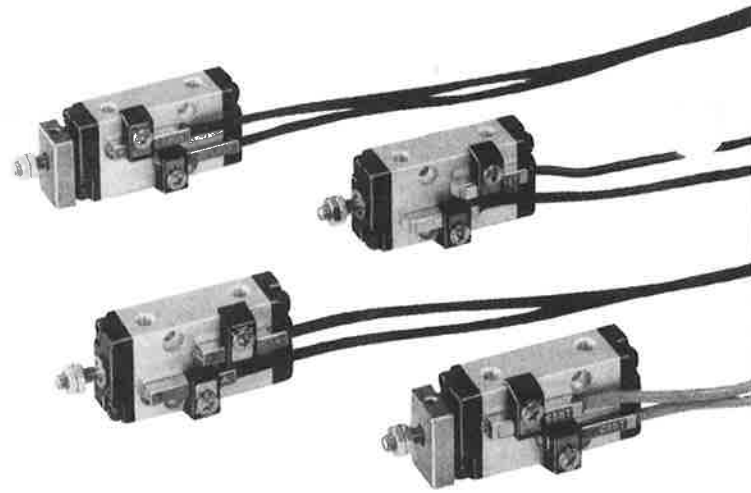
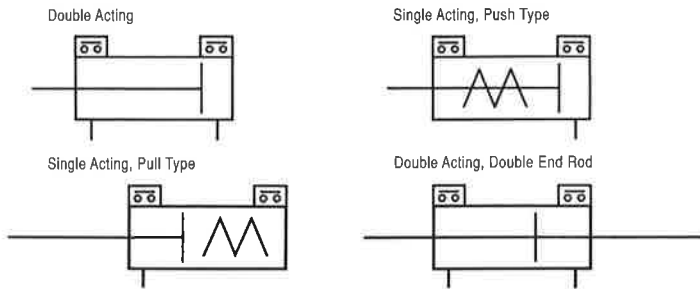


# SENSOR SWITCHES

## HALL EFFECT AND REED SWITCH TYPES

### SYMBOLS



### SPECIFICATIONS

Hall effect (solid state) type

Item	Model	
	ZC130□	ZC153□
Sensor type & operating method	DC 2-wire type, magnetic sensing	DC 3-wire type, magnetic sensing
Power supply voltage	—	4.5 ~ 28 VDC
Load voltage	10 ~ 28 VDC	4.5 ~ 28 VDC
Load current	4 ~ 50 mA	100 mA max.
ON current consumption	—	10 mA max. @ 24 VDC
Internal voltage drop*	3.5 V max.	0.5 V max @ 50 mA
Leakage current	1 mA @ 24 VDC	50 μA max. (24 VDC)
Delay time	1 ms max.	
Insulation resistance	100 ohms min. (At 500 VDC. Megger between case and lead wire)	
Dielectric strength	500 VAC 50/60 Hz. (Between case and lead wire)	
Shock resistance	30G (Non-repeated shock)	
Vibration resistance	9G (Total amplitude 1.5mm, 10-55 Hz.)	
Environmental protection	IP65 (IEC standard)	
Indicator lamp	ON: Red LED	
Lead wire	PVC insulated cable (2 x 24 AWG) White/Black x ℓ**	PVC insulated cable (3 x 24 AWG) White/Black/Red x ℓ**
Temperature range	32 ~ 140° F (0 ~ 60° C)	
Storage temperature	14 ~ 158° F (-10 ~ 70° C)	
Weight w/mounting bracket and suffix A lead wires	0.71 oz. (20 gf)	

\* Internal voltage drop depends on load current.

\*\* Lead wire length: A – 39 in. (nom.) 1000mm (actual); B – 118 in. (nom.) 3000mm (actual); C – 196 in. (nom.) 5000mm (actual).

