaned with detergent and rinsed with water.

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Plug-In Time Delays

Photoelectric Sensor Accessories

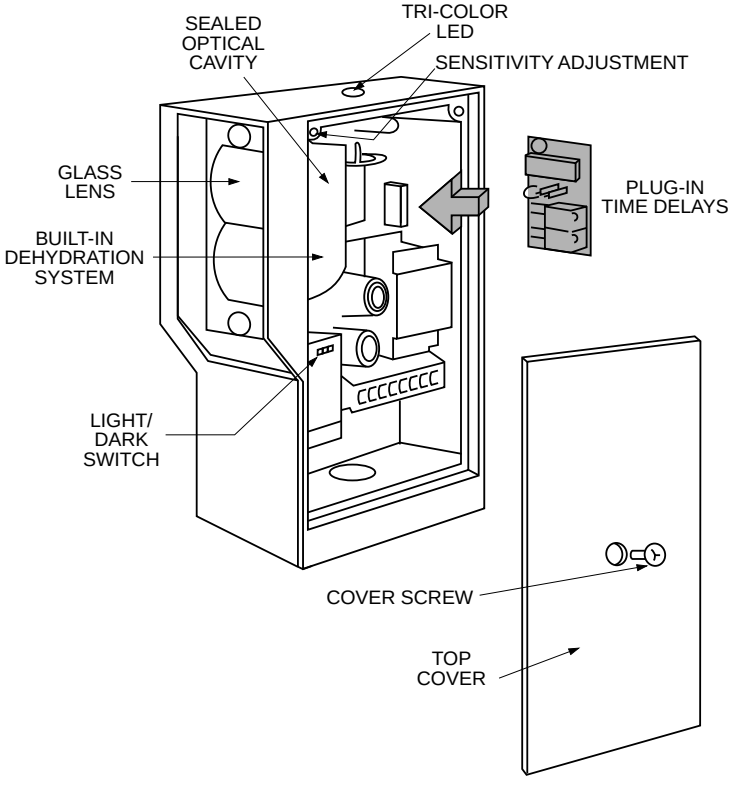
Model No.	Delay	ON Delay*	OFF Delay**	Description
EP115-00020	Adjustable ON & OFF; Retriggerable	250 ms to 10 sec.	250 ms to 10 sec.	Shifts Output signal.
EP115-00040	Adjustable ON	250 ms to 10 sec.	None	Output and Input turn OFF at the same point (signal removal).
EP115-00060	Adjustable OFF	None	250 ms to 10 sec.	Output turns ON with Input (catches and stretches short input signals).
EP115-00080	Adjustable ON; Adjustable One Shot (Single Pulse)	100 ms to 5 sec.	Output pulse duration: 100 ms to 5 sec.	Provides uniform Output signal for different Input signals (pulse starts at the end of ON delay period).

* Input signal must be longer than ON delay setting. Shorter input signals will be ignored.
** Input signal must be OFF longer than OFF delay setting.

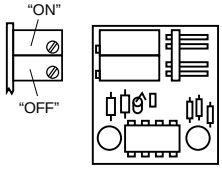
- When ordering factory installed time-delay units, specify model number to be installed with required time delay.
- Consult factory for plug-in "Under Speed" logic boards.
  Switch output is held unless speed drops below present pulse rate.

Plug-In Time Delays/Installation

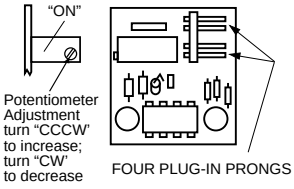
PLUG-IN TIME DELAY FEATURES



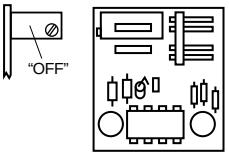
EP115-00020 – DUAL "ON" & "OFF" DELAY



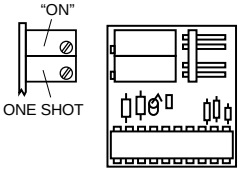
EP115-00040 – "ON" DELAY



EP115-00060 – "OFF" DELAY

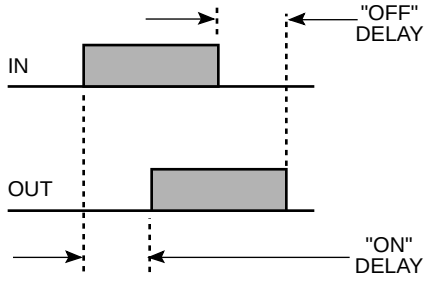


EP115-00080 – DELAYED ONE SHOT

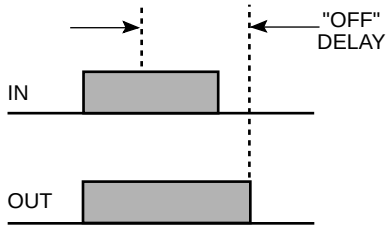


Plug-In Time Delay Graphics

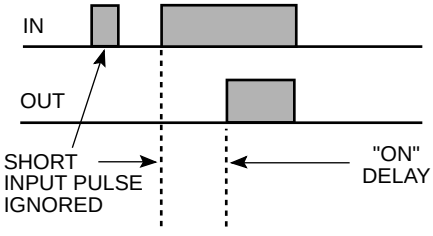
ADJUSTABLE "ON" & "OFF"



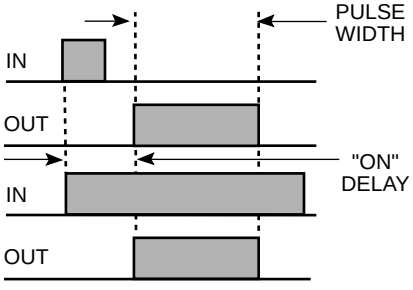
ADJUSTABLE "OFF"



ADJUSTABLE "ON"



ADJUSTABLE "ON" ONE SHOT SINGLE PULSE



Specifications

PLUG-IN TIME DELAYS	
Retriggerable	Timing function will re-start if another object is sensed prior to completion of initial delay setting.
Non-Retriggerable	Timing function will not re-start until full cycle is completed.

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Range Selection Guide

Photoelectric Sensors

Photoelectric Performance

The selection of the proper photoelectric sensor for an application is critical for reliable, trouble-free operation. The graphs shown below are meant to be a guide for matching a type of environment to the sensor types most likely to perform in that environment.

Fiber optic sensor types are not shown due to the different performance characteristics of the many styles of fiber optic cables.

These charts were derived from the Excess Gain Curves for each product. Excess Gain Curves for specific sensors are available on request from Namco Controls.

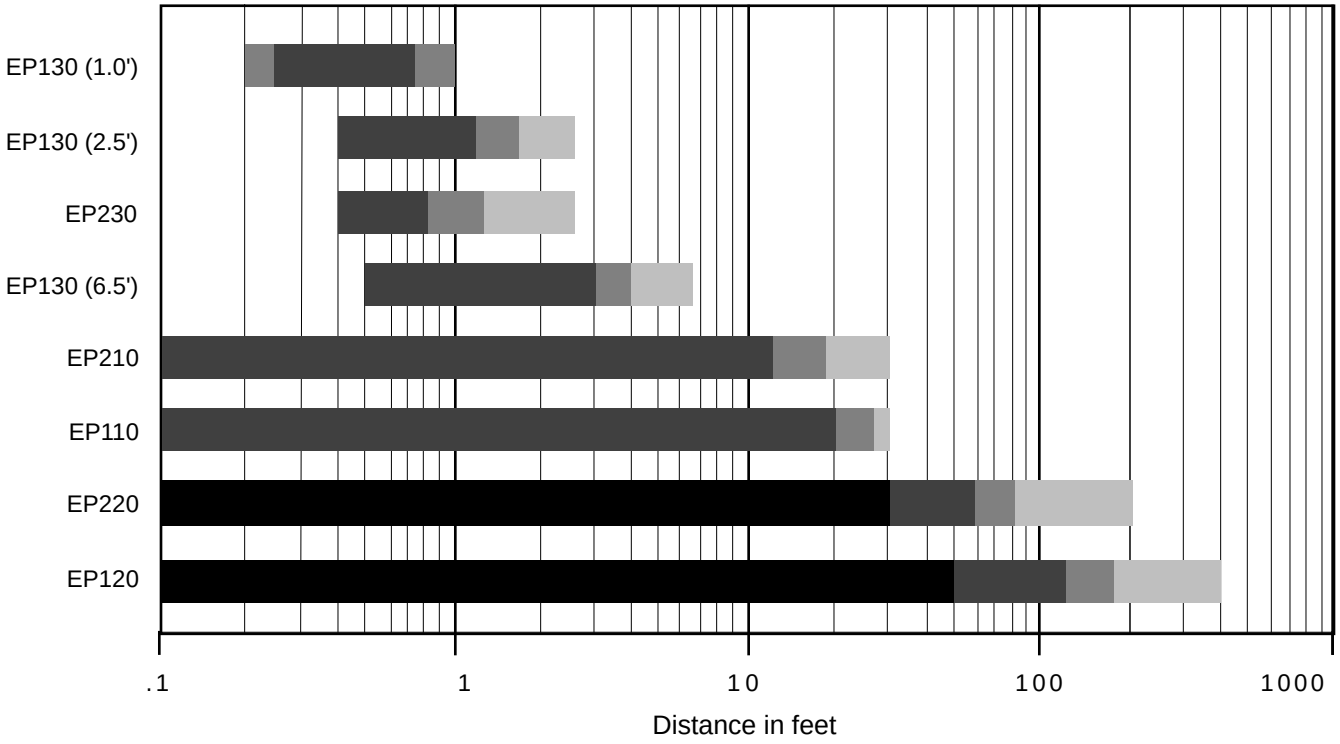
If you have any questions regarding the suitability of a Namco photoelectric sensor for your application, call our toll-free Technical Assistance Hotline at 1-800-NAMTECH (1-800-626-8324).

Suitable for use at these ranges in "clean" environments with no dirt, dust, or water accumulation on the lenses.

Can be used at these ranges in slightly dirty environments; lenses should be cleaned regularly. Typical of warehouse or light industrial installations.

At these ranges, the sensor can be used in moderately dirty applications where there is visible contamination of lenses or reflectors. Lenses should be cleaned regularly. Most industrial applications fit this category.

Suitable for use in extremely dirty environments, or where heavy smoke, steam, or dust is present or when lenses will be cleaned only rarely. Typical environments are steel or paper mills.



NOTE: EP570 – See Excess Gain Chart in Photoelectric WFI Sensors section.

Photoelectric Sensors

Evolution of Photoelectrics

As photoelectrics have evolved, increasing emphasis has been placed on offering user-oriented values. Indicator lamps have been incorporated to signal sensing status; circuits have been expanded to include a solution for every wiring application; and with the implementation of surface mount technology, the features-to-size ratio has improved.

Sensor Light Sources

The first photoelectrics used incandescent light sources. These early products were susceptible to ambient light conditions and limited in application. With the introduction of light emitting diodes ("L.E.D.'s"), the opportunity for applying photoelectric sensors expanded. By modulating (pulsing) the L.E.D. and tuning the receiving photodiode to respond only to this rate of change, immunity to ambient light is improved. Further enhancements have been achieved by incorporating transmission filters to improve the signal-to-noise ratio associated with ambient light.

Reflectors are used in some sensing modes to provide an effective method for returning the emitted light beam to the receiving photodiode. While the most fundamental reflector returns the incident light back to the source only when the incident light strikes the reflector at 90 degrees to the surface of the reflector, the more commonly used "corner cube" retro-reflector will return the incident light to the receiving photodiode over a wide range of incident angles, making alignment angle with respect to the sensor significantly less critical.

Polarizing a light source orients the emitted rays into one plane. If a receiving photodiode is polarized in the same plane as the received light, it will detect the light. In sensing modes where retro-reflectors are used, the retro-reflector shifts the incident light 90 degrees. Photoelectric sensors designed for this mode of sensing are polarized to expect a shift of the incident light by the retro-reflector. Any light returned by specular reflection (from shiny objects) is not shifted and is intentionally undetected by the receiver.

Photoelectric controls are applicable in a wide range of industrial situations because of their long life, versatility, safety, and reliability. Namco's sensors have been tested and proven over many years of operation in all types of environments. Their precision optics can detect objects that cannot be detected by conventional photoelectrics. Namco photoelectric sensors are available in incandescent or LED and feature rugged construction, long-life LED output indication, and insensitivity to ambient light. They also offer time delays, logic delay systems, short circuit protection, and reverse polarity protection. All electronic circuitry is solid state. DC units may be operated from plant power supply or from optional relay/power pack combinations.

Performance

The performance of photoelectrics is dependent on environmental conditions; e.g., air contamination, steam, fog, oil spray. Excess gain is merely a statement of how much extra gain the sensor has over the minimum it needs to communicate in ideal conditions at a given range. The higher the excess gain for a given distance, the more likely the photoelectric is to be able to penetrate through the contamination to reach and be detected by the corresponding receiving photodiode. Since most applications are less than ideal, photoelectrics should be selected with ample excess gain for the intended range.

Output Options

Most of the photoelectrics offered in this catalog are self-contained in that no external stages of circuitry are required to operate the sensors. Newer circuit types include 2-wire AC for ease of installation and lowest cost installation, 3-wire AC for load current independent of input current, and 4-wire DC for user selectable sink (NPN) or source (PNP) connection. All of these are Programmable Logic Controller compatible.

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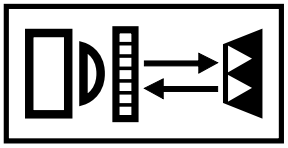
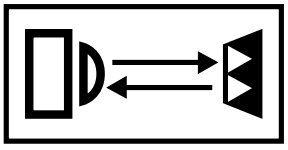
Sensing Modes

Photoelectric Sensors





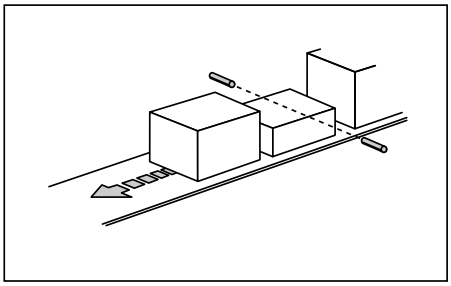
Retro-Reflective Sensing Mode

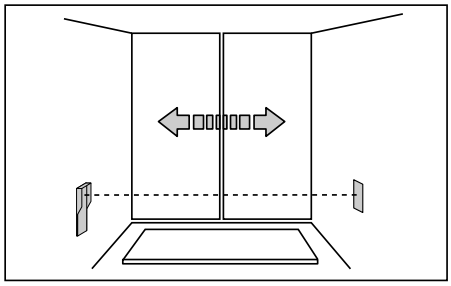
Retro-reflective sensing is particularly effective in applications that offer the following conditions: (1) the object to be sensed is generally opaque; (2) a reflector can be easily installed so that the object must pass between the reflector and the sensor; or (3) the object may be detected by adding reflective tape to the object.

Available ranges of retro units are generally a fraction of the range of comparable size thru-beam units.

In the retro-reflective mode, a single sensor is used to both send and receive light directed to a reflector. Objects passing between the sensor unit and its corresponding reflector interrupt the light beam and signal the sensor to provide the indicated output. Using corner cube reflectors enables the light signal to be returned to the sensor over a wide range of incident angles.

Retro-reflective sensing is popular for its simplicity of installation, and if properly equipped with polarizing options, is independent of target material/color/texture. Operates at distances of up to 30 feet.

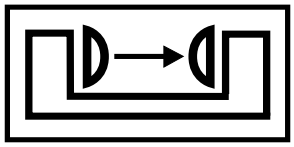


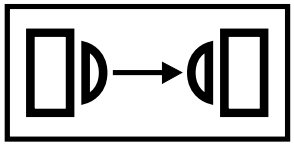


Thru-Beam Sensing Modes

Thru-Beam (Opposed) Sensing Mode

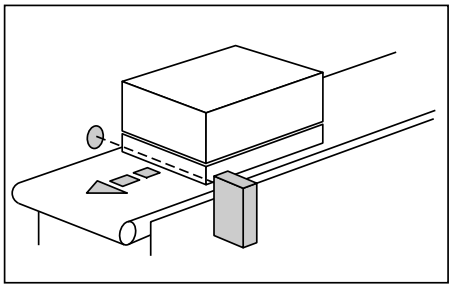
Thru-beam sensing should be employed wherever longer sensing ranges (up to 400 ft.) are required and where harsh or dirty environments require more powerful performance or individually mounted transmitted receiver units.

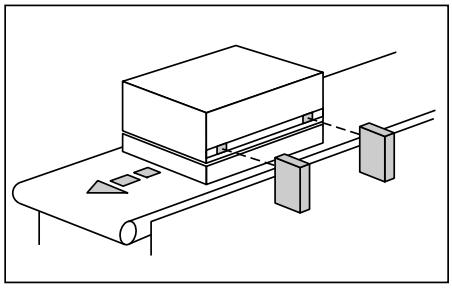




Thru-beam configurations consist of separate emitter and receiver units aimed at one another and separated so that objects will pass between both units. Without the presence of objects, the emitted light beam is sensed by the receiver. As objects pass between the two units, the light beam is interrupted, and the corresponding sensor output is provided.

Thru-beam is the most reliable sensing mode. Since the receiver is a separate unit, sensing is totally immune to false proxing from shiny objects. Sensing of transparent objects may require gain control adjustment. Thru-beam systems are inherently higher cost and require additional wiring to the second unit.

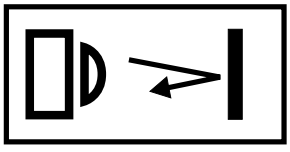


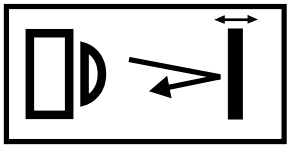


Retro-Reflective Sensing Modes

Diffuse Proximity Sensing Mode

Diffuse proximity sensing should be used when the following conditions exist: (1) the object itself is sufficiently reflective to return incident light to the receiver photodiode; (2) the installation of a reflector on the opposite side of the object is impractical.



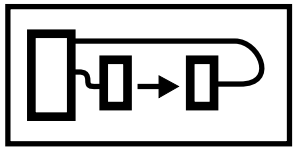


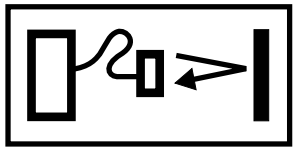
The diffuse proximity mode utilizes a single sensor unit as emitter and receiver and relies upon the object sighted to reflect sufficient light to be sensed by the receiver. Absence of objects in the light beam path result in light not returned to the receiver.

Diffuse sensing is the lowest cost approach but depends on the reflectivity (and color) of the target material. This system is suitable for detecting like objects where the gain can be adjusted once for the best performance.

Fiber-Optic Sensing Mode

Introducing a set of fiber-optic cables to photoelectric sensors adds considerable flexibility from an applications perspective. Fiber-optics work well in applications requiring either small part detection or where space in the immediate vicinity of the target object is at a premium. Using fiber-optic cables to reach into environments too harsh for the sensor unit itself is a common application. Fiber-optic cables are immune to electrical and radio frequency interference (EMI and RFI).





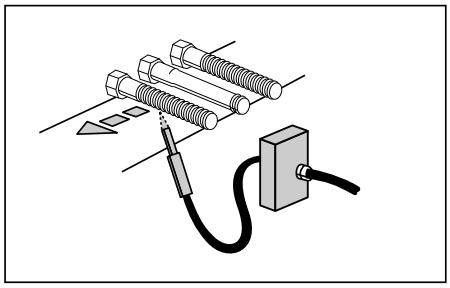
The fiber-optic sensing mode is obtained simply by adding fiber-optic cables to an existing sensor designed to accommodate them. While any sensing mode could utilize fiber-optics, typical cable offerings are designed for thru-beam and diffuse operation. Glass and plastic core materials are common in the industry, each offering their respective advantages and tradeoffs.

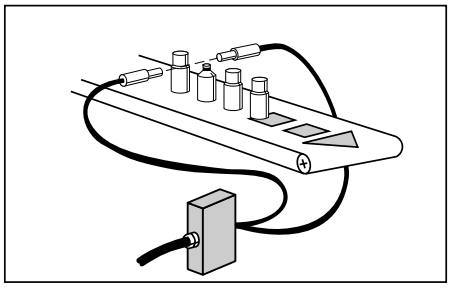
Glass cables have better light transmission capabilities, higher operating temperatures and cost, with a sacrifice in physical flexibility. Glass cables cannot be cut to length by the average user.

Plastic cables are lower temperature rated, are less efficient in light transmission, more flexible, lower cost, and can be easily cut to length in the field.

Protective jacketing for fiber-optics include either stainless steel spiral wrap armor or extruded pvc for glass fibers and extruded pvc for plastic fibers.

Both glass and plastic fiber-optic cables offer immunity to electrical interference and permit relocating of the sensor unit in applications where the environment in the sensing area is unusually harsh.





Fiber Optic Sensing Modes

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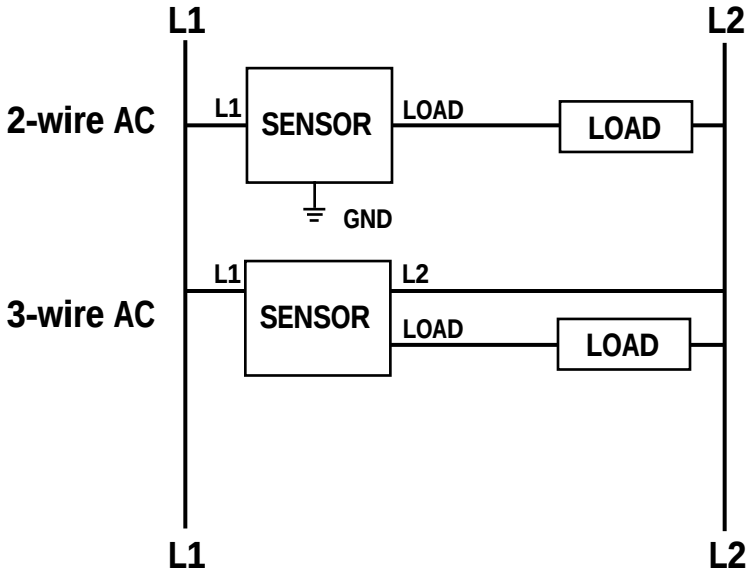
Typical Wiring Diagrams

Photoelectric Sensors

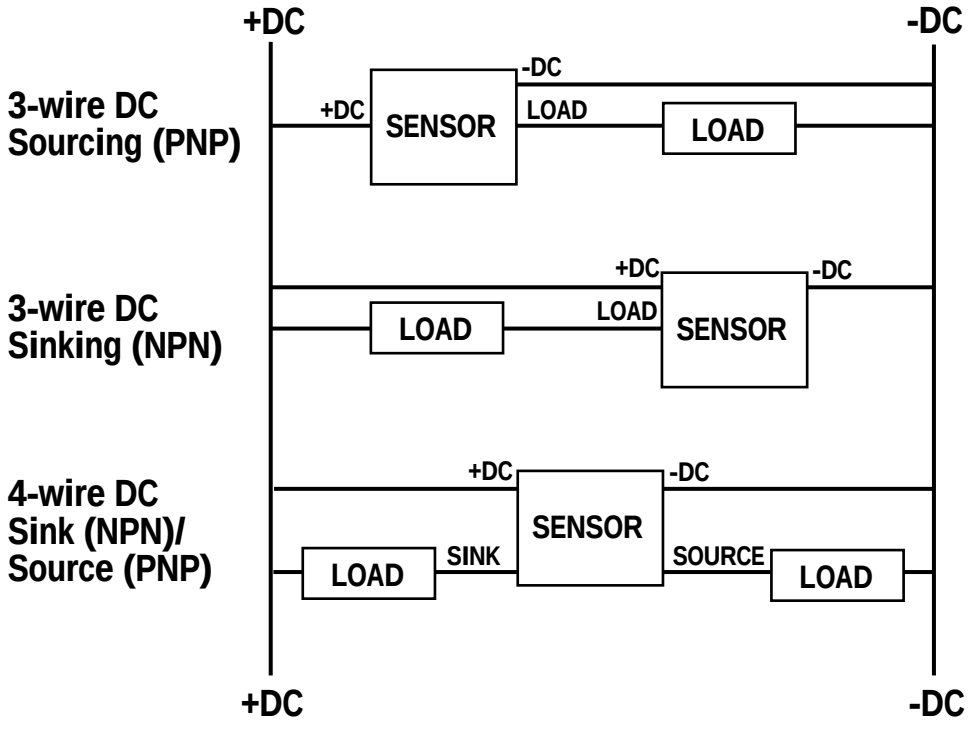
Notes:

1. These diagrams are valid for sensors with cables and connectors.
2. Sensors may or may not have ground connections or grounded housings. Refer to the specific connector or cable diagram for your particular sensor's model number to determine if it is grounded.
3. The markings on these wiring diagrams (L1, Load, etc.) are identical to those on the connector diagrams.
4. All switches are Normally Opened (N.O.) unless specifically marked Normally Closed (N.C.).
5. All switch outputs are Sourcing unless specifically marked Sink.

AC Wiring Diagrams



DC Wiring Diagrams



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Glossary

Photoelectric Sensors

Alignment: Relationship of the light source and the receiver. Proper alignment is necessary to achieve maximum sensitivity to objects being monitored.

Ambient Light: The surrounding light in which the photoelectric sensor operates. Because they use modulated LED switches, Namco sensors are insensitive to ambient light.

Control Module: A remote unit containing the power supply in which amplification, modulation, and conditioning of the photoreceiver signal take place.

Cross-Talk Immunity: A unique capability of Namco sensors that allows several LED controls to be placed close to each other with each receiver responding only to the light beam frequency of its own transmitter.

Current Sinking: The output circuit grounds or sinks the load or current. Current sinking (NPN) or sourcing (PNP) outputs are available on Namco sensors.

Current Sourcing: The output circuit switches the source voltage to the load. Current sinking (NPN) or sourcing (PNP) outputs are available on Namco sensors.

Dark-Operated: Operating mode in which the control is activated by interrupting the beam of light.

Diffuse Proximity: Sometimes called a proximity because of the required nearness of the light source and the photosensor to the reflective object.

Excess Gain: The diffused amount of light falling on the face of a receiver over and above the amount required to operate amplifier of the scanner. It is a guideline measurement for selection of retro-reflective and scanner type units.

Fiber Optic: Cables transmit light from a control unit to an object and then return the reflected light back to the control unit producing an electrical signal.

LED: Light emitting diode. Can be visible or invisible (infrared).

Light-Operated: Operating mode in which the control is activated by an uninterrupted beam of light.

Modulated LED: An LED in which the light is pulsed at a predetermined frequency to reduce interference from ambient light and/or to increase the sensing distance. The receiver is preset to respond only to that predetermined frequency.

Opaque: The quality of a material or object that prohibits light from passing through it.

Operating Mode: Condition of a sensor (dark or light-operated) that will activate it.

Photoreceiver: A unit positioned to detect light, or its absence, in a photoelectric sensor. It consists of a photosensor and a focusing lens in an enclosure.

Proximity: Sensing technique that utilizes a single sensor unit containing both emitter and receiver. Relies upon object to be sensed having high reflectivity.

Range: The distance at which a sensor (excluding thru-beams) will sense white paper on a flat black surface for maximum signal ratio. Retro-reflective units and diffuse proximity units are rated in distance from the unit to a reflector or target.

Repeatability: The ability of a photoelectric unit to sense an object continuously and reliably at a predetermined point within a given tolerance.

Response Time: Time required by a photosensor to respond to an input signal and activate the output.

Retro-Reflective: A sensing technique in which a beam of light is aimed at a specified reflector and reflected back to the photoreceiver.

Reverse Polarity Protection: Usually a diode inserted in one of the power leads of a D.C. switch. This protects the internal circuitry if connections are accidentally reversed.

Self-Contained Control: A photoelectric sensor capable of sensing, signal conditioning, and output in a single unit.

Signal Ratio: The relationship of light to dark when the sensor is illuminated. Proper control alignment is necessary to establish optimum light-to-dark signal ratio.

Specular: Reflective technique in which a light beam is reflected back to a photoreceiver at a predetermined angle from the object being monitored.

Thru-Beam: Sensing technique in which the light source and the sensor are located opposite each other, and the light beam passes from the source to the receiver directly without the use of a reflector.

Translucent: The quality of a material or object that permits light to pass through it but diffuses it. For detection purposes, a retro-reflective technique works best with translucent objects because light must pass through twice, thus producing a larger signal change.

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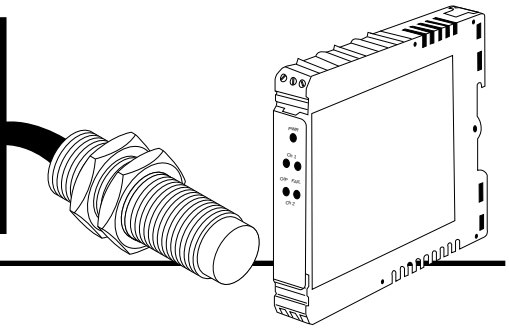
NAMUR Sensors

Hazardous Location Sensor Systems



NAMUR refers to the standards committee of measurement and control of the chemical industry of Europe. Namco sensors comply with DIN 19234 and therefore are compatible with the NAMUR requirements.

NAMUR sensors are typically used for hazardous location sensing in areas that require extremely compact sensors. Namur Sensors are not stand-alone sensors unless your control system input is capable of determining current change. Unlike most other sensors, the Namur Sensor uses very low voltage as a source and changes the current passed through as a function of how close the target is to the sensing coil. Namur sensors are used with either stand-alone amplifiers or Namur specific PLC input cards. When used in a hazardous location, an appropriate barrier is required.

Connector Type	Circuit Description	Housing Material	Housing Length	Shielded Model No.	Unshielded Model No.	Sensing Range		Maximum Load Current	Maximum Switching Frequency		Short Circuit Protected
						Shielded	Unshielded		Shielded	Unshielded	
6.5mm Diameter NAMUR 5-25 VDC Smooth											
6.6' Cable	Analog	Metal	30mm	**ET112-00310**	—	1mm	—	N/A	1KHz	—	N/A
8mm Diameter NAMUR 5-25 VDC											
6.6' Cable	Analog	Metal	30mm	**ET112-10310**	—	1mm	—	N/A	1KHz	—	N/A
12mm Diameter NAMUR 5-25 VDC											
6.6' Cable	Analog	Metal	30mm	**ET112-20310**	**ET112-21310**	2mm	4mm	N/A	800Hz	400Hz	N/A
6.6' Cable	Analog	Plastic	30mm	**ET212-20310**	**ET212-21310**	2mm	4mm	N/A	800Hz	400Hz	N/A
18mm Diameter NAMUR 5-25 VDC											
6.6' Cable	Analog	Metal	30mm	**ET112-30310**	**ET112-31310**	5mm	8mm	N/A	500Hz	200Hz	N/A
6.6' Cable	Analog	Plastic	30mm	**ET212-30310**	**ET212-31310**	5mm	8mm	N/A	500Hz	200Hz	N/A
30mm Diameter NAMUR 5-25 VDC											
6.6' Cable	Analog	Metal	40mm (Sh) 42mm (UnSh)	**ET112-40310**	**ET112-41310**	10mm	15mm	N/A	300Hz	250Hz	N/A
6.6' Cable	Analog	Plastic	40mm	**ET212-40310**	**ET212-41310**	10mm	15mm	N/A	300Hz	250Hz	N/A
Small Rectangular NAMUR 5-25 VDC											
6.6' Cable	Analog	Plastic	12x26x40mm	**ET912-10310**	**ET912-11310**	2mm	4mm	N/A	800Hz	400Hz	N/A

Please consult factory for other versions.

Special Application Solutions

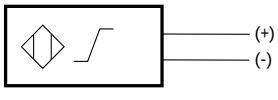
Protected by the NAMCO Lifetime Replacement Program

Common Sensor Characteristics

NAMUR DC SENSORS	
Shielded Sensing Range	6.5mm: 1mm 8mm: 1mm 12mm: 2mm 18mm: 5mm 30mm: 10mm Sm. Rec.: 2mm
Unshielded Sensing Range	8mm: 2mm 12mm: 4mm 18mm: 8mm 30mm: 15mm Sm. Rec.: 4mm
Shielded Standard Target (mm) (mild steel)	6.5mm: 8x8x1 8mm: 8x8x1 12mm: 12x12x1 18mm: 18x18x1 30mm: 30x30x1 Sm. Rec.: 12x12x1
Unshielded Standard Target (mm) (mild steel)	8mm: 8x8x1 12mm: 12x12x1 18mm: 24x24x1 30mm: 45x45x1 Sm. Rec.: 16x16x1
Repeatability	2%
Hysteresis	3-8% (typ.); 15% (max.)
Temperature Drift (Max.)	±15%
Ambient Temperature Range	-13˚F to +158˚F
Current Consumption	N/A
NEMA Rating	1, 3, 4, 6, 13
LED Indicator	N/A
Metal Housings	Chromed Brass
Plastic Housings	Ultradur®
Shipping Weight	6.5mm: 8 oz. 8mm: 8 oz. 12mm: 8 oz. 18mm: 8 oz. 30mm: 10 oz. 34mm: 11 oz. Flat Pack: 5 oz. (Add 5 oz. for Cable model)

Circuit Drawings

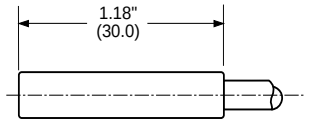
SENSOR WIRING DIAGRAM



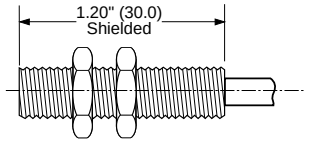
Dimensional Drawings

NAMUR

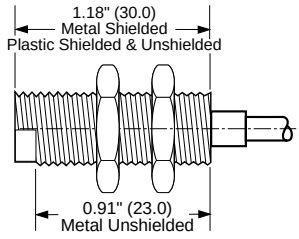
6.5mm DIAMETER SENSOR



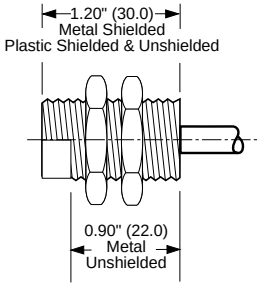
8mm DIAMETER SENSOR



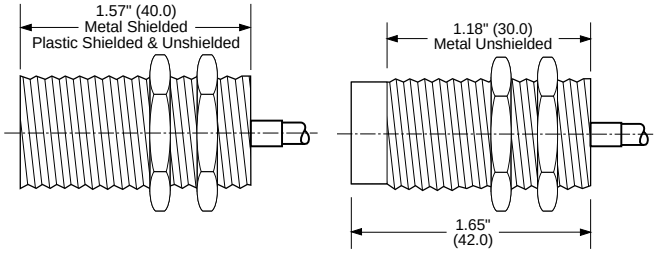
12mm DIAMETER SENSOR



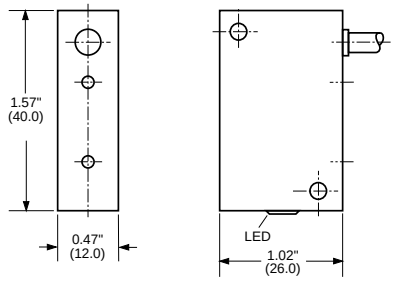
18mm DIAMETER SENSOR



30mm DIAMETER SENSOR



Small Rectangular SENSOR



Special Application Solutions

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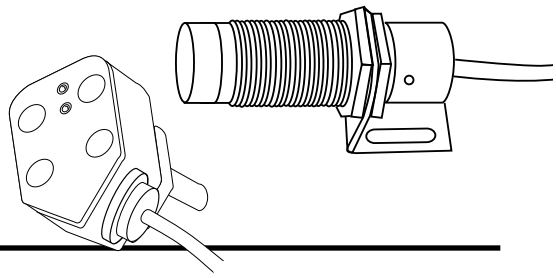
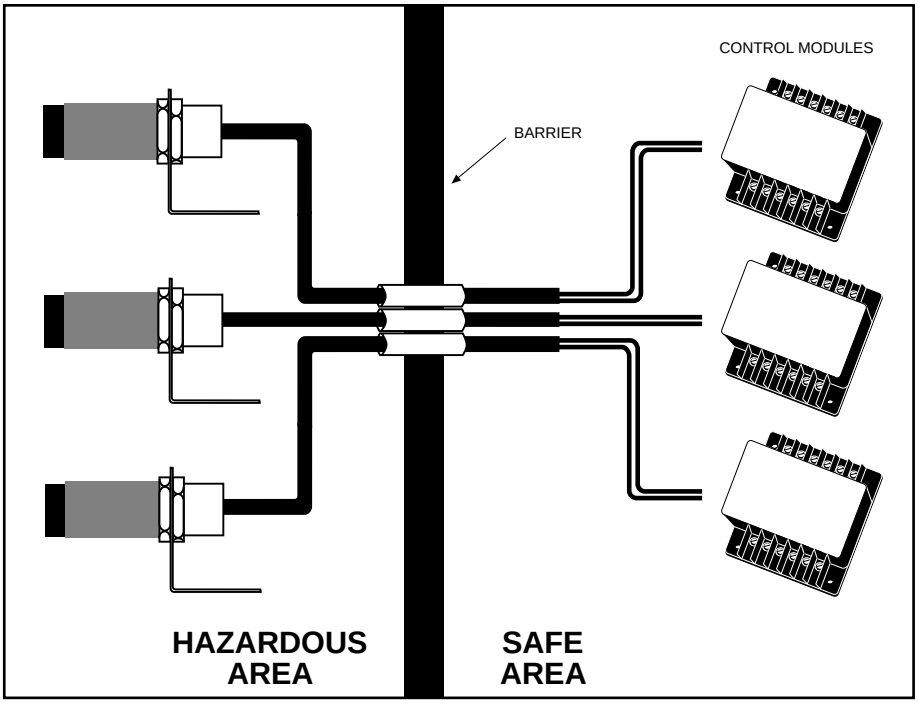
Intrinsically Safe

Hazardous Location Sensor Systems



For use in:
Class I - Groups A, B, C, & D
Class II - Groups E, F, & G

The EE931 Hazardous Location sensor system is excellent for sensing of position in paint spray booths, belt slip on conveyors, or anywhere that explosion proof switches are normally used. Since the EE931 system is intrinsically safe, no special housings are required to contain any potential flame. Intrinsic Safety is obtained by design of the product such that extremely limited energy is available in the hazardous location. For this reason, these Namco sensors must only be used with the Namco control module. It is possible, however, to use the Namco control module with either the Namco sensors listed in this section or a standard limit switch. (Limit switches must be of the gold contact type due to the low current and voltage supplied by the control module.)



An intrinsically safe proximity sensor system consists of a sensor, which is mounted in the hazardous area, and a control module, which is mounted in the safe area.

Sensors

Namco offers a variety of intrinsically safe sensors for use in Class I, Groups A, B, C, and D and Class II, Groups E, F, and G hazardous locations. These EE931-series sensors must be used ONLY in conjunction with Namco's EE931-series control modules. The hazardous location sensors are completely encapsulated and contain a transistor oscillator circuit. Variations in oscillator amplitude caused by metallic objects passing in front of the sensor face produce activation of the control module output.

Twenty feet of 18AWG oil resistant cable is provided with tubular sensors, although up to 1000 feet can be obtained for applications where the hazardous area is a considerable distance away from the safe area control panel. Sensors providing up to one inch of sensing range are available.

Cylindicator® sensor versions are provided with 50 feet of cable. For longer cable lengths, consult factory.

Protected by the NAMCO Lifetime Replacement Program

Cylindicator® Sensors

Model No.	Probe Length
EE931-30101	0.950
EE931-30401	1.025
EE931-31301	1.250
EE931-38701	2.062
EE931-37801	2.875
EE931-39001	3.775

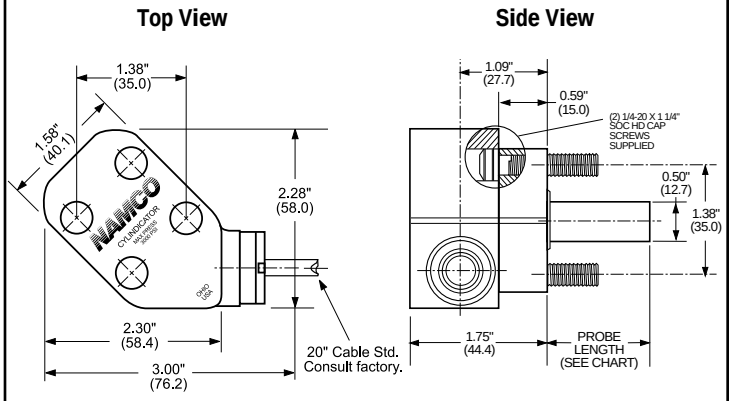
Tubular Sensors (See "Sensing Range" opposite page)

Model No.	Sensing Range		"C" Mtg. Clear.	Thread	Cable (20')
	"A" Sensing Field	"B" Side			
EE931-56200	0.20" (5.0)	0.25" (6.3)	0.40" (10.1)	3/4"-20	2 Cond. 18 AWG SVO
EE931-76500	0.37" (9.5)	0.25" (6.3)	0.57" (14.6)	M30 x 1.5	2 Cond. 18 AWG SVO
EE931-75100	1.00" (25.4)	0.50" (12.7)	2.50" (63.5)	M30 x 1.5	2 Cond. 18 AWG SVO

Special Application Solutions

Dimensional Drawings

90° ROTATABLE CYLINDICATOR® SENSOR



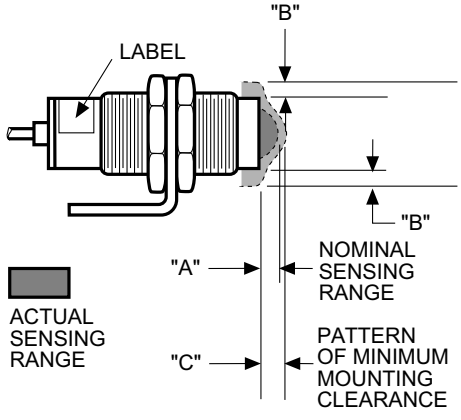
Sensor Mounting

Sensors may be installed with mounting bracket furnished in any position provided the sensor face is kept free of electrically conductive material. See below for maximum sensing range and pattern of minimum mounting distances from other conductive materials for the EE931-series sensors.

See the Cylindicator section in this book for application information on Cylindicator sensors.

Factors influencing sensing range are temperature, target size, target material, and speed. For best all-around performance, use "slide-by" actuation as opposed to "head-on" actuation. Target should present as much surface area to the sensor face as practical. Sensing of non-ferrous metals may reduce sensing range by as much as 50%, depending on the type of material. Since the sensing range of each sensor is fixed, no control module adjustment is required. The target should be placed as close to the sensor face as possible. Namco recommends setting the target at one-half the "maximum" sensing range or closer for best system operation.

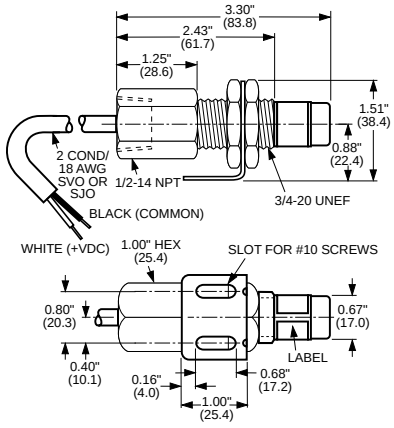
Sensing Range



Dimensional Drawings

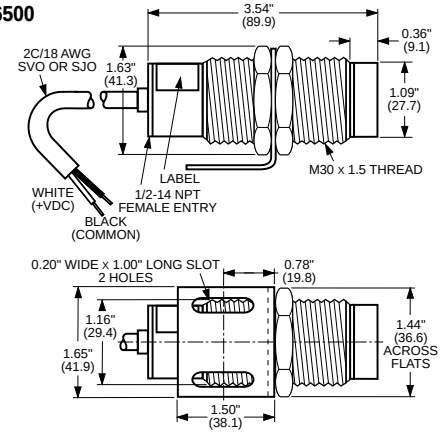
TUBULAR SENSOR – 3/4-20 THREAD 17mm SMOOTH BARREL

Model No. EE931-56200



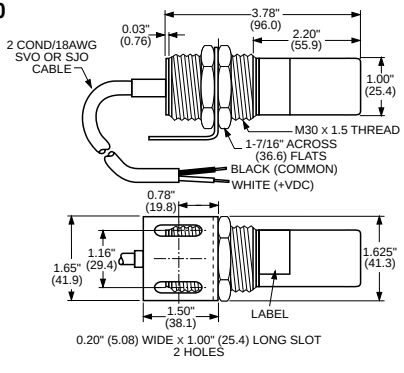
TUBULAR SENSOR – M 30x1.5 FULL THREAD

Model No. EE931-76500



TUBULAR SENSOR – M 30x 1.5 THREAD 1" SMOOTH BARREL

Model No. EE931-75100



Continued on next page.

Special Application Solutions

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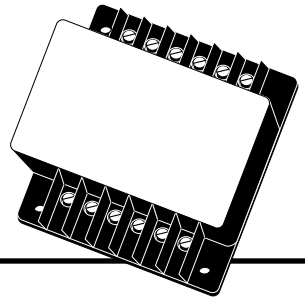
Intrinsically Safe

Hazardous Location Sensor Systems



Control Modules

The EE931-series control modules are designed to be mounted in the safe area. These modules provide limited energy to Namco's line of hazardous location sensors described on the previous pages. The control modules are housed in high impact Lexan® enclosures and are equipped with eight screw terminals (#8 stud size) for ease of installation. The EE931-02103 module provides an electro-mechanical relay output (One Form C), while the EE931-02303 unit has a photo-darlington (open collector) output for higher speed requirements. The outputs become energized when a metallic target is present in front of the associated sensor.

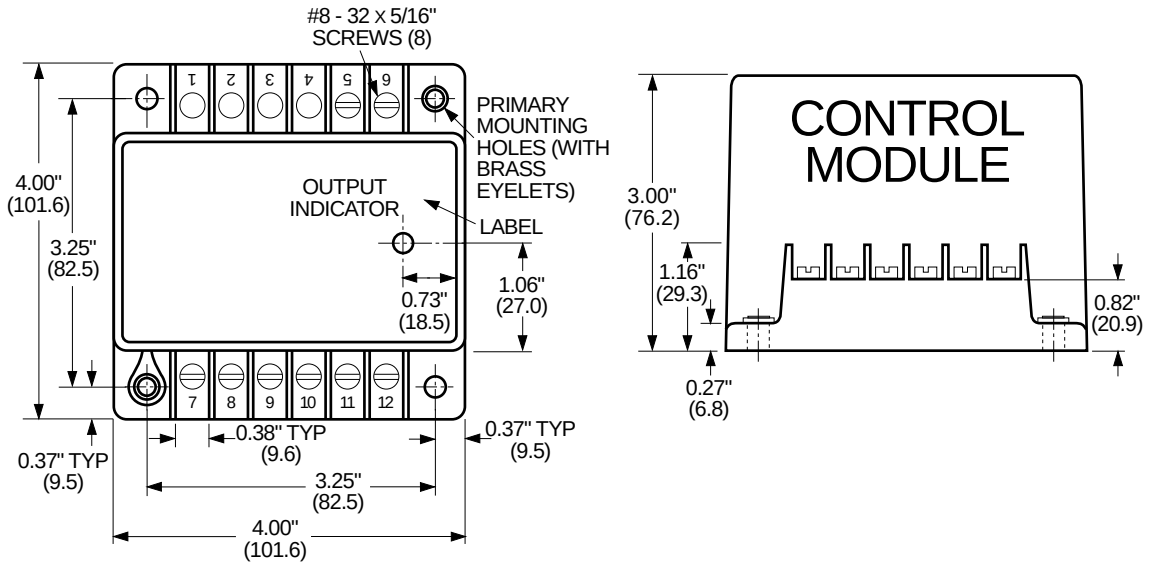
Control Module Mounting:

The EE931-series control module should be panel mounted in the safe area where it will be protected from physical damage, dirt, and vibration. The location should be established within the limits of the sensor cable. The unit can be mounted vertically or horizontally using two No. 8 screws. When mounting with only two screws, **it is imperative to use the two mounting holes provided with brass eyelet inserts**. This method provides an additional ground path for the electronic circuit contained in the module. The ambient temperature range should be from -40°F to +158°F. The physical construction of the control module housing insures a separation of at least two inches between intrinsically safe terminals (5 and 6) and non-intrinsically safe terminals (7 thru 12).

It is important when installing the sensor cable to the control unit terminals (5 and 6) to maintain this minimum spacing of two inches. A separate wiring duct is required to insure that the intrinsically safe sensor cable does not become intermingled with non-intrinsically safe wiring due to vibration. A separate conductor MUST be wired from Terminal 9 to earth ground to insure intrinsic safety of the system. Terminal 8 is for the neutral side of AC line. Terminal 7 is hot side of AC line and MUST be wired accordingly or intrinsic safety is voided.

Namco advises that the Instrument Society of America Specification RP12.6, which gives the recommended practice for installation of intrinsically safe systems, be followed when using the EE931-series control modules and sensors.

Dimensional Drawing



Circuit Drawings

RELAY OUTPUT

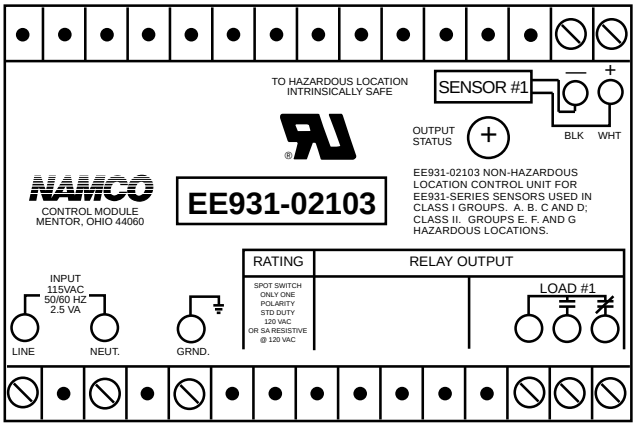
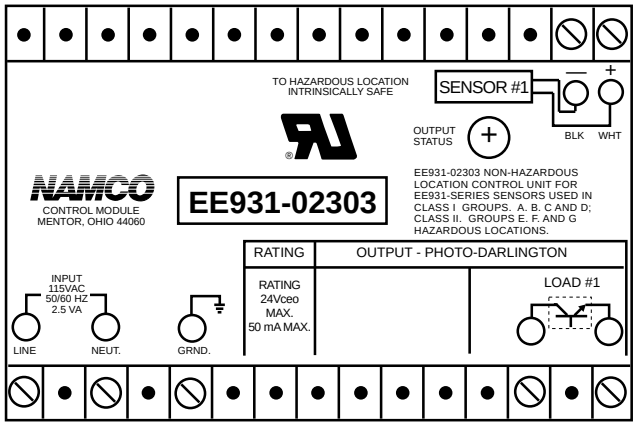


PHOTO-DARLINGTON



Common Control Module Characteristics

INTRINSICALLY SAFE CONTROL MODULE		
	EE931-02103	**EE931-02303**
Output	Electro-Mechanical SPDT Relay Rated 5A Resist. One form C	Photo-Darlington 50mA max. @ 24 VAC Open Collector
Speed (Hz)	3	1400
Supply Voltage	120 VAC	
Sensor Input	Namco EE931-Series only	
Ambient Temperature	-40˚F to +158˚F	
Case Material	Lexan	

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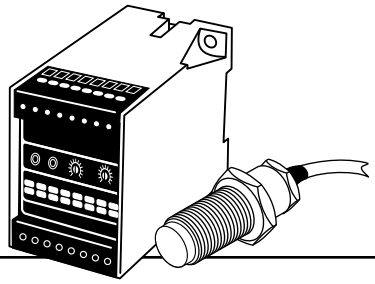
Machinery Protection Flow Sensors



- **Sensor does not impede media flow**
- **Totally solid-state—no mechanical parts to wear out**
- **Monitors both flow and temperature of media**
- **Rugged, stainless steel sensor**

Namco Flow Sensors operate on the calorimetric flow principal providing an economical, reliable way to detect variations in media flow by thermal conduction.

To measure the "heat sinking" capability, or thermal transfer of the media, two temperature sensitive silicon semiconductors and a heater are mounted directly underneath the sensor face. Flow rates deviating from the user set points are detected by a Wheatstone-Bridge/Amplifier package. This design combines a proven method of measurement with a fully encapsulated, industrial quality, flat-head sensor.

The sensor head is constructed so that no protrusions into the flow media occur. The sensor itself is made entirely of stainless steel. Both flow and temperature are monitored and user adjustable. Switching functions are indicated by LEDs.

The remote electronic packaging enables the system to be operated in applications where monitoring and/or adjusting flow and setpoints is difficult or hazardous such as in a robot cell. The remote electronic module can be mounted outside of the cell while the sensor is inside enabling easy access even while the robot is in motion.

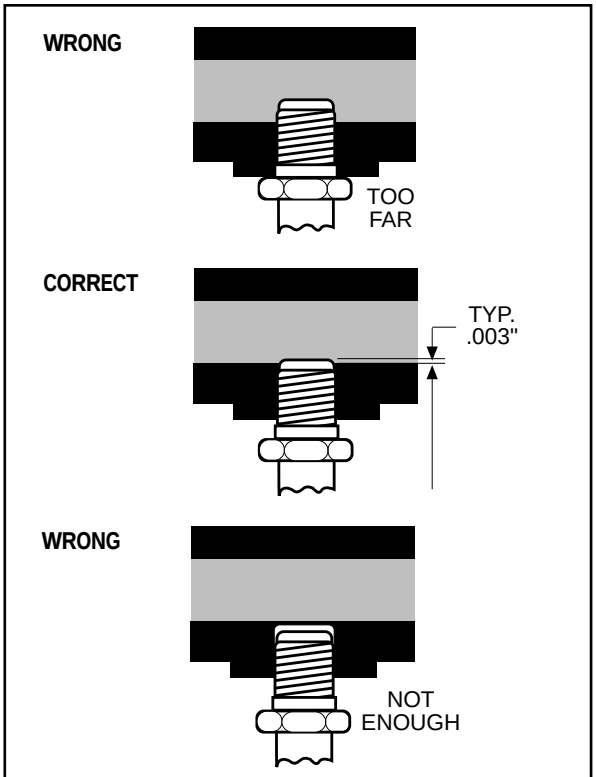
Applications

Coolant, water or lubricant temperature and/or flow indication.

- Dry running protection of pumps
- Flow rate control in boiler systems
- Flow rate monitoring of coolant in welding machines
- Heating systems and exchangers
- Chemical process monitoring
- Pharmaceutical process control
- Lubrication flow rate monitoring
- Process control monitoring of media flow in food and beverage, sewage/ wastewater industries, etc.

Model Number	Supply Voltage	Output
Total System (Sensor & Control Module)		
ER320-10000	110VAC	Thyristor NO/NC
ER320-10002	110VAC	DPDT Relay
ER320-10001	24VDC	NPN & PNP Transistor NO/NC
Sensor Only		
ER310-10000	—	—
Control Module Only		
ER300-10000	110VAC	Thyristor NO/NC
ER300-10002	110VAC	DPDT Relay
ER300-10001	24VDC	NPN & PNP Transistor NO/NC

Typical Sensor Installation



Sensor surface to have minimal protrusion into flow.

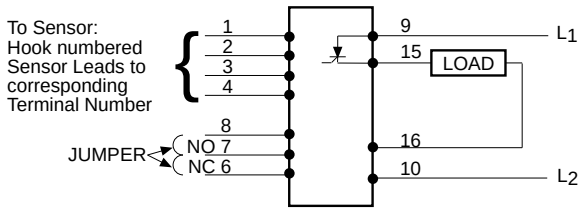
Common Sensor Characteristics

FLOW SENSOR SYSTEMS			
	AC/Thyristor	**AC/Relay**	**DC/Transistor**
Pipe O.D. (inches)	Min. Detectable Flow (gal/min)		Max. Detectable Flow (gal/min)
1/2"	0.020		6.023
3/4"	0.045		13.551
1"	0.080		24.090
1 1/4"	0.125		37.641
1 1/2"	0.181		54.203
2"	0.321		96.360
Supply Voltage	110 VAC 50/60 Hz	110 VAC 50/60 Hz	24VDC
Power Consumption	3VA	4VA	2W
Sensor Pressure Rating	435 psi max.		
Ambient Temperature	+14˚F to +158˚F		
Media Temperature	+14˚F to +176˚F		
Temperature Set Point	+23˚F to +176˚F		
Flow and Temperature Adjustment	Potentiometer and LED		
Output	Thyristor	DPDT Relay	NPN & PNP Transistor
Load Current	30 mA min. 300 mA max.	8A @ 220VAC	500mA
Short Circuit Protection	Yes	No	Yes
Response Time	<5 seconds		

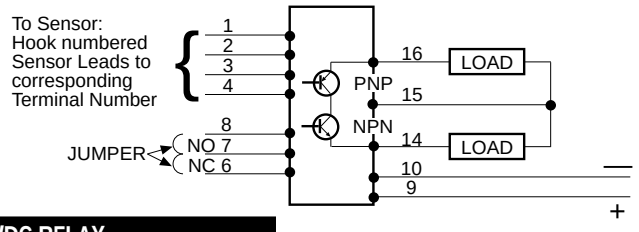
Maximum distance between Control Module and Sensor is 328 ft. using low inductance cable.

Circuit Drawings

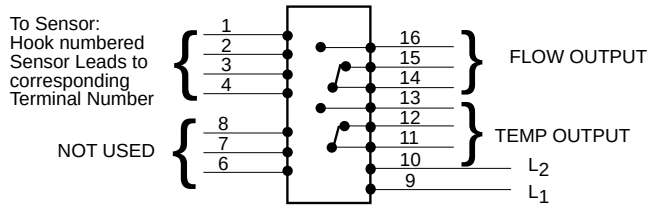
AC THYRISTOR MODELS



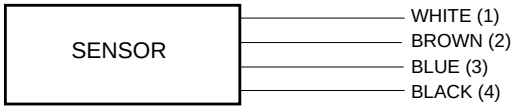
DC TRANSISTOR MODELS



AC/DC RELAY

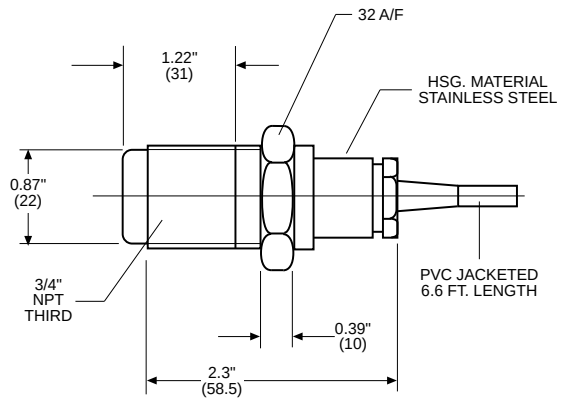


SENSOR WIRING

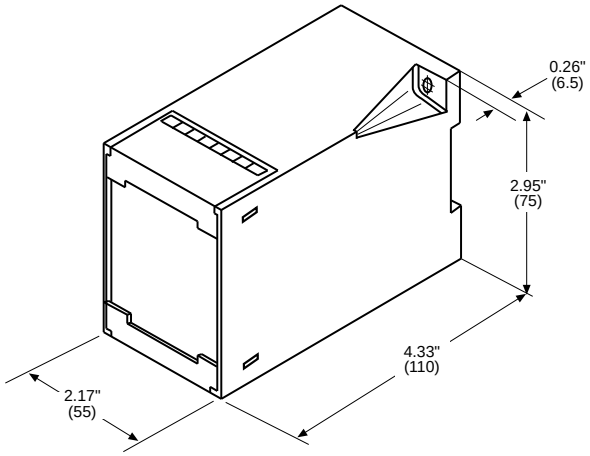


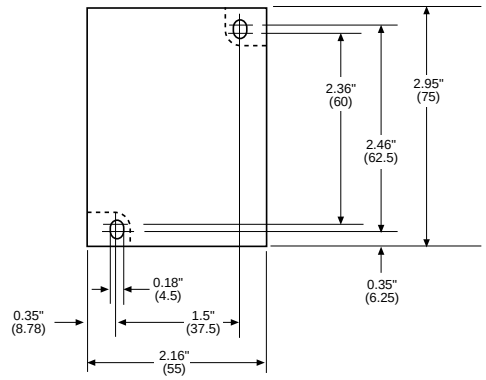
Dimensional Drawings Flow Sensors

SENSOR



CONTROL MODULE





Special Application Solutions

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Mayfield Village, OH 44143
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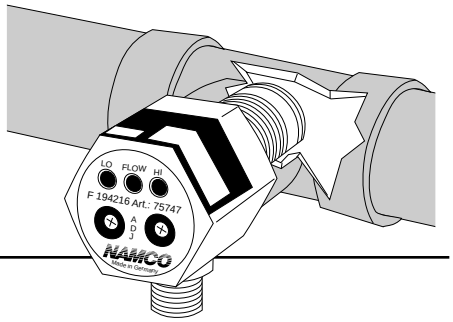
For technical assistance, call 1-800-NAMTECH

Self-Contained

Machinery Protection Flow Sensors



Applications:

Coolant, water or lubricant temperature and/or flow indication.

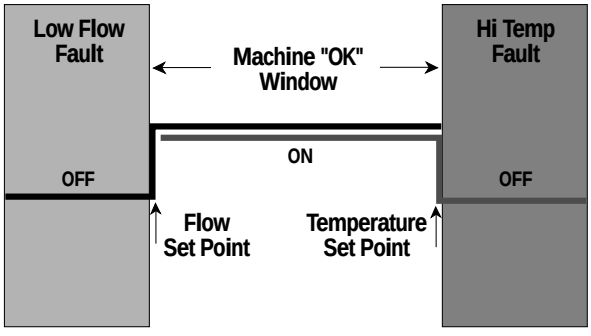
- **Dry running protection of pumps**
- **Flow rate monitoring of coolant in welding machines**
- **Heating systems and exchangers**
- **Chemical process monitoring**
- **Pharmaceutical process control**
- **Lubrication flow rate monitoring**
- **Process control monitoring of media flow in food and beverage, sewage/ wastewater industries, etc.**

The Namco ER330-10004 (GmbH # 75743) High Temp/Low Flow Sensor acts as a comprehensive machinery coolant or lubrication system monitor. It monitors two key indicators of your machinery's health: the temperature and flow of either coolant or lubricants. The switch alarms when flow is too low or when temperature is too high.

The sensor mounts into fluid supply lines using a 3/4" NPT pipe fitting. Its self-contained design uses a "flat head" sensing surface that does not protrude into the media, so it doesn't obstruct media flow. Solid state circuitry within the sensor detects flow variations based on thermal conduction. Construction is all stainless steel.

The high temp/low flow sensor monitors media temperature and will signal when coolant is too hot (indicating your equipment is overheating) or when coolant flow is too low. These sensors are both 24 VDC only.

High Temp/Low Flow Sensor



Special Application Solutions

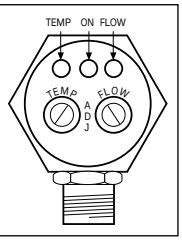
Common Sensor Characteristics

SELF-CONTAINED FLOW SENSORS		
Pipe O.D. (inches)	Min. Detectable Flow (gal/min)	Max. Detectable Flow (gal/min)
1/2"	0.020	6.023
3/4"	0.045	13.551
1"	0.080	24.090
1 1/4"	0.125	37.641
1 1/2"	0.181	54.203
2"	0.321	96.360

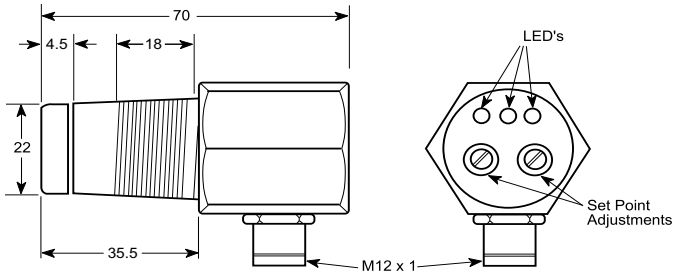
Response Time	<5 seconds
Ambient Temperature	-10°C to +70°C
Media Temperature	-10°C to +80°C
Temperature Set Points	Potentiometer and LED
Adjustment	Potentiometer and LED
Supply Voltage	24 VDC
Power Consumption	<2 Watts
Load Current	0.5 to 300mA
Voltage Drop	<3.5 VDC
Leakage Current	<10µA
On/Off Indication	LED
Short Circuit Protection	Yes
Reverse Polarity Protection	Yes
Protection Class	IP 67
Housing Material	Stainless Steel
Pressure Rating	Maximum 435 PSI
Connector	4-pin Euro Style

High Temp/Low Flow - LED Functions

RED	GREEN	RED	CONDITION
Over Temp (TEMP)	Power (ON)	Flow-in-Range (FLOW)	High Temp/Low Flow (ER330-10004)
OFF	ON	OFF	Under-flow Fault
OFF	ON	ON	Temp/Flow Okay
ON	ON	OFF	Over-temperature Fault

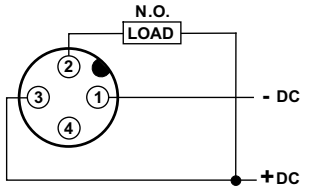


Dimensional Drawings

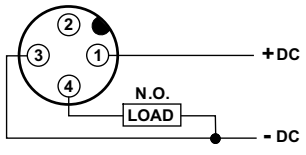


Wiring Diagrams

NPN (Sinking) N.O.



PNP (Sourcing) N.O.



Special Application Solutions

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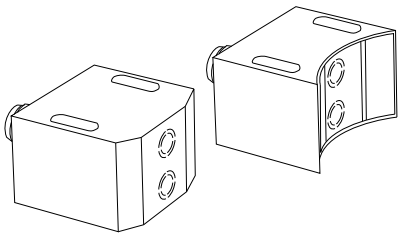
Flat Face
Round Face

Dual Position Valve Sensors

DC
AC



- **Senses open and closed valve position in a single-piece compact housing**
- **Epoxy encapsulated**
- **Available in AC, DC, and Namur configurations**
- **4-pin Euro connector or cable versions available**
- **Easily mountable**
- **Compact; approximately one square inch mounting footprint**

The new NAMCO Valve Position Proximity Sensor employs a single-piece design to simplify installation. Two inductive proximity sensors are in a single housing. These sensors monitor target disks on the valve actuator, sensing up to four disk combinations which correspond to valve positions. The sensor is epoxy encapsulated and utilizes surface mount electronics for reliable operation under harsh industrial conditions. Three models are available: one with a standard 10-30 VDC output, one with 80-250 VAC, and the other a Namur-style for hazardous location use.

Special Application Solutions

4mm Range Plastic Housing Valve Sensors

Connector Type	Circuit Description	Housing Style	Model Number	Voltage Drop	Maximum Load Current	Short Circuit Protected
4mm SENSING RANGE NAMUR						
2 m Cable	2 W NAMUR	Round Face	ET912-43310	4.5V@ 200mA	200mA	Yes
2 m Cable	2 W NAMUR	Flat Face	ET912-53310	4.5V@ 200mA	200mA	Yes
4-pin euro	2 W NAMUR	Round Face	ET912-43351	4.5V@ 200mA	200mA	Yes
4-pin euro	2 W NAMUR	Flat Face	ET912-53351	4.5V@ 200mA	200mA	Yes
4 mm SENSING RANGE 10 - 30VDC						
2 m Cable	3-W PNP NO	Round Face	ET911-43110	2.5V@ 200mA	200mA	Yes
2 m Cable	3-W NPN NO	Round Face	ET910-43110	2.5V@ 200mA	200mA	Yes
2 m Cable	3-W PNP NO	Flat Face	ET911-53110	2.5V@ 200mA	200mA	Yes
2 m Cable	3-W NPN NO	Flat Face	ET910-53110	2.5V@ 200mA	200mA	Yes
4-pin euro	3-W PNP NO	Round Face	ET911-43151	2.5V@ 200mA	200mA	Yes
4-pin euro	3-W NPN NO	Round Face	ET910-43151	2.5V@ 200mA	200mA	Yes
4-pin euro	3-W PNP NO	Flat Face	ET911-53151	2.5V@ 200mA	200mA	Yes
4-pin euro	3-W NPN NO	Flat Face	ET910-53151	2.5V@ 200mA	200mA	Yes
4mm SENSING RANGE 80 - 250VAC						
2 m Cable	2 W AC NO	Round Face	ET920-43410	11V@ 200mA	200mA	No
2 m Cable	2 W AC NO	Flat Face	ET920-53410	11V@ 200mA	200mA	No
3 pin micro	2 W AC NO	Round Face	ET920-43420	11V@ 200mA	200mA	No
3 pin micro	2 W AC NO	Flat Face	ET920-53420	11V@ 200mA	200mA	No

▶ Consult factory for normally closed model availability.

Protected by the NAMCO Lifetime Replacement Program

Common Sensor Characteristics

VALVE PROXIMITY SENSORS			
	3-Wire DC	2-Wire AC	NAMUR
Supply Voltage	10-30V DC	80-250V AC	5-25V DC
Voltage Drop	≤ 2.5V @ 200mA	11V @ 200mA	n/a
Max. Load Current @ 25°C	200mA	200mA	2.2mA
Leakage Current	10µA	10µA	n/a
Sensing Range	4mm		
Reverse Polarity Protected	Yes	Yes	n/a
Max. Switching Frequency	180/400Hz	20Hz	400Hz
Ambient Temp. Range	-25°C to 70°C (-13°F to 158°F)		
Short Circuit Protected	Yes	No	n/a

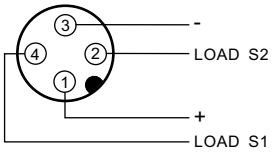
LED Functions

	3-Wire DC	2-Wire AC	NAMUR
	Yellow	Yellow	Yellow
Power Off	Off	Off	Off
Power On - Load De-energized	Off	Off	Off
Power On - Load Energized	On	On	On

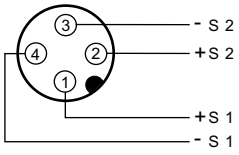
Circuit Drawings

EURO CONNECTOR MODELS

3 Wire DC N.O.

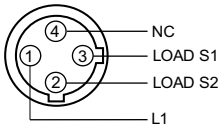


NAMUR



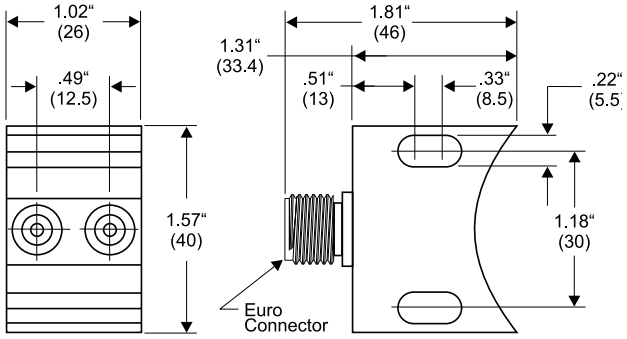
MICRO CONNECTOR MODEL

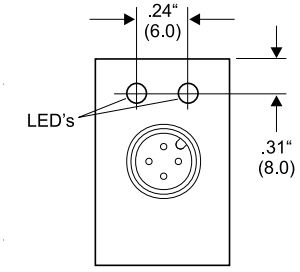
2 Wire AC N.O.



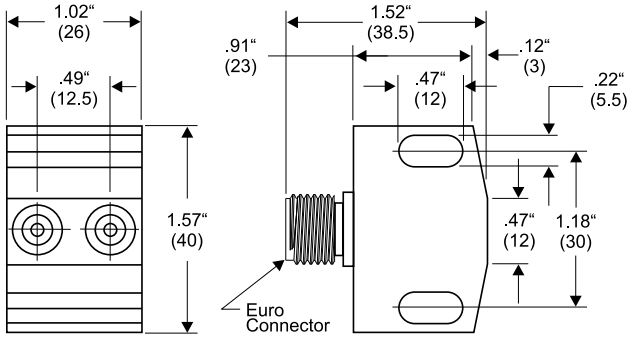
Dimensional Drawings

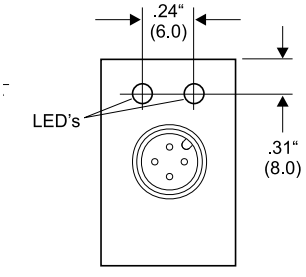
ROUND FACE





FLAT FACE





Special Application Solutions

NAMCO

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Mayfield Village, OH 44143
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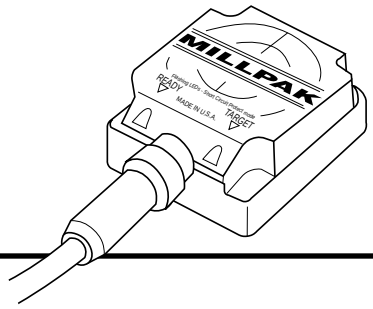
Mill Hardened

Focused Field Long Range Sensors



- **Mill Hardened**
- **Highly Liquid Resistant**
- **Non-Corrosive cable connection**
- **Focused Field Will not Lock on Surrounding Metal**
- **Resistant to electrical noise**
- **Latching SCP - Simplifies Troubleshooting**
- **Made in USA**

The NAMCO MillPak Hardened Flatpak® Proximity Sensor is the first long range sensor designed to operate reliably in the toughest mill environments.

With liquid and mechanical damage being the largest contributors to switch failure in the harsh mill environment, the MillPak proximity sensor has been designed to effectively combat the effects of both problems, increasing the life expentancy of your sensor.

The MillPak proximity sensor has been sealed to provide a high degree of liquid resistance, allowing the sensor to be used in areas where water cooling and overspray are not a random occurence, but a daily operation. The mating of the cordset and stainless steel receptacle is also a watertight connection. The stainless steel receptacle resists most corrosive elements and allows the MillPak proximity sensor to remain watertight over many hours of operation.

Competitive sensors have traditionally incorporated two piece housings which are susceptible to liquid leakage and overall water damage.

The MillPak sensor integrates Namco's focused sensing field into it's heavy duty structure. This focused sensing field minimizes sensing of surrounding metal and with a clearance of 0.25" around the sensor, the sensor will never lock on to surrounding metal. This allows the MillPak sensor to be mounted tightly in brackets or directly in and flush to metal flooring!

Competitive sensors often incorporate a trim pot which allows the user to adjust the sensing range of the sensor as the ambient temperature conditions change. Their sensing field often increases dramatically as the ambient temperature increases, causing the sensor to eventually "lock-on" to surrounding metal. With Namco's patented focused field technology and temperature stability, this sensor never has to be adjusted. The field shape is maintained over the sensor's entire rated temperature range!

With the most noise resistant circuitry in the business, the MillPak sensor is extremely resistant to radio frequency interference and other forms of electrical noise. False detection problems are not an issue with the MillPak sensor.

The MillPak sensor also incorporates Namco's Short Circuit Protection (SCP). If the sensor detects excessive current, it reverts to a limiting state with the LED's alternately flashing. This flashing provides a clear indication of a problem in the circuit thereby simplifying troubleshooting.

Connector Type	Circuit Description	Housing Dimensions	Model No.	Maximum Load Current	Leakage Current	Voltage Drop*	Maximum Switching Frequency	Short Circuit Protected
40mm SENSING RANGE DC 10-30V								
4-pin Mini	3W, NO	92x79x40mm	**ER511-88430**	200mA	10µA	<2.5V @ 200mA	15Hz	yes
40mm SENSING RANGE AC/DC 20-150V								
3-pin Mini	3W, NO	92x79x40mm	**ER530-88430**	.2A	1.7mA	≤10V	15Hz	yes

Please consult factory for additional versions.

Common Sensor Characteristics

MILLPAK PROXIMITY SENSORS		
Supply Voltage	10-30V DC	20-150V AC/DC
Voltage Drop	≤ 2.5V @ 200mA	≤ 10V
	≤ 2.0V @ 100mA	
Max. Load Current @ 25°C	200mA	0.2A
Inrush Current (rms 1Hz)	-	1.5A
Leakage Current	10µA	1.7mA
Sensing Range	40mm	
Response Time	30ms	
Power-up Time	70ms	
Max. Switching Frequency	15Hz	
Ambient Temp. Range	-25°C to 70°C (-13°F to 158°F)	

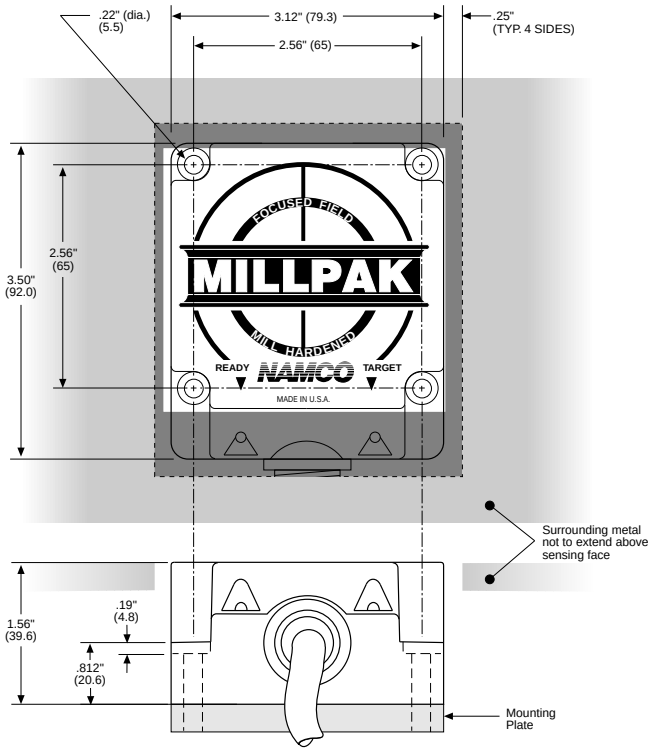
LED Functions

	10-30V DC		20-150V AC/DC	
	Red	**Green**	**Red**	**Green**
Power Off	Off	Off	Off	Off
Power On Load De-energized	On	Off	On	Off
Power On Load Energized	On	On	Off	On
*SCP Mode Activated	Both Flashing		Both Flashing	

**Short Circuit Protection: If the sensor is shorted, the sensor's Short Circuit Protection (SCP) will be activated. When this occurs, both LEDs will flash and the sensor will limit current flow to about 2.0mA.*

Dimensional Drawings

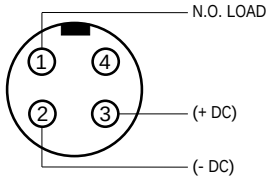
METAL EMBEDDED APPLICATION



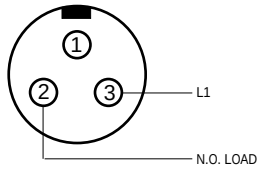
Circuit Drawings

MINI CONNECTOR MODELS Male views shown

3 Wire DC N.O.



2 Wire AC/DC N.O.



Special Application Solutions

NAMCO

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Mayfield Village, OH 44143
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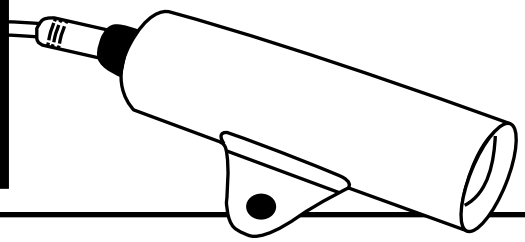
Hot Metal Detectors



Reliably sense hot objects in high ambient temperature and dirty conditions.

NAMCO Infra-Red (IR) Hot Metal Detectors not only survive in hot environments, they work because of them. When the IR energy level emitted from a hot object exceeds the HMD's internal set point, the sensor output energizes. Set points of 250°, 450°, 360°, or 800°C and lenses of different viewing angles adapt the HMD to application requirements. The unit's 2-wire AC or 3-wire DC discrete output directly interfaces with programmable controllers or relay coils. The optional pre-check feature allows for remote triggering of the sensor output to verify switching performance.

Available in self-contained and remote lens styles, the tubular stainless steel housing with glass lens is impervious to steam, water, dust, shock, and vibration common to heavy industrial environments.

The self-contained style HMD has a lower installed cost than the remote style HMD and is ambient temperature rated to 85°C. Units with optional cooling jacket increase this rating to 125°C.

The remote lens system is used in applications with high ambient temperatures and/or where system flexibility is invaluable. The sensor electronics are encapsulated in an oil- and water-tight control module. The remote lens is connected to the control module by a stainless steel-jacketed fiber optic cable. The remote lens, void of electronic circuitry, will survive ambient temperatures to 150°C. The fiber optic cable has a 260°C ambient temperature rating and can be used without a remote lens. (Consult factory for details.)

Hot Metal Detectors are ideally suited for continuous caster, hot strip, bar and wire, forge and foundry applications.

Temperature response curve

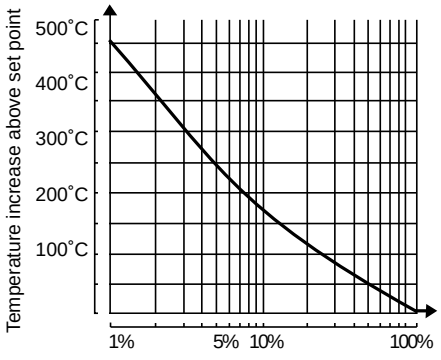
If the surface to be sensed is exactly at the set point temperature of the sensor, then 100% of the scanned area must be covered by the hot surface. As this surface is elevated in temperature, less of the scanned area needs to be covered. The Temperature Response Curve shows the % scanned area to be covered as temperature of sensed surface is elevated above set point.

Example: The IR Sensor ER920-13812 - Response temperature when scanned area is covered 100% by hot product = 450˚C

However, if only 5% of scanned area contains hot product, the IR Sensor requires an additional (see chart) set point temperature (250˚C).

Set Point Temperature of ER920-13812 = +250˚C

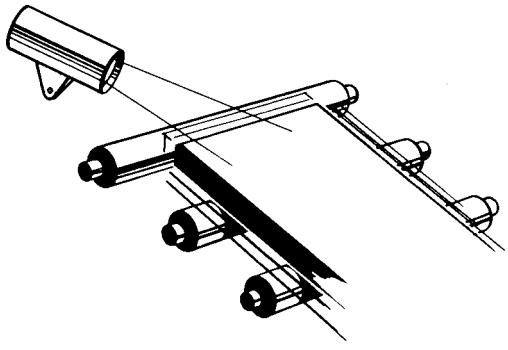
Effective response temperature is therefore = 700˚C



Hot Product Sensors Series ER 800 & 900

Call Namco 1-800-NAMTECH for ordering assistance, or consult your local Namco representative or distributor.

Temperature of Object Being Sensed	Remote or Self-Contained Style	Viewing Angle
≥ 800°C	• Remote control module with lens and fiber optic cable • Remote control module with only fiber optic cable (no lens) • Self contained • Self contained with water-cooled jacket	• 25° • 7° • 2° • 1° • 1/2° • 2° x 25° • 1° x 25° • 1/2° x 25°
≥ 450°C		
≥ 360°C		
≥ 250°C		



What role does product temperature play?

Namco offers four set point temperatures for its line of HMD's. The set point temperature is the minimum temperature level at which the sensor will detect the product. For example, if the HMD set point temperature is 360°C, it will not detect products with temperatures less than 360°C. The sensor will, however, sense all products hotter than 360°C that cross into its field of view. Available set point temperatures and basic application guidelines are as follows:

800°C - Used for continuous cast monitoring, ladle pour applications, and other operations where temperatures of the metal are between 800°C and molten.

450°C - This is the most frequently used HMD throughout hot strip mills, bar mills, forging presses, etc. It can also accommodate reasonable quantities of steam, water spray, etc. expected in the rolling or forging process.

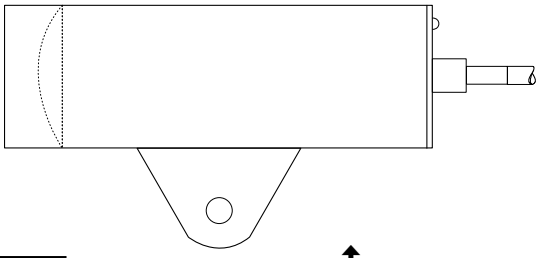
360°C - Used for lower temperature applications where background "noise" temperatures are less than 360°C but the product itself is still hotter than 360°C.

250°C - The lowest set point temperature is good for steel applications where the metal has cooled considerably over time, as in cooling beds and at downcoilers. The 250°C set point temperature is suitable for non-ferrous applications such as aluminum processing in which product temperatures are lower than those in steel operations.

Three Styles of Hot Metal Detectors:

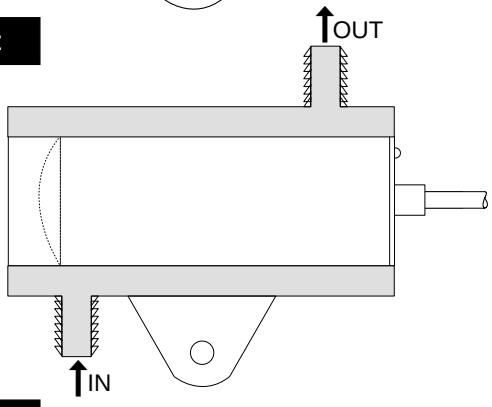
Self-contained (ER900)

This standard unit integrates the lens and electronics in one housing and has an ambient temperature rating of 185°F (85°C).



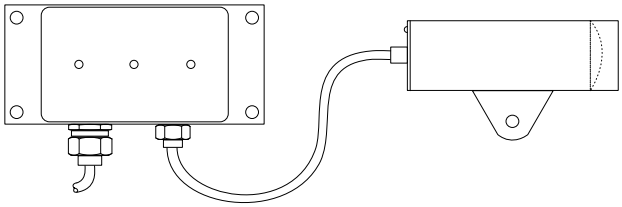
Self-contained with cooling jacket

This is also an integrated unit but is surrounded by a sleeve that circulates either water or shop air around the sensor, cooling the sensor and increasing its ambient temperature rating to 257°F (125°C).



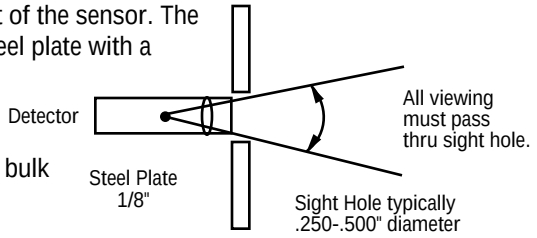
Remote lens system (ER800)

This unit uses a remote lens that is connected to the control module using fiberoptic cable. Since the control module that houses the temperature-sensitive electronics can be placed in a cooler area, this system offers the highest ambient temperature ratings:



Fiberoptic cable 500°F (260°C)
Remote lens 302°F (150°C)
Control module 185°F (85°C)

If temperature levels cannot be maintained, additional protection can be obtained by placing a radiant heat shield in front of the sensor. The heat shield is a 1/8" thick steel plate with a sight hole up to .5" diameter that allows the sensor a full field of view while it is shielded from the bulk of the radiated heat energy.



Continued on next page.

Special Application Solutions

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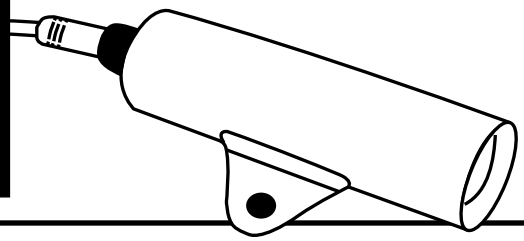
Hot Metal Detectors



Q. "How far away from its target can a hot metal detector be placed?"

A. Excessive heat and physical damage account for nearly 100% of all HMD failures. One of the many advantages of the Namco HMD is that up-close mounting is not a requirement, which adds flexibility to installation and application possibilities.

The Namco HMD responds only to IR energy within the viewing field of a given lens type regardless of distance. However, as mounting distance increases, the viewing field increases proportionally and may exceed the overall dimensions of the product and/or see other IR sources (adjacent pass lines, hot scale, background metal temperatures, etc.). In such cases, the HMD lens and minimum response temperature must be selected (see charts) to accommodate these factors.

Applying Namco HMDs is normally a very simple and straightforward process. Well over 50% of all applications can be resolved with a 450°C, non-cooled, 2° lens. Additionally, reliable detection is possible with only 5% of the view field covered at 700°C.

In general, the application process should consider the following:

- Sensing objective (tracking, positioning, cut, etc.)
- Product to be sensed (size, temperature, distance, etc.)
- Sensing conditions (water, steam, scale, ambient temp., etc.)
- HMD selection (response temperature, lens, cooling requirements, etc.)

Q. "How can sensing accuracy vs. distance be maintained?"

A. Viewing angle and distance combine to determine the size of the scanned area (see chart). Therefore, different lenses can be selected to produce viewing angles ranging from 25° (broad) to 1/2° (tight). In general, pickup/dropout accuracy and repeatability will improve with a tighter lens. This will hold true up to the point where product size and viewing field size become equal. Once the viewing field size is within the product size, there are no additional gains in accuracy.

Where accuracy is not a primary factor, and the product size and temperature relationship will assure detection, it is not always necessary to select a tight lens.

Q. "How does the size and shape of the product affect the choice of a hot product sensing system?"

A. Namco's elongated (rectangular) viewing field lenses (1/2 x 25, 1 x 25, and 2 x 25) are designed to solve specialized hot product sensing applications. In general, repeatability and overall accuracy is improved when the product abruptly enters or exits a vertical (straight line) viewing field boundary as compared to a circular field of the same total area (sharp turn ON/OFF).

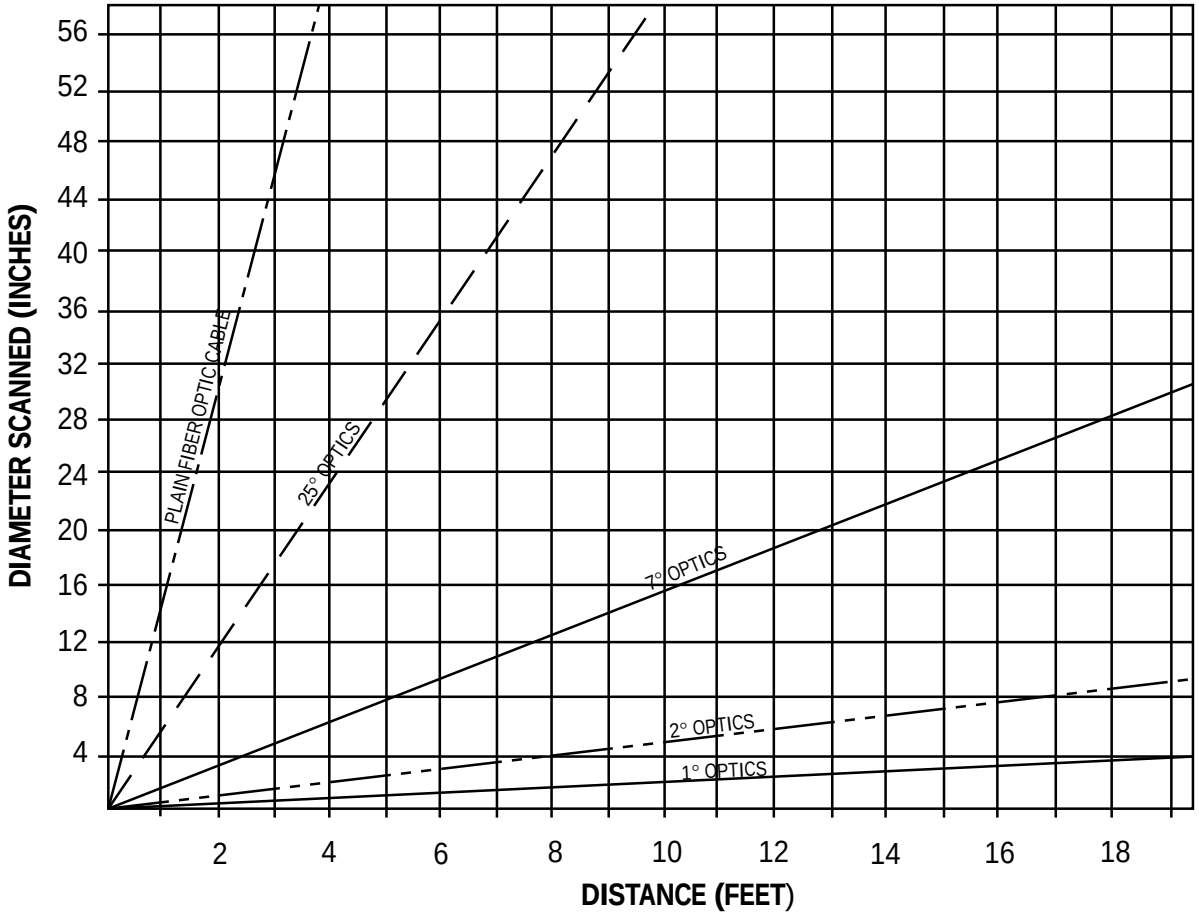
An elongated viewing field lens can be positioned to provide a long, narrow scan area across the length of a runout table, roll face, etc. Products with varying lateral position or irregular shapes will be sensed at the first point of entry/exit along the scan area. Vertical orientation of the field will permit similar detection of varying passline applications.

Mill housings, downcoilers, etc. provide limited vision areas for product sensing. A long narrow field can be applied to sight through these areas with little or no cropping of the viewing field.

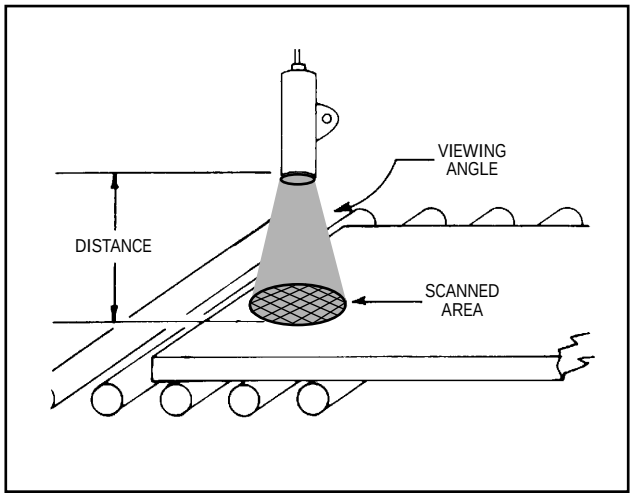
Note: The vertical (25°) viewing field of all Namco elongated field HMDs is in the same plane as the HMD mounting lug.

As previously stated, product temperature and percent of scan area covered within the viewing field combine to determine the "effective" minimum response temperature. Elongated viewing field applications for sensing small diameter rod, etc., should have the "effective" response temperature verified (see charts).

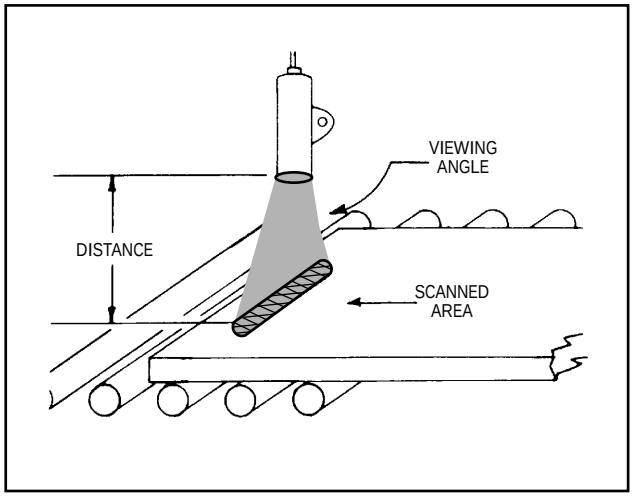
Scanned Area vs. Viewing Angle



Scanned Area for 1/2°, 1°, 2°, 7° and 25° Lenses



Scanned Area for 1/2° x 25°, 1° x 25° and 2° x 25° Lenses



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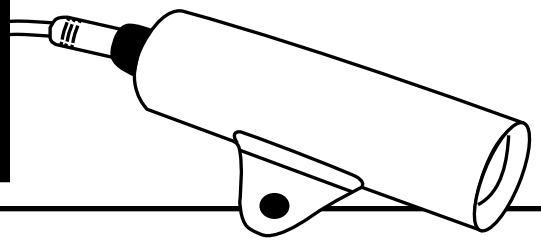
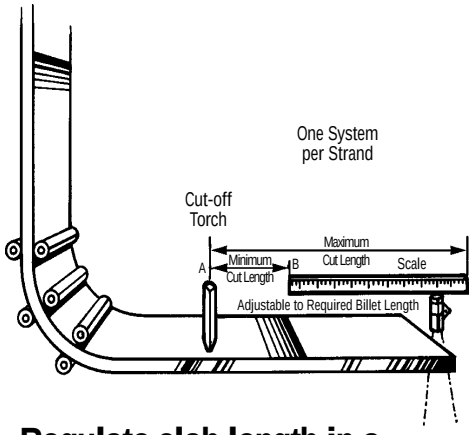
Application Examples

Hot Metal Detectors

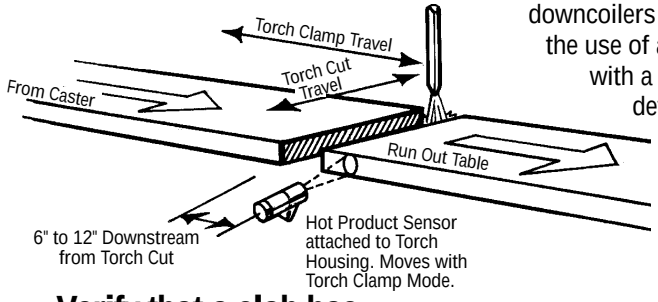




Regulate slab length in a continuous caster steel mill ▲

The process of cutting a slab into lengths is a hot process, requiring the use of a Namco 800°C set point HMD like the ER900.

Using a 1/2° lens will allow the HMD to be placed six feet away while still producing a refined viewing area of .8". The sensor can be mounted on a sliding scale which is relative to the cutting torch. The sensor detects the leading edge of the slab and initiates the torch clamp and cut sequence, which can occur anywhere between points A and B, depending on predetermined needs. An additional sensor may be mounted to the torch housing to relay information for control of the cutting process.

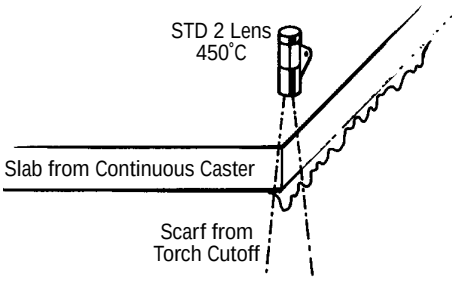


Verify that a slab has been cut ▲

Another 800°C set point temperature HMD can be mounted on the torch housing 6-12" downstream from the torch cut. The cut sequence does not end until the HMD detects the separated slab.

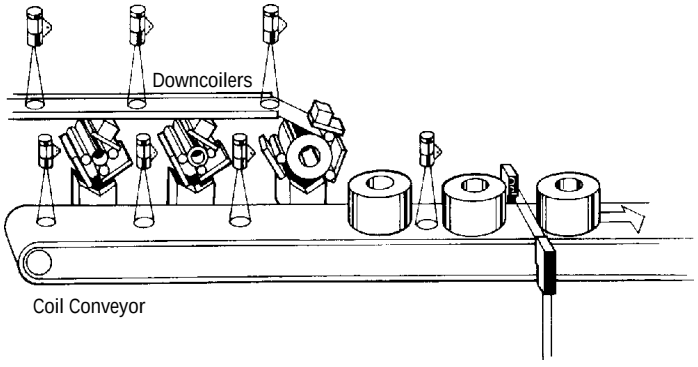
Automate the flash trimmer process ▼

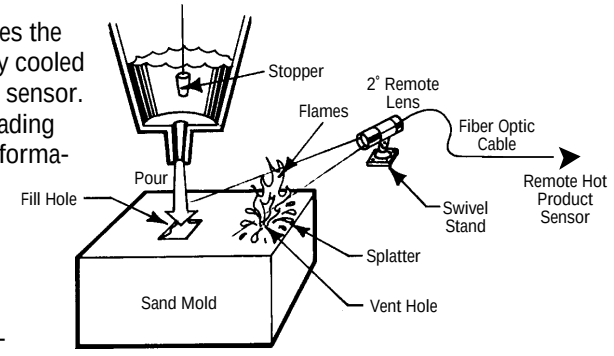
By the time the slab reaches the flash trimmer, it is sufficiently cooled to use a standard 450°C sensor. The HMD detects the leading edge of the slab. The information is relayed to the control board, which initiates positioning of the slab farther down the line. The slab is stopped while the flash trimmer is moved up into position. The rollers bring the slab backward over the trimmer, which removes the scarf from the torch cutting process.



Automate the down-coiling process in a steel mill ▼

Although the steel has cooled considerably by the time it reaches the downcoilers, the automation of the downcoilers is a hot process requiring the use of a Namco ER900 HMD sensor with a 250°C or 360°C set point. By detecting whether there is already a coil on the conveyor leading to the storage area and relaying that information, a low set point sensor can help automate the process by eliminating the need for an operator to manually control the operation.

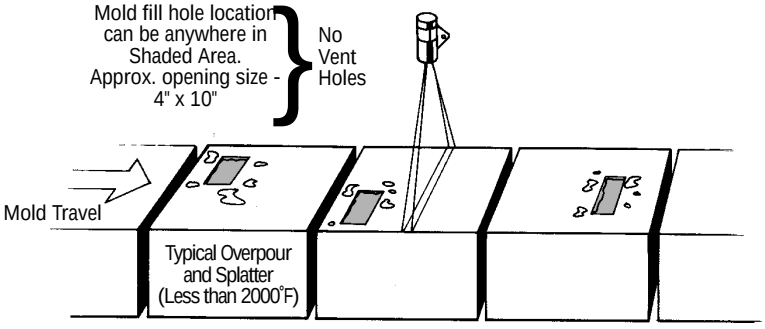


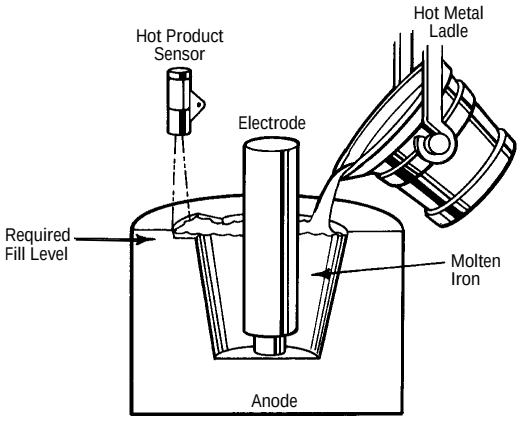


Mold auto fill sequence ▲

For the harsh environment of a foundry's mold fill line, an 800°C remote lens and a sensor system will be required in order for the sensor to accurately view the process. A 2° lens monitors the fill level through the vent hole as the mold is filled by the stationary ladle. When the molten metal in the mold rises to the level of the vent hole, the sensor detects the metal and relays the information to the control board. The stopper is closed and the line is indexed for the next mold to be filled.

Special Application Solutions



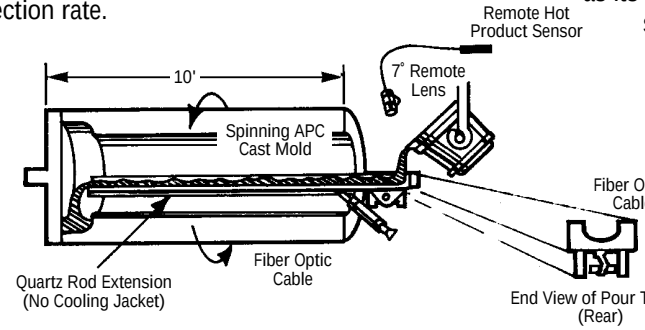


Detect filled molds even if the fill hole isn't always in the same spot ▲

Even if fill holes are located in a different position on each mold, an 800°C set point HMD can still provide accurate detection when it is used with an elongated lens. A lens with a 2° x 25° scan area, for example, will cover the full width of the mold, detecting fill holes as the molds cross the viewing field. This system allows accurate detection of filled molds such as would be needed for a production count.

Monitor a spin cast process ▼

The same 800°C sensing system used to detect overfill of molten metal can also be used to detect the initial pour sequence of molds for products like pipe. A second sensor placed at the opening of the mold can detect the fill level of the mold, sensing when the mold is full and relaying the message to the controller, which retracts the mold. Presently, the pour and fill sequences are timed from when the ladle first begins to pour, which is inaccurate and leads to a high rejection rate.

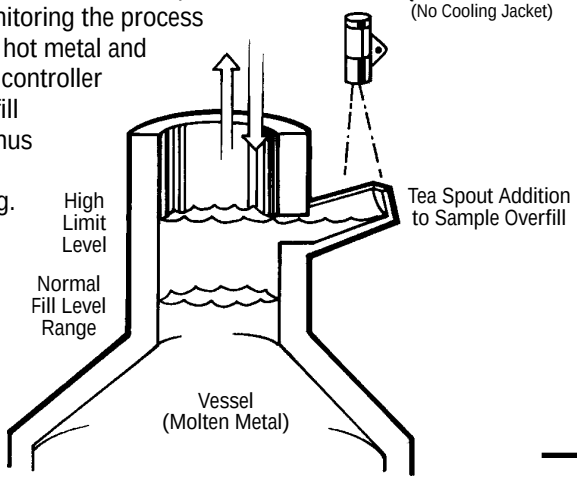


Automate an anode assembly process ▲

For anode assembly in aluminum or other nonferrous industries, hot metal is poured around the electrode in order to firmly cast the electrode to the anode. In order to automate this process, the chance for overpour must be eliminated so that an operator does not have to visually monitor the process. This can be accomplished by using a sensor with a narrow viewing angle to sense the metal as its level reaches a specified point, just as in a vessel fill application. The sensor detects the molten metal when it spills into a notch cut at the required fill level and signals the ladle to cease pouring.

A sensor for high level limit control ▼

If a tea spout overfill area is added at the high level mark of the vessel, a 800°C HMD can be used as the primary level control system. Indexed over the tea spout during the fill cycle, it will sense the molten metal as it reaches the fill level and spills into the tea spout. The sensor monitoring the process detects the hot metal and signals the controller to end the fill cycle and thus prevent overpouring.



Special Application Solutions

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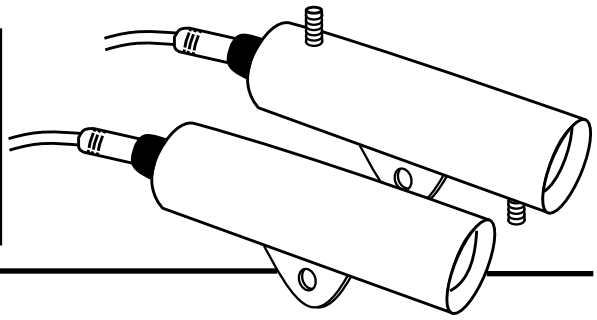
Hot Metal Detectors



Namco Hot Metal Detectors (HMD's) were designed to be simple and cost effective in applications requiring dependable detection. Available trigger set points include a 250°, 360°, 450°, or 800°C range. Whether the application is in a steel mill or for flame detection in a burner application, the Namco IR sensor can be counted on for many years of reliable operation.

These devices work on the principle that all heated objects emit infra-red energy. Using a sophisticated optic and internal baffling system, the infra-red energy is collected and precisely focused on a photo detector inside of the stainless steel housing. When the energy level is sufficient to meet the set point of the HMD, a digital output signal is generated.

The HMD's are totally self-contained in a rugged 4541 stainless steel housing with high quality electronics and glass optic components.

The water jacket models add an additional measure of heat resistance. These water cooled HMD's are specifically designed to be used where temperatures exceed the ambient rating of the standard HMD's.

Both standard and water cooled HMD's are impervious to the effects of steam, water, dust, shock and vibration associated with heavy industrial environments.

Typical Applications:

Continuous casters, hot strip mills, bar mills, shape mills, pipe mills, forges & foundries, coke plants, glass industries, cutoff and measuring of hot product.

360˚C* Model No.	450˚C Model No.	800˚C Model No.	Housing Length	Viewing Angle	Circuit Description	Connector	Minimum Load Current	Leakage Current	Voltage Drop	Maximum Switching Frequency
AC MODELS										
ER920-12817	**ER920-13817**	**ER920-14817**	170mm	25˚	2W, AC, NO	3-pin Mini	20mA	5mA	12 volts	20Hz
ER920-12813	**ER920-13813**	**ER920-14813**	170mm	7˚	2W, AC, NO	3-pin Mini	20mA	5mA	12 volts	20Hz
ER920-12812	**ER920-13812**	**ER920-14812**	170mm	2˚	2W, AC, NO	3-pin Mini	20mA	5mA	12 volts	20Hz
ER920-22811	**ER920-23811**	**ER920-24811**	254mm	1˚	2W, AC, NO	3-pin Mini	20mA	5mA	12 volts	20Hz
ER920-22819	**ER920-23819**	**ER920-24819**	300mm	1/2˚	2W, AC, NO	3-pin Mini	20mA	5mA	12 volts	20Hz
ER920-12814	**ER920-13814**	**ER920-14814**	170mm	2 X 25˚	2W, AC, NO	3-pin Mini	20mA	5mA	12 volts	20Hz
ER920-22818	**ER920-23818**	—	300mm	1 X 25˚	2W, AC, NO	3-pin Mini	20mA	5mA	12 volts	20Hz
ER920-22815	**ER920-23815**	**ER920-24815**	300mm	1/2 X 25˚	2W, AC, NO	3-pin Mini	20mA	5mA	12 volts	20Hz
AC MODELS WITH WATER COOLED JACKETS										
—	**ER920-43813**	—	170mm	7˚	2W, AC, NO	3-pin Mini	20mA	5mA	12 volts	20Hz
—	**ER920-43812**	**ER920-44812**	170mm	2˚	2W, AC, NO	3-pin Mini	20mA	5mA	12 volts	20Hz
ER920-52811	**ER920-53811**	**ER920-54811**	250mm	1˚	2W, AC, NO	3-pin Mini	20mA	5mA	12 volts	20Hz
—	**ER920-53819**	—	300mm	1/2˚	2W, AC, NO	3-pin Mini	20mA	5mA	12 volts	20Hz
—	**ER920-43814**	**ER920-44814**	170mm	2 X 25˚	2W, AC, NO	3-pin Mini	20mA	5mA	12 volts	20Hz
AC MODELS WITHOUT WATER COOLED JACKETS WITH PRECHECK										
ER920-16812	**ER920-17812**	—	170mm	2˚	2W, AC, NO	5-pin Mini	20mA	5mA	12 volts	20Hz
—	—	**ER920-28811**	254mm	1˚	2W, AC, NO	5-pin Mini	20mA	5mA	12 volts	20Hz
—	**ER920-27819**	**ER920-28819**	300mm	1/2˚	2W, AC, NO	5-pin Mini	20mA	5mA	12 volts	20Hz

*Note: 250˚C setpoint versions and DC powered versions are also available. All versions are available with optional pre-check. Consult the factory for ordering information.

Common Sensor Characteristics

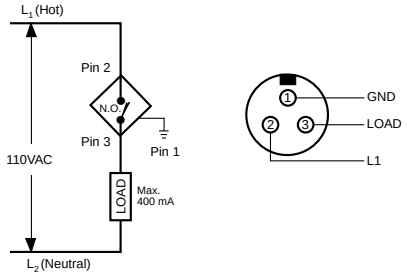
SELF-CONTAINED INFRA-RED SYSTEMS WITH AND WITHOUT WATER COOLED JACKETS	
Supply Voltage	105-132 VAC, 50/60 Hz
Output	500mA
Switching Delay Activation Release	 1 ms 10 ms
Short Circuit Protected	Yes
Precheck Current Consumption (optional)	20 mA
NEMA Rating	3, 4, 12, 13
Connector With optional Pre-check	3-pin mini 5-pin mini
Output	Thyristor, NO
Ambient Temperature (water cooled HMD)	Determined by temperature, specific heat capacity and flow rate of coolant. Precautions must be taken to insure that water does not freeze in cooling jacket and that coolant flow is maintained when working above +55˚C.
Ambient Temperature (standard HMD)	360˚C: -30˚C to +55˚C 450˚C: -30˚C to +75˚C 800˚C: -30˚C to +85˚C

Wiring Diagrams

AC UNITS - with and without Precheck Mail views shown

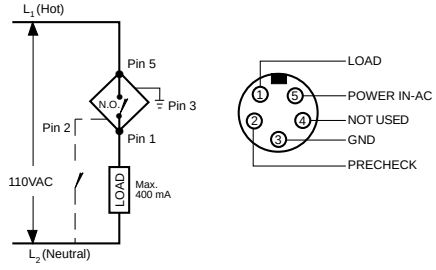
3 Pin Without Precheck

(Use on all 2 wire AC's)



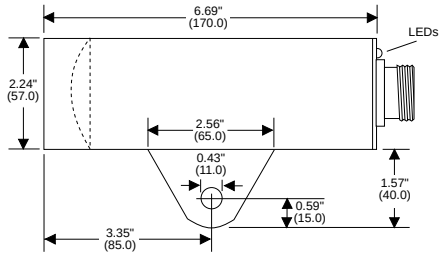
5 Pin With Precheck

(Use on all AC Devices with IR Precheck)

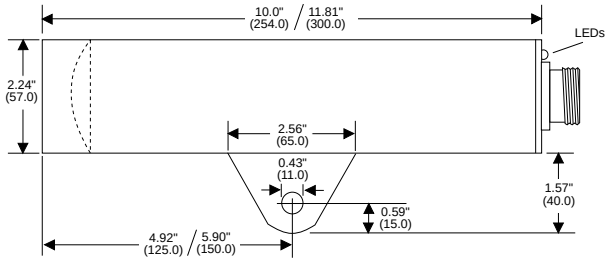


Dimensional Drawings

SHORT HOUSING - 170mm

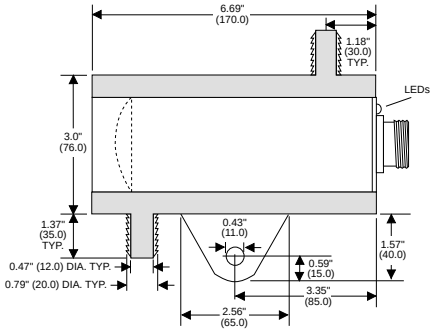


LONG HOUSINGS - 254mm/300mm

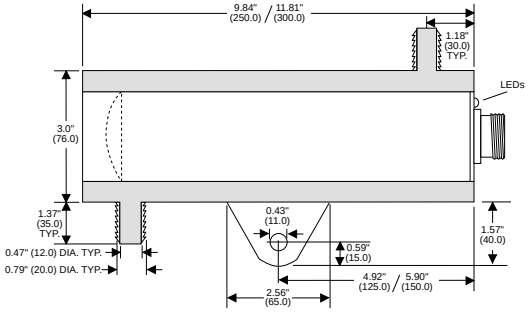


SHORT HOUSING (WATER COOLED) - 170mm

Either air or water may be used for cooling.



LONG HOUSING (WATER COOLED) - 250mm/300mm



Special Application Solutions

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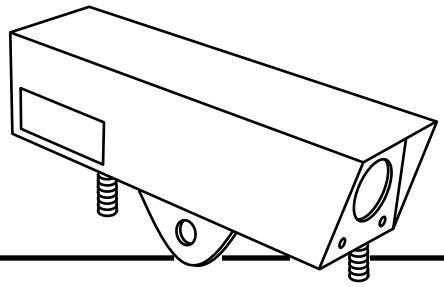
Multi Setpoint Hot Metal Detectors



- **Multi-setpoint versatility**
- **Reduces stocking requirements**
- **Integrated air/water cooling jacket with rear hose connection interface**
- **Low leakage current offers ease of installation to PLC inputs**
- **Industry standard mounting for easy upgrade**
- **Factory serviceable**
- **Surface Mount Technology**
- **Made in USA**

Namco Hot Metal Detectors (HMD's) were designed to be simple and cost effective in applications requiring dependable detection. A single Hot Metal Detector (HMD) can be used nearly anywhere in your hot mill process. The Namco Multi-Setpoint HMD is the first to offer local or remote programmable setpoints to the industry standard of 350°C-450°C-800°C response temperatures. Automatic re-calibration with no physical switch virtually eliminates tampering or mill environment problems. Now when your sensing conditions change, so can you. No longer do you have to order or inventory multiple HMD types specific to your application. Now you can use the same unit from the caster and re-heat furnaces through the coiler or cooling beds. Plus, because the setpoint is selectable, the new HMD is forgiving in applications where rolling or background temperatures are not as originally envisioned. If the current selected setpoint is not appropriate, the HMD can quickly be changed.

Namco's HotSpot HMD uses the industry standard for mounting. So, direct replacement of an existing HMD is easy to upgrade.

Typical Applications:

For tracking, positioning, length control on hot strip, rod, bar, shapes, seamless pipe mills and casters.

Special Application Solutions

Model No.	Viewing Angle	Circuit Description	Connector	Minimum Load Current	Leakage Current	Voltage Drop	Maximum Switching Frequency
AC/DC MODEL							
ER720-10702	2°	2W, AC/DC, NO	5-pin Micro	5mA	1.7mA	< 10 volts	1.5Hz

Please consult factory on availablity of lens viewing angles: 1°, 2°, 1°x25°, 2° x25°.

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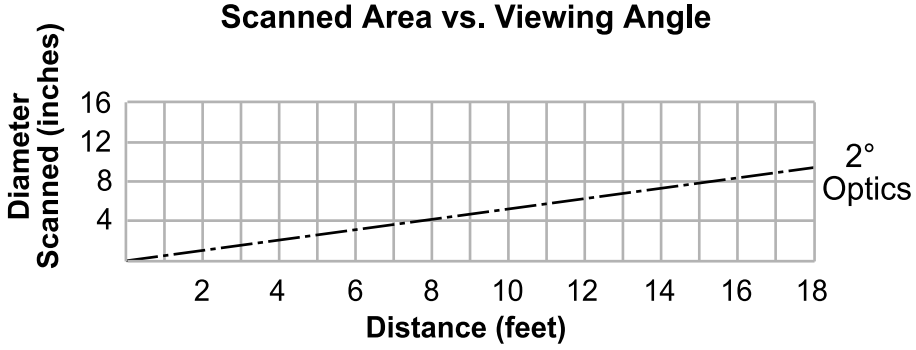


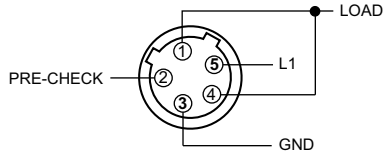
Common Sensor Characteristics

HOTSPOT INFRA-RED SYSTEMS	
Supply Voltage	80-230 VAC/DC 50/60 Hz
Voltage Drop	< 10 V
Output	200mA
Minimum Load Current	5 mA
Leakage Current	1.7 mA
Switching Delay Activation Release	 300 ms 50 ms
Short Circuit Protected	Yes
Max. Switching Freq.	1.5 Hz
Precheck Current Consumption	25 mA
Enclosure Designed to meet NEMA Type	3, 4, 12, 13
Connector With optional Pre-check	5-pin micro
Output	Thyristor, NO
Ambient Temperature	Determined by temperature, specific heat capacity and flow rate of coolant. Precautions must be taken to insure that water does not freeze in cooling jacket and that coolant flow is maintained when working above +55°C.

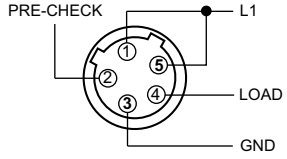
Wiring Diagrams

MICRO CONNECTOR MODELS — **5 Pin Micro**
(Mail views shown)

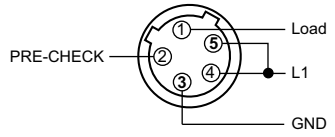
350°



450°

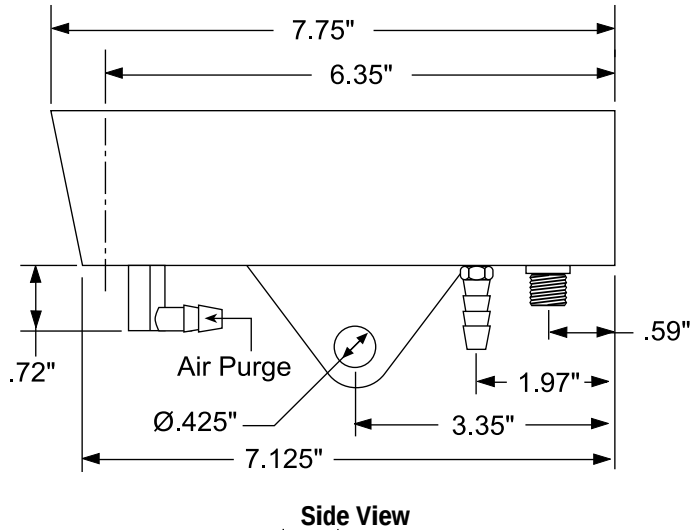


800°

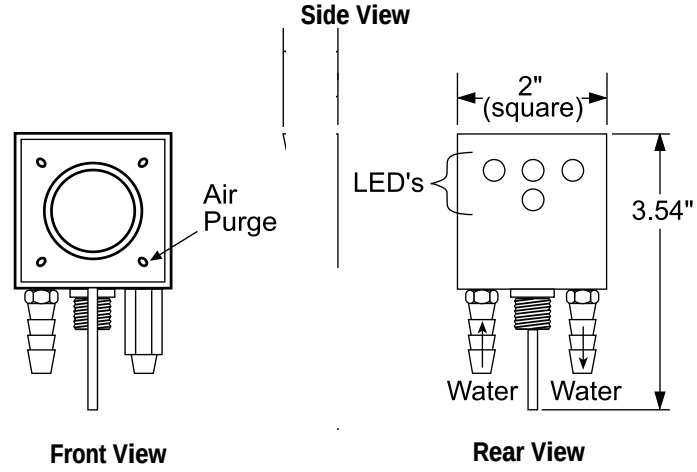


Dimensional Drawings

HOTSPOT HMD



Side View



Front View **Rear View**

Note: The water cooling jacket uses the 1/4" hose fittings.
The air lens purge uses the 5/16" hose fittings.

LED Indicators

	RED 350°C	RED 450°C	RED 800°C	GREEN
Power Off	Off	Off	Off	Off
Power On @ 350°C Setpoint	On	Off	Off	Off
Power On @ 450°C Setpoint	Off	On	Off	Off
Power On @ 800° Setpoint	Off	Off	On	Off
Target	Off	Off	Off	On
Pre-check On	Off	Off	Off	On

Special Application Solutions

NAMCO

Namco Controls Corporation
Mayfield Village, OH 44143
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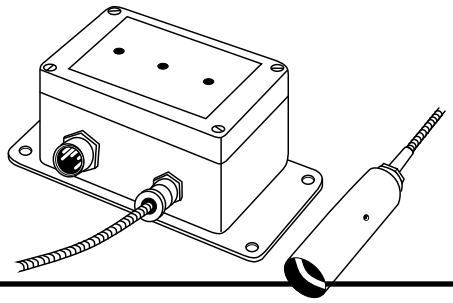
Remote Detection Systems

Hot Metal Detectors



Namco IR detectors are digital switches which respond intelligently to infra-red energy given off by heated surfaces at 4 different pre-set temperatures and above. They are temperature compensated which allows them to be used in high ambient (up to 200°F) locations. Temperature settings are pre-set and never require adjustment. An IR precheck feature on all remote units is standard. This allows the user easy access to verification of system performance.

The Namco remote HMD system is designed with the user in mind. A number of different remote type lenses are available which give the system versatility and added value during the selection of such a system. These lenses, having different viewing angles, will sense a known scanned area and, when a heated object enters this area, its emitted IR energy is detected and transmitted via the fiberoptic cable to the remote electronics package where a digital response signal takes place.

Namco utilizes fiberoptic cables that have a flexible stainless steel jacket designed to withstand severe environmental abuse. All fiberoptic cables are constructed with the highest quality glass bundles thereby assuring optimum IR transmission to the detector. All remote lenses are made from premium quality glass optics and sealed in stainless steel housings to ensure reliable operation in the most adverse applications.

Typical Applications:

Continuous casters, hot strip mills, bar mills, shape mills, pipe mills, forges & foundries, coke plants, glass industries, cutoff and measuring of hot products.

Control Module

Style	Set Point Temperature[2]	Ambient Temperature	Output	Model No.	
				Connector	Cable
Flat Pak	360˚C	-30˚ to +55˚C	120V AC N.O. Thyristor	**ER920-36816**	**ER920-36826**
Flat Pak	450˚C	-30˚ to +75˚C		**ER920-37816**	**ER920-37826**
Flat Pak	800˚C	-30˚ to +85C		**ER920-38816**	**ER920-38826**

Consult factory for DC units.

Remote Lens

Viewing Angle	Scanned Area at 2 Meters	Model No.
150˚C max. amb.		
1/2°	0.8" Dia.	**ER800-00009**
1°	1.6" Dia.	**ER800-00001**
2°	3.2" Dia.	**ER800-00002**
7°	11" Dia.	**ER800-00003**
25°	40" Dia.	**ER800-00007**
1/2 x 25°	3/4" x 40"	**ER800-00005**
1 x 25°	1.6" x 40"	**ER800-00008**
2 x 25°	3" x 40"	**ER800-00004**

Fiber Optic Cable[1]

Cable Length	Note	Model No.
250˚C max. amb.		
2 Meters	–	**ER800-00600**
Specify	–	**ER800-00700**
3 Meters	2	**ER800-00100**
4 Meters	3	**ER800-00200**

Notes:

[1] All cables may be used with or without lens. Viewing Angle = 67˚

[2] Signal loss = 50˚C

[3] Signal loss = 100˚C

Special Application Solutions

Common Sensor Characteristics

REMOTE DETECTION SYSTEMS	
	AC
Supply Voltage	105-132 VAC
Output	500 mA
Minimum Load	20 mA
Leakage Current	7 mA
Voltage Drop	12 VAC
Switching Frequency	20 Hz
Switching Delay Activation Release	 1 ms 10 ms
Short Circuit Protected	Yes
Precheck Current Consumption	20 mA
NEMA Rating	3, 4, 12, 13
Metal Housing	Aluminum-Epoxy Paint
Connector	5-pin Mini

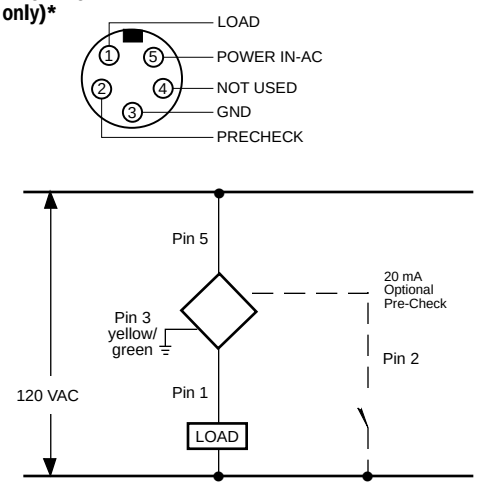
Accessories

Model No.	Description
ER800-10000	Purge mount for 7° remote lens
ER800-01000	Swivel stand mount

Circuit Drawings

5-PIN MINI CONNECTOR

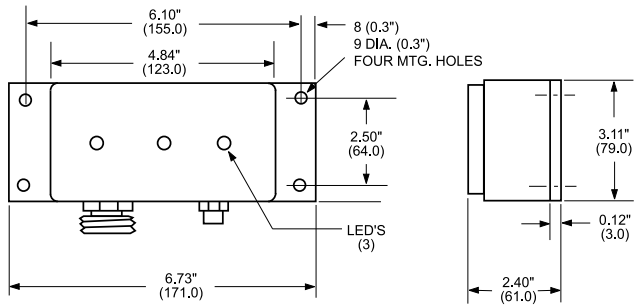
AC Wiring Diagram (Ref. only)*



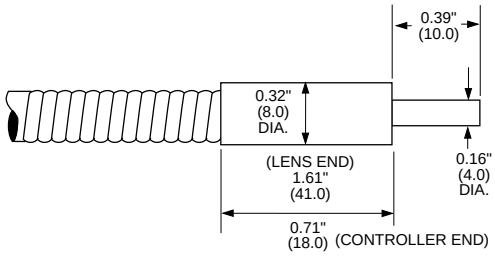
*Always connect as shown on label.

Dimensional Drawings

CONTROL MODULE

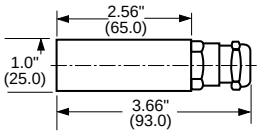


FIBER OPTIC CABLE

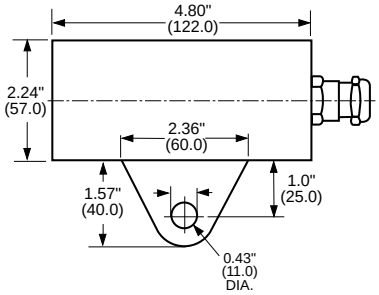


REMOTE LENS

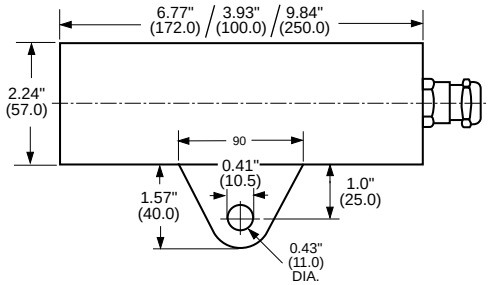
7° Lens



2° and 2 x 25° lens



1°, 25° and 1/2 x 25° lens



Special Application Solutions

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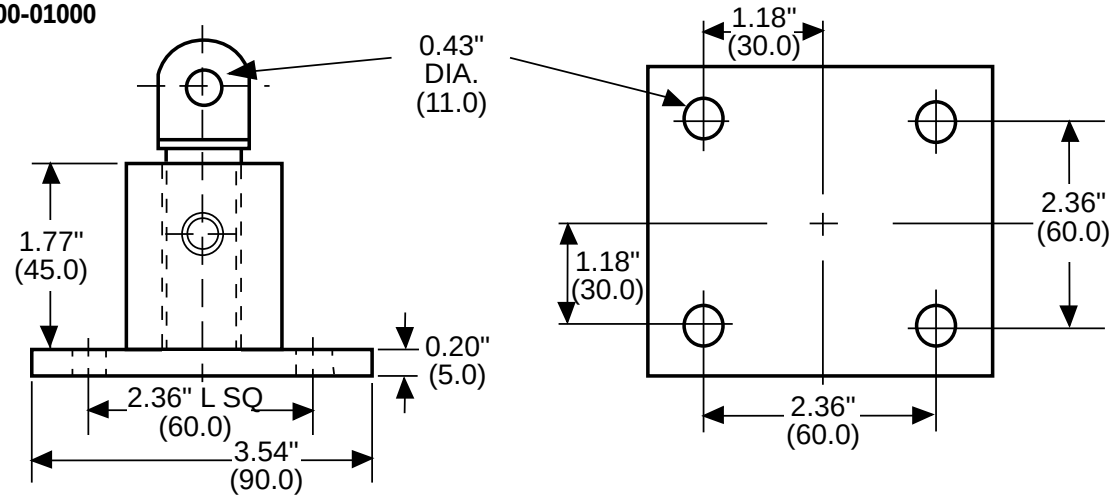
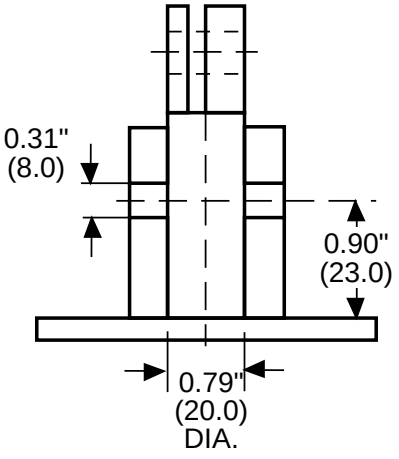
Hot Metal Detectors

Swivel Stand

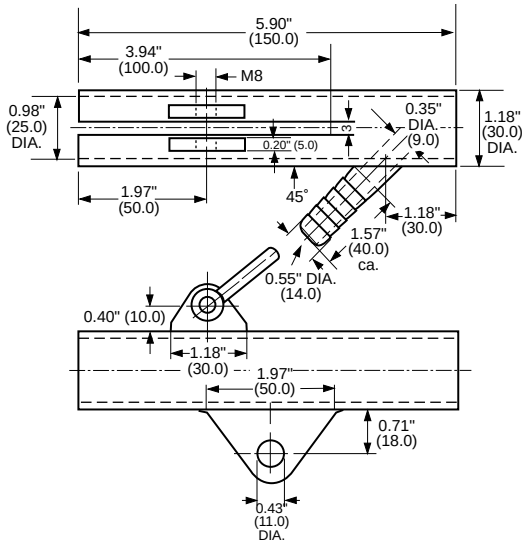
Part No. ER800-01000



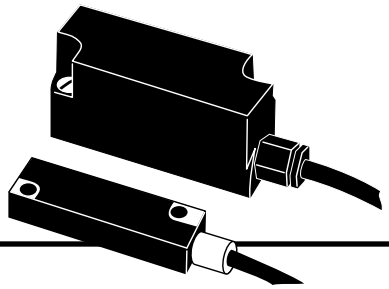


PURGE MOUNT FOR REMOTE 7° LENS

Part No. ER800-10000



Ferrous/Magnet Actuated Switches



- **14° to 122°F**
- **High-shock resistant**
- **Water, oil, and dust tight**
- **Fully submersible to 200 psi**

Namco's Maglock proximity switches are small, tough, and versatile. They are ideal for use in signal circuits and similar applications up to 5A, 250 volts. They are operated by an actuator which is either a permanent magnet (in the case of magnetically actuated types) or a piece of ferrous material such as ordinary mild steel (in the case of ferro-actuated models).

The switching elements comprise fast-acting, hermetically sealed, dry reed switches, permanently mounted in brass, glass-filled nylon, or stainless steel housings.

Operating Principles

The actuation procedure depends on the particular function to be performed. The successful selection of switch and actuator requires an understanding of the techniques employed.

Magnetically Actuated Switches

The switch and its actuator must be brought within a specific proximity to each other (operating distance). The actual distance in any particular case will depend on their relative attitudes, sensitivity, and direction of closing.

When the actuator (magnet) is brought close enough, the switch will operate. When it is withdrawn, it will reset itself. The gap between the switch and the actuator when the switch operates is always less than the gap at which the switch resets. The difference between the two is referred to as the "operating differential".

Ferro-Actuated Switches

The fundamental difference between a Maglock magnetically actuated switch and a ferro-actuated type is that the latter has a built-in system of permanent magnets. Unlike magnetically actuated switches that require the approach of an external permanent-magnet actuator before they will operate, ferro-actuated switches operate upon the approach of a simple piece of ferrous material, i.e., mild steel.

The effect of the ferro-magnetic material is to modify or shunt a part of the internal magnetic field surrounding the switch contacts allowing the switch to operate.

Typical Applications

Proximity switches, limit switches, door interlock switches, machine tool control, liquid level control, weight and measurement control, material handling programming, machine guard interlocks, systems interlocks, alarm systems, batching and timing mechanisms, instrument counters, valve position indicators, and all types of automatic control devices.

Voltage	Current	Power (Max.)	Contact Arrangement	Switch Model No.	Actuator Model No.	Operating Range	On-Off Diff.	Minimum Target Size
Ferrous Actuated, Rectangular								
250V, AC/DC	0.25A DC, 1A AC	15W DC 15VA AC	SPST, NO	**EE960-10000**	—	.25"	.50"	2" x .50" x .125"
250V, AC/DC	2A DC, 2A AC	40W DC 40VA AC	SPST, NO	**EE960-20000**	—	.12" .37" .71"	.75"	1/2" dia. x 3/16" 5/8" dia. x 1/4" 3-1/4" dia. x 1-1/4" x 1/16"
Magnet Actuated, Tubular								
300V, DC	1A DC	20W DC	SPST, NO	**EE960-00100**	**EE961-03800** **EE961-03900** **EE961-04000**	.25" .39" .98"	.24" .27" .47"	—
250V, AC	1.5A AC	24VA AC	SPST, NO	**EE960-00100**	**EE961-03800** **EE961-03900** **EE961-04000**	.25" .39" .98"	.24" .27" .47"	—
250V, AC/DC	1.25A AC/DC	20W DC 20VA AC	SPDT NO/NC	**EE960-00200**	**EE961-03900** **EE961-04000**	.08" .69"	.27" .27"	—
Magnet Actuated, Rectangular								
250, AC/DC	1.25A DC, 1.35A AC	20W DC 20VA AC	SPDT NO/NC	**EE960-02000**	**EE961-02000** **EE961-03000**	.37" .87"	.44" .69"	—
200V, AC 250V, DC	.5A, AC/DC	12VA AC 10W DC	SPST, NO	**EE960-03000**	**EE961-02000** **EE961-03000**	.62" 1.00"	.38" .69"	—
110V, AC 250V, AC	3A AC, 2A AC	—	SPST, NO	**EE960-16000***	**EE961-01600** **EE961-02500**	.20"	.45"	—

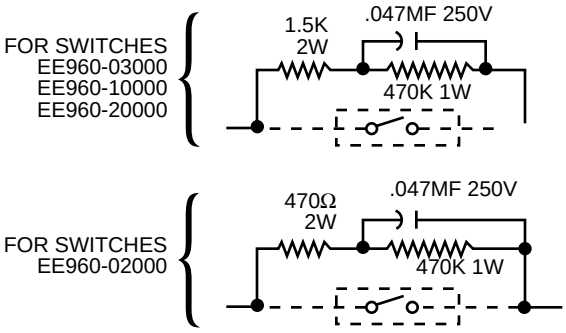
** The EE960-16000 Magnet Actuated Proximity Switch is designed for power applications, such as motor starters. This SPST NO switch has double contacts: one for breaking circuit current, the other for ensuring continuity at low currents. Typical life of this series is 100 million operations (at or below rated load).*

Circuit Drawings

CONTACT PROTECTION

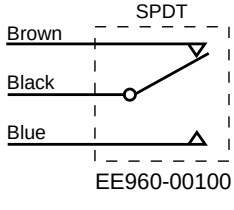
Voltage and current values given are maximum values of each but must not be construed to be a Volt-Amp rating. Switch capacity is listed as wattage or V-A except in the case of the EE960-16000 where switch capacity is the product of the applied voltage and the break-current.

All switch capacities are resistive (except for the EE960-16000) ratings, and surge protection should be used when switching inductive loads.

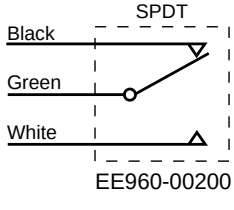


SWITCH EE960-16000-SURGE SUPPRESSION NOT NEEDED

Wiring Diagrams



EE960-00100

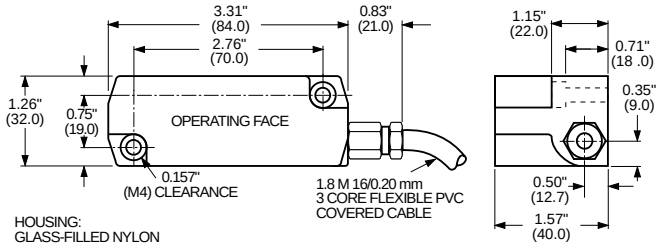


EE960-00200

Dimensional Drawings

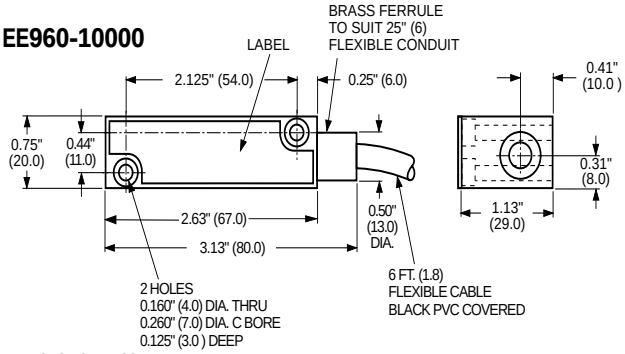
FERROUS ACTUATED SWITCHES, RECTANGULAR

EE960-20000



HOUSING: GLASS-FILLED NYLON

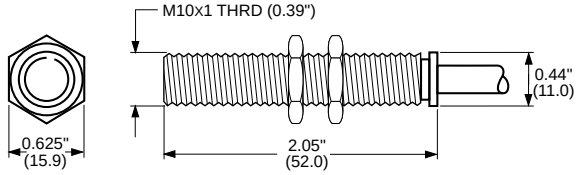
EE960-10000



HOUSING: BRASS

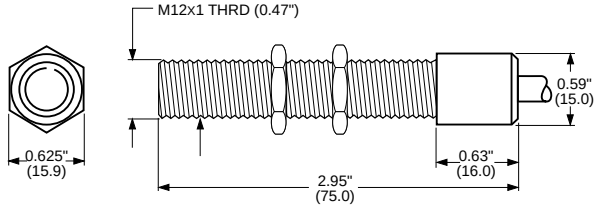
MAGNET ACTUATED SWITCHES, TUBULAR

EE960-00100



HOUSING: BRASS

EE960-00200



HOUSING: BRASS

Special Application Solutions

Continued on next page.

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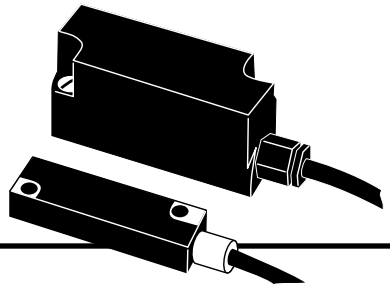
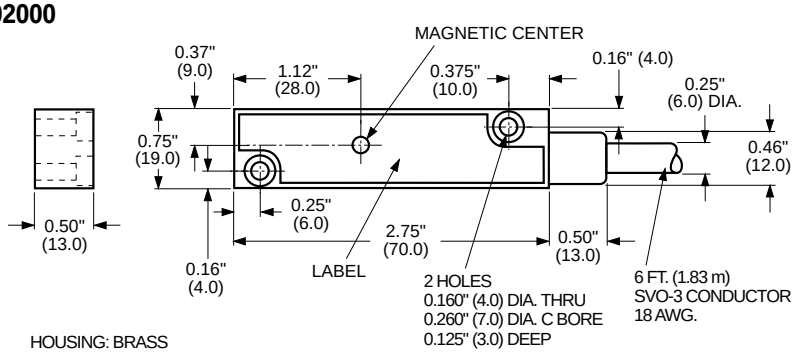
Ferrous/Magnet Actuated Switches



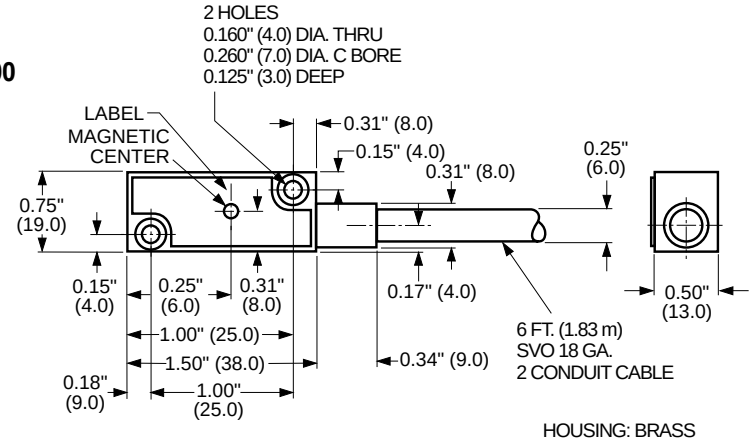
Dimensional Drawings

MAGNET ACTUATED SWITCHES, RECTANGULAR

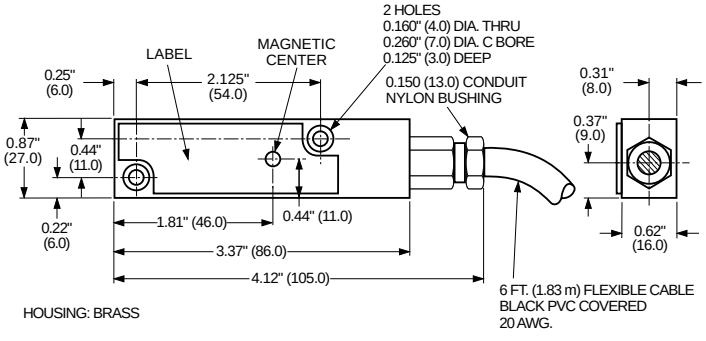
EE960-02000



EE960-03000



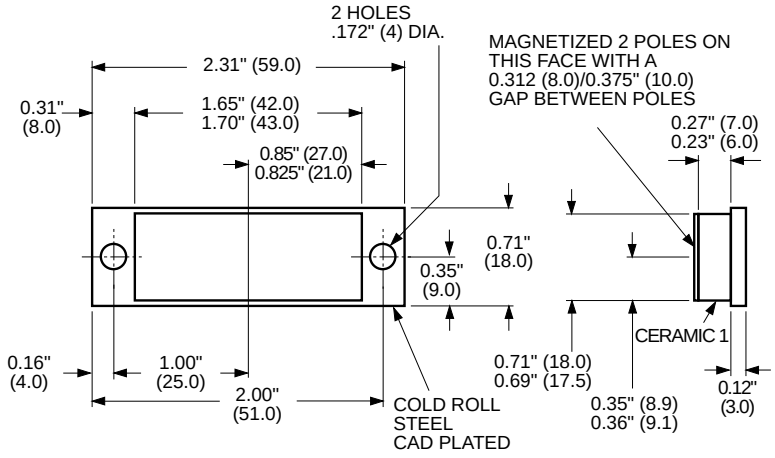
EE960-16000



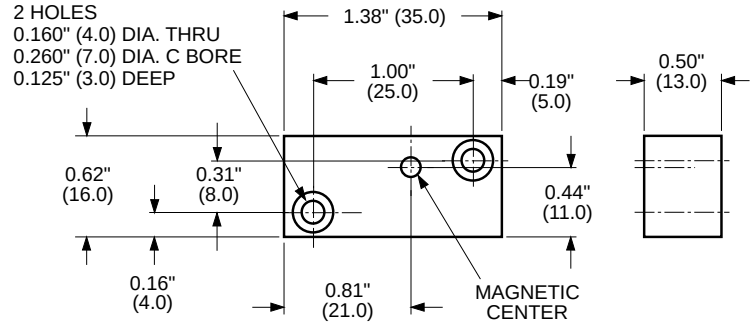
Special Application Solutions

MAGNET ACTUATED SWITCHES, RECTANGULAR

EE961-02500



EE961-02000



CASE MATERIAL BRASS

Special Application Solutions

Continued on next page.

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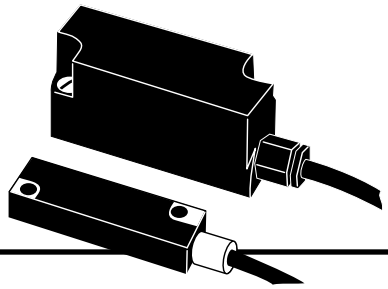
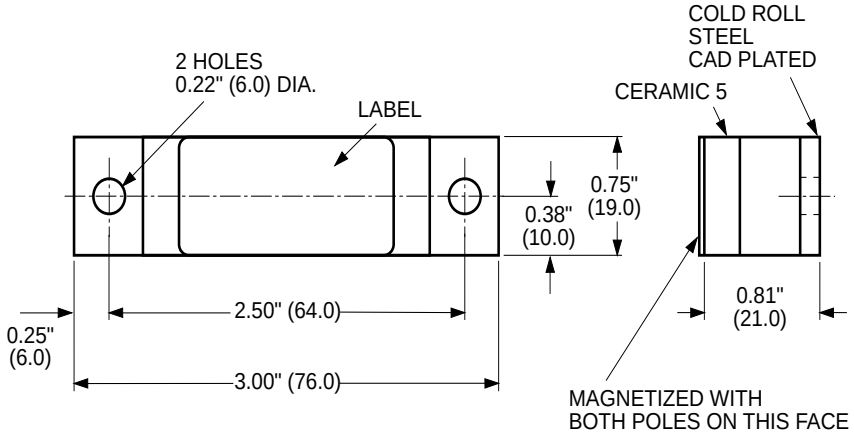
Ferrous/Magnet Actuated Switches



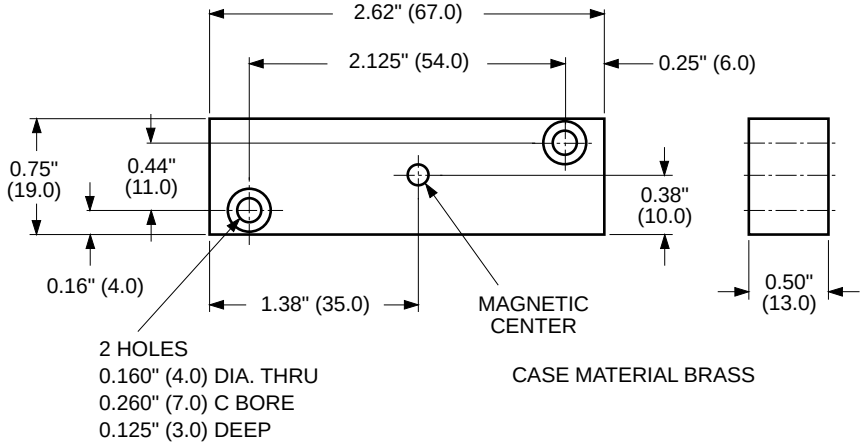
Dimensional Drawings

MAGNETIC ACTUATORS, RECTANGULAR

EE961-01600



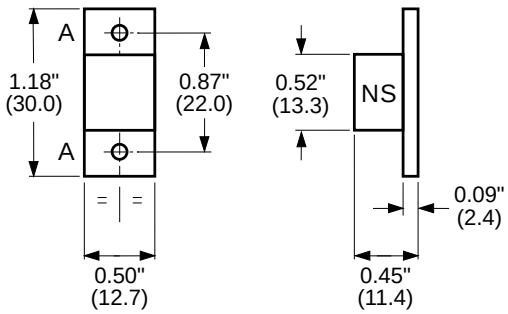
EE961-03000



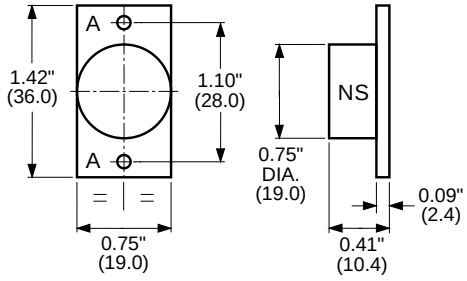
Special Application Solutions

MAGNETIC ACTUATORS, TUBULAR

EE961-03800



EE961-03900



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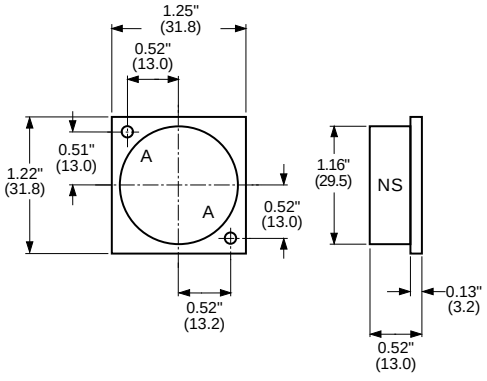

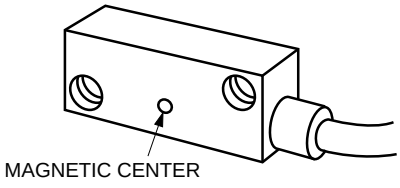

The magnetic center of a MAGLOCK SWITCH or an ACTUATOR is denoted by the mark “O” on its housing.

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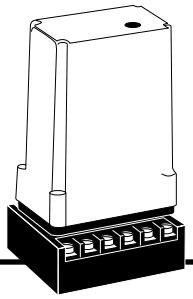
Motion Detection Systems



- **Underspeed/Overspeed**
- **Underspeed Only**
- **Zero Speed**

Motion Switch

Namco Controls EE891 Series Motion Switch is a digital system. It compares the time between input pulses with an adjustable reference time base.

The Motion Switch can be used in any of four modes. It may be used for overspeed or underspeed monitoring of rotating equipment with either manual reset or automatic reset. These functions are easily programmed into the unit via external jumper connections.

This series includes models for underspeed detection only as well as zero-speed unit. A choice of outputs is also available.

Series EE891 Motion Switches will accept a wide range of input signals including a simple contact closure. Used in conjunction with our EE510/ET series self-contained DC proximity switches, they offer a high reliability system.

The switch point (or trip frequency) is adjustable through the top of the enclosure. A screwdriver is required to set the trip point. A 15-turn potentiometer with a slip clutch at both ends prevents accidental damage due to excessive rotation.

The unit comes in a tough Lexan* enclosure to protect it from accidental damage. The unit also features plug-in convenience for easy installation or replacement.

**Lexan is a General Electric Product*

Zero Speed Switch

The EE891-32103 Zero Speed Switch is designed to accept either a sinking or sourcing input. The output function can be reversed, relay normally de-energized or normally energized, with the selector switch located on top of the module. An internal regulated power supply is provided to supply power to self-contained Proximity Switches.

Operating Principles: Standard Motion Switches

Input Signal

- Ground based positive
- Pulse rate to 1KHz with 300 microsecond minimum pulse width. Contains input bounce filter (up to 375 microseconds) for contact closure inputs.
- Internal switch for selecting NPN (sinking) or PNP (sourcing) inputs is accessible through a hole in the top of the module.

Underspeed

Underspeed operation is programmed in the unit by connecting a jumper between pin 3 and pin 4 of the terminal socket. The unit will now drop out if the input pulse rate should fall below the internal reference rate (variable through top of unit by screwdriver adjustment of 15-turn potentiometer).

Overspeed

Overspeed operation is programmed in the unit by connecting a jumper between pin 2 and pin 4 of the terminal socket. The unit will now drop out if the input rate rises above the internal reference rate (variable through top of unit by screwdriver adjustment of 15-turn potentiometer).

Automatic Reset

The output (once de-energized) will remain off until a reset button is closed momentarily. However, if your application requires an automatic reset function, this may be accomplished by connecting a jumber between the manual reset pins instead of a normally open switch.

Input

The Motion Switch is only as reliable as the input information. Therefore, it is extremely important that a good, reliable signal be made available. This can either be from a proximity switch or a contact closure. For reliable operation, the frequency of the target signal should be determined through use of an oscilloscope or tachometer. This frequency can then be applied to the input terminal of the motion switch. We recommend that a signal generator be used for this purpose. (Note: the signal generator should produce a positive only square wave. Any other wave form may damage the unit.)

The adjust potentiometer is then set to the proper “pick-up” point. We recommend that the values chosen for this frequency be approximately 5% above or below the normal “run” speed to allow for normal variations in the target speed. This is a minimum value. Please follow the set-up procedure provided with the particular type of switch used in your application.

NOTE: The EE891-32103 zero speed control module provides for an adjustable OFF delay when either the ON or OFF mode is selected. The OFF delay is retriggerable; therefore, the timing function starts at the beginning of each input pulse. (See Time Delay Chart.)

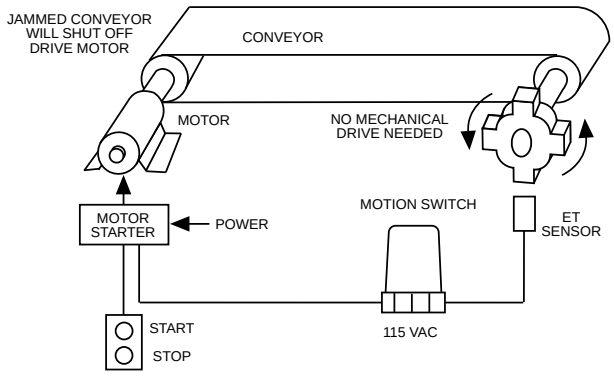
Operating Principles: Zero Speed Switches

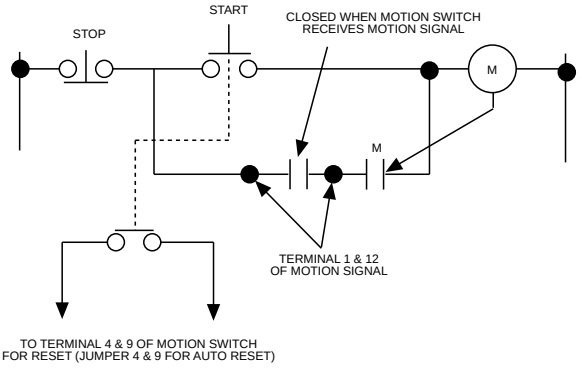
Like the Motion Switch, the Zero Speed Switch accepts either a contact closure, proximity, or photoelectric sensor input. This control module is based on time from the last input to the next as the equipment being monitored slows down.

When the pulse rate disappears for a time exceeding the set point, the output of the zero speed module will change. (The zero speed unit will not be “confused” if the input remains activated due to the target remaining in front of the sensor.)

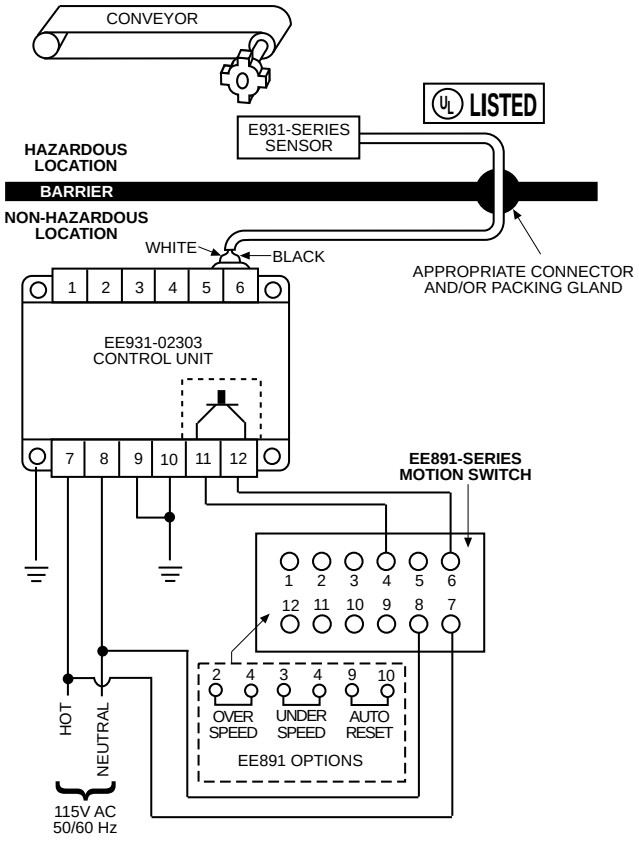
Typical Applications

CONVEYOR



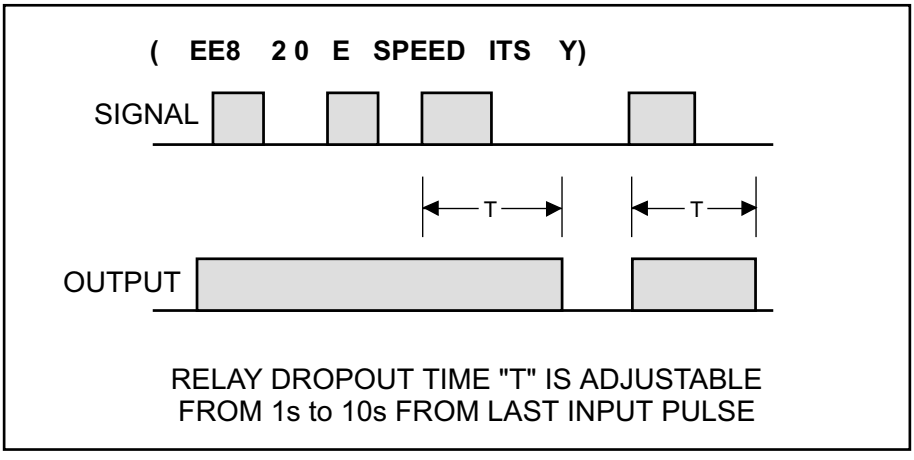


HAZARDOUS LOCATION*



* See Hazardous Location section for more information on Series EE931 products.

Time Delay Chart



Special Application Solutions

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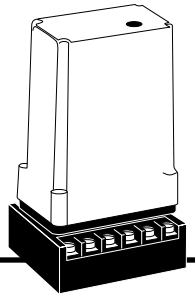
Motion Detection Systems



Motion Detection Systems consist of these motion detection modules coupled with a DC proximity sensor. Either the EE510 series or any DC ET-series sensor is compatible. EE931 sensors may also be employed for hazardous location requirements.

Motion Detection Modules

Output	Speed Adjustment Range: 3 to 60 Pulses Per Minute **Model No.**	Speed Adjustment Range: 24 to 480 Pulses Per Minute **Model No.**	Speed Adjustment Range: 384 to 7680 Pulses Per Minute **Model No.**	Speed Adjustment Range: See Time Delay Chart **Model No.**	UL Listed
Motion Switch					
Electromechanical Relay 1 Set Form C 5A-115 VAC Resistive	**EE891-02103***	**EE891-12103***	**EE891-22103***	—	✔
Open Collector 20 ma. sink V ext. max. 40 volts	**EE891-02303***	**EE891-12303***	**EE891-22303***	—	✔
Reed Relay 1 NO, 1 NC, 12VA or 10 watts	**EE891-02403***	**EE891-12403***	**EE891-22403***	—	✔
Underspeed Only Switch					
Electromechanical Relay 1 Set Form C 5A-115 VAC Resistive	**EE891-02113**	**EE891-12113**	**EE891-22113**	—	
Zero Speed Switch					
Electromechanical Relay 2 Form C 5A-115 VAC Resistive	—	—	—	**EE891-32103**	

**UL Listed.*
Order numbers shown are for 120 VAC units.

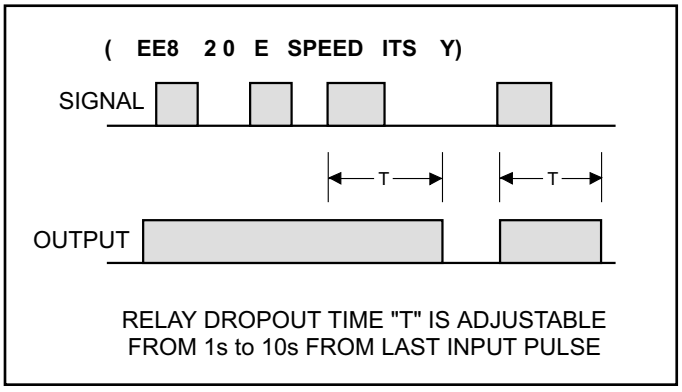
For intrinsically safe applications, use any EE981 sensor.

Specifications

MOTION DETECTION SYSTEMS		
	MOTION SWITCH	**ZERO SPEED**
Input	120VAC, 50/60Hz or 230 VAC	120 VAC, 50/60Hz
Electromechanical Relay	1 Set Form C 5A Resistive @ 120 VAC	DPDT 5A Resistive @ 120 VAC
Reed Relay	1 NO - 1 NC 10 W or 12 VA	N/A
Transistor	Vext. 40 VDC max. Sinking, 10 mA	N/A
Solid State Relay	.050 Amps min. to 1.5 Amps max. 240 VAC max.	
DC Power Supply	24VDC, 50 mA max. for sinking (NPN) or sourcing (PNP) Input***	
Drop-Out Time	N/A	1-10 Sec. Adjustable
Hysteresis	5%	N/A
Latch	Yes	N/A
Mode of Operation	Overspeed or Underspeed programmed	N/A
Trip Point Adjust	Yes	N/A
Response Time	<10ms: electromechanical <2ms: reed relay	N/A

**The use of an external suppressor network on relay output models is recommended to prolong contact life.
*** Early models may have 12 VDC supply.

Time Delay Chart



Compatible Sensors (DC versions only)

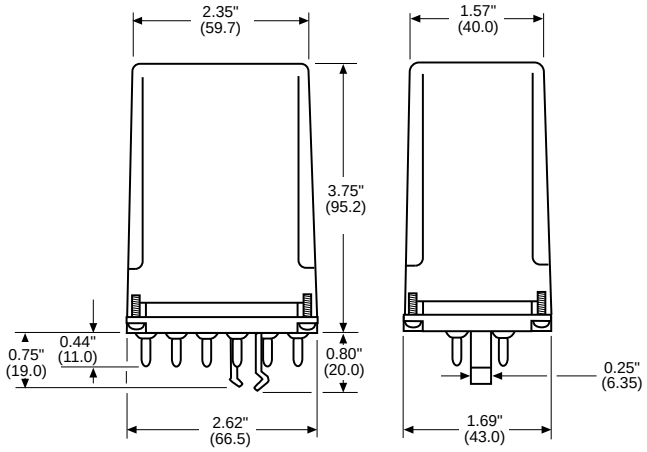
EE510 Series

ET Series

EE931 Series (for Hazardous Locations)

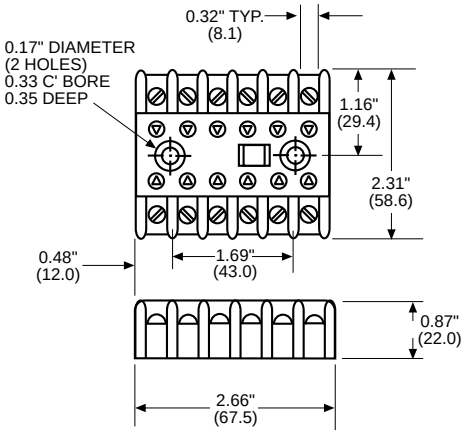
Dimensional Drawings Motion Detection

CONTROL MODULE



BASE PIN SOCKET

EE012-50004
(Order as separate item)



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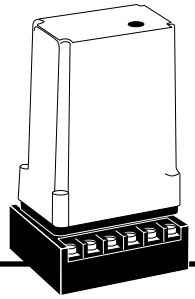
Motion Detection Systems

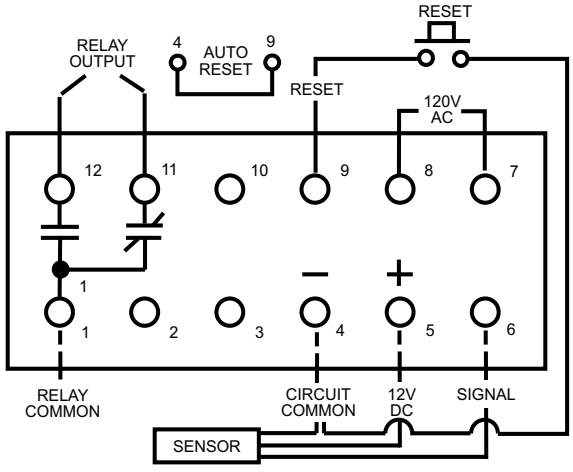


Circuit Drawings

UNDERSPEED ONLY SWITCH, ELECTROMECHANICAL RELAY

RELAY OUTPUT 1 FORM "C"
5 AMPS RESISTIVE @ 120V AC

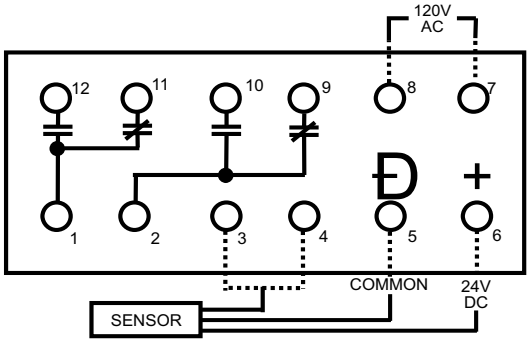
Model Nos.
EE891-02113
EE891-12113
EE891-22113



ZERO SPEED SWITCH, ELECTROMECHANICAL RELAY SOLID STATE RELAY

RELAY OUTPUT: 2 FORM "C" 5 AMP RESISTIVE
@ 120V AC

Model Nos.
EE891-32103



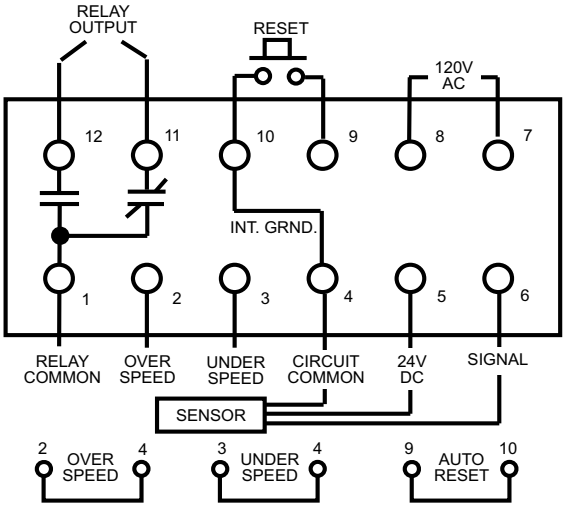
INTERNAL SWITCH
FOR NORMALLY "ON" OR NORMALLY "OFF"
RELAY OPERATION

Special Application Solutions

MOTION SWITCH, ELECTROMECHANICAL RELAY

Model Nos.
EE891-02103
EE891-12103
EE891-22103

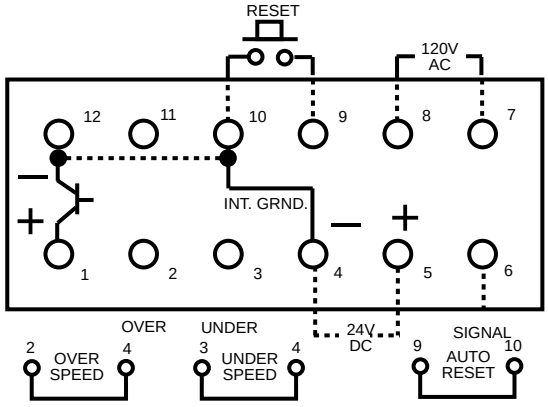
RELAY OUTPUT 1 FORM "C"
5 AMP MAX. RESISTIVE @ 120V AC



MOTION SWITCH, OPEN COLLECTOR

Model Nos.
EE891-02303
EE891-12303
EE891-22303

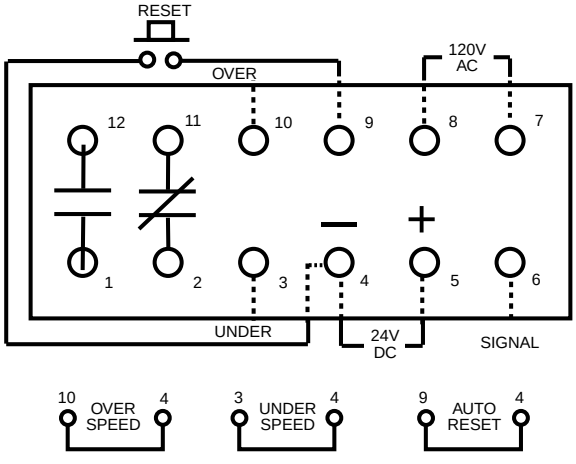
V EXT = 40V DC 20 ma MAX.



MOTION SWITCH, REED RELAY

Model Nos.
EE891-02403
EE891-12403
EE891-22403

RELAY OUTPUT
FORM "A" FORM "B"
12 va 120V OR
10 WATT MAX., 500 ma MAX., 120V MAX



NOTE: Early models may have 12VDC supply.

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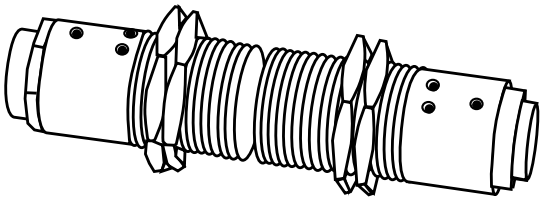
Sensor Wiring Systems

Non-Contact Coupling System



- **Provides connector-free installation and operation between stationary and moving assemblies**
- **Any Namco 2-wire AC/DC low leakage sensor can be used for part sensing on the moving equipment side of the system**
- **Up to 0.10" gap between Master and Remote Coupler**

The Namco ProxCoupler™ System is designed primarily for use on equipment that has both stationary and movable elements. The ProxCoupler replaces cumbersome connector contact or slip-ring assemblies with a non-contact, solid-state system consisting of two parts. The Master Coupler is used on the stationary side of the equipment and provides power to the Remote Coupler. The Remote Coupler supplies power to the Remote Sensor and target status information to the Master Coupler. The Remote Sensor can be either a Namco 2-Wire AC/DC device or a mechanical contact device. Interconnection of the Remote Coupler and Remote Sensor is via standard double-ended Mini-style cordsets.

Applications:

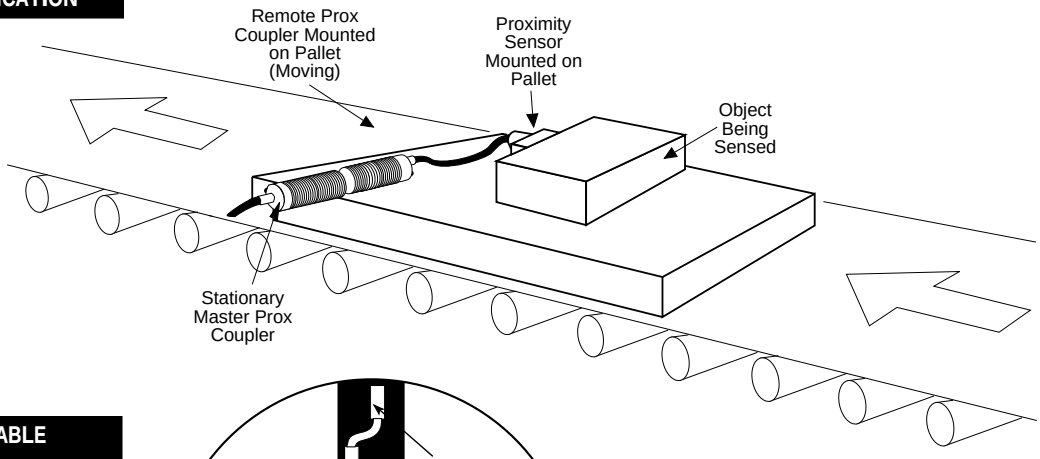
- **Material Handling Systems**
- **Monitoring Robot Arm Applications**
- **Rotary Transfer Machines**
- **Transfer Presses**

Model No.	Description
EE100-00125	Master Coupler (2-wire DC)
EE970-77600	Master Coupler (3-wire DC, PNP)
EE970-77000	Remote Coupler

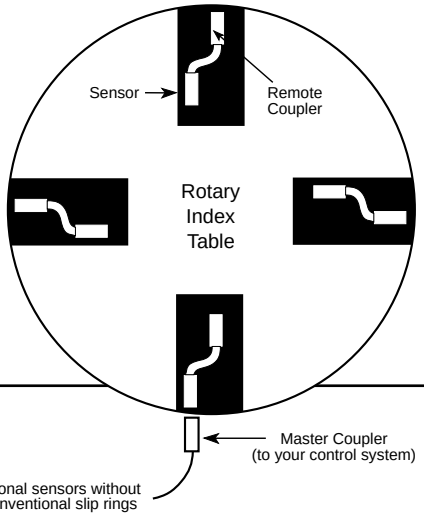
Special Application Solutions

Potential Uses of the Prox Coupler System

CONVEYOR APPLICATION



ROTARY INDEX TABLE APPLICATION



Protected by the NAMCO Lifetime Replacement Program

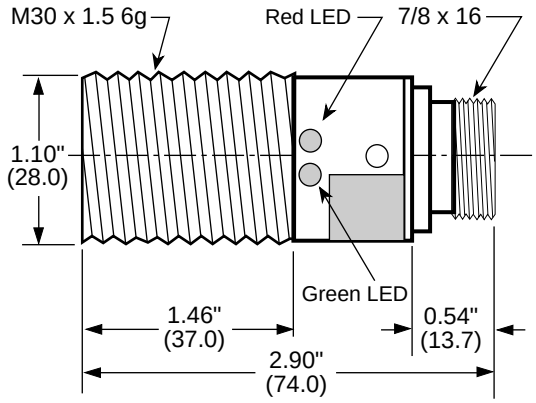
Prox Coupler

Specifications

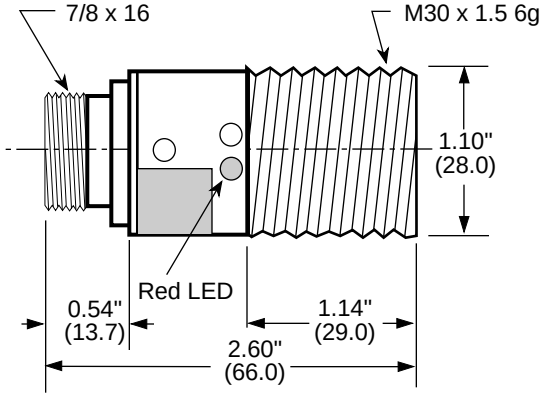
NON-CONTACT COUPLING SYSTEM		
MASTER COUPLER	**3-Wire DC, PNP**	**2-Wire DC**
Supply Voltage	20-30 VDC	
On-State Voltage Drop	+2.5 V	+10 V
Maximum Load	0.2 A	
Minimum Load	N/A	60 mA
Leakage Current	10 µA	15 mA
WFI/SCP	yes	
Air Gap (minimum)	0.01 inch	
Air Gap (maximum)	0.10 inch	
Lateral Misalignment	0.01 inch (max.)	
Operating Temperature	-20˚C to +70˚C	
LED Indicators	Red On: Power on/non-conducting Green On: Target sensed/conducting Both Flashing: Short circuit condition	
REMOTE COUPLER		
LED Indicator	Red On: Energized by Master Coupler	
Remote Coupler Connection	3-pin male/female Mini style cordset	

Dimensional Drawings

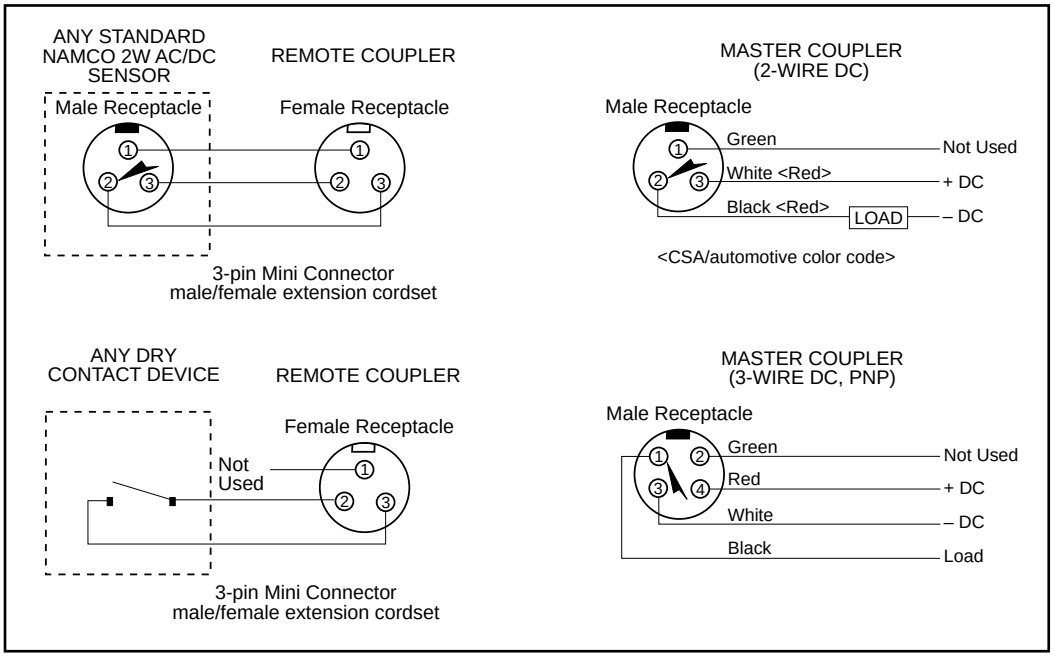
MASTER COUPLER



REMOTE COUPLER



Circuit Drawings



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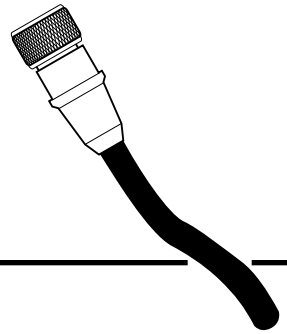
For technical assistance, call 1-800-NAMTECH

Single Ended Female

Cable Cordsets



Cable Length	Pin Configuration	Euro Connector		Mini Connector		Micro Connector	
		Model No.	Wire Size	Model No.	Wire Size	Model No.	Wire Size
STRAIGHT CONNECTOR							
6 ft.	3-pin	**EE978-52301**	22 AWG	**EE978-50301**	16 AWG	**EE978-51301**	18 AWG
6 ft.	4-pin	**EE978-52401**	22 AWG	**EE978-50401**	16 AWG	**EE978-51401**	18 AWG
6 ft.	5-pin	**EE978-52501**	22 AWG	**EE978-50501**	16 AWG	**EE978-51501**	18 AWG
12 ft.	3 pin	**EE978-52302**	22 AWG	**EE978-50302**	16 AWG	**EE978-51302**	18 AWG
12 ft.	4-pin	**EE978-52402**	22 AWG	**EE978-50402**	16 AWG	**EE978-51402**	18 AWG
12 ft.	5-pin	**EE978-52502**	22 AWG	**EE978-50502**	16 AWG	**EE978-51502**	18 AWG
90° CONNECTOR							
6 ft.	3-pin	**EE978-52311**	22 AWG	**EE978-50311**	16 AWG	**EE978-51311**	18 AWG
6 ft.	4-pin	**EE978-52411**	22 AWG	**EE978-50411**	16 AWG	**EE978-51411**	18 AWG
6 ft.	5-pin	**EE978-52511**	22 AWG	**EE978-50511**	16 AWG	**EE978-51511**	18 AWG
12 ft.	3-pin	**EE978-52312**	22 AWG	**EE978-50312**	16 AWG	**EE978-51312**	18 AWG
12 ft.	4-pin	**EE978-52412**	22 AWG	**EE978-50412**	16 AWG	**EE978-51412**	18 AWG
12 ft.	5-pin	**EE978-52512**	22 AWG	**EE978-50512**	16 AWG	**EE978-51512**	18 AWG

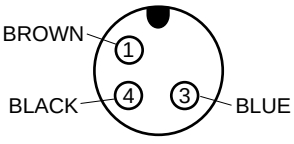
All cables are PVC Jacketed, STO/STOW

**Optional cable material and wire gauges available.*
Consult factory for additional information.

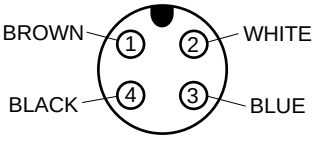
Connector Drawings (Female views shown)

EURO CONNECTOR

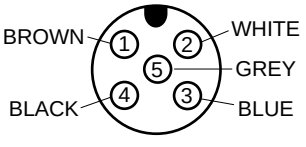
3-pin



4-pin

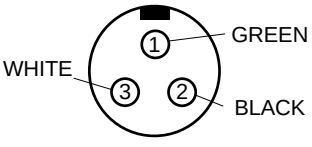


5-pin

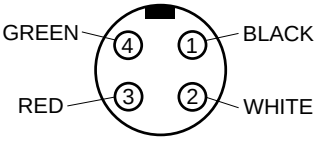


MINI CONNECTOR

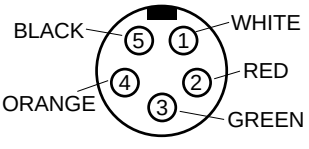
3-pin



4-pin

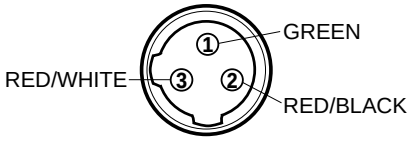


5-pin

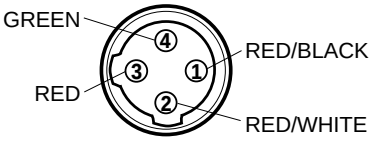


MICRO CONNECTOR

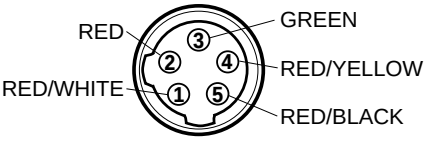
3-pin



4-pin

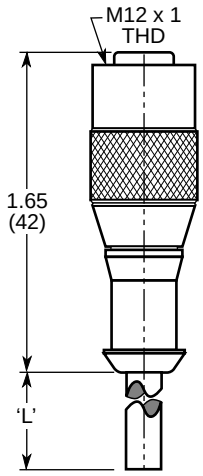


5-pin

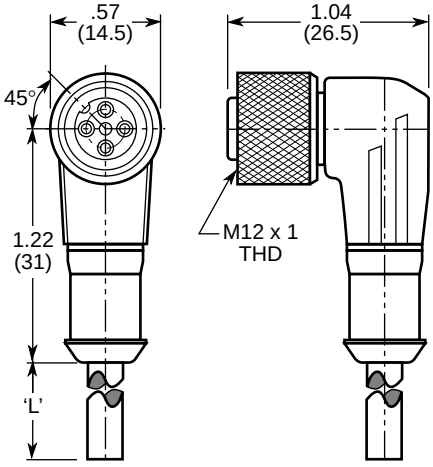


Euro Connectors - Dimensional Drawings

STRAIGHT FEMALE

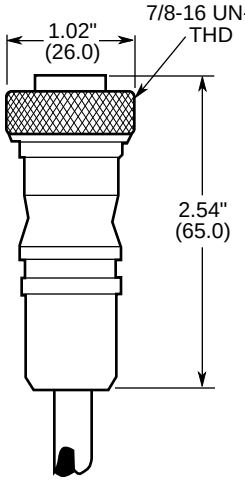


90° FEMALE

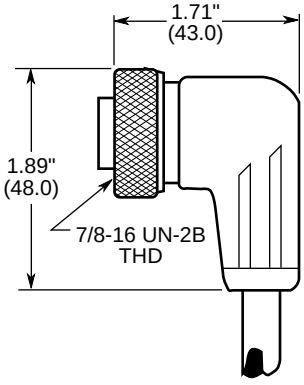


Mini Connectors - Dimensional Drawings

STRAIGHT FEMALE

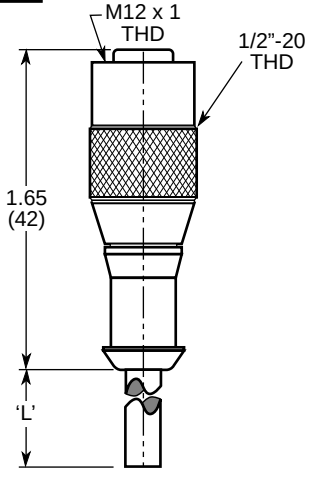


90° FEMALE

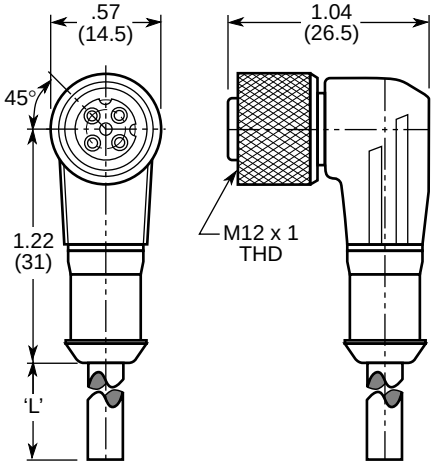


Micro Connectors - Dimensional Drawings

STRAIGHT FEMALE



90° FEMALE



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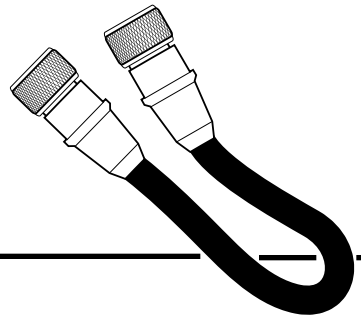
Double Ended Cable Cordsets



Cordsets

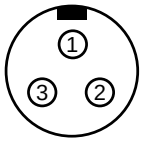
Cable Length	Model Number	Wire Size
DOUBLE-ENDED STRAIGHT EURO / 4-PIN MALE/FEMALE		
1’	**PB978-30001**	22AWG
3’	**PB978-30003**	22AWG
6’	**PB978-30006**	22AWG
9’	**PB978-30009**	22AWG
12’	**PB978-30012**	22AWG
DOUBLE-ENDED 90° EURO / 4-PIN STRAIGHT MALE		
1’	**PB978-30101**	22AWG
3’	**PB978-30103**	22AWG
6’	**PB978-30106**	22AWG
9’	**PB978-30109**	22AWG
12’	**PB978-30112**	22AWG
20’	**PB978-30120**	22AWG
DOUBLE-ENDED (2) 90° EURO / 4-PIN MALE/FEMALE		
1’	**PB978-30201**	22AWG
3’	**PB978-30203**	22AWG
6’	**PB978-30206**	22AWG
9’	**PB978-30209**	22AWG
12’	**PB978-30212**	22AWG
20’	**PB978-30220**	22AWG
DOUBLE-ENDED STRAIGHT MINI / 3-PIN MALE/FEMALE		
1’	**PB978-30301**	18AWG
3’	**PB978-30303**	18AWG
6’	**PB978-30306**	18AWG
9’	**PB978-30309**	18AWG
12’	**PB978-30312**	18AWG
20’	**PB978-30320**	18AWG

**Optional cable material, wire gauges and custom lengths available. Consult factory for additional information.*

Connector Drawings (Female views shown)

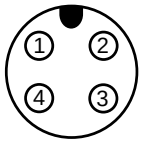
MINI CONNECTOR

3-pin



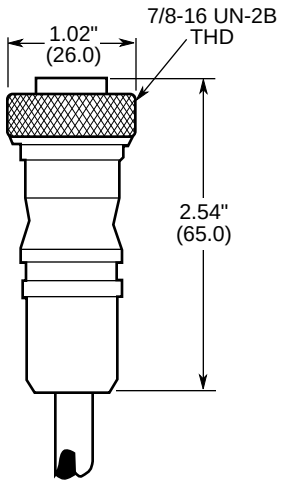
EURO CONNECTOR

4-pin

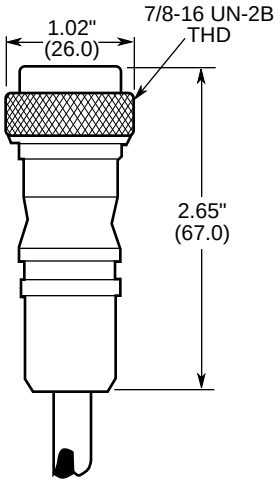


Mini Connectors - Dimensional Drawings

STRAIGHT FEMALE

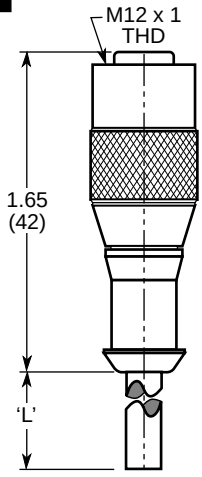


STRAIGHT MALE

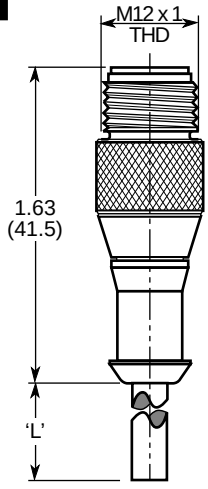


Euro Connectors - Dimensional Drawings

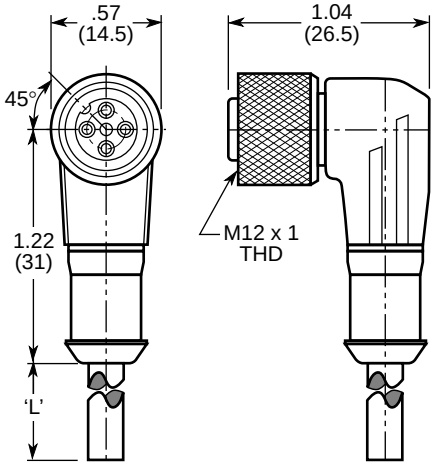
STRAIGHT FEMALE



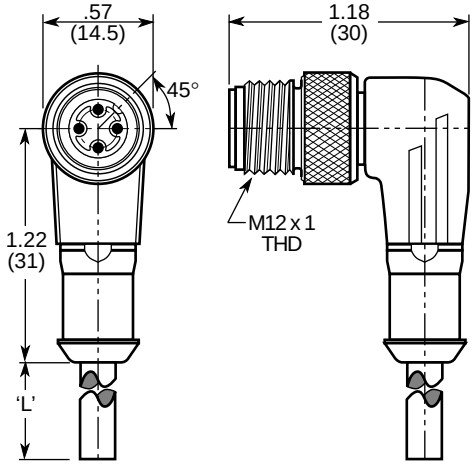
STRAIGHT MALE



90° FEMALE



90° MALE



Cables and cordsets are purchased to Namco specifications from multiple sources. As such, styles may vary slightly.

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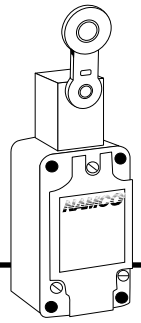
Compact Body
Standard Environment
Butt Contacts

Limit Switches



- **Small Size**
- **Rotatable Head**
- **Light Operating Force**
- **Compact Durable Housing**
- **SPDT; Positive Opening in event of Minor Contact Welding**

The new Namco Snap-Lock® EA530 Series limit switches are intended for reliable sensing performance in rugged industrial environments. They have a compact 30mm x 60mm mounting footprint and trip force of 40 in • oz., making them ideal for lighter force applications. These compact limit switches have a die cast zinc housing with epoxy paint and positive-acting contacts. They are NEMA A300 AC and Q300 DC rated and UL and CSA listed.

A variety of actuator styles are available, including top roller plunger and rotary roller lever. The switch heads are rotatable by 90° increments to allow for four positions of operation. Action can be changed from momentary clockwise and counterclockwise to momentary clockwise only or momentary counterclockwise only by setting the head internally.

EA530 Single Pole 1 N.O. - 1 N.C. / Butt Contacts

Model Number	Type	A Trip Travel	B Reset Travel	C Recommended Travel	D Total Travel	Operating Force
STANDARD TRAVEL/COMPACT						
EA530-14700	Plunger	.130"	.053"	.169"	.197"	33 oz.
EA530-15701	Roller Plunger	.102"	.053"	.141"	.197"	33 oz.
EA530-17702	Lever	35°	17°	48.5°	75°	40 in oz.

EA530 DPDT 2 N.O. - 2 N.C. / Butt Contacts

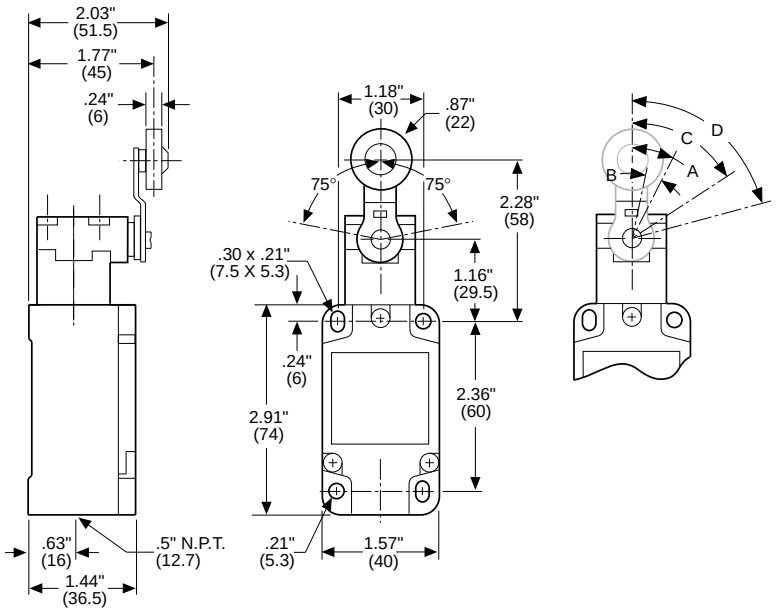
Model Number	Type	A Trip Travel	B Reset Travel	C Recommended Travel	D Total Travel	Operating Force
STANDARD TRAVEL/COMPACT						
EA530-47702	Lever	25°	10°	48.5°	75°	40 in oz.

Common Switch Characteristics

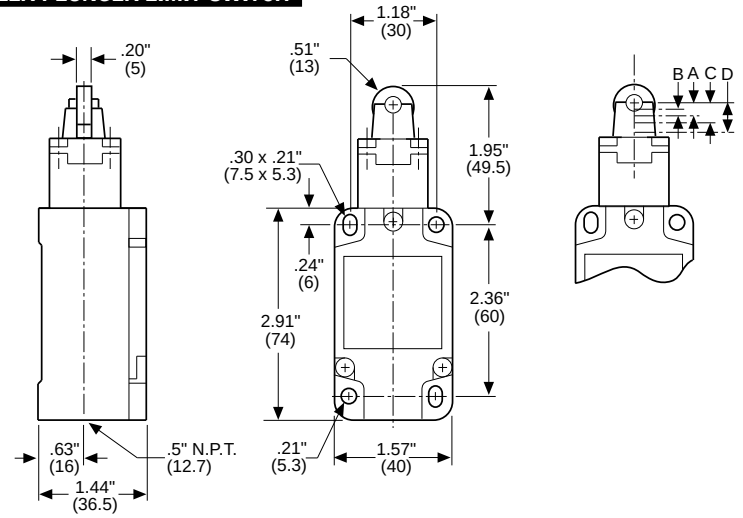
SINGLE POLE, STANDARD ENVIRONMENT, COMPACT BODY, BUTT CONTACTS	
NEMA Enclosure Type	Designed to meet 1, 2, 4, 12 & 13 (IP66)
Ambient Temperature Range	-25°C to +80°C
Rotatable Head	yes
Light Operating Force	yes
UL/CSA	yes

Dimensions and Mounting

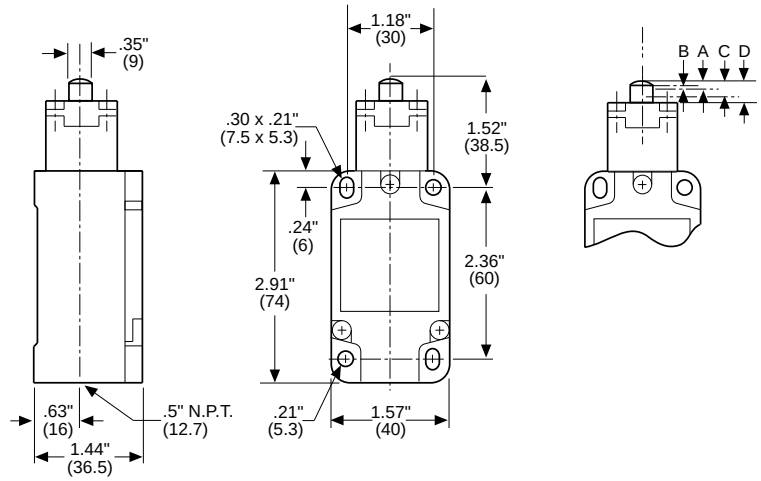
LEVER LIMIT SWITCH



ROLLER PLUNGER LIMIT SWITCH



PLUNGER LIMIT SWITCH



Dimensions: inches/(mm)

Continuous Current Rating - Amperes

AC 50/60 Hz NEMA A300				
AC	**Make**	**Break**	**Continuous**	**Voltamperes**
120V	60A	6A	10A	7200 (make) 720 (break)
240V	30A	3A		
480V	15A	1.5A		
480V	15A	1.5A		
600V	12A	1.2A		

DC NEMA Q300			
DC	**Make or Break**	**Continuous**	**Voltamperes**
125V	.55A	N/A	69
250V	.27A	N/A	69
300V to 600V	12A	1.2A	N/A

Contact Configurations

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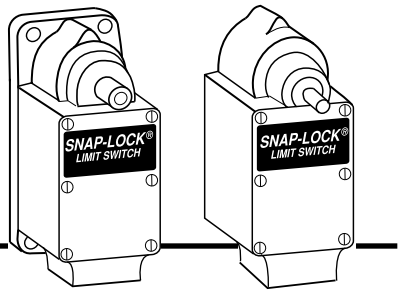
Single Pole Standard Environment Limit Switches Butt Contacts



EA080
Single pole, double throw, heavy duty limit switch having mechanical travel of 10° to trip and with one normally open and one normally closed circuit. Can be furnished with wide and long mountings.

EA060
With mechanical travel of 6-1/2° required to trip, this heavy duty limit switch operates with one normally open and one normally closed circuit. Can be furnished with wide and long mountings.

EA040
Designed for applications where a neutral position is essential in operation. This series provides the same snap locking action of the other series of Snap-Lock switches.

EA700
The versatility of the Snap-Lock mechanism is gained through the use of a series of uniquely designed cams. The cam and cam mechanism allow features such as bi-directional operation and generous overtravel. These features make the EA700 Series one of the most popular. Can be furnished with standard, wide or long mounting.

EA060 & EA080 Single Pole 1 N.O. - 1 N.C. / EA040 2 N.O. / Butt Contacts / Standard Travel / Rocker Type

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.	Data Drawing
NEUTRAL POSITION												
-	**EA040-21100**	**EA040-11100**	CW/CCW	7°	6°	7°30'	33°	-	-	22	C	1
SHORT TRAVEL												
-	**EA060-21100**	**EA060-11100**	CW	6°30'	4°	7°	35°	-	-	24	A	1
-	**EA060-22100**	**EA060-12100**	CCW	6°30'	4°	7°	35°	-	-	24	B	1
-	**EA060-23100**	**EA060-13100**	Maintained	6°30'	4°	7°	35°	-	-	12	-	1
STANDARD TRAVEL												
-	**EA080-21100**	**EA080-11100**	CW	10°	8°	13°	38°	-	-	14	A	1
-	**EA080-22100**	**EA080-12100**	CCW	10°	8°	13°	38°	-	-	14	B	1
-	**EA080-23100**	**EA080-13100**	Maintained	10°	8°	13°	38°	-	-	5	-	1

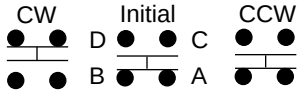
EA700 Single Pole 1 N.O. - 1 N.C. / Butt Contacts / Cam Action

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.	Data Drawing
STANDARD TRAVEL												
EA700-10000	**EA700-40000**	**EA700-70000**	CW	18°	14°	30°	90°	-	-	15	A	1
EA700-10001	**EA700-40001**	**EA700-70001**	CCW	18°	14°	30°	90°	-	-	15	D	1
EA700-10100	**EA700-40100**	**EA700-70100**	CW/CCW	18°	14°	30°	90°	-	-	15	E	1
MAINTAIN CONTACT AND LEVER POSITION												
EA700-16000	**EA700-46000**	**EA700-76000**	CW CCW	55° 25°	22° 25°	60° 60°	116° 124°	55° 54°	64° 56°	6 9	J	2
MAINTAIN CONTACTS AND SPRING RETURN LEVER POSITION												
EA700-16700	**EA700-46700**	**EA700-76700**	CW CCW	30° 16°	26° 30°	45° 45°	90° 90°	30° 26°	- -	12 13.5	J	3
NEUTRAL POSITION - ALL CONTACTS OPEN												
EA700-15000	**EA700-45000**	**EA700-75000**	CW CCW	11° 35°	9° 13°	45° 45°	90° 90°	- -	- -	18 13.5	F	1
NEUTRAL POSITION - ALL CONTACTS CLOSED												
EA700-15100	**EA700-45100**	**EA700-75100**	CW CCW	11° 35°	9° 13°	45° 45°	90° 90°	- -	- -	18 13.5	G	1
NEUTRAL POSITION - ALL CONTACTS OPEN												
EA700-15700	**EA700-45700**	**EA700-75700**	CW CCW	31° 31°	22° 12°	45° 45°	90° 90°	- -	- -	15 19.5	H	1
NEUTRAL POSITION - ALL CONTACTS CLOSED												
EA700-15800	**EA700-45800**	**EA700-75800**	CW CCW	31° 31°	22° 12°	45° 45°	90° 90°	- -	- -	15 19.5	I	1

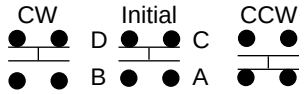
See Operating Levers Section

Contact Configurations

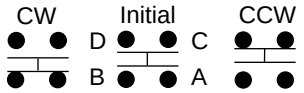
CIRCUIT A



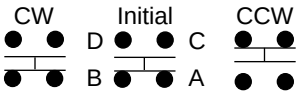
CIRCUIT B



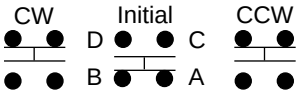
CIRCUIT C



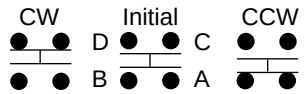
CIRCUIT D



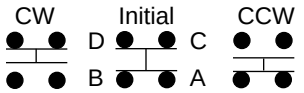
CIRCUIT E



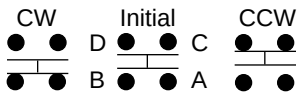
CIRCUIT F



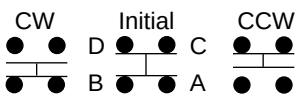
CIRCUIT G



CIRCUIT H

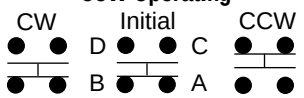


CIRCUIT I

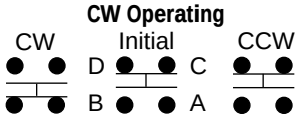


CIRCUIT J

CCW Operating

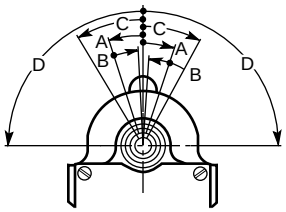


CW Operating



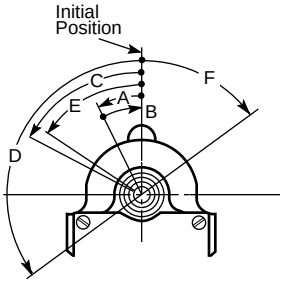
Operational Data Drawings

DRAWING #1

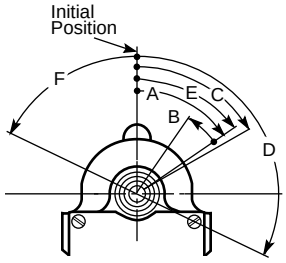


DRAWING #2

CCW Operating



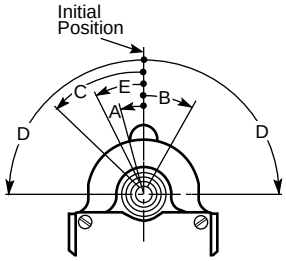
CW Operating



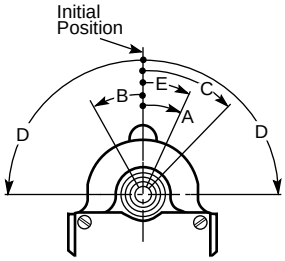
To change switch operation from CW operating to CCW operating, operate switch through angle E. Remove lever and reset at initial position.

DRAWING #3

CCW Operating



CW Operating



To change switch operation from CW operating to CCW operating, operate switch through angle E.

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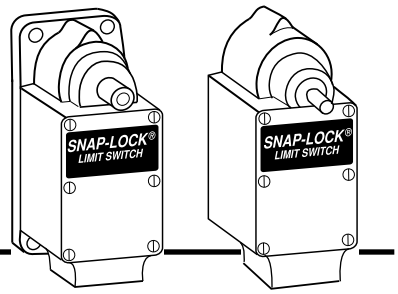
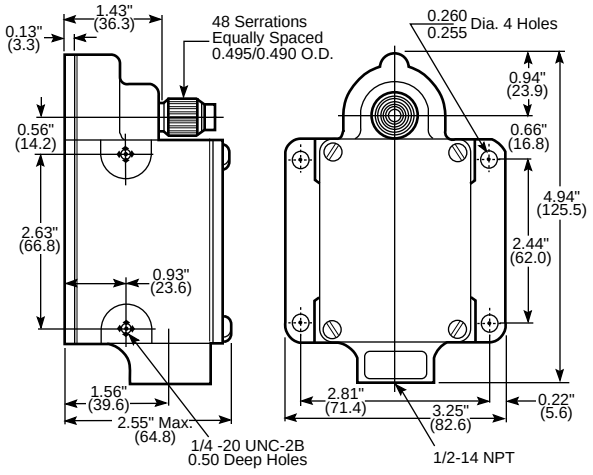
Limit Switches

Butt Contacts

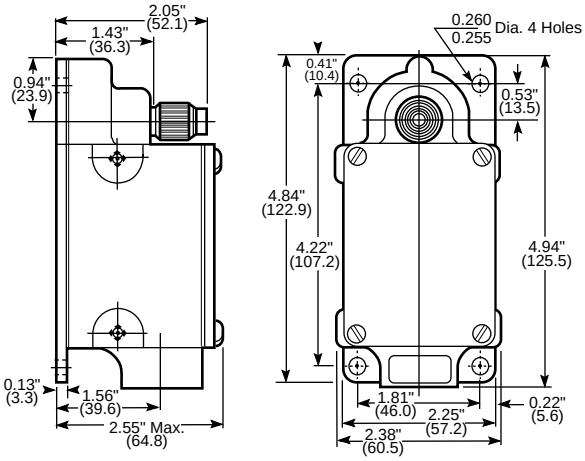


EA040/060/080 Series Drawings

WIDE MOUNTING PLATE

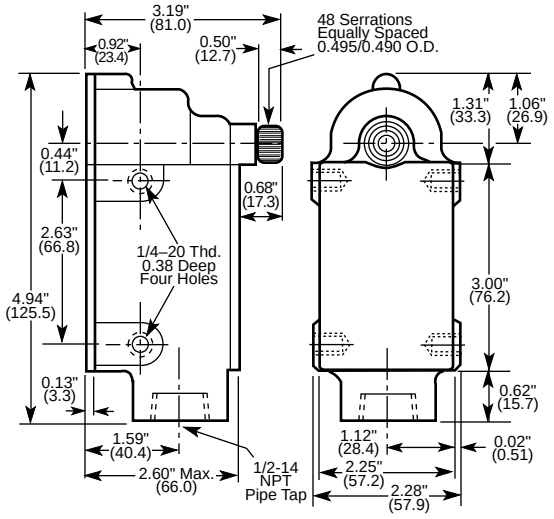


LONG MOUNTING PLATE

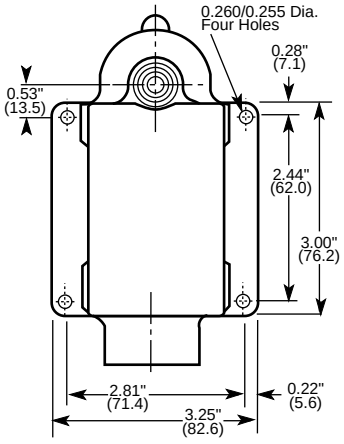


Dimensions: inches/(mm)

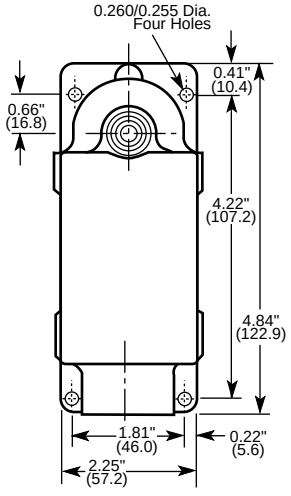
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE



LONG MOUNTING PLATE



Dimensions: inches/(mm)

Common Switch Characteristics

SINGLE POLE, STANDARD ENVIRONMENT, BUTT CONTACTS		
	EA040, 060, 080	**EA700**
NEMA Enclosure Type	1, 4, 13	
Housing Material	Zinc	
Ambient Temperature Range*	-20°C to +90°C	
Shipping Weight	2.3 lbs. approx.	3 lbs. approx.
Lever Adjustment	7°30' Increments thru 167°	7°30' Increments thru 360°
Contacts	Butt, Silver Alloy, Form Z	

*Some high temperature (+20°C to 180°C) and low temperature (-40°C to +90°C) versions available. Contact factory.

Continuous Current Rating - Amperes

VOLTAGE	AC	DC
125	20.0	5.0
250	15.0	1.5
480	10.0	-
600	5.0	-

75-100% Power Factor

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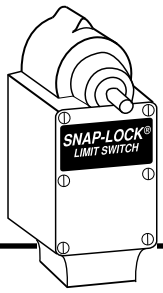
Limit Switches

Sliding Contacts



The versatility of the Snap-Lock mechanism is gained through the use of a series of uniquely designed cams. The cam and cam mechanism allow features such as bi-directional operation and generous overtravel. These features make the EA710 Series one of the most popular. Can be furnished with Standard, Wide or Long mounting.

EA710 Single Pole 1 N.O. - 1 N.C. / Sliding Contacts / Cam Action

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.	Data Drawing
STANDARD TRAVEL												
EA710-10000	**EA710-40000**	**EA710-70000**	CW	18°	14°	30°	90°	-	-	15	A	1
EA710-10001	**EA710-40001**	**EA710-70001**	CCW	18°	14°	30°	90°	-	-	15	B	1
EA710-10100	**EA710-40100**	**EA710-70100**	CW/CCW	18°	14°	30°	90°	-	-	15	C	1
MAINTAINED CONTACTS AND LEVER POSITION												
EA710-16000	**EA710-46000**	**EA710-76000**	CW	55°	22°	60°	116°	55°	64°	6	D	2
			CCW	25°	25°	60°	124°	54°	56°	9		

Common Switch Characteristics

SINGLE POLE, STANDARD ENVIRONMENT, SLIDING CONTACTS	
NEMA Enclosure Type	1, 4, 13
Housing Material	Zinc
Ambient Temperature Range*	-20°C to +90°C
Shipping Weight	3 lbs. approx.
Lever Adjustment	7°30' Increments Thru 360°
Contacts	Sliding, Silver Alloy, Form Z

Continuous Current Rating - Amperes

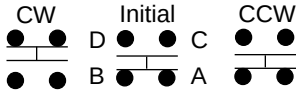
VOLTAGE	AC	DC
125	10.0	2.5
250	7.5	.75
480	5.0	-
600	2.5	-

75-100% Power Factor

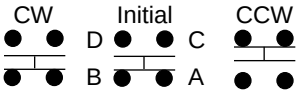
See Operating Levers Section

Contact Configurations

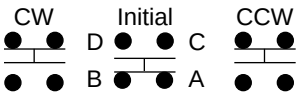
CIRCUIT A



CIRCUIT B

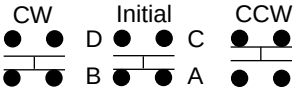


CIRCUIT C

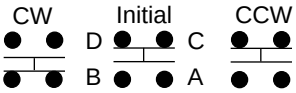


CIRCUIT D

CCW Operating

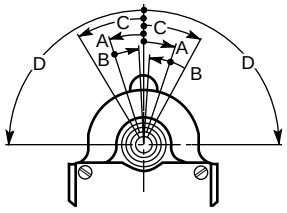


CW Operating



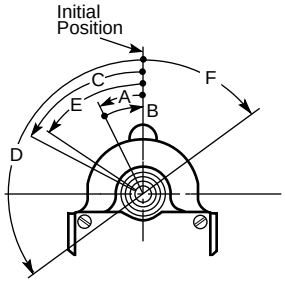
Operational Data Drawings

DRAWING #1

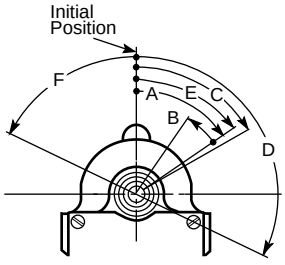


DRAWING #2

CCW Operating



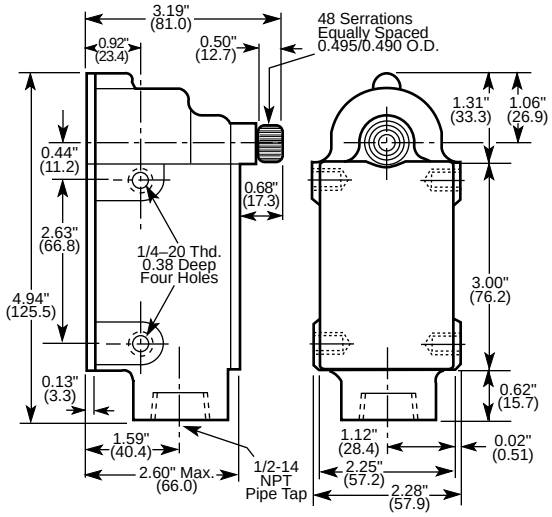
CW Operating



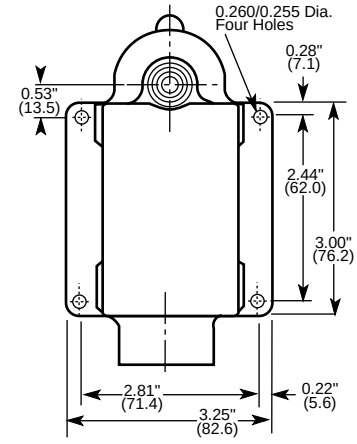
To change switch operation from CW operating to CCW operating, operate switch through angle E. Remove lever and reset at initial position.

Dimensions and Mounting

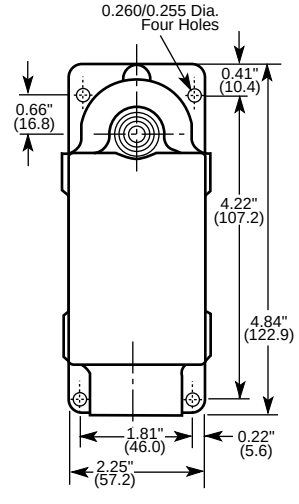
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE



LONG MOUNTING PLATE



Dimensions: inches/(mm)

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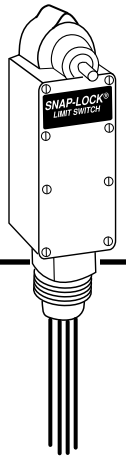
Single Pole
Standard Environment
(Super Sealed)

Limit Switches

Butt Contacts



- **Multiple Contacts — SPDT**
- **Epoxy Sealed**
- **Generous Overtravel**
- **Heavy Duty Cam Operated**
- **Flexibility of Motion CW, CCW and CW/CCW**

Wide range of operation...modular construction...practical flexibility.

The Series EA770 Super Sealed Water & Oil Tight Snap-Lock Limit Switches are the "ultimate" of the industry. By incorporating the moisture seal with these switches, trouble caused by water, soluble oils or condensation has been eliminated. The scope of models is tailored to meet today's rugged requirements...there is a model of size and type to meet virtually all demands.

Besides covering all functional requirements, this line is designed to meet practically every condition of installation. These Snap-Lock Switches provide reliable "machine-life" service and have the stamina to operate under unusual conditions...at the same time giving millions of consistently fast, accurate contacts.

Here are a few of the outstanding features built into the switch for maximum performance. Generous overtravel and by-pass, flexibility of motion, fast contact action, and Form Z contact arrangement.

Options Available

- Low temperature (-40°C to +90°C) components and lubricants.
- A variety of levers can be ordered from Namco Controls Series EL. NOTE: Levers must be ordered as separate item. See pages 294-301.
- Basic design permits mounting from either side or back. Style L or W mounting plates, for back mounting.

EA770 Single Pole 1 N.O. - 1 N.C. / Butt Contacts / Cam Action

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.
STANDARD TRAVEL											
EA770-10000	**EA770-40000**	**EA770-70000**	CW	18°	14°	30°	90°	-	-	15	A
EA770-10001	**EA770-40001**	**EA770-70001**	CCW	18°	14°	30°	90°	-	-	15	B
EA770-10100	**EA770-40100**	**EA770-70100**	CW/CCW	18°	14°	30°	90°	-	-	15	C

See Operating Levers Section

Common Switch Characteristics

SINGLE POLE, STANDARD (SUPER-SEALED) ENVIRONMENT, BUTT CONTACTS	
NEMA Enclosure Type	1, 4, 6, 13
Housing Material	Zinc
Ambient Temperature Range*	-20°C to +90°C
Shipping Weight	3 lbs. approx.
Lever Adjustment	7°30' Increments Thru 360°
Contacts	Butt, Silver Alloy, Form Z
Lead Wires**	4 lead wires, part no. shown is for 15 ft.

*Some low temperature (-40°C to +90°C) versions available. Contact factory.
**Available in increments of 5 ft. Contact factory.

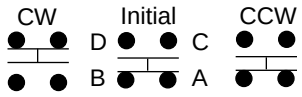
Continuous Current Rating - Amperes

VOLTAGE	AC	DC
125	20.0	5.0
250	15.0	1.5
480	10.0	-
600	5.0	-

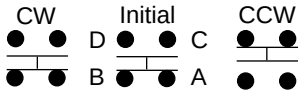
75-100% Power Factor

Contact Configurations

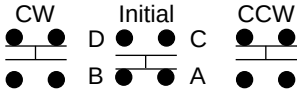
CIRCUIT A



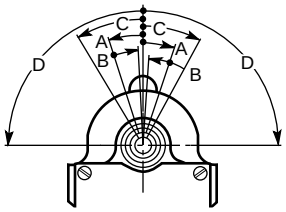
CIRCUIT B



CIRCUIT C

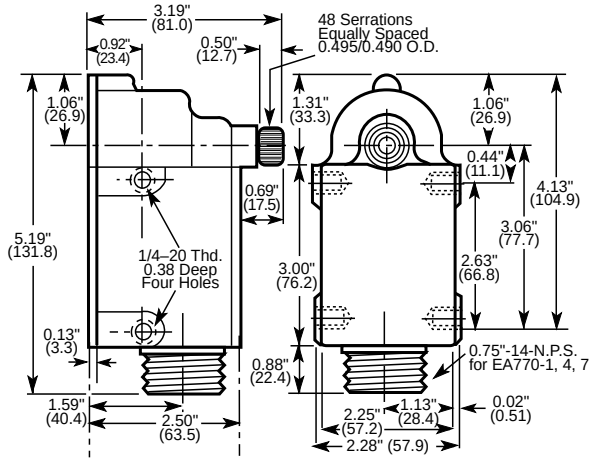


Operational Data Drawings

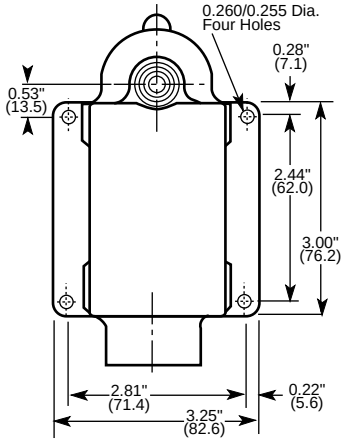


Dimensions and Mounting

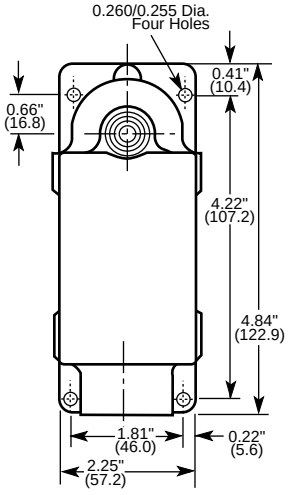
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE



LONG MOUNTING PLATE



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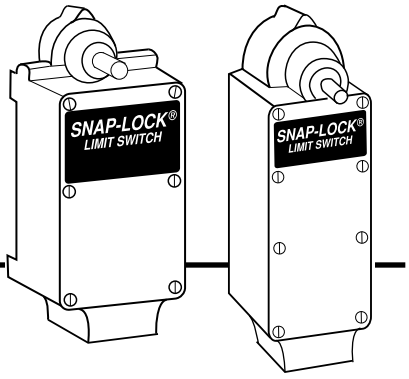
Limit Switches

Butt Contacts



Standard (EA170)

Double pole, double break, double throw, heavy duty limit switch having mechanical travel of 10° to trip and with two normally open and two normally closed circuits. Can be furnished with standard, wide or long mounting.

Short Travel (EA170)

With mechanical travel of 6-1/2° required to trip, this heavy duty limit switch operates with two normally open and two normally closed circuits. Can be furnished with standard, wide or long mounting.

Reverse Shaft (EA170)

Designed for applications where a reverse shaft is essential in operation. This series provides the same snap locking action of the other series of EA170 Snap-Lock Switches. Can be furnished with standard, wide or long mounting.

EA700 (Standard)

The versatility of the Snap-Lock mechanism is gained through the use of a series of uniquely designed cams. The cam and cam mechanism allow features such as bi-directional operation and generous overtravel. These features make the EA700 Series one of the most popular. Can be furnished with Standard, Wide or Long mounting.

EA170 Double Pole 2 N.O. - 2 N.C. / Butt Contacts / Rocker Type

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.	Data Drawing
STANDARD TRAVEL												
EA170-11100	**EA170-21100**	**EA170-31100**	CW	10°	8°	13°	37°	-	-	23	A	1
EA170-12100	**EA170-22100**	**EA170-32100**	CCW	10°	8°	13°	37°	-	-	23	B	1
EA170-13100	**EA170-23100**	**EA170-33100**	Maintain	10°	8°	13°	37°	-	-	10	-	1
SHORT TRAVEL												
EA170-14100	**EA170-24100**	**EA170-34100**	CW	6° 30'	4°	7°	36°	-	-	32	A	1
EA170-15100	**EA170-25100**	**EA170-35100**	CCW	6° 30'	4°	7°	36°	-	-	32	B	1
EA170-16100	**EA170-26100**	**EA170-36100**	Maintain	6° 30'	4°	7°	36°	-	-	10.5	-	1
STANDARD TRAVEL - REVERSE SHAFT												
EA170-41100	**EA170-51100**	**EA170-61100**	CW	10°	8°	13°	37°	-	-	30	A	1
EA170-42100	**EA170-52100**	**EA170-62100**	CCW	10°	8°	13°	37°	-	-	30	B	1
EA170-43100	**EA170-53100**	**EA170-63100**	Maintain	10°	8°	13°	37°	-	-	23	-	1

EA700 Double Pole Standard 2 N.O. - 2 N.C. / Neutral Position 4 N.O. or 4 N.C. / Butt Contacts

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.	Data Drawing
STANDARD TRAVEL / CAM ACTION												
EA700-20000	**EA700-50000**	**EA700-80000**	CW	18°	14°	30°	90°	-	-	27	C	1
EA700-20001	**EA700-50001**	**EA700-80001**	CCW	18°	14°	30°	90°	-	-	27	D	1
EA700-20100	**EA700-50100**	**EA700-80100**	CW/CCW	18°	14°	30°	90°	-	-	27	E	1
NEUTRAL POSITION / CAM ACTION - ALL CONTACTS OPEN												
EA700-25000	**EA700-55000**	**EA700-85000**	CW	11°	9°	45°	90°	-	-	19.5	F	1
			CCW	35°	13°	45°	90°	-	-	15		

See Operating Levers Section

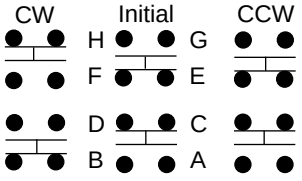
EA700 Double Pole Standard

2 N.O. - 2 N.C. / Neutral Position 4 N.O. or 4 N.C. / Butt Contacts / Cam Action

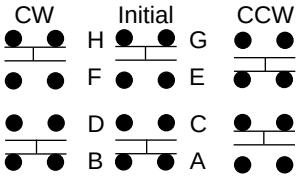
Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.	Data Drawing
NEUTRAL POSITION - ALL CONTACTS OPEN												
EA700-25102	EA700-55102	EA700-85102	CW	31°	22°	45°	90°	-	-	16.5	G	1
			CCW	31°	12°	45°	90°	-	-	20.5		
NEUTRAL POSITION - ALL CONTACTS CLOSED												
EA700-25108	EA700-55108	EA700-85108	CW	31°	22°	45°	90°	-	-	16.5	H	1
			CCW	31°	12°	45°	90°	-	-	20.5		
MAINTAINED CONTACT - MAINTAINED CONTACTS & LEVER POSITION												
EA700-26000	EA700-56000	EA700-86000	CW	55°	22°	60°	116°	55°	64°	6	I	2
			CCW	25°	25°	60°	124°	54°	56°	12		
MAINTAINED CONTACT - MAINTAINED CONTACTS - LEVER RETURNED												
EA700-26700	EA700-56700	EA700-86700	CW	30°	26°	45°	90°	30°	-	15	I	3
			CCW	16°	30°	45°	90°	26°	-	16.5		

Contact Configurations

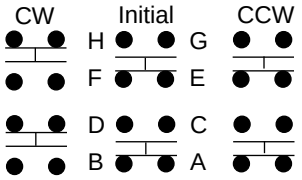
CIRCUIT A



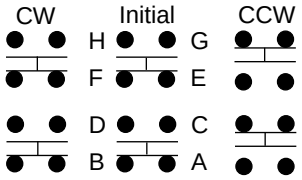
CIRCUIT B



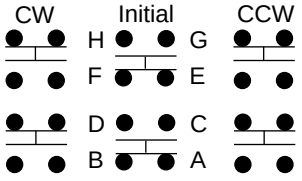
CIRCUIT C



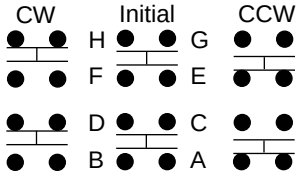
CIRCUIT D



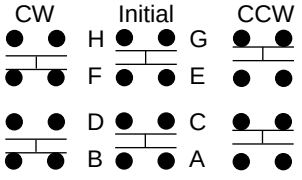
CIRCUIT E



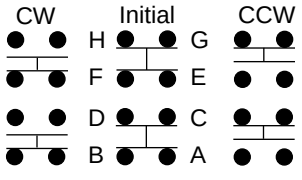
CIRCUIT F



CIRCUIT G

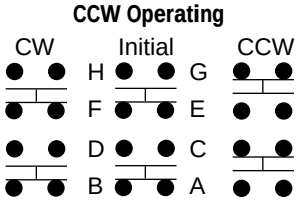


CIRCUIT H

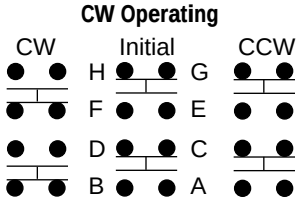


CIRCUIT I

CCW Operating

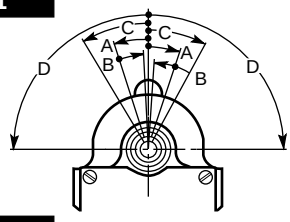


CW Operating



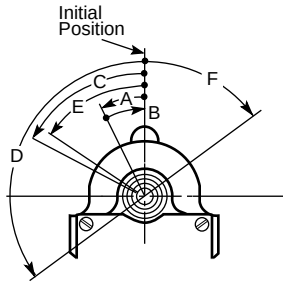
Operational Data Drawings

DRAWING #1

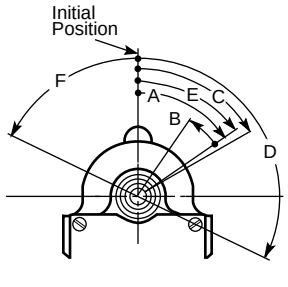


DRAWING #2

CCW Operating



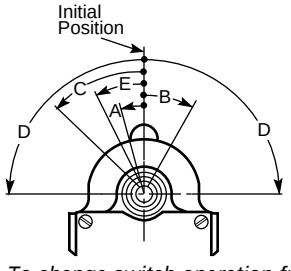
CW Operating



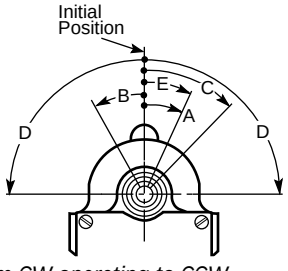
To change switch operation from CW operating to CCW operating, operate switch through angle E. Remove lever and reset at initial position.

DRAWING #3

CCW Operating



CW Operating



To change switch operation from CW operating to CCW operating, operate switch through angle E.

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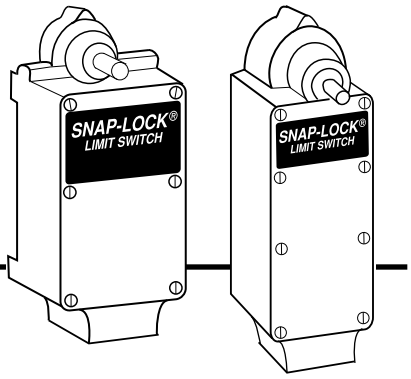
Double Pole Standard Environment Limit Switches Butt Contacts



Common Switch Characteristics

DOUBLE POLE, STANDARD ENVIRONMENT, BUTT CONTACTS		
	EA170	**EA700**
NEMA Enclosure Type	1, 4, 13	
Housing Material	Zinc/Al.	Zinc
Ambient Temperature Range*	-20°C to +90°C	
Shipping Weight	3.5 lbs. approx.	4 lbs. approx.
Lever Adjustment	**EA170 Std. Shaft:** 7°30' Increments thru 167° **EA170 Rev. Shaft:** 7°30' Increments thru 360°	7°30' Increments thru 360°
Contacts	Butt, Silver Alloy, Form Z	

*Some high temperature (+20°C to 180°C) and low temperature (-40°C to +90°C) versions available. Contact factory.

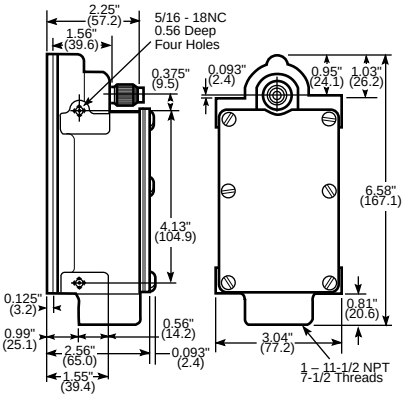
Continuous Current Rating - Amperes

VOLTAGE	AC	DC
125	20.0	5.0
250	15.0	1.5
480	10.0	-
600	5.0	-

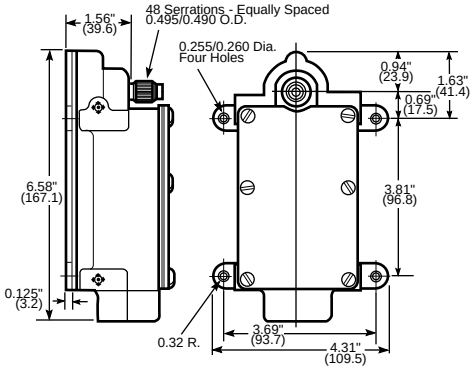
75-100% Power Factor

EA170 (Standard) Series Drawings

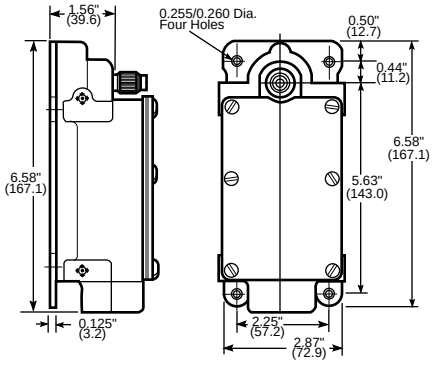
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE



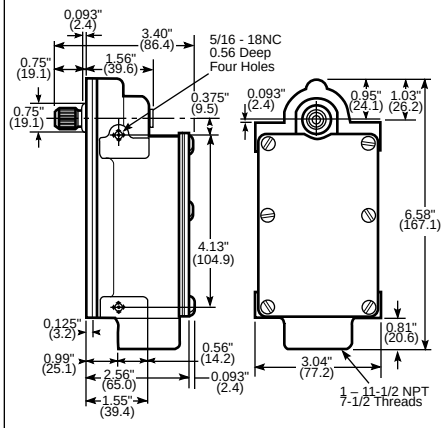
LONG MOUNTING PLATE



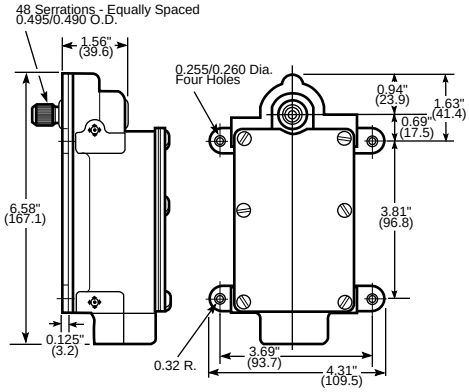
Dimensions: inches/(mm)

EA170 (Reverse Shaft) Series Drawings

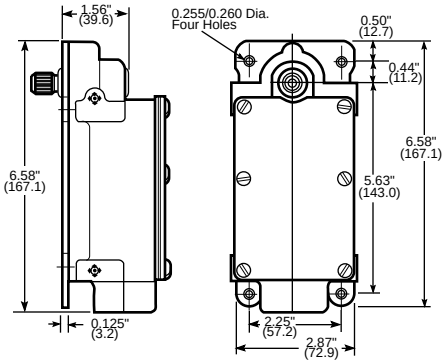
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE



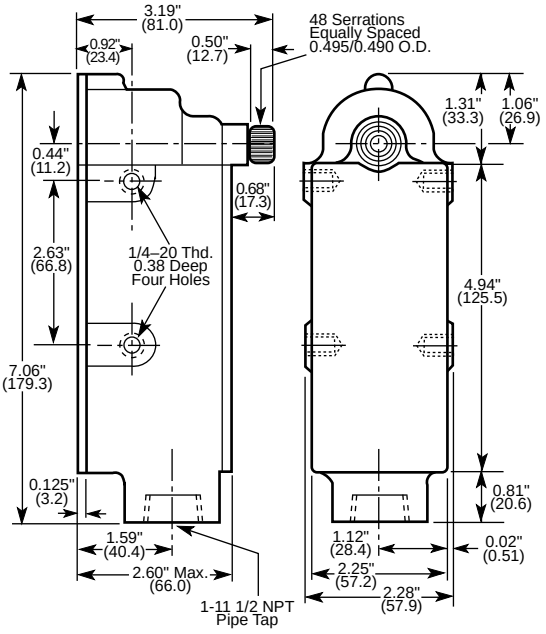
LONG MOUNTING PLATE



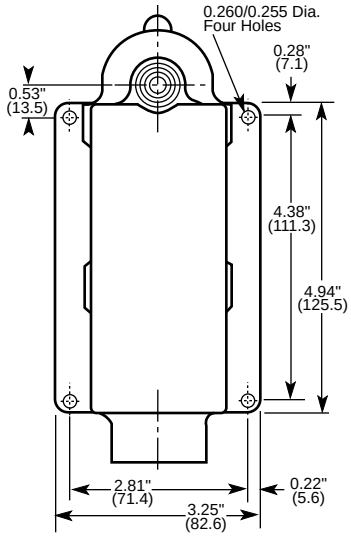
Dimensions: inches/(mm)

EA700 Series Drawings

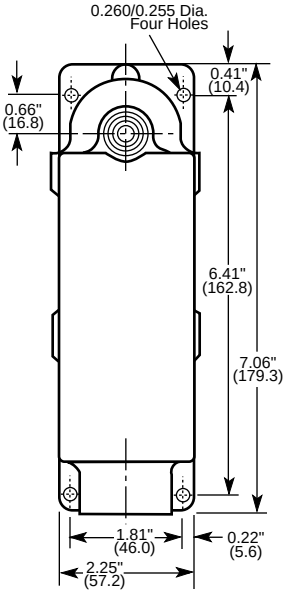
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE



LONG MOUNTING PLATE



Dimensions: inches/(mm)

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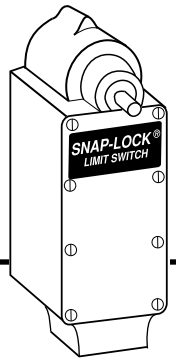
Double Pole Standard Environment Limit Switches Sliding Contacts



The versatility of the Snap-Lock mechanism is gained through the use of a series of uniquely designed cams. The cam and cam mechanism allow features such as bi-directional operation and generous overtravel. These features make the EA710 Series one of the most popular. Can be furnished with Standard, Wide or Long mounting.

EA710 Double Pole 2 N.O. - 2 N.C. / Sliding Contacts / Cam Action

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.	Data Drawing
STANDARD TRAVEL												
EA710-20000	**EA710-50000**	**EA710-80000**	CW	18°	14°	30°	90°	-	-	20	A	1
EA710-20001	**EA710-50001**	**EA710-80001**	CCW	18°	14°	30°	90°	-	-	20	B	1
EA710-20100	**EA710-50100**	**EA710-80100**	CW/CCW	18°	14°	30°	90°	-	-	20	C	1
MAINTAINED CONTACT AND LEVER POSITION												
EA710-26000	**EA710-56000**	**EA710-86000**	CW	55°	22°	60°	116°	55°	64°	6	D	2
			CCW	25°	25°	60°	124°	54°	56°	9		

Common Switch Characteristics

DOUBLE POLE, STANDARD ENVIRONMENT, SLIDING CONTACTS	
NEMA Enclosure Type	1, 4, 13
Housing Material	Zinc
Ambient Temperature Range*	-20°C to +90°C
Shipping Weight	4 lbs. approx.
Lever Adjustment	7°30' Increments Thru 360°
Contacts	Sliding, Silver Alloy, Form Z

*Some high temperature (0 to 150°C) versions available. Contact factory.

Continuous Current Rating - Amperes

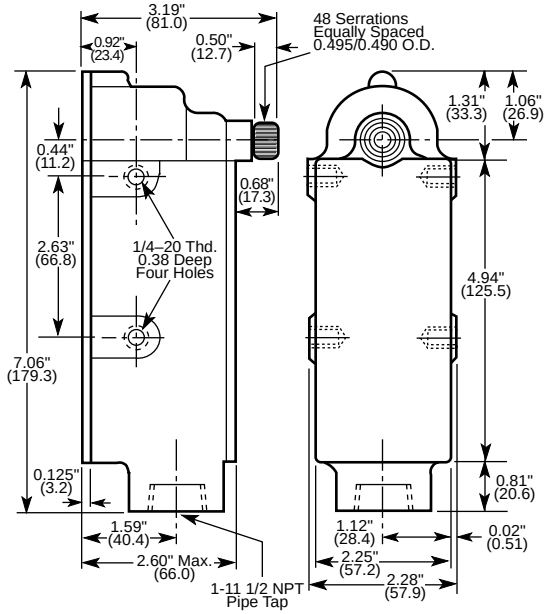
VOLTAGE	AC	DC
125	10.0	2.5
250	7.5	.75
480	5.0	-
600	2.5	-

75-100% Power Factor

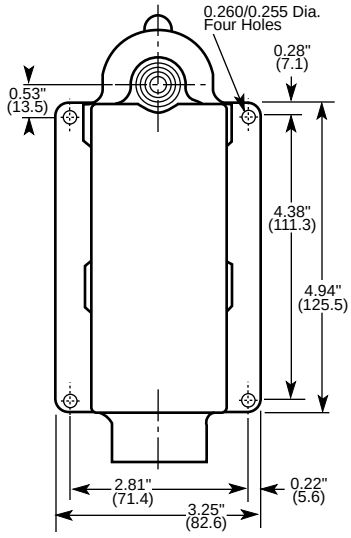
See Operating Levers Section

Dimensions and Mounting

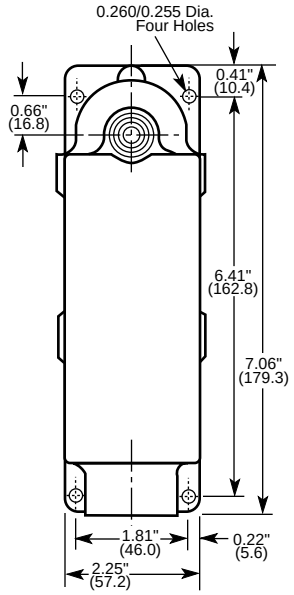
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE



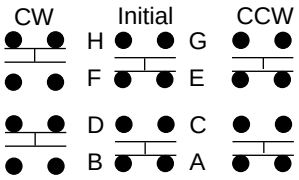
LONG MOUNTING PLATE



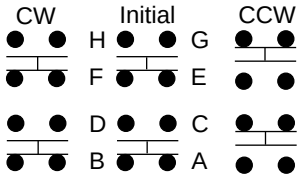
Dimensions: inches/(mm)

Contact Configurations

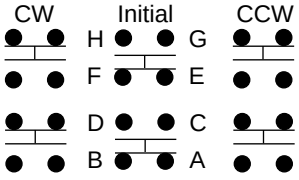
CIRCUIT A



CIRCUIT B

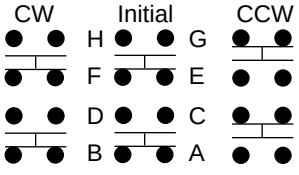


CIRCUIT C

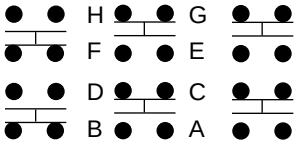


CIRCUIT D

CCW Operating

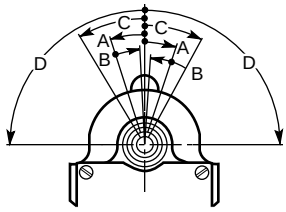


CW Operating

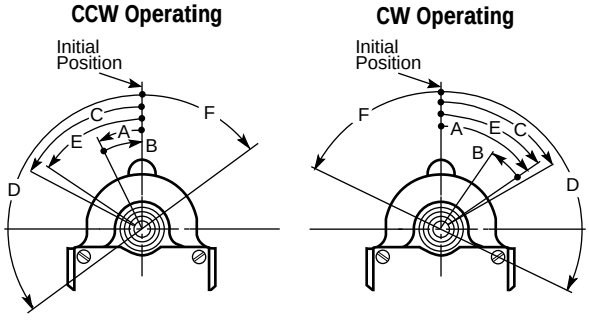


Operational Data Drawings

DRAWING #1



DRAWING #2



To change switch operation from CW operating to CCW operating, operate switch through angle E. Remove lever and reset at initial position.

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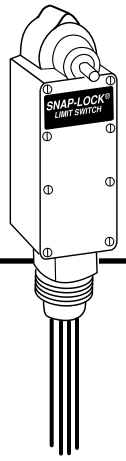
For technical assistance, call 1-800-NAMTECH

Double Pole Standard Environment (Super Sealed) Limit Switches Butt Contacts



- **Multiple Contacts - DPDT**
- **Epoxy Sealed**
- **Generous Overtravel**
- **Heavy Duty Cam Operated**
- **Flexibility of Motion CW & CCW**

Wide Range of Operation...Modular Construction...Practical Flexibility

The Series EA770 Super Sealed Water & Oil Tight Snap-Lock Limit Switches are the "ultimate" of the industry. By incorporating the moisture seal with these switches, trouble caused by water, soluble oils or condensate interfering with switching mechanism has been eliminated. The scope of models is tailored to meet today's rugged requirements...there is a model of size and type to meet virtually all demands.

Besides covering all functional requirements this line is designed to meet practically every condition of installation. These Snap-Lock Switches provide reliable "machine-life" service and have the stamina to operate under unusual conditions...at the same time giving millions of consistently fast, accurate contacts.

Here are a few of the outstanding features built into the switch for maximum performance. Generous overtravel and by-pass; Flexibility of motion, clockwise and counterclockwise; Light operating torque; Fast contact action; and Form Z contact arrangement.

Options Available

- Low temperature (-40°C to + 90°C) components and lubricants.
- A variety of levers can be ordered from Namco Controls Series EL. NOTE: Levers must be ordered as separate items.
- Basic design permits mounting from either side or back. Style L or W mounting plates, for back mounting, available at no extra cost.

EA770 Double Pole 2 N.O. - 2 N.C. / Butt Contacts / Cam Action

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.
STANDARD TRAVEL											
EA770-20000	**EA770-50000**	**EA770-80000**	CW	18°	14°	30°	90°	-	-	27	A
EA770-20001	**EA770-50001**	**EA770-80001**	CCW	18°	14°	30°	90°	-	-	27	B
EA770-20100	**EA770-50100**	**EA770-80100**	CW/CCW	18°	14°	30°	90°	-	-	27	C

Common Switch Characteristics

DOUBLE POLE, STANDARD (SUPER SEALED) ENVIRONMENT, BUTT CONTACTS	
NEMA Enclosure Type	1, 4, 6, 13
Housing Material	Zinc
Ambient Temperature Range*	-20°C to +90°C
Shipping Weight	4 lbs. approx.
Lever Adjustment	7°30' Increments Thru 360°
Contacts	Butt, Silver Alloy, Form Z
Lead Wires**	8 lead wires, part no. shown is for 15 ft.

*Some low temperature (-40 to +90°C) versions available. Contact factory.
**Available in increments of 5 ft. Contact factory.

Continuous Current Rating - Amperes

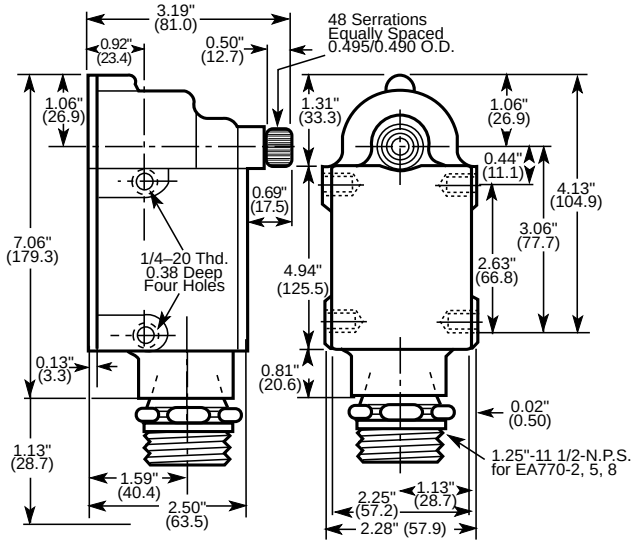
VOLTAGE	AC	DC
125	20.0	5.0
250	15.0	1.5
480	10.0	-
600	5.0	-

75-100% Power Factor

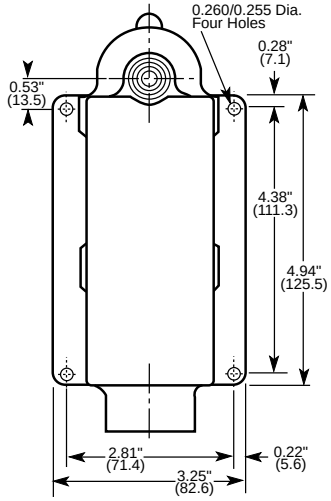
See Operating Levers Section

Dimensions and Mounting

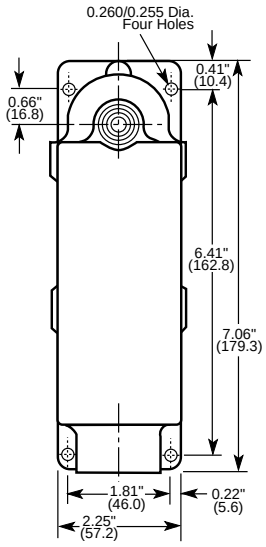
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE

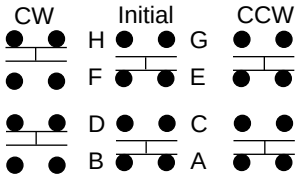


LONG MOUNTING PLATE

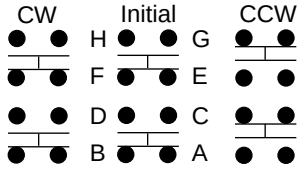


Contact Configurations

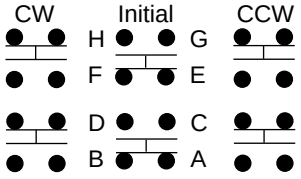
CIRCUIT A



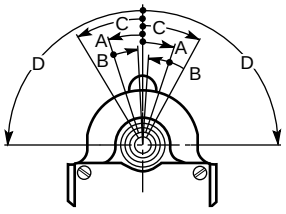
CIRCUIT B



CIRCUIT C



Operational Data Drawing



Limit Switches

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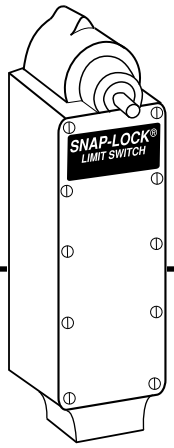
Triple Pole Standard Environment

Limit Switches

Butt Contacts



The versatility of the Snap-Lock mechanism is gained through the use of a series of uniquely designed cams. The cam and cam mechanism allow features such as bi-directional operation and generous overtravel. These features make the EA700 Series one of the most popular. Can be furnished with Standard, Wide or Long mounting.

EA700 Triple Pole 3 N.O. - 3 N.C. / Butt Contacts / Cam Action

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.
STANDARD TRAVEL											
EA700-30000	**EA700-60000**	**EA700-90000**	CW	18°	14°	30°	90°	-	-	33	A
EA700-30001	**EA700-60001**	**EA700-90001**	CCW	18°	14°	30°	90°	-	-	33	B
EA700-30100	**EA700-60100**	**EA700-90100**	CW/CCW	18°	14°	30°	90°	-	-	33	C

Common Switch Characteristics

TRIPLE POLE, STANDARD ENVIRONMENT, BUTT CONTACTS	
NEMA Enclosure Type	1, 4, 13
Housing Material	Zinc
Ambient Temperature Range*	-20°C to +90°C
Shipping Weight	5 lbs. approx.
Lever Adjustment	7°30' Increments Thru 360°
Contacts	Butt, Silver Alloy, Form Z

*Some high temperature (+20°C to 180°C) and low temperature (-40°C to +90°C) versions available. Contact factory.

Continuous Current Rating - Amperes

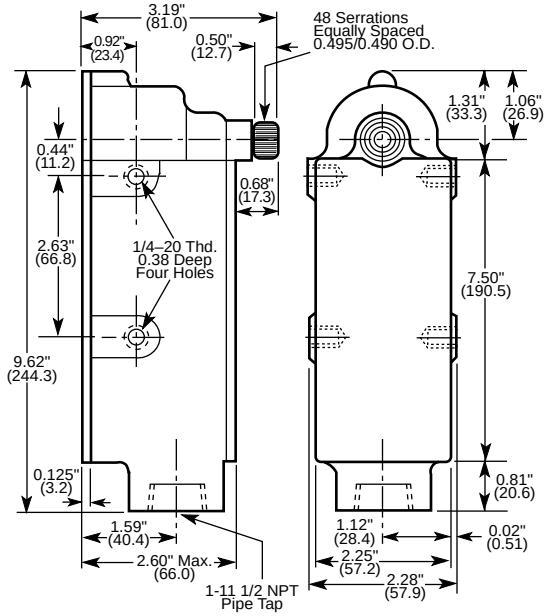
VOLTAGE	AC	DC
125	20.0	5.0
250	15.0	1.5
480	10.0	-
600	5.0	-

75-100% Power Factor

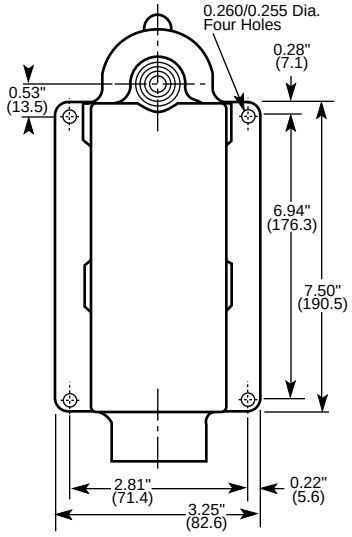
See Operating Levers Section

Dimensions and Mounting

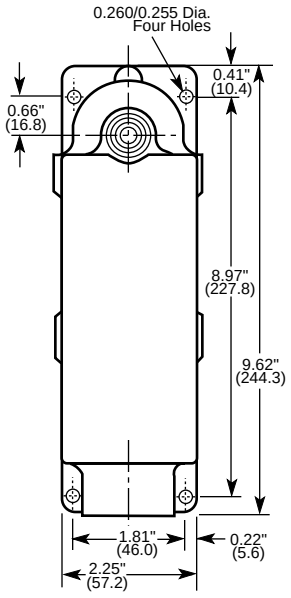
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE



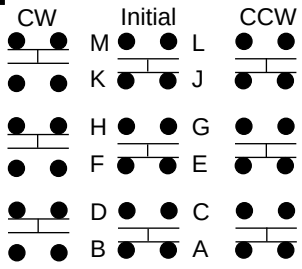
LONG MOUNTING PLATE



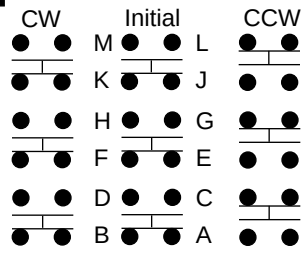
Dimensions: inches/(mm)

Contact Configurations

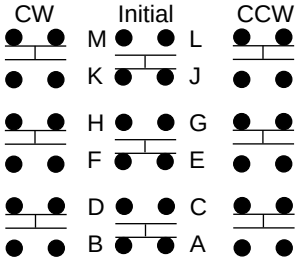
CIRCUIT A



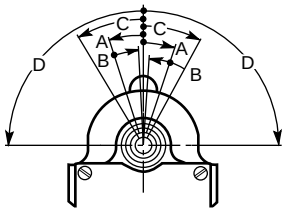
CIRCUIT B



CIRCUIT C



Operational Data Drawings



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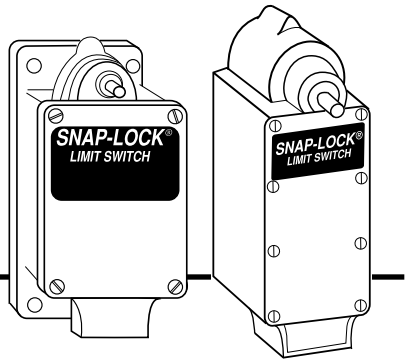
Limit Switches

Butt/ Sliding Contacts



EA140 — Standard

Single pole, double throw, double break limit switch having mechanical travel of 14.83° to trip with one normally open and one normally closed circuit.

EA130 — Short Travel

Single pole, double throw, double break limit switch having mechanical travel of 5.8° to trip with one normally open and one normally closed circuit.

EA130 — Neutral Position

Single pole, double throw, double break limit switch having mechanical travel of 7° to trip with normally open contacts.

EA730

Construction — The aluminum housing with epoxy paint and high quality stainless steel shaft provide a high degree of corrosion resistance. Sealing against leakage is achieved through the use of high quality gaskets on machined surfaces and "O" ring protection, plus close tolerance between the shaft and bushing.

Durability — All internal components are of high grade stainless steel or copper alloy, chrome plated when required, to protect against bearing surface wear and to provide millions of operations.

Contacts — The EA730 switches are available with sliding contact arrangement 1 N.O.-1 N.C. Operation direction available CW, CCW or CW/CCW.

Levers — A variety of corrosion resistant levers are available to meet specific actuating requirements.

EA130, EA140 & EA730 Single Pole 1 N.O. - 1 N.C. Butt / Sliding Contacts

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.
STANDARD TRAVEL / ROCKER TYPE / BUTT CONTACTS											
EA140-12200	**EA140-22200**	—	CW	14.83°	12.3°	16.5°	41.5°	—	—	15	A
EA140-11200	**EA140-21200**	**EA140-31200**	CCW	14.83°	12.3°	16.5°	41.5°	—	—	15	B
—	**EA140-23200**	—	Maintain	14.83°	12.3°	16.5°	41.5°	—	—	5.5	-
STANDARD TRAVEL / ROCKER TYPE / BUTT CONTACTS											
—	—	**EA140-32300**	CW	14.83°	12.3°	16.5°	41.5°	—	—	15	A
EA140-11300	—	—	CCW	14.83°	12.3°	16.5°	41.5°	—	—	15	B
SHORT TRAVEL / ROCKER TYPE / BUTT CONTACTS											
EA130-11202	**EA130-21202**	**EA130-31202**	CW	5.8°	4°	8°	26°	—	—	22	A
EA130-12202	**EA130-22202**	—	CCW	5.8°	4°	8°	26°	—	—	22	B
SHORT TRAVEL / ROCKER TYPE / HI - TEMP / BUTT CONTACTS											
—	—	**EA130-31302**	CW	5.8°	4°	8°	26°	—	—	22	A
NEUTRAL POSITION / ROCKER TYPE / BUTT CONTACTS											
EA130-14200	**EA130-24200**	**EA130-34200**	Neutral	7°	6°	7.5°	26°	—	—	22	C
STANDARD TRAVEL/ CAM ACTION / SLIDING CONTACTS											
EA730-10000	**EA730-40000**	**EA730-70000**	CW	18°	14°	30°	90°	—	—	15	D
EA730-10001	**EA730-40001**	**EA730-70001**	CCW	18°	14°	30°	90°	—	—	15	E
EA730-10100	**EA730-40100**	**EA730-70100**	CW/CCW	18°	14°	30°	90°	—	—	15	F

See Operating Levers Section

Common Switch Characteristics

SINGLE POLE, MILD ENVIRONMENT/NAVY MARINE, BUTT/SLIDING CONTACTS		
	EA130/140	**EA730**
NEMA Enclosure Type	1, 2, 3, 4, 5, 6	1, 4, 6, 6P, 13
Housing Material	Zinc	Aluminum
Ambient Temperature Range*	-20°C to +90°C	
Shipping Weight	2.3 lbs. approx.	3 lbs. approx.
Lever Adjustment	7°30' Increments thru 167°	7°30' Increments thru 360°
Contacts	Butt, Silver Alloy, Form Z	Sliding, Silver Alloy Alloy, Form Z
Special Switch Features (EA730 Series)	MIL-C-2212F Watertight (3 ft. for 60 min.) and (15 ft. for 30 min.) per MIL-STD-108E Vibration Requirements per MIL-STD-167B, type 1 High Shock per MIL-S-901, grade A, Class 1, type A	

*Some high temperature (0°C to 150°C) versions available (EA130/140). See chart.

EA130/140
Continuous Current Rating - Amperes

VOLTAGE	AC	DC
125	20.0	5.0
250	15.0	1.5
480	10.0	-
600	5.0	-

75-100% Power Factor

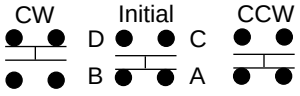
EA730
Continuous Current Rating - Amperes

VOLTAGE	AC	DC
125	10.0	2.5
250	7.5	.75
480	5.0	-
600	2.5	-

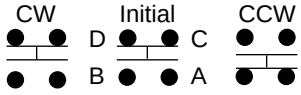
75-100% Power Factor

Contact Configurations

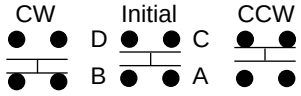
CIRCUIT A



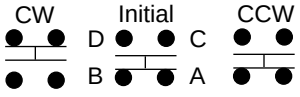
CIRCUIT B



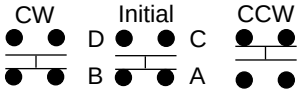
CIRCUIT C



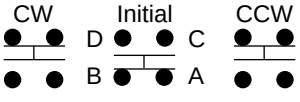
CIRCUIT D



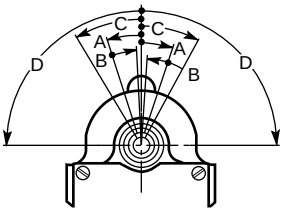
CIRCUIT E



CIRCUIT F



Operational Data Drawings



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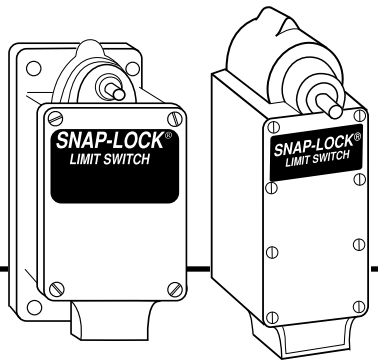
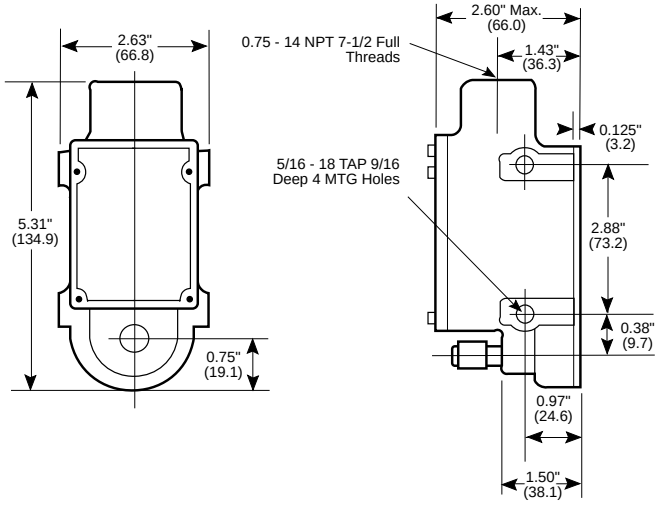
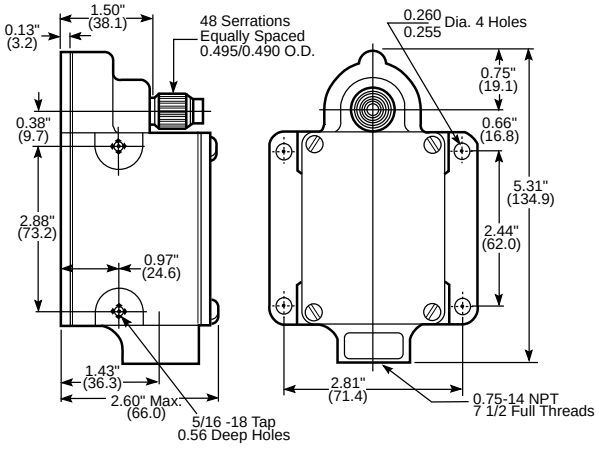


EA130/140 Series Drawings

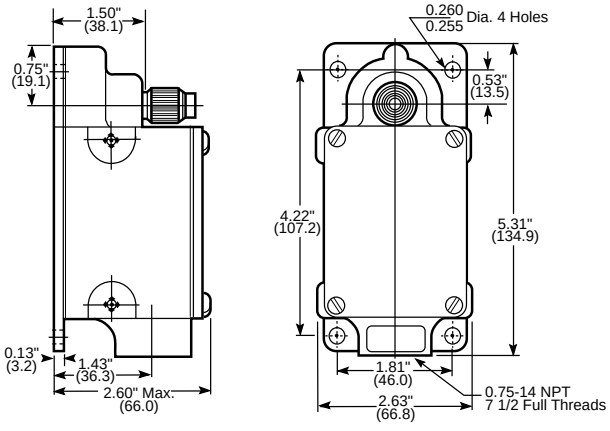
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE

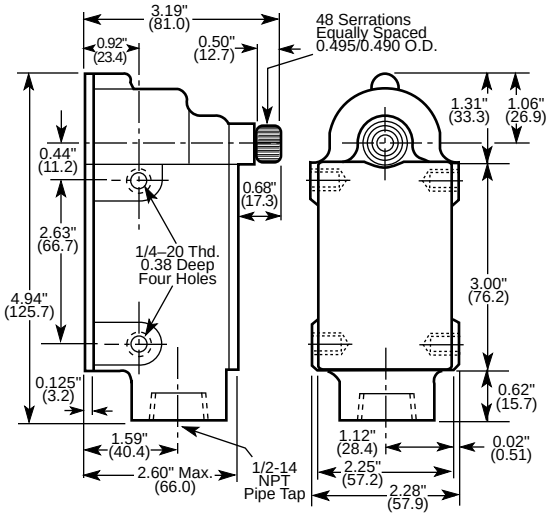


LONG MOUNTING PLATE

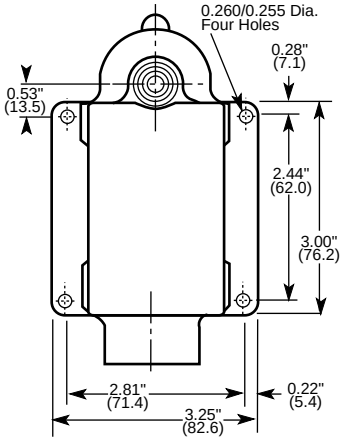


Dimensions: inches/(mm)

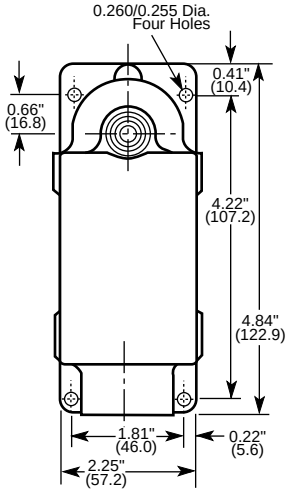
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE



LONG MOUNTING PLATE



Dimensions: inches/(mm)

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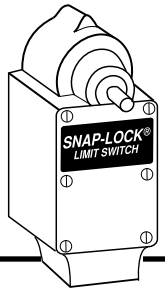

NAVY meets MIL-C-2212F

Construction — Completely fabricated from non-corrosive materials, its bronze housing and high quality stainless steel shaft insure against external damage to the switch from salt spray corrosive elements. Sealing against leakage is achieved through the use of high quality gaskets on machined surfaces and "O" ring protection, plus close tolerance between the shaft and bushing.

Durability — All internal components are of high grade stainless steel or copper alloy, chrome plated when required, to protect against bearing surface wear and to provide millions of operations.

Both the EA780 and EA790 series switches have heavy duty electrical contacts. The EA780 switches have sliding, double break type contacts built to meet the high shock requirements outlined in MIL-S-901.

EA790 switches have heavy duty, double break butt type contacts.

Contacts — EA780 switches contain sliding contact arrangement which wipe clean with each operation.

EA790 switches contain butt style contacts.

Both series available with operation direction CW, CCW or CW/CCW.

Levers — A variety of corrosion resistant levers are available to meet specific actuating requirements.

NOTE: Levers must be ordered as separate items. See Operating Levers Section.

EA780 Single Pole 1 N.O. - 1 N.C. / Sliding Contacts / Cam Action

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.	Data Drawing
STANDARD TRAVEL												
EA780-10000	**EA780-40000**	**EA780-70000**	CW	18°	14°	30°	90°	-	-	15	A	1
EA780-10001	**EA780-40001**	**EA780-70001**	CCW	18°	14°	30°	90°	-	-	15	B	1
EA780-10100	**EA780-40100**	**EA780-70100**	CW/CCW	18°	14°	30°	90°	-	-	15	C	1
MAINTAINED CONTACTS & LEVER POSITION												
EA780-16000	**EA780-46000**	**EA780-76000**	CW	55°	22°	60°	116°	55°	64°	6	D	2
			CCW	25°	25°	60°	124°	54°	56°	9		
MAINTAINED CONTACT-LEVER RETURNED												
EA780-16700	**EA780-46700**	**EA780-76700**	CW	30°	26°	45°	90°	30°	-	12	D	3
			CCW	16°	30°	45°	90°	26°	-	13.5		

See Operating Levers Section

EA790 Single Pole 1 N.O. - 1 N.C. / Butt Contacts / Cam Action

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.	Data Drawing
STANDARD TRAVEL												
EA790-10000	EA790-40000	EA790-70000	CW	18°	14°	30°	90°	-	-	15	A	1
EA790-10001	EA790-40001	EA790-70001	CCW	18°	14°	30°	90°	-	-	15	B	1
EA790-10100	EA790-40100	EA790-70100	CW/CCW	18°	14°	30°	90°	-	-	15	C	1
MAINTAINED CONTACT & LEVER POSITION												
EA790-16000	EA790-46000	EA790-76000	CW	55°	22°	60°	116°	55°	64°	6	D	2
			CCW	25°	25°	60°	124°	54°	56°	9		
MAINTAINED CONTACT-LEVER RETURNED												
EA790-16700	EA790-46700	EA790-76700	CW	30°	26°	45°	90°	30°	-	12	D	3
			CCW	16°	30°	45°	90°	26°	-	13.5		
SHORT TRAVEL												
EA790-10900	EA790-40900	EA790-70900	CW/CCW	13°	10°	30°	90°	-	-	15	C	1
NEUTRAL POSITION - ALL CONTACTS OPEN												
EA790-15700	EA790-45700	EA790-75700	CW	31°	12°	45°	90°	-	-	15	E	1
			CCW	31°	22°	45°	90°	-	-	19.5		
NEUTRAL POSITION - ALL CONTACTS CLOSED												
EA790-15800	EA790-45800	EA790-75800	CW	31°	12°	45°	90°	-	-	15	F	1
			CCW	31°	22°	45°	90°	-	-	15		

Common Switch Characteristics

SINGLE POLE, HARSH ENVIRONMENT NAVY MARINE, BUTT/SLIDING CONTACTS		
	EA780	**EA790**
NEMA Enclosure Type	1, 4, 4X, 6, 6P, 13	
Housing Material	Bronze	
Ambient Temperature Range*	-20°C to +90°C	
Shipping Weight	4 lbs. approx.	
Lever Adjustment	7°30' Increments thru 360°	
Contacts	Sliding, Silver Alloy Form Z	Butt, Silver Alloy Form Z
Special Switch Features	MIL-C-22122F Watertight (3 ft. for 60 min.) and Submersible (15ft. for 30 min.) per MIL STD-108E Vibration requirements per MIL-STD-167B, Type 1 High Shock per MIL-S-901, grade A, Class 1, type A	

*Some high temperature (0°C to 150°C) and low temperature (-40°C to +90°C) versions available. Contact factory.

EA780 Continuous Current Rating - Amperes

VOLTAGE	AC	DC
125	10.0	2.5
250	7.5	.75
480	5.0	-
600	2.5	-

75-100% Power Factor

EA790 Continuous Current Rating - Amperes

VOLTAGE	AC	DC
125	20.0	5.0
250	15.0	1.5
480	10.0	-
600	5.0	-

75-100% Power Factor

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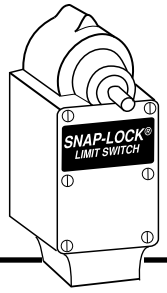
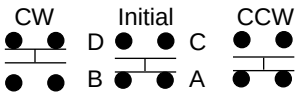
Limit Switches

Butt/ Sliding Contacts

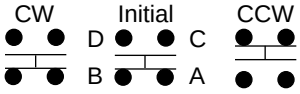


Contact Configurations

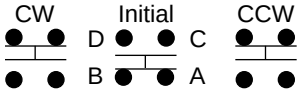
CIRCUIT A



CIRCUIT B

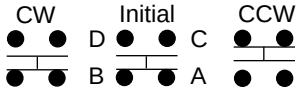


CIRCUIT C

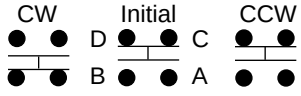


CIRCUIT D

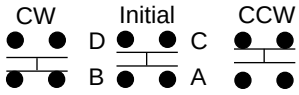
CCW Operating



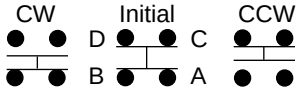
CW Operating



CIRCUIT E

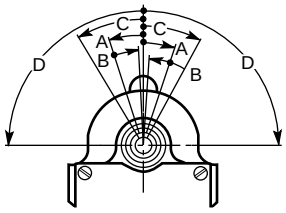


CIRCUIT F



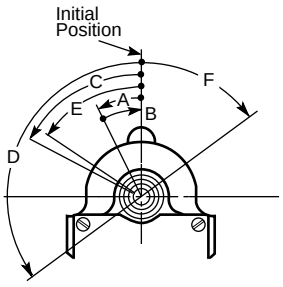
Operational Data Drawings

DRAWING #1

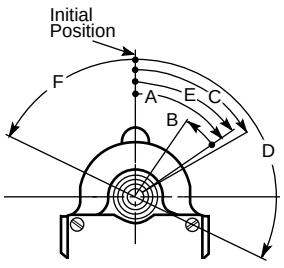


DRAWING #2

CCW Operating



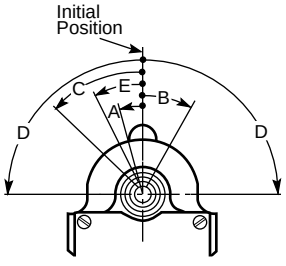
CW Operating



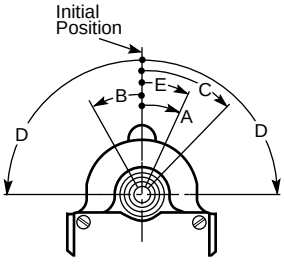
To change switch operation from CW operating to CCW operating, operate switch through angle E. Remove lever and reset at initial position.

DRAWING #3

CCW Operating



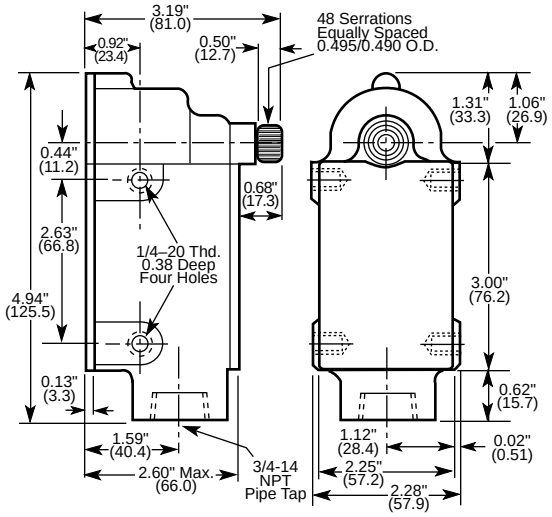
CW Operating



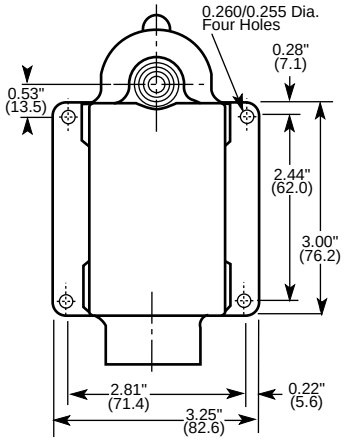
To change switch operation from CW operating to CCW operating, operate switch through angle E.

EA780/790 Series Drawings

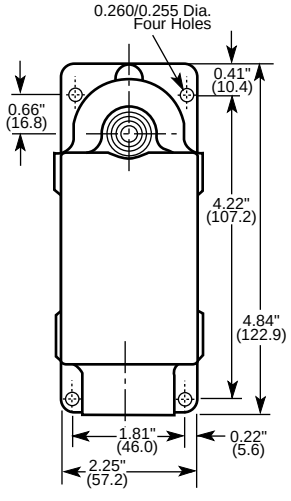
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE



LONG MOUNTING PLATE



Dimensions: inches/(mm)

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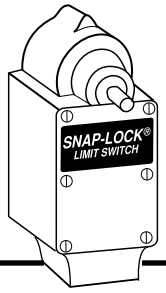
Limit Switches

Sliding Contacts



Construction

The aluminum housing with epoxy paint and high quality stainless steel shaft provides a high degree of corrosion resistance. Sealing against leakage is achieved through the use of high quality gaskets on machined surfaces and "O" ring protection, plus close tolerance between the shaft and bushing.

Durability

All internal components are of high grade stainless steel or copper alloy, chrome plated when required, to protect against bearing surface wear and to provide millions of operations.

Contacts

The EA730 switches are available with sliding contact arrangement 2 N.O.-2 N.C. Operation direction available in CW, CCW or CW/CCW.

Levers

A variety of corrosion resistant levers is available to meet specific actuating requirements.

EA730 Double Pole 2 N.O. - 2 N.C. / Sliding Contacts

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.
STANDARD TRAVEL / CAM ACTION											
EA730-20000	**EA730-50000**	**EA730-80000**	CW	16°	14°	30°	90°	-	-	20	A
EA730-20001	**EA730-50001**	**EA730-80001**	CCW	16°	14°	30°	90°	-	-	20	B
EA730-20100	**EA730-50100**	**EA730-80100**	CW/CCW	16°	14°	30°	90°	-	-	20	C

Common Switch Characteristics

DOUBLE POLE, MILD ENVIRONMENT/NAVY MARINE, SLIDING CONTACTS	
NEMA Enclosure Type	1, 4, 6, 6P, 13
Housing Material	Aluminum
Ambient Temperature Range*	-20°C to +90°C
Shipping Weight	4 lbs. approx.
Lever Adjustment	7°30' Increments Thru 360°
Contacts	Sliding, Silver Alloy, Form Z
Special Switch Features	MIL-C-2212F Watertight (3 ft. for 60 min.) & submersible (15 ft. for 30 min.) per MIL-STD-108E Vibration requirements per MIL-STD-167B, type 1 High shock per MIL-S-901, grade A, class 1, type A

*Some high temperature (+20°C to 180°C) and low temperature (-40°C to +90°C) versions available. Contact factory.

Continuous Current Rating - Amperes

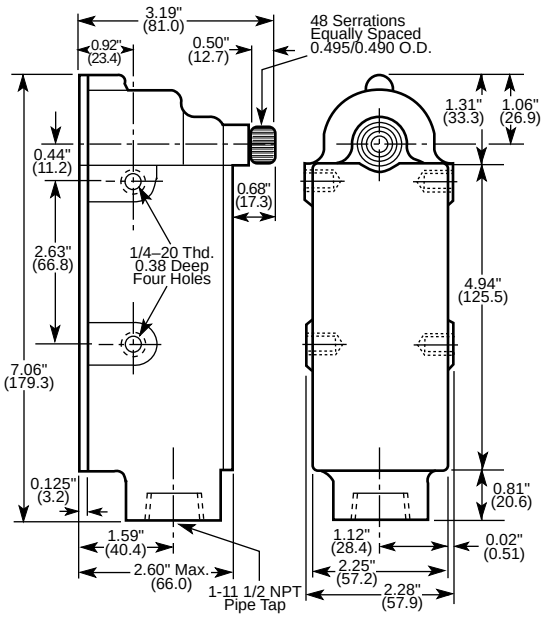
VOLTAGE	AC	DC
125	10.0	2.5
250	7.5	.75
480	5.0	-
600	2.5	-

75-100% Power Factor

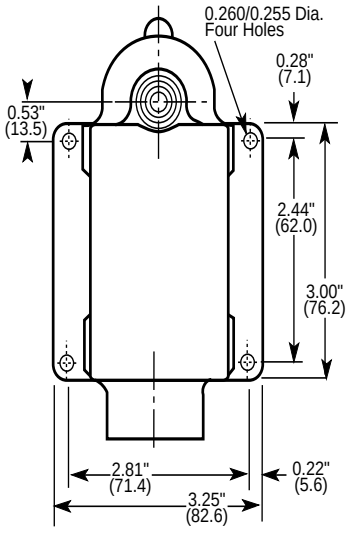
See Operating Levers Section

Dimensions and Mounting

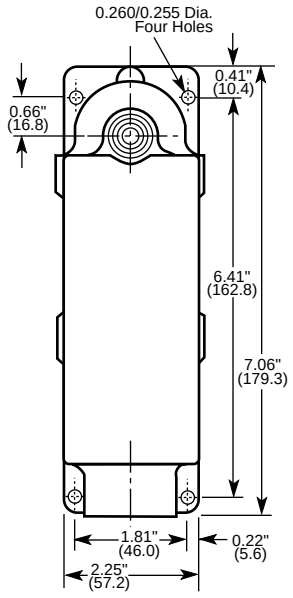
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE

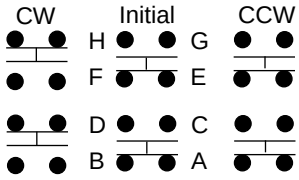


LONG MOUNTING PLATE

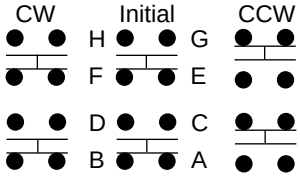


Contact Configurations

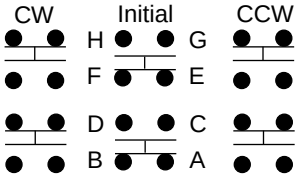
CIRCUIT A



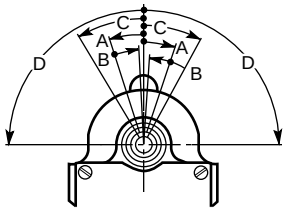
CIRCUIT B



CIRCUIT C



Operational Data Drawings



Limit Switches

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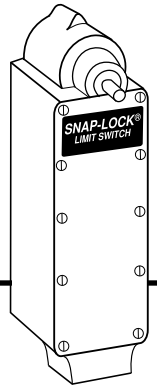

NAVY meets MIL-C-2212F Current

Construction - Completely fabricated from non-corrosive materials, its bronze housing and high quality stainless steel shaft insure against external damage to the switch from salt spray corrosive elements. Sealing against leakage is achieved through the use of high quality gaskets on machined surfaces and "O" ring protection, plus close tolerance between the shaft and bushing.

Durability - All internal components are of high grade stainless steel or copper alloy, chrome plated when required, to protect against bearing surface wear and to provide millions of operations.

Both the EA780 and EA790 series switches have heavy duty electrical contacts. The EA780 switches have sliding, double-break type contacts built to meet the high shock requirements outlined in MIL-S-901.

EA790 switches have heavy duty, double-break, butt type contacts.

Contacts - EA780 switches contain sliding contact arrangements which wipe clean with each operation.

EA790 switches contain butt-style contacts.

Both series available with operation direction CW, CCW or CW/CCW.

Levers - A variety of corrosion resistant levers are available to meet specific actuating requirements.

NOTE: Levers must be ordered as separate items. See Operating Levers Section.

EA780 Double Pole 2 N.O. - 2 N.C. / Sliding Contacts / Cam Action

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.	Data Drawing
STANDARD TRAVEL												
EA780-20000	**EA780-50000**	**EA780-80000**	CW	18°	14°	30°	90°	-	-	27	A	1
EA780-20001	**EA780-50001**	**EA780-80001**	CCW	18°	14°	30°	90°	-	-	27	B	1
EA780-20100	**EA780-50100**	**EA780-80100**	CW/CCW	18°	14°	30°	90°	-	-	27	C	1
MAINTAINED CONTACT & LEVER POSITION												
—	**EA780-56000**	—	CW	55°	22°	60°	116°	55°	64°	6	D	2
			CCW	25°	25°	60°	124°	54°	56°	9		
MAINTAINED CONTACT-LEVER RETURNED												
EA780-26700	**EA780-56700**	**EA780-86700**	CW	30°	26°	45°	90°	30°	-	15	D	3
			CCW	16°	30°	45°	90°	26°	-	16.5		

See Operating Levers Section

EA790 Double Pole 2 N.O. - 2 N.C. / Butt Contacts / Cam Action

Standard Mounting Model No.	Wide Mouning Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.	Data Drawing
STANDARD TRAVEL												
EA790-20000	EA790-50000	EA790-80000	CW	18°	14°	30°	90°	-	-	27	A	1
EA790-20001	EA790-50001	EA790-80001	CCW	18°	14°	30°	90°	-	-	27	B	1
EA790-20100	EA790-50100	EA790-80100	CW/CCW	18°	14°	30°	90°	-	-	27	C	1
MAINTAINED CONTACT & LEVER POSITION												
EA790-26000	EA790-56000	EA790-86000	CW	55°	22°	60°	116°	55°	64°	6	D	2
			CCW	25°	25°	60°	124°	54°	56°	9		
MAINTAINED CONTACT-LEVER RETURNED												
EA790-26700	EA790-56700	EA790-86700	CW	30°	26°	45°	90°	30°	-	15	D	3
			CCW	16°	30°	45°	90°	26°	-	16.5		
SHORT TRAVEL												
EA790-20900	EA790-50900	EA790-80900	CW/CCW	13°	10°	30°	90°	-	-	27	C	1
NEUTRAL POSITION ALL CONTACTS OPEN												
EA790-25102	EA790-55102	EA790-85102	CW	31°	12°	45°	90°	-	-	16.5	E	1
			CCW	31°	22°	45°	90°	-	-	16.5		
NEUTRAL POSITION ALL CONTACTS CLOSED												
EA790-25104	EA790-55104	EA790-85104	CW	31°	12°	45°	90°	-	-	16.5	F	1
			CCW	31°	22°	45°	90°	-	-	16.5		

Common Switch Characteristics

DOUBLE POLE, HARSH ENVIRONMENT/NAVY MARINE, BUTT/SLIDING CONTACTS		
	EA780	**EA790**
NEMA Enclosure Type	1, 4, 4X, 6, 6P, 13	
Housing Material	Bronze	
Ambient Temperature Range*	-20°C to +90°C	
Shipping Weight	4 lbs. approx.	
Lever Adjustment	7°30' Increments thru 360°	
Contacts	Sliding, Silver Alloy Form Z	Butt, Silver Alloy Form Z
Special Switch Features	MIL-C-2212F Watertight (3 ft. for 60 min.) and Submersible (15ft. for 30 min.) per MIL STD-108E Vibration requirements per MIL-STD-167B, Type 1 High Shock per MIL-S-901, grade A, Class 1, type A	

*Some high temperature (0°C to 150°C) and low temperature (-40°C to +90°C) versions available. Contact factory.

EA780 Continuous Current Rating - Amperes

VOLTAGE	AC	DC
125	10.0	2.5
250	7.5	.75
480	5.0	-
600	2.5	-

75-100% Power Factor

EA790 Continuous Current Rating - Amperes

VOLTAGE	AC	DC
125	20.0	5.0
250	15.0	1.5
480	10.0	-
600	5.0	-

75-100% Power Factor

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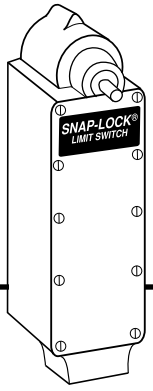
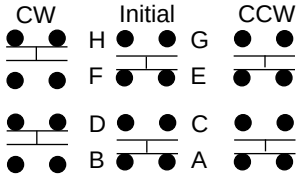
Limit Switches

Butt/ Sliding Contacts

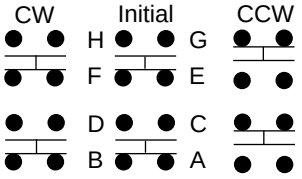


Contact Configurations

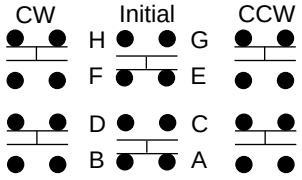
CIRCUIT A



CIRCUIT B

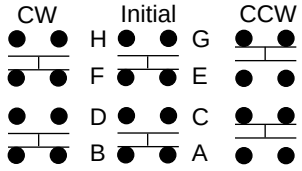


CIRCUIT C

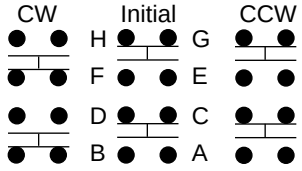


CIRCUIT D

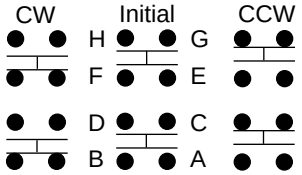
CCW Operating



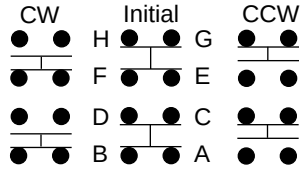
CW Operating



CIRCUIT E

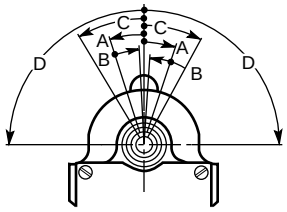


CIRCUIT F



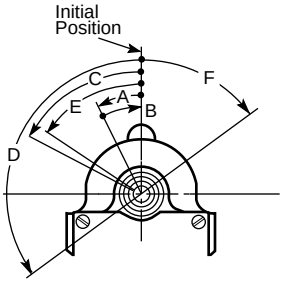
Operational Data Drawings

DRAWING #1

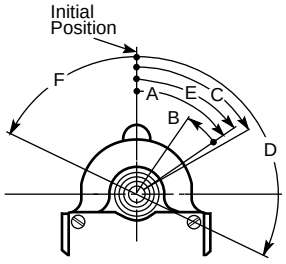


DRAWING #2

CCW Operating



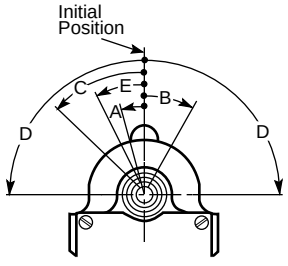
CW Operating



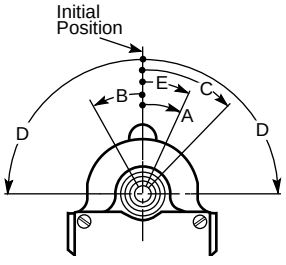
To change switch operation from CW operating to CCW operating, operate switch through angle E. Remove lever and reset at initial position.

DRAWING #3

CCW Operating



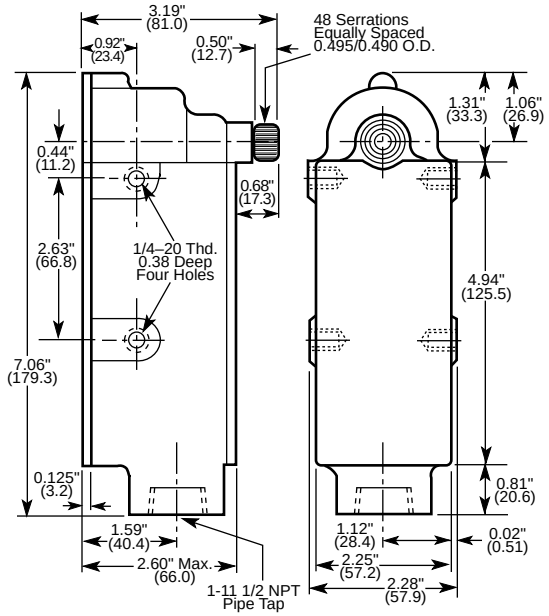
CW Operating



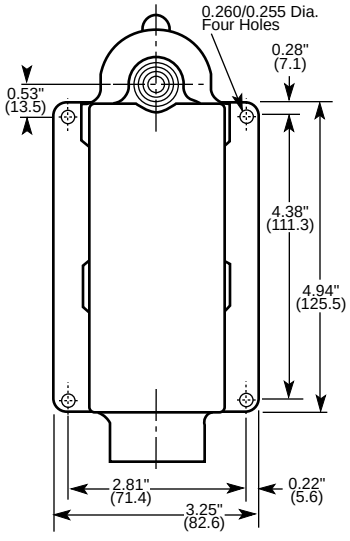
To change switch operation from CW operating to CCW operating, operate switch through angle E.

EA780/790 Series Drawings

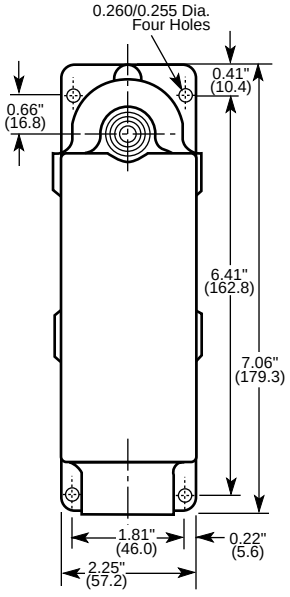
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE



LONG MOUNTING PLATE



Dimensions: inches/(mm)

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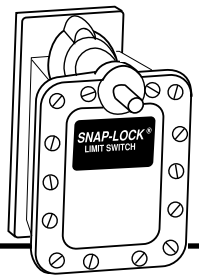
Limit Switches

Butt Contacts



Severe Environment Limit Switches are available on the three standard series of Snap-Lock switches. Regularly furnished with wide or long mounting.

EA990 Single Pole 1 N.O. - 1 N.C. / Standard / Butt Contacts

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.
STANDARD TRAVEL/ ROCKER TYPE											
CW											
—	**EA990-00125**	**EA990-00115**	CW	10°	8°	13°	38°	-	-	14	A
CW / REVERSE SHAFT											
—	**EA990-00535**	—	CW	10°	8°	13°	38°	-	-	14	A
CCW											
—	**EA990-20055**	**EA990-20035**	CCW	10°	8°	13°	38°	-	-	14	B
MAINTAINED CONTACT AND LEVER POSITION											
—	**EA990-30025**	**EA990-30045**	Maintain	10°	8°	13°	38°	-	-	5	-

Common Switch Characteristics

SINGLE POLE, SEVERE ENVIRONMENT, BUTT CONTACTS	
Housing Material	Zinc
Ambient Temperature Range	-20°C to +90°C
Shipping Weight	3.7 lbs. approx.
Lever Adjustment	7°30' Increments Thru 360°
Contacts	Butt, Silver Alloy, Form Z

Continuous Current Rating - Amperes

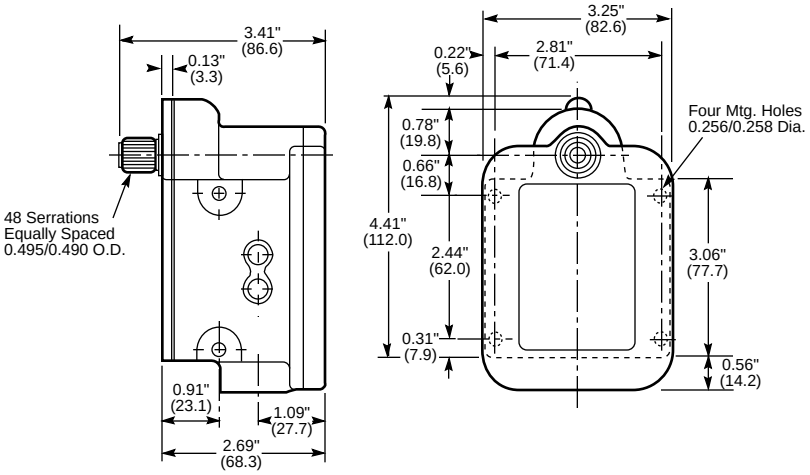
VOLTAGE	AC	DC
125	20.0	5.0
250	15.0	1.5
480	10.0	-
600	5.0	-

75-100% Power Factor

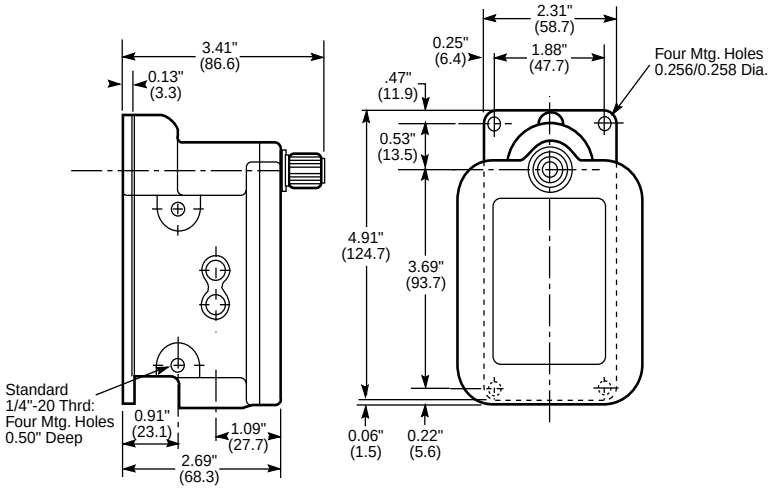
See Operating Levers Section

Dimensions and Mounting

WIDE MOUNTING PLATE



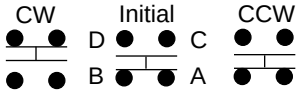
LONG MOUNTING PLATE



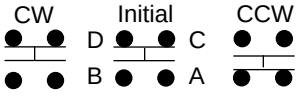
Dimensions: inches/(mm)

Contact Configurations

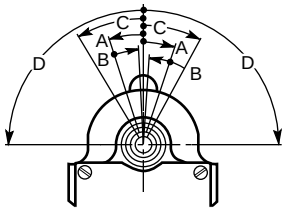
CIRCUIT A



CIRCUIT B



Operational Data Drawings



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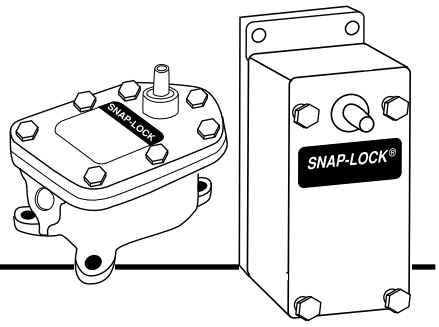
Single, Double and Triple Pole Hazardous Location Limit Switches Butt Contacts



- **NEMA Rated for Hazardous Location**
- **1 NO-1 NC, 2 NO-2 NC, 3 NO-3 NC**
- **Bronze, Aluminum or Cast Iron Housing**
- **Generous Overtravel-EA800 Series**
- **Heavy Duty Cam Operated-EA800 Series**
- **Heavy Duty Rocker Type-EA880 Series**
- **Flexibility of Motion, CW and CCW**
- **Ample Wiring Space**

Service Conditions - The Series EA800/EA880 hazardous location limit switches operate dependably where gases, vapors, and dusts are potential explosion hazards. The switch bodies resist corrosion.

Rugged Construction - Approved spark-proof bronze, aluminum, or cast-iron housings can withstand internal and external gas explosions. Silver alloy butt contact arrangement is standard. Wiring space is ample for up to size 12 wire.

Proven Performance - Cycle life is in the millions, when operated at rated current, voltage, and temperature. Standard switches have maximum ambient temperature ratings of 90°C continuous. Switches can be specially ordered with either -40°C or + 150°C capabilities.

Levers Available - A variety of levers for hazardous location limit switches can be ordered from Namco Controls Series EL.

NOTE: Only non-sparking levers should be used in hazardous locations.

Not all models are UL approved.

EA800 Single Pole 1 N.O. - 1 N.C. / Butt Contacts / Cam Action

Bronze Housing	Aluminum Housing	Cast Iron Housing	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.
STANDARD TRAVEL											
EA800-10040	EA800-10050	-	CW	18°	14°	30°	90°	-	-	15	A
EA800-10041	EA800-10051	-	CCW	18°	14°	30°	90°	-	-	15	B
EA800-10140	EA800-10150	-	CW/CCW	18°	14°	30°	90°	-	-	15	C

EA800 Double Pole 2 N.O. - 2 N.C. / Butt Contacts / Cam Action

Bronze Housing	Aluminum Housing	Cast Iron Housing	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.
STANDARD TRAVEL											
EA800-20040	EA800-20050	-	CW	18°	14°	30°	90°	-	-	27	D
EA800-20041	EA800-20051	-	CCW	18°	14°	30°	90°	-	-	27	E
EA800-20140	EA800-20150	-	CW/CCW	18°	14°	30°	90°	-	-	27	F

EA800 Triple Pole 3 N.O. - 3 N.C. / Butt Contacts / Cam Action

Bronze Housing	Aluminum Housing	Cast Iron Housing	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E Min. Travel to Maintain	Angle F Overall Travel	Torque (inch lbs)	Contact Config.
STANDARD TRAVEL											
EA800-30040	EA800-30050	-	CW	18°	14°	30°	90°	-	-	33	G
EA800-30041	EA800-30051	-	CCW	18°	14°	30°	90°	-	-	33	H
EA800-30140	EA800-30150	-	CW/CCW	18°	14°	30°	90°	-	-	33	I

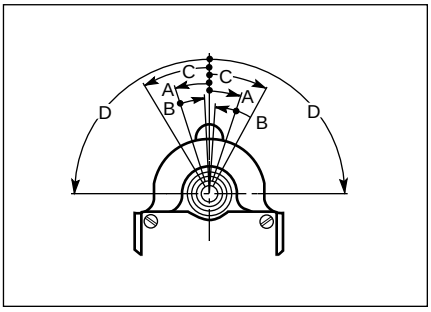
See Operating Levers Section

EA880 Single Pole 1 N.O. - 1 N.C. / Butt Contacts / Rocker Type

Aluminum Housing	Description	Temperature Range	Dir. Of Operation	NEMA Type 4	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Torque (inch lbs)	Contact Config.
STANDARD TRAVEL										
EA880-11100	Standard	-20C to +90C	CW	No	10°	8°	13°	38°	13	A
EA880-11500	Watertight	-20C to +90C	CW	Yes	10°	8°	13°	38°	13	A
EA880-11700	Watertight	-40C to +90C	CW	Yes	10°	8°	13°	38°	13	A
EA880-12100	Standard	-20C to +90C	CCW	No	10°	8°	13°	38°	13	J
EA880-12500	Watertight	-20C to +90C	CCW	Yes	10°	8°	13°	38°	13	J
EA880-12700	Watertight	-40C to +90C	CCW	Yes	10°	8°	13°	38°	13	J
MAINTAINED										
EA880-13100	Standard	-20C to +90C	CW/CCW	No	10°	-	-	38°	5	-
EA880-13500	Watertight	-20C to +90C	CW/CCW	Yes	10°	-	-	38°	5	-
EA880-13700	Watertight	-40C to +90C	CW/CCW	Yes	10°	-	-	38°	5	-
NEUTRAL POSITION										
EA880-17100	Standard	-20C to +90C	CW/CCW	No	7°	6°	7°30'	33°	22	K
EA880-17500	Watertight	-20C to +90C	CW/CCW	No	7°	6°	7°30'	33°	22	K
EA880-17700	Watertight	-40C to +90C	CW/CCW	No	7°	6°	7°30'	33°	22	K

Bronze Housing	Description	Temperature Range	Dir. Of Operation	NEMA Type 4	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Torque (inch lbs)	Contact Config.
MAINTAINED										
EA880-13200	Standard	-20C to +90C	CW/CCW	No	10°	-	-	38°	5	-
EA880-13600	Watertight	-20C to +90C	CW/CCW	Yes	10°	-		38°	5	-

Operational Data Drawing



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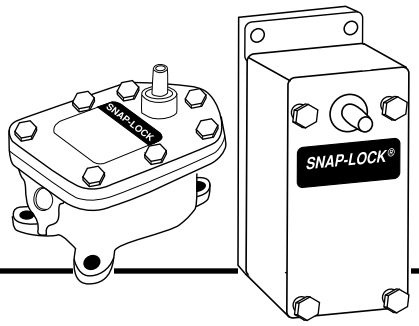
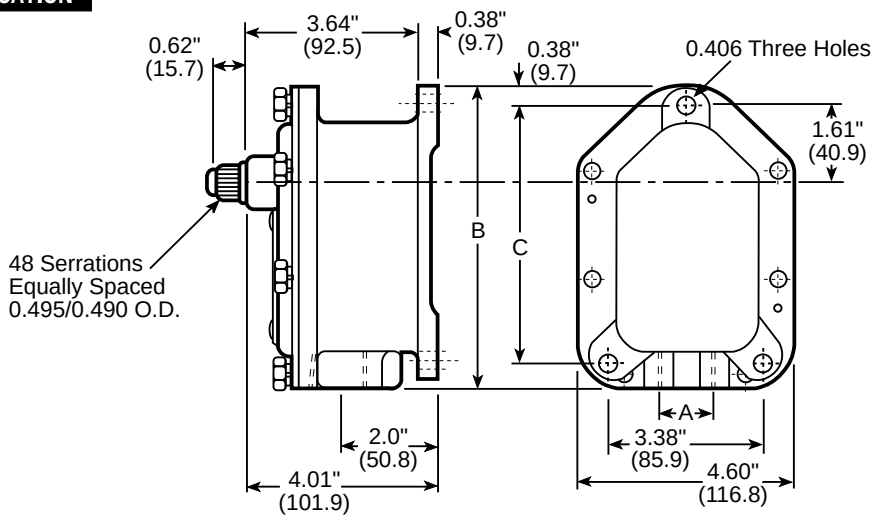
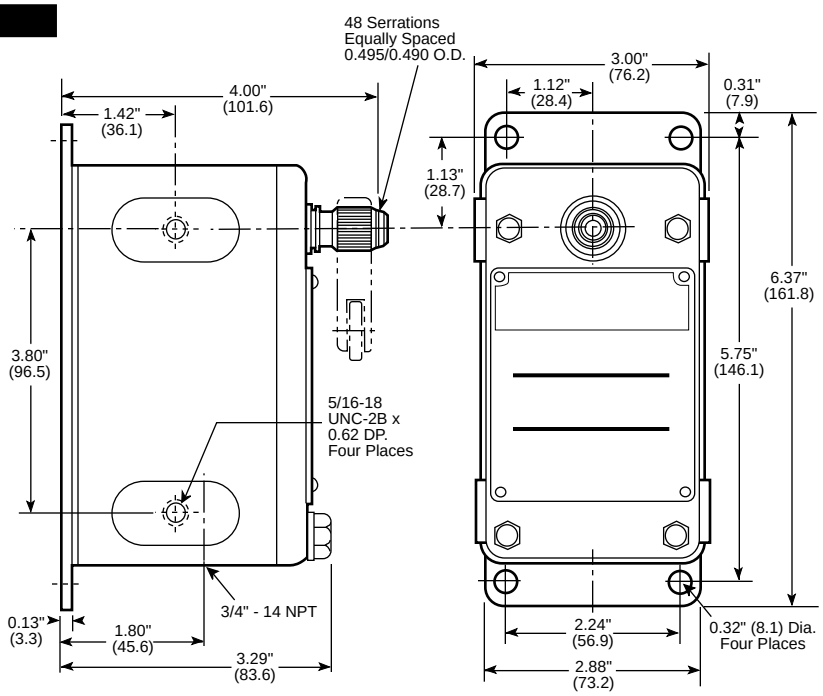


EA800/880 Series Drawings

EA800 HAZARDOUS LOCATION



EA880 ROCKER



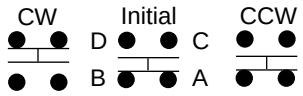
Not to Scale

Dimensions: inches/(mm)

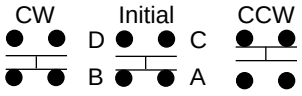
Switch Type	Conduit Opening NPT A	Total Height B	Mounting Height C
EA800-1	3/4”-14	6.47” (164.3)	5.42” (137.7)
EA800-2	1”-11 1/2	8.50” (215.9)	7.58” (192.5)
EA800-3	1 1/4”-11 1/2	10.56” (268.2)	9.67” (245.6)

Contact Configurations

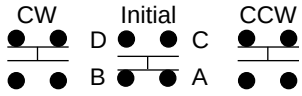
CIRCUIT A



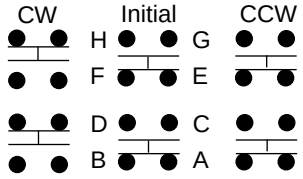
CIRCUIT B



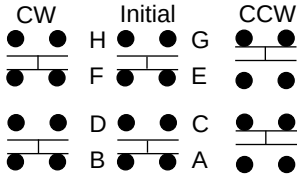
CIRCUIT C



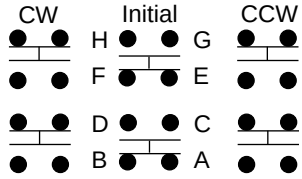
CIRCUIT D



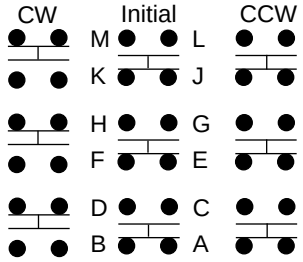
CIRCUIT E



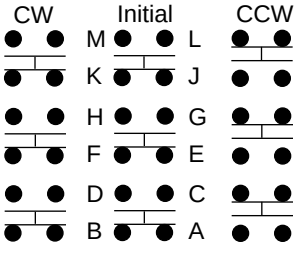
CIRCUIT F



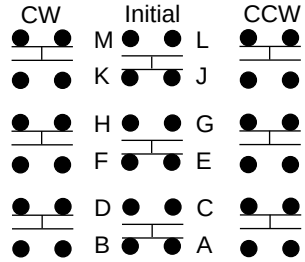
CIRCUIT G



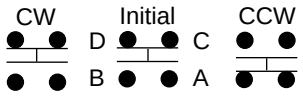
CIRCUIT H



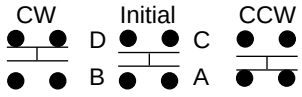
CIRCUIT I



CIRCUIT J



CIRCUIT K



Common Switch Characteristics

SINGLE, DOUBLE & TRIPLE POLE, HAZARDOUS LOCATION, BUTT CONTACTS		
	EA800	**EA880**
NEMA Enclosure Type	4, 4X, 6, 6P, 7 Class I, Group C & D, 9 Class II, Group E, F & G	7 Class I, Group C & D, 9 Class II, Group E, F & G (Some 4, see p/n chart)
Housing Material	Bronze/Aluminum/ Cast Iron (See p/n chart)	Bronze/Aluminum
Ambient Temperature Range*	-20°C to +90°C	
Shipping Weight	EA800-1: Al-6 lbs. Brz-12 lbs. EA800-2: Al-7 lbs. Brz-16 lbs. EA800-3: Al-8 lbs. Brz-19 lbs.	Aluminum: 5 lbs. Bronze: 8 lbs.
Lever Adjustment	7°30' Increments thru 360°	
Contacts	Butt, Silver Alloy, Form Z	

*Some high and low temperature versions available. For EA880, see p/n chart. For EA800, contact factory.

Continuous Current Rating - Amperes

VOLTAGE	AC	DC
125	20.0	5.0
250	15.0	1.5
480	10.0	-
600	5.0	-

75-100% Power Factor

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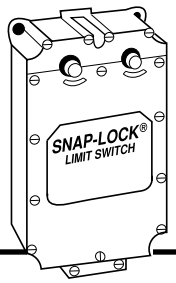
Multi Station Limit Switches Butt Contacts



The Multiple Station Switch now makes it possible to incorporate from two to four EA700 Namco Series Snap-Lock Limit Switches into a single assembly. Here's a unit that can be adapted to most any application where individual limit switches are mounted side by side. This single assembly reduces installation time, cuts wiring costs and presents a more compact appearance than individually mounted switches. Furthermore, you can now perform an almost unlimited number of switching functions within a single enclosure by combining the Single Action type switches.

EA760 1 N.O. - 1 N.C. / Butt Contacts / Cam Action

Part Number	Station 1	Station 2	Station 3	Station 4	Conduit Diameter**	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Contact Configuration	Conduit Location	Torque (inch/ lbs)
STANDARD TRAVEL / 2 STATION												
EA760-10000*	CW	CW	-	-	1.50"-11.50 N.P.T.	18°	14°	30°	90°	B	Bottom	33
EA760-10001*	CCW	CCW	-	-	1.50"-11.50 N.P.T.	18°	14°	30°	90°	B	Bottom	33
EA760-10005	CCW	CW	-	-	0.75"	13°	10°	30°	90°	A	Left	16.5
STANDARD TRAVEL / 4 STATION												
EA760-00265	CW	CW	CW	CCW	1.00"	18°	14°	30°	90°	A	Left	15
EA760-00445	CCW	CW	CCW	CCW	1"-11.50 NPT	13°	10°	30°	90°	A	L & R	16.5
EA760-00455	CW	CW	CCW	CW	1"-11.50 NPT	13°	10°	30°	90°	A	L & R	16.5
EA760-30002	CW	CW	CCW	CCW	1.716"	18°	14°	30°	90°	A	Left	15
EA760-30003	CW	CW	CCW	CCW	1.38"	18°	14°	30°	90°	A	Left	15
EA760-30004	CW	CW	CCW	CCW	1.38"	18°	14°	30°	90°	A	Right	15
EA760-30006	CW	CW	CCW	CCW	1"-11.50 NPT	13°	10°	30°	90°	A	L & R	16.5

* All switch stations are single pole except EA760-10000 and EA760-10001, which are 3 pole.
** Non-threaded, smooth-hole type, except "N.P.T."

Common Switch Characteristics

MULTI-STATION, SINGLE POLE, STANDARD ENVIRONMENT, BUTT CONTACTS	
NEMA Enclosure Type	1
Housing Material	Aluminum
Ambient Temperature Range***	-20°C to +90°C
Lever Adjustment	7°30' Increments Thru 360°
Contacts	Butt, Silver Alloy, Form Z

*** EA760-10000 and -10001 rated +20°C to +180°C
EA760-00445, EA760-00455 and EA760-30006 rated 0°C to +150°C

Continuous Current Rating - Amperes

VOLTAGE	AC	DC
125	20.0	5.0
250	15.0	1.5
480	10.0	-
600	5.0	-

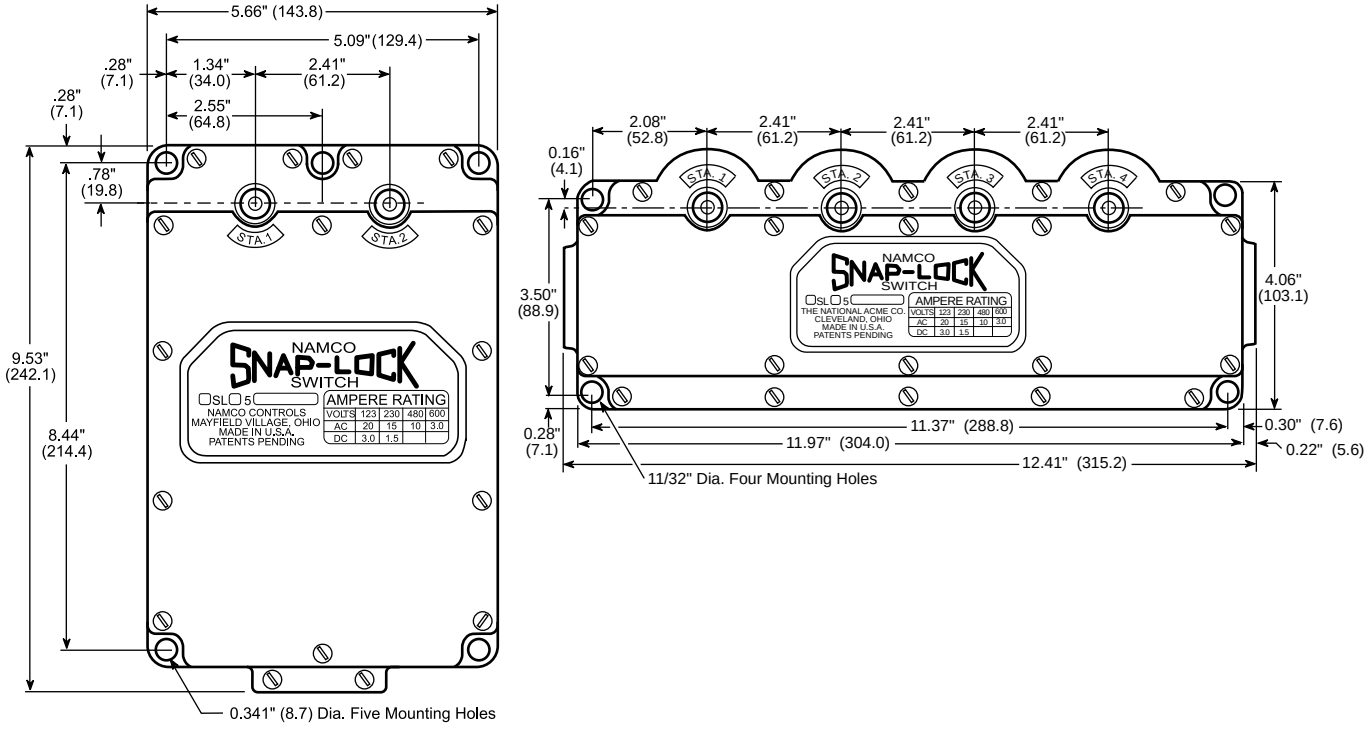
75-100% Power Factor

See Operating Levers Section

Dimensions and Mounting

TWO STATION - THREE POLE **FOUR STATION - SINGLE POLE**

See table on opposite page for location, diameter, and type.



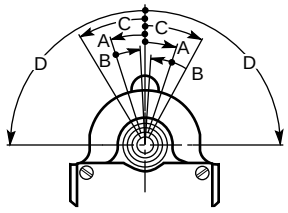
Dimensions: inches/(mm)

Contact Configurations

Contact configuration A	
Clockwise Stations	Counter Clockwise Stations
D C / B A — CW; D C / B A — Initial	D C / B A — Initial; D C / B A — CCW
Polarity must be the same on each pole	

Contact configuration B		
Counter Clockwise Stations	Clockwise Stations	
M L / K J — Initial; M L / K J — CCW	M L / K J — CW; M L / K J — Initial	Pole 3
H G / F E — Initial; H G / F E — CCW	H G / F E — CW; H G / F E — Initial	Pole 2
D C / B A — Initial; D C / B A — CCW	D C / B A — CW; D C / B A — Initial	Pole 1
Polarity must be the same on each pole		

Operational Data Drawing



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Limit Switches

EA190 — Crank Interlock Switch

Crank Interlock Switches provide an interlock between the boat davit hand crank and gear box. Specify either left or right hand. Switch cannot be converted in the field.

EA190 — Brake Interlock Switch

The Brake Interlock Switch provides an interlock for braking of the boat davit and is available in either left or right hand models. Please specify by correct part number since these cannot be modified in the field.

EA190 — Trackway Limit Switch

The Trackway Switch limits the up or down travel of the boat davit and, like the other switches, is offered in right or left hand units and normally open or closed contact arrangements. Specify whether left hand or right hand is required and whether normally open or normally closed contacts are required.

EA190

Model Number	Lever Location	Arrangement	Trip Travel
CRANK INTERLOCK SWITCH			
EA190-00055	Left hand	-	20°
EA190-00065	Right hand	-	20°
BRAKE INTERLOCK SWITCH			
EA190-00035	Left hand	-	20°
EA190-00045	Right hand	-	20°
TRACKWAY LIMIT SWITCH			
EA190-00015	Left hand	N.C.	6°
EA190-00025	Right hand	N.C.	6°
EA190-00016	Left hand	N.O.	6°
EA190-00026	Right hand	N.O.	6°

Common Switch Characteristics

SINGLE POLE, SPECIAL NAVY MARINE, SLIDING CONTACTS	
Ambient Temperature Range	-50°C min.
Enclosure	Watertight (3 ft. for 2 hrs.) per MIL-STD-108E

Crank Interlock

MIL-C-2212
Navy "A" High Shock
Continuous Current Carrying - 15 amps @ 440 VAC or 230 VDC
Insulation Class B

Brake Interlock

MIL-C-2212, MIL-C-2214
Navy "A" High Shock
Continuous Current Carrying - 15 amps @ 440 VAC or 230 VDC
Insulation Class B

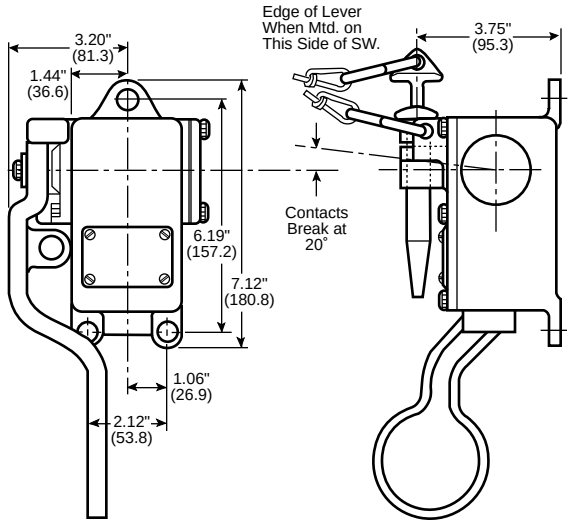
Trackway

MIL-C-2174, MIL-C-2212
Continuous Current Carrying - 20 amps @ 440 VAC or
5 amps @ 230 VDC
Non-Magnetic/Fungistatic Materials
Lever Adjustment - 10° increments thru 360°

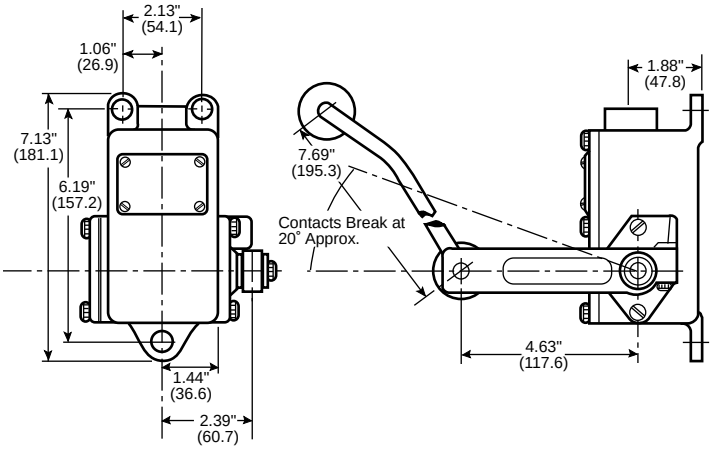
See Operating Levers Section

Dimensions and Mounting

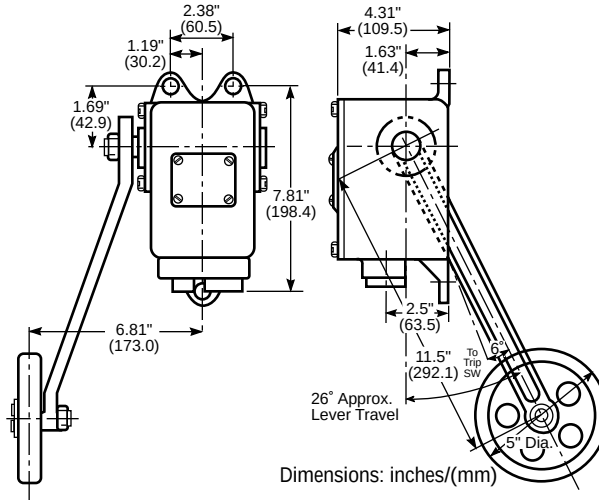
CRANK INTERLOCK SWITCH



BRAKE INTERLOCK SWITCH



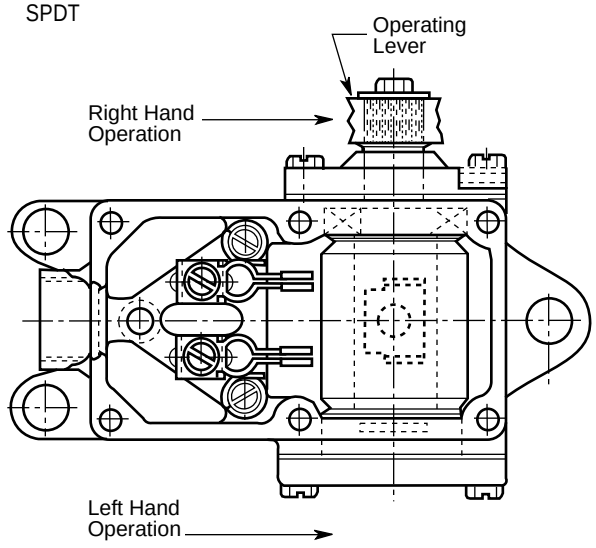
TRACKWAY LIMIT SWITCH

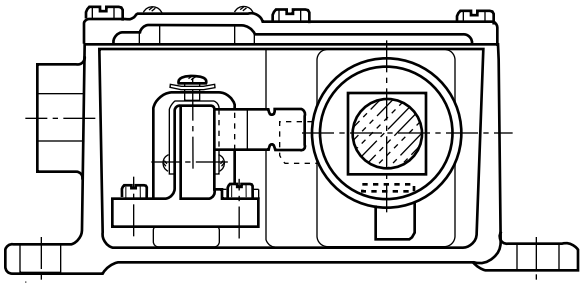


Dimensions: inches/(mm)

Operational Data Drawing

Contacts:
Knife-Disconnect
SPDT





Limit Switches

NAMCO

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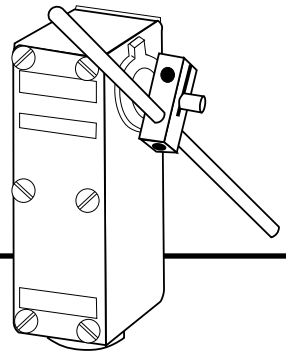
Super Sensitive Limit Switches Butt Contacts



Designed for sensing small, lightweight objects. Rotary units are gravity return and have 360° total travel either clockwise or counterclockwise. Trip torques range from 1.5 to 7 inch-ounces. Oscillating units are spring return versions with 15 inch-ounce trip torque.

Outputs include SPDT (1 NO and 1 NC) and DPDT (2 NO and 2 NC). Output indicator lights are optional.

Ideal for fill detection on vibratory feeder bowls, small parts sensing or counting, gauging devices, time delay mechanisms, safety interlock switch applications, liquid level control and governors.

EA150 1 N.O. - 1 N.C. & 2 N.O. - 2 N.C / Super Sensitive / Butt Contacts

Model Number	Description	Dir. of Operation	Travel to Make or Break Contacts	Torque Inch Oz	Over Travel	Total Travel
OSCILLATING TYPE (INCLUDES 1/8" X 10" STEEL ROD UNLESS NOTED OTHERWISE)						
EA150-10013	Standard Unit 1 N.O. 1 N.C.	CW/CCW	Adjustable (4° - 90°)	15	Adj. to 86°	180°
EA150-10313	Standard Unit with L.E.D. Top Cover	CW/CCW	Adjustable (4° - 90°)	15	Adj. to 86°	180°
EA150-10173	Standard Unit with 1/8" x 10" Fiber Rod	CW/CCW	Adjustable (4° - 90°)	15	Adj. to 86°	180°
EA150-10083	Standard Unit with 1/4" x 9" Steel Rod	CW/CCW	Adjustable (4° - 90°)	15	Adj. to 86°	180°
EA150-10093	Same as EA150-10083 with L.E.D. Top Cover	CW/CCW	Adjustable (4° - 90°)	15	Adj. to 86°	180°
EA150-10143	Standard Unit 2 N.O. - 2 N.C.	CW/CCW	Adjustable (4° - 90°)	15	Adj. to 86°	180°
EA150-10343	Standard Unit 2 N.O. - 2 N.C. w/ L.E.D. Top Cover	CW/CCW	Adjustable (4° - 90°)	15	Adj. to 86°	180°
ROTARY TYPE (INCLUDES 1/4" X 9" STEEL ROD UNLESS NOTED OTHERWISE)						
EA150-30014	Standard Unit 1 N.O. - 1N.C.	CW/CCW	4°	5	180°	360°
EA150-30303	Standard Unit with L.E.D. Top Cover	CW/CCW	4°	5	180°	360°
EA150-30283	Standard Unit with 1/4" x 12" Fiber Rod	CW/CCW	4°	5	180°	360°
EA150-30223	Standard Unit with 1/8" x 10" Steel Rod	CW/CCW	4°	5	180°	360°
EA150-30233	Same as EA150-30223 w/ L.E.D. Top Cover	CW/CCW	4°	5	180°	360°
EA150-30396	Standard Unit with LH shaft extension	CW/CCW	4°	5	180°	360°
EA150-30143	Standard Unit 2 N.O. - 2N.C.	CW/CCW	4°	5	180°	360°
EA150-30145	Standard Unit 2 N.O. - 2N.C. w/ L.E.D. Top Cover	CW/CCW	4°	5	180°	360°
EA150-30500	Low Torque, 1 N.O. - 1N.C., 1/4" clamp w/o Rod	CW/CCW	4°	1.5°	180°	360°
EA150-30274	Standard Unit, 1 N.O. - 1 N.C., Double-ended Shaft	CW/CCW	4°	5°	180°	360°
EA150-30275	Standard Unit, 1 N.O. - 1 N.C., Double-ended Shaft w/o Rod and Clamp	CW/CCW	4°	5°	180°	360°

Spare Lever Clamp Kits*

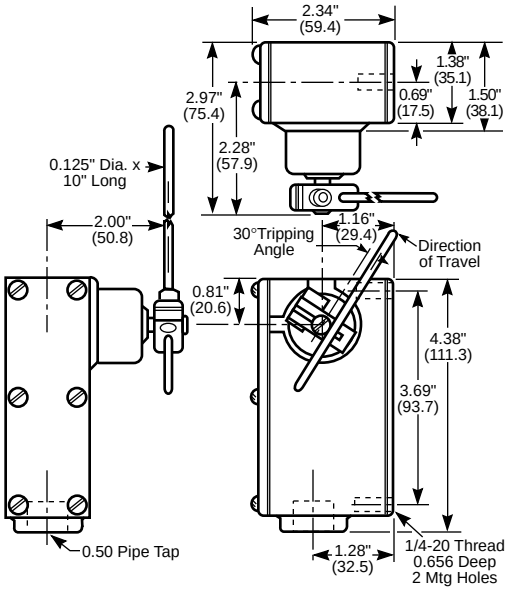
EL140-18900	1/4" x 9" Steel Rod
EL140-18901	1/8" x 10" Steel Rod
EL140-18902	1/4" x 12" Fiber Rod
EL140-18903	1/8" x 10" Fiber Rod

*contains Rod, Lever Clamp, Lockwasher, Set Screw and Cap Screw

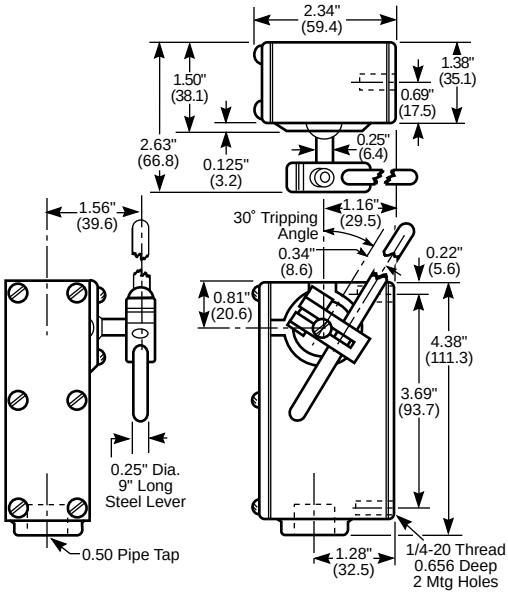
See Operating Levers Section

Dimensions and Mounting

OSCILLATING



ROTARY



Dimensions: inches/(mm)

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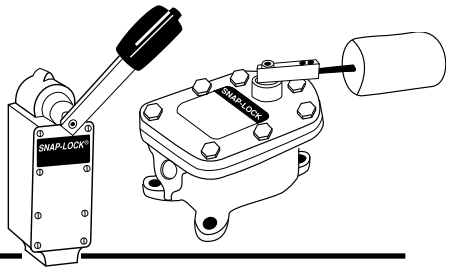
Limit Switches



Switches for use on conveyor systems. Standard as well as Hazardous Location versions. One step maintained, two step and two step maintained versions available. Generous overtravel, Snap Action contacts action, Form Z Contact arrangement.

EA700 Cam Action 2 N.O. - 2 N.C.

Standard Mounting Model No.	Wide Mounting Model No.	Long Mounting Model No.	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E 2nd Trip Travel	Angle F 2nd Reset Travel	Torque (inch lbs)
ONE STEP-MAINTAINED LEVER AND CONTACTS										
EA700-20137	**EA700-50137**	**EA700-80137**	CW/CCW	18°	14°	30°	90°	-	-	27
TWO STEP-MAINTAINED LEVER AND CONTACTS										
EA700-28437	**EA700-58437**	**EA700-88437**	CW/CCW	12°	10°	45°	90°	22°	10°	-
TWO STEP-SPRING RETURN										
EA700-20176	**EA700-50176**	**EA700-80176**	CW/CCW	12°	10°	45°	90°	22°	10°	-

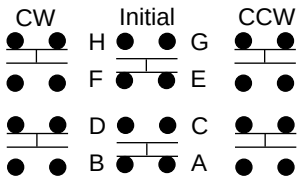
EA800 Cam Action 2 N.O. - 2 N.C.

Bronze Housing	Aluminum Housing	Cast Iron Housing	Dir. Of Operation	Angle A Trip Travel	Angle B Reset Travel	Angle C Recom. Travel	Angle D Total Travel	Angle E 2nd Trip Travel	Angle F 2nd Reset Travel	Torque (inch lbs)
ONE-STEP MAINTAINED LEVER AND CONTACTS										
-	**EA800-20157**	**-**	CW/CCW	18°	14°	30°	90°	-	-	27
TWO STEP-SPRING RETURN										
EA800-28440	**EA800-28450**	**-**	CW/CCW	12°	10°	45°	90°	22°	10°	-

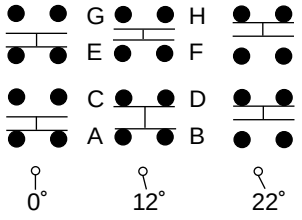
See Operating Levers Section

Contact Configurations

ONE-STEP SWITCH



TWO-STEP SWITCH / BI-DIRECTIONAL OPERATION



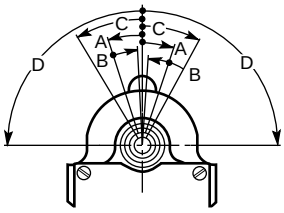
Common Switch Characteristics

DOUBLE POLE, STANDARD/HAZARDOUS LOCATION ENVIRONMENT, BUTT CONTACTS		
	EA700	**EA800**
NEMA Enclosure Type	1, 4, 13	4, 4X, 6, 6P, 7 Class I, Group C & D, 9 Class II, Group E, F & G
Housing Material	Zinc	Bronze/Aluminum/ Cast Iron
Ambient Temperature Range*	-20°C to +90°C	
Lever Adjustment	7°30' Increments thru 360°	
Contacts	Butt, Silver Alloy, Form Z	

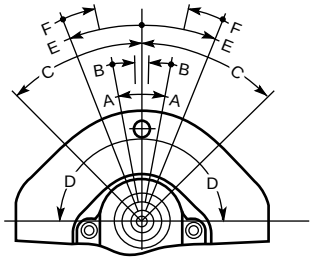
*Some high temperature (0° to 150°C) and low temperature (-40° to +90°C) versions available. Contact factory.

Operational Data Drawing

ONE-STEP SWITCH



TWO-STEP SWITCH



Continuous Current Rating - Amperes

VOLTAGE	AC	DC
125	20.0	5.0
250	15.0	1.5
480	10.0	-
600	5.0	-

75-100% Power Factor

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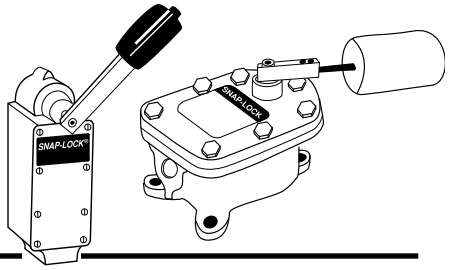
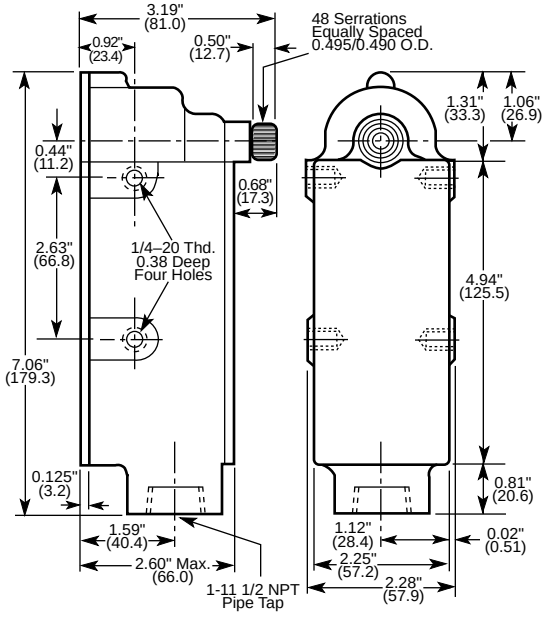
Limit Switches

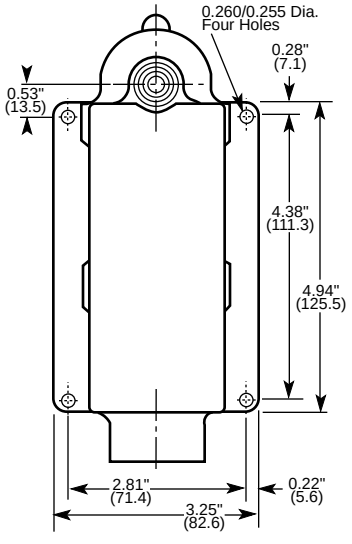


EA700 Series Drawings

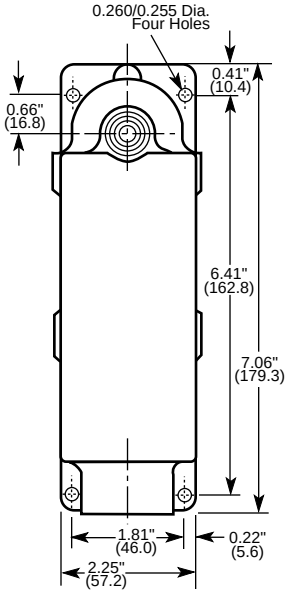
STANDARD MOUNTING PLATE



WIDE MOUNTING PLATE



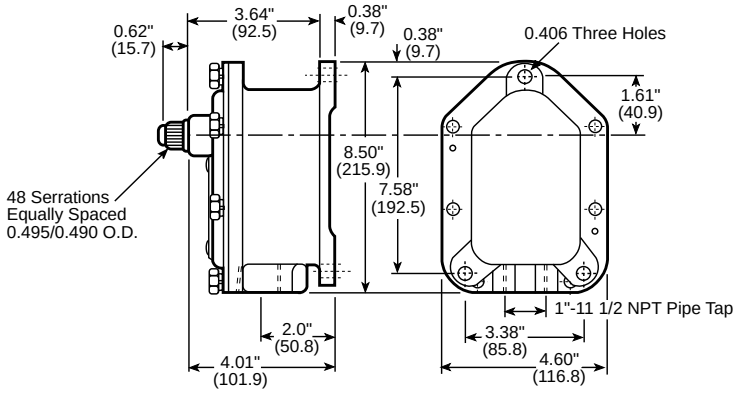
LONG MOUNTING PLATE



Dimensions: inches/(mm)

EA800 Series Drawings

STANDARD MOUNTING PLATE



Dimensions: inches/(mm)

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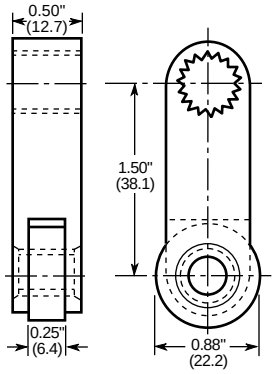
Operating Levers



Standard Operating Lever
EL010-53420 (D-1260)
(for .500 Dia. Shaft Switches)

For Series:
EA040, EA060, EA080, EA130, EA140, EA170, EA700, EA710, EA730, EA760, EA770, EA780, EA790, EA800, EA880, EA990

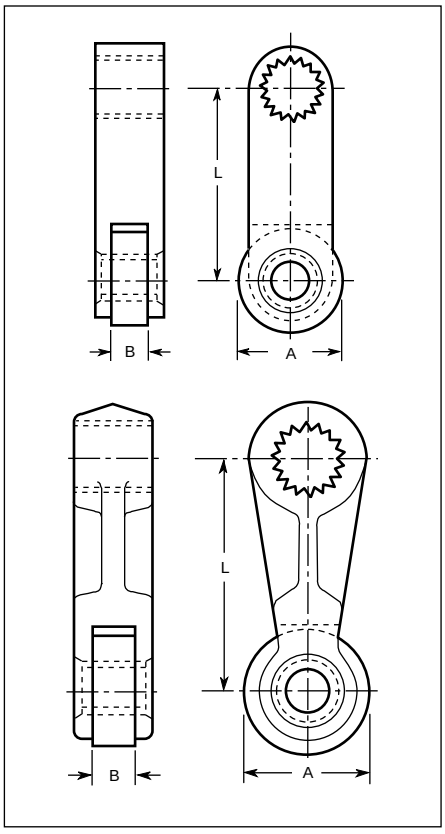
Select the operating lever for your application with regards to dimensions and materials required.

Requests for operating levers not shown should include lever style and all pertinent information as to limit switch number, dimensions, materials, etc.

Depending upon your application, levers are available in cold rolled steel, stainless steel, or bronze. Rollers are available in steel, nylon, Bryl. Cop., stainless steel or steel ball bearings. Please consult materials column of the lever of your choice.

This style and size operating lever is considered standard for the majority of snap-lock switch installations. The EL010-53420 (D1260) lever is steel with a nylon roller and a stainless steel roller pin. Like all snap-lock levers, the serrated mounting hole matches the serrated lever shaft of the switches to provide fixed adjustment of the lever in 7.5° increments.

For Series EA040, 060, 080, 130, 140, 170, 700, 710, 730, 760, 770, 780, 790, 800, 880, 990



Style R - *Regular Straight Type*

Ordering Numbers					Material	
Part Number	Reference	L	A	B	Lever	Roller
EL060-50320	D1260BA	3/4	3/4	1/4	C.R.S.	C.R.S.
EL060-51319	—	1	3/4	1/4	C.R.S.	Bryl. Cop.
EL060-52321	D1260GQ	1-1/4	3/4	1/4	C.R.S.	C.R.S.
EL060-53923	D1260BH	1-1/2	1-1/4	1/4	C.R.S.	C.R.S.
EL010-53338	DS1260	1-1/2	3/4	1/4	Steel	C.R.S.
EL060-53300	—	1-1/2	3/4	1/4	Brass	Bryl. Cop.
EL010-53336	—	1-1/2	3/4	1/4	Steel	S.S.
EL010-53337	—	1-1/2	3/4	1/4	Steel	Bryl. Cop.
EL060-53401	D126ORF	1-1/2	7/8	9/32	Brass	Nylon
EL060-53402	—	1-1/2	7/8	9/32	Brass	Bryl. Cop.
EL010-53420	D1260	1-1/2	7/8	9/32	Steel	Nylon
EL010-53429	D1260Y	1-1/2	7/8	9/32	Steel	B.B.
EL060-53536	D1260Z	1-1/2	1	1/4	C.R.S.	C.R.S.
EL060-53926	D1260CL	1-1/2	1-3/8	1/4	C.R.S.	C.R.S.
EL060-55327	D1260E	2	3/4	1/4	C.R.S.	C.R.S.
EL060-55300	—	2	3/4	1/4	C.R.S.	Bryl. Cop.
EL060-55520	D1260AC	2	1	1/4	C.R.S.	C.R.S.
EL060-55601	—	2	1	1/4	C.R.S.	Bryl. Cop.
EL060-55530	D1260RT	2	1	1/4	Brass	Bryl. Cop.
EL060-55927	D1260GT	2	1-1/2	1/4	C.R.S.	C.R.S.
EL060-50321	D1260BC	2-1/8	3/4	1/4	C.R.S.	C.R.S.
EL060-50501	D1260B	2-1/8	1	1/4	C.R.S.	C.R.S.
EL060-50334	D1260M	2-1/4	3/4	1/4	C.R.S.	C.R.S.
EL060-59300	D1260KC	2-3/8	3/4	1/4	C.R.S.	C.R.S.
EL010-56427	D1260K	2-1/2	7/8	9/32	Steel	Nylon
EL010-56334	DS1260K	2-1/2	3/4	1/4	Steel	C.R.S.
EL010-55421	D1260DF	2-1/2	1	1/4	C.R.S.	C.R.S.
EL060-56500	D1260RR	2-1/2	1	1/4	Brass	Bryl. Cop.
EL060-56920	D1260CP	2-1/2	1-1/2	1/4	C.R.S.	C.R.S.
EL060-50322	D1260BD	2-3/4	3/4	1/4	C.R.S.	C.R.S.
EL060-57300	—	2-3/4	3/4	1/4	C.R.S.	Bryl. Cop.
EL010-58300	—	3	3/4	1/4	Steel	Bryl. Cop.
EL010-58337	DS1260L	3	3/4	1/4	Steel	C.R.S.
EL060-58305	—	3	3/4	1/4	Brass	Bryl. Cop.
EL010-58400	—	3	7/8	9/32	Steel	Bryl. Cop.
EL010-58423	D1260L	3	7/8	9/32	Steel	Nylon
EL010-58451	—	3	7/8	9/32	Steel	C.R.S.
EL060-58401	—	3	7/8	9/32	Brass	Nylon
EL060-58403	D1260VQ	3	7/8	9/32	S.S.	Bryl. Cop.
EL010-58521	D1260CJ	3	1	1/4	Steel	C.R.S.
EL010-58522	—	3	1	1/4	C.R.S.	Bryl. Cop.
EL010-58923	D1260CN	3	1-1/4	1/4	Steel	C.R.S.
EL060-58923	—	3	1-1/4	1/4	Brass	Steel
EL010-58900	D1260VR	3	1-1/2	1/4	Steel	Nylon
EL010-58920	D1260AE	3	1-1/2	1/4	Steel	C.R.S.
EL060-58320	D1260BB	3-1/2	3/4	1/4	C.R.S.	C.R.S.
EL060-58431	D1260AP	3-1/2	1	1/4	C.R.S.	C.R.S.
EL060-58932	—	3-1/2	3/4	1/4	Brass	Bryl. Cop.
EL060-58930	—	3-1/2	1-1/2	1/4	Brass	Bryl. Cop.
EL060-58326	D1260C	4	3/4	1/4	C.R.S.	C.R.S.
EL060-58304	D1260WD	4	3/4	1/4	C.R.S.	Bryl. Cop.
EL060-50523	D1260BL	4	1	1/4	C.R.S.	C.R.S.
EL060-58925	—	4	1-1/4	1/4	Brass	Bryl. Cop.
EL060-58920	D1260AB	4	1-1/2	1/4	C.R.S.	C.R.S.
EL060-58901	—	4	1-1/2	9/32	C.R.S.	Nylon
EL060-50335	D1260N	5	3/4	1/4	C.R.S.	C.R.S.
EL060-50925	D1260BW	5	1-1/2	1/4	C.R.S.	C.R.S.
EL060-50305	D1260CQ	6	3/4	1/4	C.R.S.	C.R.S.
EL060-50338	—	6	3/4	1/4	C.R.S.	Bryl. Cop
EL060-50930	D1260JE	6	1-1/4	1/4	C.R.S.	C.R.S.
EL060-50703	D1260KD	6	3	1/4	C.R.S.	C.R.S.

All dimensions are in inches.

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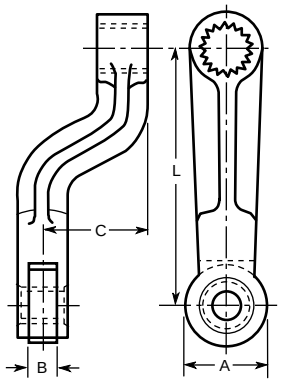
Operating Levers

For Series EA040, 060, 080, 130, 140, 170, 700, 710, 730, 760, 770, 780, 790, 800, 880, 990 Only

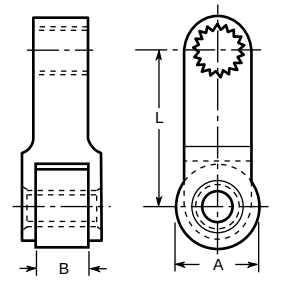


Offset lever with straddle-supported roller.

Style RLO - *Regular Lever Offset Type*

Ordering Numbers						Material	
Part Number	**Reference**	**L**	**A**	**B**	**C**	**Lever**	**Roller**
***EL020-53326**	D1260GX	1-1/2	3/4	1/4	1-1/4	Mang. Br.	Steel
***EL020-53325**	D1260GU	1-1/2	3/4	1/4	1-3/16	Mang. Br.	Steel
EL020 55327	D1260HZ	2	3/4	1/4	1-1/8	Mang. Br.	Steel
***EL020-55300**	D1260JD	2	3/4	1/4	1-1/2	Mang. Br.	Steel
EL020-56320	D1260BT	2-1/2	3/4	1/4	1	Mang. Br.	Steel
***EL020-56321**	D1260DW	2-1/2	3/4	1/4	2-1/4	Mang. Br.	Steel
EL020-56421	D1260DG	2-1/2	1	1/4	1	Mang. Br.	Steel
EL020-58922	D1260FT	3	1-1/4	1/4	1-1/4	Mang. Br.	Steel
EL020-58923	—	3	1-1/4	1/4	1-1/4	Mang. Br.	S.S.
EL020-59900	D1260AY	5-1/2	1-1/2	1/4	1-3/4	C.R.S.	Steel

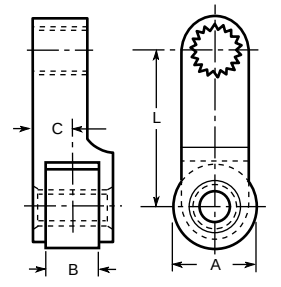
**On Series EA040/060/080/170, Lever will not clear top of switch when mounted with Roller facing the rear.*



Machined lever with wide roller straddle-supported directly in line with the serrated mounting hole.

Style RW - *Wide Roller Regular Type*

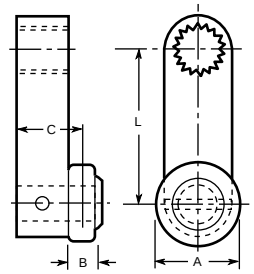
Ordering Numbers					Material	
Part Number	**Reference**	**L**	**A**	**B**	**Lever**	**Roller**
EL070-53501	D1260AJ	1-1/2	1	1/2	C.R.S.	Bryl. Cop.
EL070-50507	D1260CY	1-5/8	1	1/2	C.R.S.	Bryl. Cop.
EL070-56921	D1260DY	2-1/2	1-1/4	1/2	C.R.S.	Steel
EL060-00024	D1260AL	3	1-1/2	1/2	C.R.S.	Steel
EL070-50921	D1260BE	4	1-1/4	1/2	C.R.S.	Steel



Lever provides straddle-type support for wide roller, which is offset from serrated lever hub. Side toward switch is machined straight.

Style RWO - *Wide Roller Offset Type*

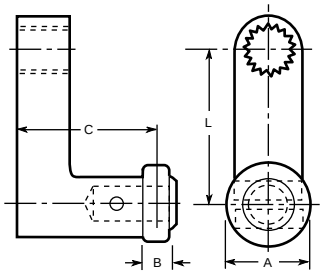
Ordering Numbers						Material	
Part Number	**Reference**	**L**	**A**	**B**	**C**	**Lever**	**Roller**
EL080-53329	D1260R	1-1/2	3/4	1/2	3/8	Mang. Br	Steel
EL080-53932	D1260P	1-1/2	1-1/2	1/2	3/8	C.R.S.	Steel
EL080-55323	D1260FR	2	3/4	1/2	3/8	C.R.S.	Steel
EL080-54905	D1260DD	2	1-1/2	1/2	3/8	C.R.S.	C.R.S.
EL080-56301	D1260AH	2-1/2	3/4	1/2	3/8	C.R.S.	Steel
EL080-56305	—	2-1/2	3/4	1/2	3/8	C.R.S.	Bryl. Cop.
EL080-58322	D1260GN	3	3/4	1/2	3/8	C.R.S.	Steel
EL080-58901	D1260DE	3	1-1/2	1/2	3/8	C.R.S.	Steel
EL080-58906	D1260DZ	3-1/2	1-1/2	1/2	3/8	C.R.S.	Steel
EL080-58909	D1260HA	4	1-1/2	1/2	3/8	C.R.S.	Steel
EL080-50924	D1260BS	6	1-1/2	1/2	3/8	C.R.S.	Steel



Side supported roller offset on front side of lever machined with straight sides

Style S - *Side Roller Type*

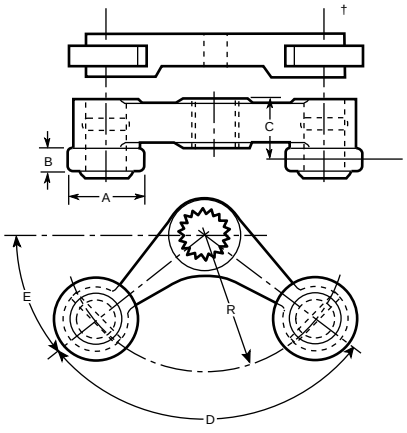
Ordering Numbers						Material	
Part Number	**Reference**	**L**	**A**	**B**	**C**	**Lever**	**Roller**
EL150-53303	—	1-1/2	3/4	3/4	7/8	C.R.S.	Bryl. Cop.
EL150-53301	D1260A	1-1/2	3/4	1/4	5/8	C.R.S.	Steel
EL150-53300	D1260DU	1-1/2	3/4	3/4	7/8	C.R.S.	Steel
EL150-53901	D1260HV	1-1/2	1-1/4	1/4	5/8	C.R.S.	Steel
EL150-55300	—	2	3/4	1/2	3/4	C.R.S.	Bryl. Cop.
EL150-55303	D1260DT	2	3/4	1/4	5/8	C.R.S.	Steel
EL150-55301	D1260JJ	2	3/4	1/2	3/4	C.R.S.	C.R.S.
EL150-56300	D1260DX	2-1/2	3/4	1/4	5/8	C.R.S.	C.R.S.
EL150-56500	—	2-1/2	1	1/2	3/4	C.R.S.	S.S.
EL150-57300	D1260DO	2-3/4	3/4	1/4	5/8	C.R.S.	C.R.S.
EL150-58901	—	4	1-1/4	1/4	5/8	Bronze	Nylon
EL150-58902	—	4	1-1/4	1/4	5/8	Bronze	Steel



Right angle offset lever has side-supported roller mounted on end.

Style SLO - *Side Roller Lever Offset Type*

Ordering Numbers						Material	
Part Number	**Reference**	**L**	**A**	**B**	**C**	**Lever**	**Roller**
EL090-53324	D1260GZ	1-1/2	3/4	1/4	1	Bronze	Steel
EL090-53336	—	1-1/2	3/4	1/4	1-3/8	Bronze	Nylon
EL090-53321	D1260CT	1-1/2	3/4	1/4	1-3/8	Bronze	Steel
EL090-53322	—	1-1/2	3/4	1/4	1-3/8	Bronze	Bryl. Cop.
EL090-53328	D1260GV	1-1/2	3/4	1/4	2	Bronze	Steel



Angle type rocker arm has both side-supported rollers mounted on same side.

Style TS - *Two Roller Same Side*

Ordering Numbers								Material	
Part Number	**Reference**	**R**	**A**	**B**	**C**	**D**	**E**	**Lever**	**Roller**
EL040-50327	D1260CM	1-3/8	3/4	1/4	5/8	107°34'	36°	Bronze	Steel
EL040-50328	D1260JQ	1-3/8	3/4	1/2	3/4	107°34'	36°	Bronze	Steel
†EL040-58904	D1260JH	3	1-1/2	1/2	3/4	150°	15°	Bronze	Steel
†EL040-58905	—	3	1-1/2	1/2	3/4	150°	15°	Bronze	Bryl. Cop.

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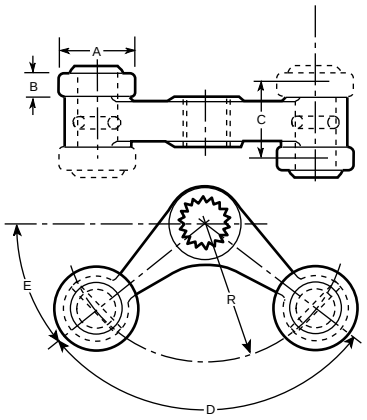
Operating Levers

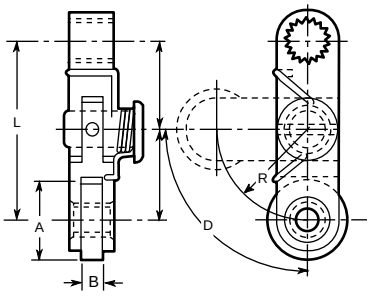
For Series EA040, 060, 080, 130, 140, 170, 700, 710, 730, 760, 770, 780, 790, 800, 880, 990 Only



Angle type rocker lever has side-supported rollers mounted on opposite sides

Style TSO - *Two Roller Opposite Side*

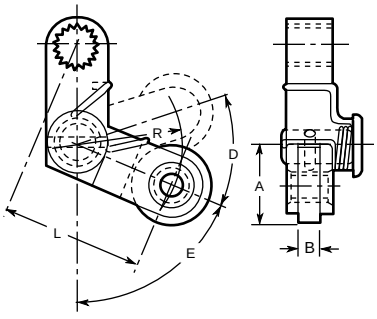
Ordering Numbers								Material	
Part Number	Reference	R	A	B	C	D	E	Lever	Roller
EL030-50301	D1260AA	1-3/8	3/4	1/4	3/4	107°34'	36°13'	Bronze	Steel
EL030-50302	D1260DH	1-3/8	3/4	1/2	1	107°34'	36°13'	Bronze	Steel
EL030-52322	D1260DQ	1-1/2	3/4	3/4	1-1/4	90°	45°	Bronze	Steel



Single-loaded lever with straddle-supported roller. Used where switch action is required in one direction only—return movement of actuating mechanism does not operate the switch.

Style KR - *Knee Action Straight Type*

Ordering Numbers							Material	
Part Number	Reference	R	A	B	D	L	Lever	Roller
EL100-55401	D1260JM	1	7/8	1/4	90°	2	Steel	Steel
EL100-55402	—	1	7/8	1/4	90°	2	Steel	Bryl. Cop.
EL100-55403	—	1	7/8	1/4	90°	2	Steel	S.S.

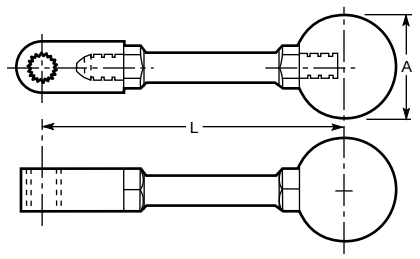


Spring-loaded offset lever with straddle-supported roller. Used where switch action is required in one direction only—return movement of actuating mechanism does not operate switch.

Style KRO - *Knee Action Offset Type*

Ordering Numbers								Material	
Part Number	Reference	R	A	B	D	E	L	Lever	Roller
EL110-50401	D1260JV	1-1/8	7/8	1/4	41°30'	67°30'	1-7/8	Steel	Steel

For Series EA040, 060, 080, 130, 140, 170, 700, 710, 730, 760, 770, 780, 790, 800, 880, 990 Only

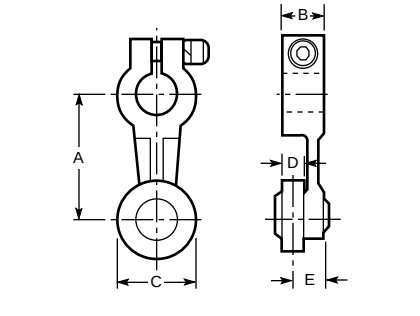


Steel shaft with bakelite knob.

Style M - *Manual Type*

Ordering Numbers				Material	
Part Number	**Reference**	**L**	**A**	**Lever**	**Knob**
EL050-58900	D1260EP-3	3	1-3/8	Steel	Bakelite
EL050-59901	D1260EP-1	4-1/16	1-3/8	Steel	Bakelite
EL050-59900	D1260EP	6-5/16	1-3/8	Steel	Bakelite

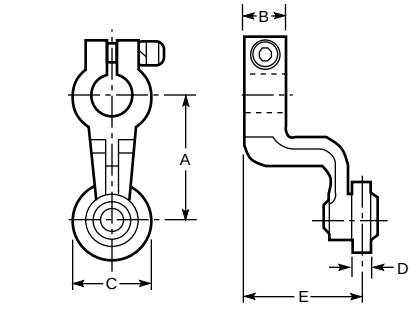
For Series EA700, 710, 730, 760, 770, 780, 790, 800, 880, 990 Only



Nickel Plate Steel (N.P.S.) Lever Nickel Plated

Straight

Ordering Numbers							Material	
Part Number	**Reference**	**A**	**B**	**C**	**D**	**E**	**Lever**	**Roller**
EL010-62401	SL-160	1-1/2	1/2	7/8	9/32	25/64	Zinc	Steel
EL010-63414	SL-160K	1-1/2	1/2	7/8	9/32	25/64	Zinc	S.S.
EL010-63415	SL-160N	1-1/2	1/2	7/8	9/32	25/64	Zinc	Nylon



Lever Nickel Plated

Offset

Ordering Numbers							Material	
Part Number	**Reference**	**A**	**B**	**C**	**D**	**E**	**Lever**	**Roller**
EL020-63412	SL-160C	1-1/2	1/2	7/8	9/32	1-7/16	Zinc	Steel
EL020-63414	SL-160L	1-1/2	1/2	7/8	9/32	1-7/16	Zinc	Nylon
EL020-63415	SL-160S	1-1/2	1/2	7/8	9/32	1-7/16	Zinc	S.S.

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Operating Levers

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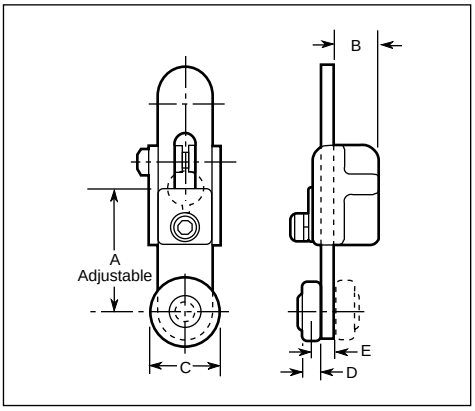
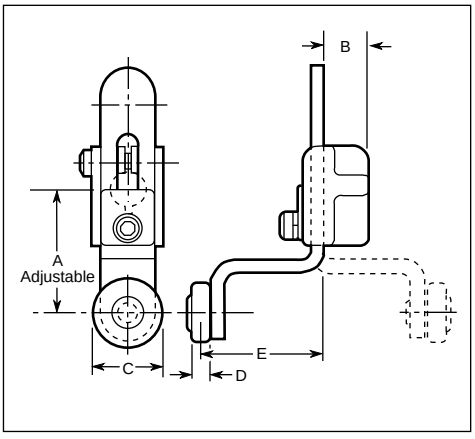


Adjustable Straight

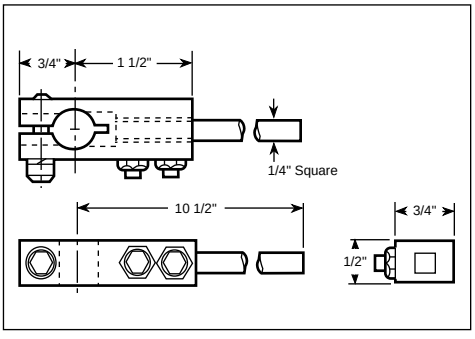
Ordering Numbers							Material	
Part Number	Reference	A	B	C	D	E	Lever	Roller
EL120-60400	SL-170A	1-3/4-3	21/32	7/8	9/32	11/32	Steel	Steel
EL120-60600	SL-170C	1-7/8-3	21/32	2	9/32	11/32	Steel	Steel
EL120-69415	SL-170K	1-3/4-3	21/32	7/8	9/32	11/32	Steel	Nylon
EL120-69421	SL-170R	3-3/4-5	21/32	7/8	9/32	11/32	Steel	Steel
EL120-60601	—	3-3/4-5	21/32	2	9/32	11/32	Steel	Steel



Adjustable Offset

Ordering Numbers							Material	
Part Number	Reference	A	B	C	D	E	Lever	Roller
EL130-64410	SL-170	1-3/4-3	21/32	7/8	9/32	1-25/32	Steel	Steel
EL130-69410	SL-170D	1-3/4-3	21/32	7/8	9/32	1-25/32	Steel	Nylon
EL130-69412	SL-170F	1-3/4-3	21/32	7/8	9/32	2-3/8	Steel	Steel
EL130-69413	SL-170G	1-3/4-3	21/32	7/8	9/32	3-1/2	Steel	Steel
EL130-69414	SL-170J	1-3/4-3	21/32	7/8	9/32	15/16	Steel	Steel
***EL130-69411**	SL-170E	1-3/4-3	21/32	7/8	9/32	1-9/32	Steel	Steel
EL130-20401	—	1-3/4-3	21/32	7/8	17/64	3-1/2	Steel	Nylon

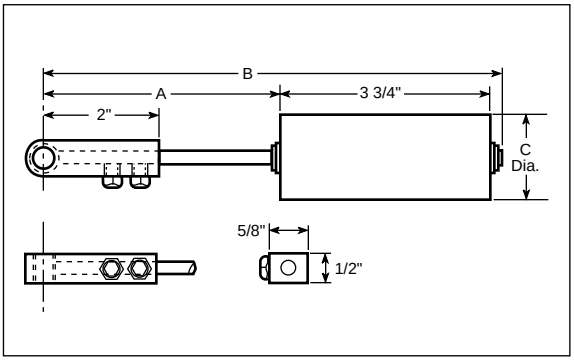
**Roller mounted on opposite side*



Rod Lever

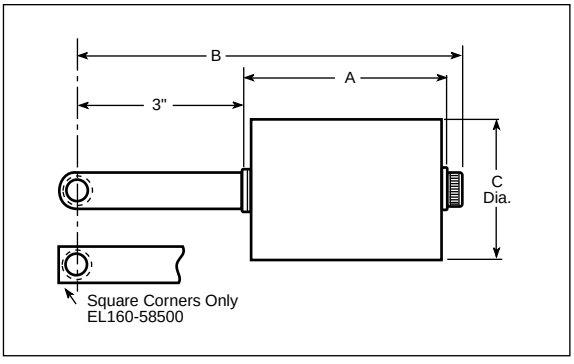
Ordering Numbers			
Part Number	Reference	Dimensions	Material
EL140-69917	SL170M-1	Other rod lengths available to suit requirements	Steel Rod

For Series EA040, 060, 080, 130, 140, 170, 700, 710, 730, 760, 770, 780, 790, 800, 880, 990 Only



Style VR - *Belt Mis-Alignment Lever-Adjustable*

Ordering Number	"A" (Adjustable)	"B" Max.	"C" Dia.	Material Lever	Material Roller
EL140-58500	4.45/3.82"	8.38"	1.50"	Steel	Delrin
EL140-58600	4.45/3.82"	8.38"	2.50"	Steel	Delrin



Style YR - *Belt Mis-Alignment Lever*

Ordering Number	"A"	"B" Max.	"C" Dia.	Material Lever	Material Roller
EL160-58500	2.24"	5.64"	1.25"	Steel	Nylon
EL160-58600	3.50"	6.90"	2.50"	Steel	Nylon

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Limit Switches

Proper Application of Limit Switches General Information

Limit switches are used to convert a mechanical motion into an electrical control signal. The mechanical motion is usually in the form of a cam, a machine component or an object moving toward a predetermined position. The cam engages the limit switch lever or plunger and this in turn makes or breaks an electrical contact inside the switch. This electrical control signal is then used to limit position or reverse the machine travel, or to initiate another operating sequence. It can also be used for counting, sorting or as a safety device.

Typical limit switch applications are in the control circuits of solenoids, control relays and motor starters which control the motion of machine tools, conveyors, hoists, elevators and practically every type of motor driven machine.

Experience has shown that most limit switch failures are the fault of the installation. In some cases an installation that is not perfect cannot be avoided, but in the majority of cases, proper application of the limit switch would have prevented failure. For application assistance, call 1-800-NAMTECH.

Definition of Limit Switch Terms

Actuator - Mechanism of the switch or switch enclosure which operates the contacts, i.e. lever arm, plunger, wobble stick.

Break - To open an electrical circuit.

Cam - Machine part or component that applies force to switch actuator causing actuator to move as intended. See also “Dog.”

Cam Track - Distance from switch mounting surface to a specified point on actuator.

Differential Travel - Distance or angle from the operating position to the reset position.

Direct-Acting Contacts - Contacts are moved directly by the operating shaft. In general should only be used where movement of actuator must break welded contacts, as in a crane safety limit switch.

Dog - Machine part or component that applies force to switch actuator causing actuator to move as intended. See also “Cam.”

Double Break - Contacts open circuit at two points.

Double Pole Double Throw (DPDT) - Switches which make and break two separate circuits. This circuit provides a normally open and normally closed contact for each pole.

Free Position - Position of switch actuator when no external force (other than gravity) is applied on the actuator. See also “Initial Position” and “Normal Position.”

Initial Position - Position of switch actuator when no external force (other than gravity) is applied on the actuator. See also “Free Position” and “Normal Position.”

Maintained Contact Switch - Designed for applications requiring sustained contact after actuator has been released, but with provision for resetting.

Make - To close or establish an electrical circuit.

Momentary Contact Switch - A switch which returns from the operated condition to normal condition when actuating force is removed. See also “Spring Return.”

Neutral Position Limit Switch - Lever arm type switch with two sets of contacts, one of which operates when the shaft is rotated clockwise and the other of which operates when the shaft is rotated counter-clockwise.

Normal Position - Position of switch actuator when no external force (other than gravity) is applied to actuator. See also “Free Position” and “Initial Position.”

Normally Closed Contact (N.C.) - Contacts that move to the closed position when no external force is on the actuator.

Normally Open Contacts (N.O.) - Contacts that move to the open position when no external force is on the actuator.

Operating Force - Amount of force applied to the actuator to cause contact operation.

Operating Position - Position of the actuator at which the contacts move to the operated position. See also "Trip Position."

Overtravel - Movement of the actuator beyond the operating position.

Pilot Duty Rating - Rating of contacts when making and breaking inductive loads such as coil and solenoids.

Pole - Parts necessary to control one conductor of a circuit.

Precision Snap Acting Switch - An electromechanical switch having predetermined and accurately controlled characteristics and having a spring loaded, quick make-and-break contact action.

Pretravel - Distance or angle through which the actuator moves from the normal position to the operating position.

Reset Position - Position of actuator at which contacts return to the normal position. See also "Releasing Position."

Releasing Position - Position of actuator at which contacts return to the normal position. See also "Reset Position."

Repeat Accuracy - Ability of a switch to repeat its characteristics precisely from one operation to the next operation. See also "Repeatability."

Repeatability - Ability of a switch to repeat its characteristics precisely from one operation to the next operation. See also "Repeat Accuracy."

Single Pole Double Throw (SPDT) - Switches which make and break one circuit. Circuit provides one normally open and one normally closed contact.

Slow Make-and-Break Contacts - The speed of contact transfer is directly dependent on the speed of the operating shaft.

Snap Action - Rapid motion of the contacts from one position to another position or their return. This action is relatively independent of the rate of travel of the actuator.

Snap Back - Sudden return of actuator to normal position.

Spring Return Switch - A switch which returns from operated condition to normal condition when actuating force is removed. See also "Momentary Contact Switch."

Trip Position - Position of the actuator at which the contacts move to the operated position. See also "Operating Position."

Total Travel - Distance from actuator-free position to over-travel limit position.

Actuator Design

For maximum limit switch life, the force applied to the lever arm by a cam should be perpendicular to the lever arm. This means that the cam angle and lever arm angle should be the same.

A good recommended cam angle and lever arm angle at moderate cam speeds (up to 90 fpm) is 45°, see Figure 1-1. Here lever acceleration is less and deceleration is also less at the lower cam edge.

The arrangement shown in Figure 1-2 is satisfactory only at cam speeds below 50 fpm. At higher speeds, the impact due to high lever acceleration causes excess roller bounce. Rapid deceleration occurs at the lower cam edge.

The cam trailing edge on overriding cams must also be considered for maximum switch life, see Figure 1-3. Lever arm snap back causes shock loads which reduce switch life. Also, with reversing cams the trailing edge becomes a leading edge on the return stroke.

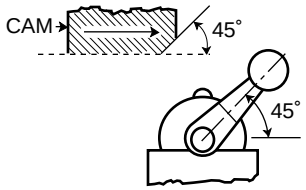

Figure 1.1
Recommended for moderate cam speeds - up to 90 fpm
Non-overriding cams

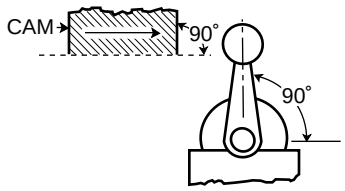

Figure 1.2
Satisfactory only for low cam speeds - 50 fpm or less
Non-overriding cams

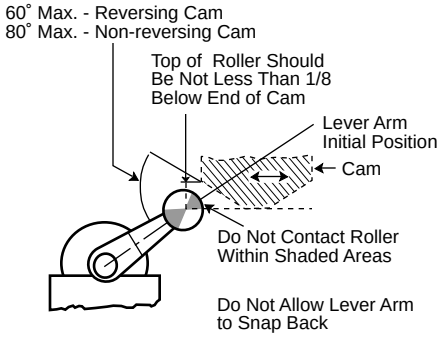

Figure 1.3
For overriding cams - up to 90 fpm

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Electrical Ratings

RATINGS —

Many control applications involve high inductive loads such as starter, contactor and relay coils; solenoids and clutches. In order to apply a control device correctly, the inductive rating must be known. Ratings are generally listed in three ways:

1. Resistive or non-inductive.
2. Inductive (pilot duty).
3. Continuous.

Resistive or non-inductive ratings - This rating indicates the resistive load only that the contacts make or break. Resistive ratings are generally based on a 75% minimum power factor for AC.

Inductive (pilot duty) ratings - The inductive rating indicates the non-motor inductive load, such as the contactors, relays and other remotely controlled devices that the contacts can make or break. These ratings usually are based on a 35% power factor for AC.

Continuous rating - Continuous rating indicates the load that the contacts can carry continuously without making or breaking the circuit.

The inductive rating is always less than the resistive or continuous rating. When contacts break an inductive circuit, the inductance in the load tends to keep the current flowing in the same direction. The result is an arc across the contacts which causes heating and burning of the contacts. Because of the extra heat generated, the allowable inductive current must be less than the resistive current for equal contact life.

Quick make and quick break (snap-action) contacts reduce the arcing time and allow higher inductive ratings than with slow make-or-break contacts. AC inductive coil loads have a momentary inrush current of approximately 10 times the sealed current. Contacts must be able to break or interrupt the inrush current in an emergency.

Excessive load - If the load exceeds the ratings of the limit switch being used, a control relay (CR) or contactor with proper ratings can be used as in Figure 1-4.

The DC current ratings of a device can be increased by placing contacts in series. This effectively increases the contact gap allowing a higher current rating. In general, the following ratings can be applied:

2 contacts in series — DC rating x 2.5

3 contacts in series — DC rating x 5

Current should never exceed the maximum continuous current rating of the device.

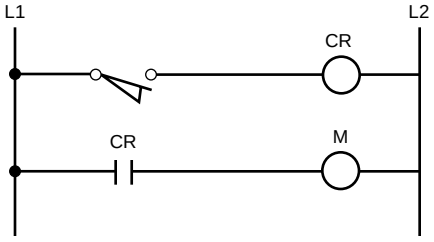

Figure 1.4

Contact Resistance

RESISTANCE OF SNAP SWITCHES

Snap switch resistance is the total electrical resistance that a snap switch adds to the circuit and consists of:

Conducting Path. Includes all terminals, inserts, stationary contact material resistance, movable contact material resistance, movable blade assembly, and any other parts in the conducting circuit.

Constriction Resistance of all joints, discontinuities, or interfaces. This is the resistance caused by limited mating surfaces through which the load must pass. If the movable and stationary contact tips are viewed through a microscope, it can be seen that they only touch at a very few points. Thus, increased resistance is presented to the current. If the current is high enough, the points of constriction are softened and enlarged through thermal effects and the resistance decreases.

Film resistance. It is well known that silver accumulates a surface resistance due to chemical reaction with its environment. The most common reaction is with sulfur and oxygen which creates a sulfide and an oxide of silver. Such a surface is known to have some resistance which can be read with a low voltage instrument such as an ohmmeter. These surfaces, however, have the characteristic of being self-clearing. When current is passed through such a surface, it creates heat which, in turn, reduces the compound to pure silver again and restores the contact to a low ohmic value. This has long been the characteristic which has made silver such a good selection for contact materials.

Standard contacts can be gold plated to reduce switch resistance, but may not provide sufficient increase in reliability to warrant the added cost. For example, if the contact material underneath is exposed at any point due to excessive current or normal mechanical wear, a contaminating film may develop and will eventually creep over the plated portion. Long-term reliability is then no better than with standard contacts.

Particle resistance. Contamination in the form of foreign material can also produce resistance. Carefully controlled production processes are used to prevent contamination during assembly of snap switches.

Namco limit switches are designed for use with industrial control equipment where voltages are relatively high — normally 120 volts or higher — and current levels are high — normally .25 amperes or higher. An increase in switch resistance may appear to be more critical in high energy circuits because it represents a greater percentage of total circuit impedance; however, the arcing produced breaks down or burns away the contaminants, reducing the actual resistance seen by the load.

Switch resistance in dry circuit (low voltage, low current) applications is more of a problem, but the resistance has to be quite high to significantly affect operation. For example, a solid state circuit operating at 20 volts and 1 ma has a circuit resistance of 20 divided by (1×10^{-3}) or 20,000 ohms. A Snap-Lock switch with 10 ohms resistance would have little effect. The problem arises with film or particle resistance which can be quite high or even present an open circuit. Use of snap switches with dry circuits is not recommended because these voltages and currents are not high enough to reduce the silver sulfide or silver oxide to pure silver or to burn away other contaminants present.

An ohmmeter test on Snap-Lock switches is unreliable because the most common voltage source in an ohmmeter is a 1.5 volt battery and to snap switch contacts being tested, this is just another dry circuit load. Several ohmmeter readings of the same contacts may vary from a few hundredths of an ohm to several ohms, yet the contacts will work perfectly with a nominal coil load.

Recommendations for Application and Testing of Limit Switch Contacts

Standard Namco limit switches are normally recommended for use with industrial control devices, not dry circuits. If lower voltages are present, the current drawn through the contacts should be on order of .25 amperes in order to maintain proper continuity.

To test continuity in the field, a six volt, .25 ampere pilot light is recommended.

Do not use an ohmmeter to test continuity.

An ohmmeter is a reliable test only if the snap switch is to be used with a dry circuit and, as stated above, this is normally not recommended.

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Wiring and Mounting

- Unless specifically designed for such service, limit switches SHOULD NOT BE submerged in or splashed with oils, coolants or other liquids. CONSULT FACTORY.
- Limit switches MUST NOT BE used in locations where temperature or atmospheric conditions are beyond those for which they have been specifically designed.
- Power from different sources MUST NOT BE connected to the contact of one limit switch unless specifically designed for such service.
- Limit switches MUST BE used within their contact ratings. Refer to switch label on cover for electrical ratings and the appropriate limit switch bulletin for acceptable environmental conditions in which the switch has been designed to function properly.
- Limit switches SHOULD BE mounted rigidly and in readily accessible locations, with suitable clearances to permit easy service and replacement when necessary. Cover plates SHOULD face the maintenance access point.
- Limit switches SHOULD BE placed in locations where machining chips do not accumulate under normal operating conditions to avoid chip interference with the lever operation.
- Opposite polarities MUST NOT BE connected to the contacts of one limit switch unless the limit switch is specifically designed for such service.

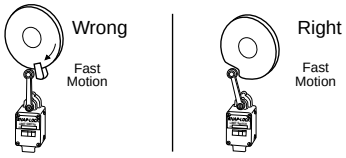
Limit Switch Selection

Selection of the proper electro-mechanical limit switch for an application generally breaks down into two major decisions, choosing the proper actuator (lever) and choosing the proper enclosure. There are other considerations, such as what operating sequences are available, temperature rating and electrical rating. These vary from switch type to switch type.

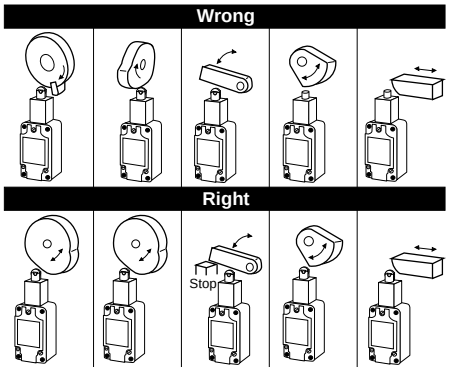
Selection of Limit Switch Actuator — Selection of a suitable actuator depends on the shape, speed, direction and total travel of the cam or part being used to trip the limit switch and the accuracy desired. See Operating Levers Section for levers offered fitting Namco limit switches.

Actuator Consideration

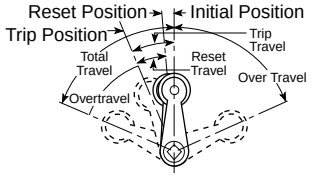
- Where relatively slow motions operate the limit switch, a snap-acting or snap-lock design SHOULD BE used.
- Where relatively fast motions are involved, cam arrangement SHOULD BE such that the actuator does not receive a severe impact.
- Where relatively fast motions are involved, cams MUST BE designed such that the limit switch will be held operated long enough to operate relays, valves, etc.



- For limit switches with pushrod actuators, the actuating force SHOULD BE applied as nearly as possible in line with the pushrod axis.

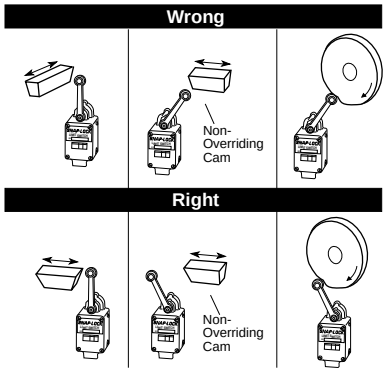


- Limit switches MUST NOT BE operated beyond the manufacturer's recommended travel. Operating positions and lever travel terminology are illustrated in drawing below. For specifications of a specific switch, refer to the switch bulletin.



NOTE: When loosening or tightening the pipe plug or set screw used to clamp the actuating lever in the desired position, care must be exercised to restrain the shaft/ lever assembly so as not to transmit the applied torque to the switch itself.

- Cam or dog arrangements SHOULD BE such that the actuator is not suddenly released to snap back freely unless specifically designed for such service.
- For limit switches with lever actuators, the actuating force SHOULD BE applied as nearly perpendicular to the lever as practical and perpendicular to the shaft axis in which the lever rotates.



- A limit switch actuator MUST BE allowed to move far enough for positive operation of the contacts.
- Limit switches MUST BE mounted in locations which will prevent false operation by normal movements of operator or machine components.
- Limit switches are designed for proper performance with the actuators with which they are supplied. Supplementary actuators SHOULD NOT BE used unless the limit switches are specifically designed for them.
- Operating mechanisms for limit switches MUST BE so designed that, under any operating or emergency conditions, the limit switch is not operated beyond its overtravel limit position. A limit switch MUST NOT BE used as a mechanical stop.

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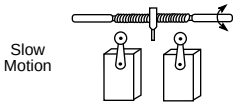
Cam Design

The most important consideration in the proper application of limit switches is external cam design. The majority of limit switch failures can be traced to poor cam design. Excessive overtravel and/or excessive snap back of the operating lever arm are the most common abuses. Good cam design will greatly increase the life of a limit switch.

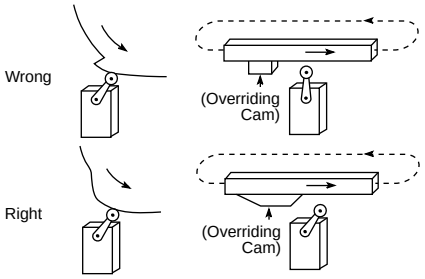
Listed below are general rules for the proper design and application of limit switch cams published by NEMA in Standards Publication ICS2-225.

ICS2-225.83 - Where relatively slow motions operate the limit switch, it should generally be snap acting.



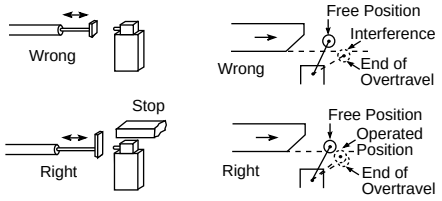
ICS2-225.84 - Where relatively fast motions are involved, cam arrangements should be such that the actuator does not receive a severe impact

ICS2-225.85 - Cam or dog arrangements should be such that the actuator is not suddenly released to snap back freely.

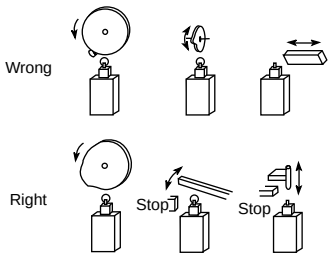


ICS2-225.86 - Where relatively fast motions are involved, cams should be designed such that the limit switch will be held operated long enough to operate relays, valves, etc.

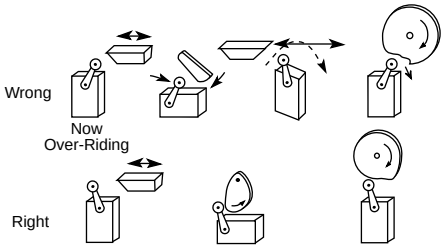
ICS2-225.88 - Operating mechanisms for limit switches should be so designed that under any operating or emergency conditions, the limit switch is not operated beyond its overtravel limit position. A limit switch should not be used as a mechanical stop.



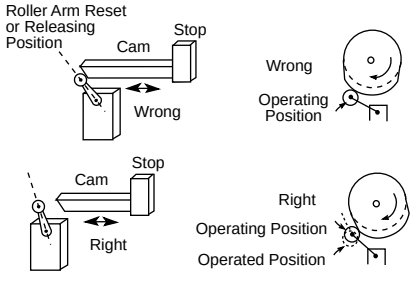
ICS2-225.89 - For limit switches with pushrod actuators, the actuating force should be applied as nearly as possible in line with the push rod axis.



ICS2-225.90 - For limit switches with lever actuators, the actuating force should be applied as nearly perpendicular to the lever as practical, and perpendicular to the shaft axis about which the lever rotates.



ICS2-225.91 - A limit switch actuator must be allowed to move far enough for positive operation of the contacts.



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UL Listing of Namco Switches

The following is a list of all switches which are listed with Underwriters Laboratories:

File: E12967 Special Use Switches

Switch Marking: Underwriters Laboratory Inc. Recognized Snap Switch

Listed Switches: EA700-10000, -10001, -10100, -40000, -40001, -40100, -70000, -70001, -70100, -20000, -20001, -20100, -50000, -50001, 50100, -80000, -80001, -80100, -30000, -30001, -30100, -60000, -60001, -60100, -90000, -90001, -90100

File: E23331, Snap Switches for Use in Hazardous Locations

Switch Marking: Listed 921M

Listed Switches: EA800-10040, -10050, -10060, -10944, -10954, -10964, -20040, -20050, -20060, -20944, -20954, -20964, -30040, -30050, -30060, -30944, -30954, -30964

File: E59180, Industrial Control Equipment, Auxiliary Devices

Switch Marking: Listed Industrial Control EQ145M

Listed Switches: EA040-11105, EA040-21105, EA060-11105, EA060-21105, EA080-11105, EA080-21105

File: E62691, Industrial Control Equipment, Auxiliary Devices for use in Hazardous Locations

Switch Marking: Listed Industrial Control EQ for Haz Loc 727U

Listed Switches: EA880-11100, -11200, -11500, -11600, -12100, -12200, -12500, -12600, -13100, -13200, -13500, -13600

As presently produced, the EA170 and EA180 switches are not listed.

ICS 6-110.01 Definitions

Acid-resistant - Acid-resistant means so constructed that it will not be injured readily by exposure to acid fumes.
NEMA Standard 12-8-1972.

Dripproof - Dripproof means so constructed or protected that falling dirt or drops of liquid will not interfere with the successful operation of the apparatus under specified test conditions. See ICS 6-110.52.
NEMA Standard 7-16-1969.

Driptight - Driptight means so constructed or protected as to exclude falling dirt or drops of liquid under specified test conditions. See ICS 6-110.52.
NEMA Standard 7-16-1969.

Dusttight - Dusttight means so constructed as to meet the requirements of a specified dusttightness test. See ICS 6-110.54.
NEMA Standard 7-16-1969.

External Mounting - External mounting means enclosure mounting provisions external to the apparatus cavity.
NEMA Standard 7-16-1969.

Flush Mounting - Flush mounting means so designed as to have a minimal front projection when set into and secured to a flat surface.
NEMA Standard 7-16-1969.

Knockout - A knockout is a portion of the wall of a box or cabinet so fashioned that it may be removed readily by a hammer, screwdriver, and pliers at the time of installation in order to provide a hole for the attachment of a raceway cable or fitting.
NEMA Standard 7-16-1969.

Hazardous Locations - Hazardous locations are those areas which may contain hazardous materials in sufficient quantity to create an explosion. See Article 50 of the *National Electrical Code*.
NEMA Standard 7-16-1969.

Nonventilated - Nonventilated means so constructed as to provide no intentional circulation of external air through the enclosure.
NEMA Standard 7-16-1969.

Outdoor - Outdoor means suitable for installation where exposed to the weather.
NEMA Standard 7-16-1969.

Proof (Used as a Suffix) - Proof (used as a suffix) means so constructed, protected or treated that successful operation of the apparatus is not interfered with when subjected to the specified material or condition.
NEMA Standard 7-16-1969.

Rainproof - Rainproof means so constructed, protected or treated as to prevent rain under specified test conditions from interfering with successful operation of the apparatus. See ICS 6-110.53.
NEMA Standard 7-16-1969.

Raintight - Raintight means so constructed or protected as to exclude rain under specified test conditions. See ICS 6-110.53
NEMA Standard 7-16-1969.

Resistant (Used as a Suffix) - Resistant (used as a suffix) means so constructed, protected, or treated that the apparatus will not be damaged when subjected to the specified material or conditions for a specified time.
NEMA Standard 7-16-1969.

Sleetproof - Sleetproof means so constructed or protected that the accumulation of sleet (ice) under specified test conditions will not interfere with the successful operation of the apparatus including external operating mechanism(s). See ICS 6-110.55.
NEMA Standard 7-16-1969.

Sleet-resistant - Sleet-resistant means so constructed that the accumulation and melting of sleet (ice) under specified test conditions will not damage the apparatus. See ICS 6-110.55.
NEMA Standard 7-16-1969.

Submersible - Submersible means so constructed as to exclude water when submerged in water under specified test conditions of pressure and time.
NEMA Standard 7-16-1969.

Tight (Used as a Suffix) - Tight (used as a suffix) means so constructed that the enclosure will exclude the specified material under specified conditions.
NEMA Standard 7-16-1969.

Watertight - Watertight means so constructed as to exclude water applied in the form of a hose stream under specified test conditions. See ICS 6-110.56.
NEMA Standard 7-16-1969.

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Industry-Proven Solenoids

EB200 Series

The EB200 series industrial solenoids are available in standard base and side mountings and have stainless steel saddle type retainers. They are available in stacking widths of 1/2, 3/4, 1 and 1-1/4 inches. Standard versions available for 115, 230, 460V, 60 Hz.

Features include:

- 1/2 inch stroke
- 115, 230, and 460V, 60 Hz models
- 2 to 10 pound pull or push force
- Standard side and base mounting
- 1-1/2" long stainless steel round loose push pin available at additional charge
- Captive pin is also available at additional cost. (Pin has head or shoulder which serves to hold it in place in the solenoid.)
- -10°C to 30°C ambient environment
- Rated for continuous duty

EB450 Series

Series EB450 solenoids are available with pull and push force of 7 to 11 pounds and a stroke up to 1 inch. The EB450 series is rated for continuous duty. Available in stacking widths of 3/4 and 1 inch. They are designed with stainless steel saddle stops. All models have through holes in stack for mounting.

Features include:

- 1 inch stroke
- 115, 460V, 60 Hz standard
- 7 to 11 pound pull or push force
- -10°C to 30°C ambient environment
- Rated for continuous duty

EB600 Series

Series EB600 solenoids are available in pull or push versions with stacking widths of
1/2, 3/4 and 1. Designed with stainless steel saddle stops and have .5 inch stroke maximum. All models have through holes in stack for mounting.

Features include:

- .5 inch stroke
- 115, 230, 60 Hz
- 3 to 8 pound pull or push force
- -10°C to 30°C ambient environment
- Rated for continuous service

EB710 Series

The EB710 series industrial solenoids are designed for use in Class B insulation systems with ambient temperatures ranging from
-10°C to 30°C with occasional excursions to 40°C. They are available in stacking widths of 1/4, 1, 1-1/4 and 2 inches and feature universal mounting brackets. They can be equipped with special coils to enable them to function under a wide range of severe industrial environments.

Features include:

- 10 to 30 pound push or pull force
- Stainless steel saddle-type retainers
- 115, 230, and 460, 60 Hz model
- 1 inch stroke
- -10°C to 30°C ambient environment
- Rated for continuous duty

The EB710 series is intended to replace the EB700 series.

Call or write for your free 18-page Namco Solenoid catalog.

General Information

Price Lists

All price lists are covered in separate publications and are subject to change without notice.

Application Assistance

NAMCO sales representatives are available to assist with the specification and selection of NAMCO products. If additional assistance is required, you may refer requests directly to the Marketing Department.

For more detailed technical information, questions on specially manufactured units or any questions concerning non-standard items, requests should be referred to the appropriate applications engineers. Application engineering assistance is available for all Namco products.

Hot Line 1-800-NAMTECH 1-800-626-8324

Hotline calls go directly to the Application Department and are intended for technical support only.

Customer Service

Customer Service personnel deal with day-to-day order requirements including standard pricing and product availability.

NAMCO
Customer Service
Mayfield Village, Ohio 44143
(440) 460-1360
FAX (440) 460-3800

Customer Service is available from 8:00 a.m. until 5:00 p.m., Eastern Standard Time.

Returned Goods

Returned goods are governed by provisions as stated in "Conditions of Sale." All requests for material return must be made in writing to the Supervisor of Customer Service at NAMCO's Mentor office, or to the local NAMCO representative who will obtain written returned goods authorization.

Only standard stock items qualify for normal return. Any non-stock or made-to-order merchandise is non-returnable. Not all items listed in currently published catalogs are stock items. (See ANPL.)

All requests for return must be made within 30 days of original shipment. Once return authorization has been granted, material must be returned within 30 days or that authorization will be considered null and void. All authorized returns due to NAMCO error will be credited at the actual purchase price plus the actual cost of return motor freight less any handling charges necessary due to abuse or improper packing. All other requests for return, if authorized, must be returned with freight prepaid.

With the exception of items qualifying for return under warranty, any product which has been installed and used does not qualify for return under any circumstances.

Dimensions

For certified construction drawings, request as a separate item when ordering or contact customer service department.

WARNING:

A SWITCH IN A PROTECTIVE INTERLOCKING CIRCUIT SHOULD BE USED WITH AT LEAST ONE OTHER DEVICE THAT WILL PROVIDE A REDUNDANT PROTECTIVE FUNCTION, AND THE CIRCUIT SHOULD BE SO ARRANGED THAT EITHER DEVICE WILL INTERRUPT THE INTENDED OPERATION OF THE CONTROLLED EQUIPMENT. (PROPOSED NEMA ICS 2-225.95 ST'D.)

SERVICING ENERGIZED INDUSTRIAL CONTROL EQUIPMENT CAN BE HAZARDOUS. SEVERE INJURY OR DEATH CAN RESULT FROM ELECTRICAL SHOCK, BURN OR UNINTENDED ACTUATION OF CONTROLLED EQUIPMENT.

RECOMMENDED PRACTICE IS TO DISCONNECT AND LOCK OUT CONTROL EQUIPMENT FROM POWER SOURCES, AND DISCHARGE STORED ENERGY TO CAPACITORS, IF PRESENT. IF IT IS NECESSARY TO WORK IN THE VICINITY OF ENERGIZED EQUIPMENT, ONLY QUALIFIED PERSONNEL SHOULD BE PERMITTED TO PERFORM SUCH WORK, USING ALL APPLICABLE SAFETY PRACTICES AND PROTECTIVE EQUIPMENT.

The user should refer to NFPA 70B, RECOMMENDED PRACTICE FOR ELECTRICAL EQUIPMENT MAINTENANCE, published by the National Fire Protection Association, for additional information.

Conditions of Sale

NOTE: The following Conditions of Sale are subject to change. All Sales Transactions are subject to the latest published Conditions of Sale of Namco Controls Corporation and to any Special Conditions of Sale which may be contained in applicable Namco Controls Corporation quotations and acknowledgments.

1. ACCEPTANCE, GOVERNING PROVISIONS, AND CANCELLATIONS. No order for Seller's products or services shall be binding upon Seller until accepted in writing by an authorized official of Seller or by shipment or other performance of such order. Any such order shall be subject to these Conditions of Sale, and acceptance shall be expressly conditioned on assent to such Conditions, which assent shall be deemed given unless Purchaser shall expressly notify Seller to the contrary prior to any shipment or other performance of an order by Seller and, in any event, within five (5) days after receipt of any acknowledgment or confirmation of such order.

No order accepted by Seller may be altered or modified by Purchaser unless agreed to in writing signed by an authorized official of Seller, and no such order may be cancelled or terminated except upon payment of Seller's loss, damage and expense arising from such cancellation or termination.

No modified or other conditions will be recognized by Seller unless specifically agreed to in writing, and failure of Seller to object to provisions contained in any purchase order or other communication from a Purchaser (including, without limitation, penalty clauses of any kind) shall not be construed as a waiver of these Conditions nor an acceptance of any such provisions.

Any contract for sale and these Conditions shall be governed by and construed according to the Laws of the State of Ohio.

2. QUOTATIONS AND PRICES. Written quotations are conditioned upon acceptance by Purchaser within thirty (30) days from date issued and shall be considered as offers by Seller to sell during such thirty (30) day period unless sooner terminated by notice. Other Seller publications are maintained as sources of general information and are not quotations or offers to sell.

All prices are subject to change without notice. In the event of a net price change, the price of products on order but unshipped will be adjusted to the price in effect at the time of shipment. Downward adjustment of prices shall apply only to unshipped portions of outstanding orders.

Orders amounting to less than $250.00 net will be billed at $250.00 plus transportation charges.

All clerical errors are subject to correction.

3. PAYMENT TERMS. Except as may otherwise be stated in quotations, discount schedules, catalogs, or other Seller publications, terms of payment to Purchaser of satisfactory credit are 30 days net.

Seller reserves the right at any time to demand full or portion payment before proceeding with a contract of sale if, in its judgment, the financial condition of Purchaser shall not justify the terms of payment specified. If delivery is delayed or deferred by Purchaser beyond the scheduled date, payment shall be due in full when Seller is prepared to ship and the products may be stored at the risk and expense of Purchaser. If Purchaser defaults when any payment is due, then the whole contract price shall become due and payable upon demand, or Seller, at its option, without prejudice to other lawful remedies, may defer delivery or cancel the contract for sale.

4. TAXES AND OTHER CHARGES. Any manufacturer's tax, retailer's occupation tax, use tax, sales tax, excise tax (except the Federal excise tax on vehicles), duty, custom, inspection or testing fee, or other tax, fee or charge of any nature whatsoever, imposed by any governmental authority, on or measured by any transaction between Seller and Purchaser, shall be paid by Purchaser in addition to the prices quoted or invoiced. In the event Seller shall be required to pay any such tax, fee or charge, Purchaser shall reimburse Seller therefore; or, in lieu of such payment, Purchaser shall provide Seller at the time the order is submitted with an exemption certificate or other document acceptable to the authority imposing the same. Purchase orders must state the existence and amount of any such tax, fee or charge which it shall be Seller's responsibility to collect from Purchaser and pay.

5. DELIVERY. Delivery of product to a carrier at any of Seller's plants or other shipping point shall constitute delivery to Purchaser; and, regardless of freight payment, title and all risk of loss or damage in transit shall pass to Purchaser at that time.

Great care is taken in packing Seller's product. Seller cannot be held responsible for breakage after having received "in good order" receipts from the transportation company. All claims for loss and damage must be made by Purchaser to the carrier.

Claims for shortages or other errors must be made in writing to Seller within 30 days after receipt of shipment, and failure to give such notice shall constitute unqualified acceptance and a waiver of all such claims by Purchaser.

Except as may otherwise be stated in quotations, discount schedules, catalogs, or other Seller publications, freight will be allowed to the common carrier free delivery point nearest the destination on shipments within THE UNITED STATES EXCLUDING ALASKA AND HAWAII.

For shipment to ANY OTHER DESTINATION, INCLUDING ALASKA AND HAWAII, consult Seller's home office for terms that apply.

No allowance will be made in lieu of transportation if Purchaser accepts shipment at factory, warehouse, freight station, or otherwise supplies its own transportation.

Method and route of shipment will be at the discretion of Seller unless Purchaser shall specify otherwise, and any additional expense of the method or route of shipment specified by Purchaser shall be borne by Purchaser.

Seller reserves the right to make delivery in installments, unless otherwise expressly stipulated in the contract for sale; and all such installments when separately invoiced shall be paid for when due per invoice, without regard to subsequent deliveries. Delay in delivery of any installment shall not relieve Purchaser of its obligations to accept remaining deliveries. Seller shall not be liable for any damage as a result of any delay due to any cause beyond Seller's reasonable control, including, without limitation, an act of God, an act of Purchaser or Seller's supplier, embargo or other governmental act, regulation or request; fire, accident, strike, slowdown, war, riot, delay in transportation, and inability to obtain necessary labor, materials or manufacturing facilities. In the event of any such delay, the date of delivery shall be extended for a period equal to the time lost by reason of the delay.

6. SUBSTITUTES. Seller may furnish suitable substitutes for materials unobtainable because of priorities or regulations established by governmental authority or nonavailability of materials from suppliers, and assumes no liability for deviation from published dimensions and descriptive information not essential to proper performance of the product.

7. WARRANTY. Seller warrants products manufactured by it to be free from defects in materials and workmanship for a period of one (1) year from date of shipment to Purchaser. If within this period any such products shall be proven to Seller's reasonable satisfaction to be so defective, they shall be repaired or replaced at Seller's option. This warranty shall not apply to (a) products not manufactured by Seller, (b) products which shall have been repaired or altered by others than Seller so as, in its judgment, to affect same adversely, (c) products which shall have been subjected to negligence, accident or damage by circumstances beyond seller's control, or to improper operation, maintenance or storage, or to other than normal use or service. With respect to products not manufactured by Seller, the warranty obligations of Seller shall conform to the warranty actually extended to Seller by its supplier, subject to the limitations and exclusions hereafter stated. The foregoing warranties do not cover reimbursement for transportation, removal, installation, or other expenses which may be incurred in connection with repair or replacement.

Except as may be expressly provided in the authorized writing by Seller, Seller shall not be subject to any other obligations or liabilities whatsoever with respect to products manufactured by Seller or services rendered by Seller.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES EXCEPT WARRANTIES OF TITLE, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

8. LIMITATIONS OF LIABILITY AND REMEDIES. SELLER SHALL NOT BE LIABLE, AND PURCHASER WAIVES ALL CLAIMS AGAINST SELLER, FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER OR NOT BASED UPON SELLER'S NEGLIGENCE OR BREACH OF WARRANTY OR STRICT LIABILITY IN TORT OR ANY OTHER CAUSE OF ACTION. Buyer's exclusive remedy for any cause of action under this contract is a claim for damages and in no event will damages or any other recovery of any kind against Seller exceed the price of the specific products as to which the claim is made. Seller will not be liable to Purchaser for any loss, damage or injury to persons or property resulting from the handling, storage, transportation, resale or use of the products in manufacturing processes, or otherwise.

9. RETURN OF PRODUCTS. No products may be returned without first obtaining Seller's written permission and a returned material identification tag.

Products accepted for credit, not involving an error on Seller's part, shall be subject to a minimum service charge of 10% of the invoice price and all transportation charges shall be prepaid by Purchaser.

Returned products must be securely packed to reach Seller without damage; any cost incurred by Seller to put equipment in first class condition will be charged to Purchaser.

10. PATENTS. As to products proposed and furnished by Seller, Seller shall defend any suit or proceeding brought against Purchaser so far as based on a claim that said equipment constitutes an infringement of any patent of the United States, if notified promptly in writing and given authority, information and assistance at Seller's expense for the defense of the same. In event of a final award of costs and damages, Seller shall pay such award. In event the use of said product by Purchaser is enjoined in such a suit, Seller shall, at its own expense, either (a) procure for Purchaser the right to continue using said equipment, (b) modify said equipment to render it noninfringing, (c) replace said equipment with noninfringing equipment, or (d) refund the purchase price (less depreciation) and the transportation and installation costs of said equipment. Seller will not be responsible for any compromise or settlement made without its written consent.

The foregoing states the entire liability of Seller for patent infringement, and in no event shall seller be liable if the infringement charge is based on the use of Seller's products for a purpose other than that for which sold by Seller. As to any products furnished by Seller to Purchaser and manufactured in accordance with designs proposed by Purchaser, Purchaser shall indemnify Seller against any award made against Seller for patent, trademark, or copyright infringements.

11. NUCLEAR INDEMNITY BY PURCHASER. If the products furnished by Seller are to be used in any nuclear installation or activity, then Purchaser shall, or cause the ultimate user to (a) secure and maintain the maximum nuclear property damage and liability insurance protection available, (b) enter into and maintain a Government Indemnity Agreement and (c) waive and require its insurers to waive all rights of recovery or subrogation against Seller and its suppliers and subcontractors or every tier for, and indemnify and hold Seller harmless from and against, any claims, losses or damages whatsoever (including contractual or special damages of any kind) arising out of a Nuclear Incident as that term is defined in the Atomic Energy Act of 1954, as amended.