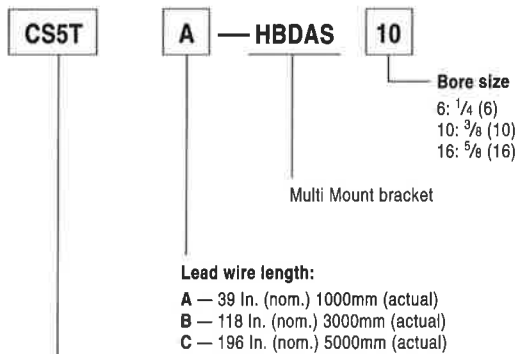
## Reed switch type

Item	Model	
	CS5T□	CS11T□
Sensor type & operating method	2-wire type magnetic sensing	
Power supply voltage	5 ~ 28 VDC, 85 ~ 115 VAC (r.m.s.)	10 ~ 28 VDC
Load current	0.1 ~ 40 mA DC, 2 ~ 25 mA AC	5 ~ 40 mA DC
Internal voltage drop	10 mV max. (load current 40 mA)	2.1 V max. (load current 40 mA)*
Leakage current	0 mA	
Delay time	1 ms max.	
Insulation resistance	100 ohms min. (At 500 VDC. Megger between case and cable.)	
Hipot voltage	1000 VAC (50/60 Hz.) One min. between case and cable.	
Shock resistance	30G non-repeated shock	
Vibration resistance	9G (Total amplitude 1.5mm, 10-55 Hz. Resonance frequency 2750 ± 250 Hz.)	
Environmental protection	IP66 (IEC standard)	
Indicator lamp	-	ON: Red LED
Lead wire	PVC insulated cable (2 x 24 AWG), white/black x ℓ**	
Cycle life	5 x 10 <sup>6</sup> min.	
Temperature range	32 ~ 140° F (0 ~ 60° C)	
Storage temperature	-14 ~ 158° F (-10 ~ 60° C)	
Sensor switch protection	Required (see sensor switch protection)	
Weight w/mounting bracket and suffix A lead wires	0.71 oz. (20 gf)	

\* Internal voltage drop depends on load current.

\*\* Lead wire length: A - 39 in. (nom.) 1000mm (actual); B - 118 in. (nom.) 3000mm (actual); C - 196 in. (nom.) 5000mm (actual).

## ORDER EXAMPLE



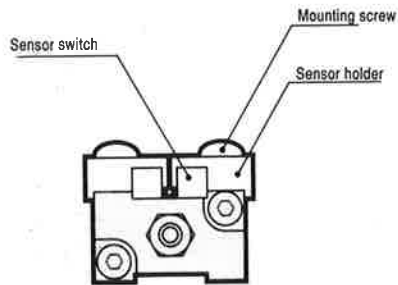
### Sensor switch model

<b>ZC130</b> — Hall effect (solid state) type w/LED	10 ~ 28VDC
<b>ZC153</b> — Hall effect (solid state) type w/LED	4.5 ~ 28 VDC
<b>CS5T</b> — Reed switch type, no LED	5 ~ 28 VDC 85 ~ 115 VAC
<b>CS11T</b> — Reed switch w/LED	10 ~ 28 VDC

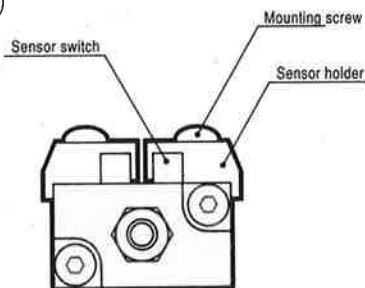
## MOVING SENSOR SWITCHES

Loosen mounting screw and move sensor switch toward cylinder rods. Do not exceed torque of 1.7 lb·in. (2 kgf·cm) on mounting screws.

1/4 (6)



3/8 (10), 5/8 (16)



## SENSOR SWITCH OPERATING RANGE / RESPONSE DIFFERENTIAL / IDEAL SENSING LOCATION

### OPERATING RANGE: $\ell$

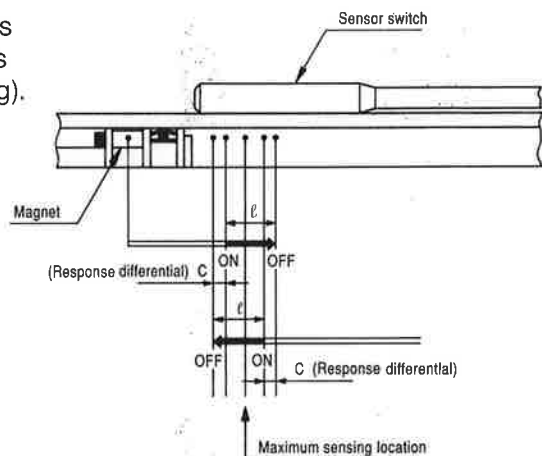
The distance the piston (magnet) travels, in one direction, while the switch is in the "ON" position (see drawing).

### RESPONSE DIFFERENTIAL: $C$

The distance between the point where the piston (magnet) turns the switch "ON", and the point where the switch turns "OFF" as the piston (magnet) travels in the opposite direction (see drawing).

in. (mm)

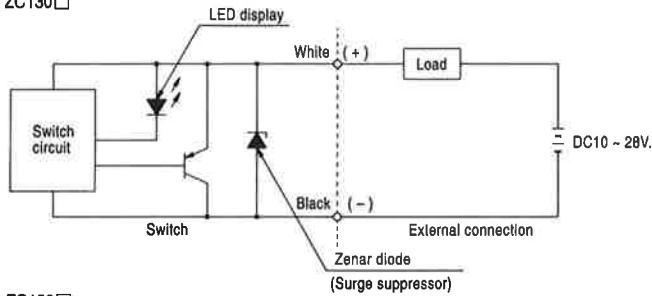
Bore size in. (nom.) mm (actual)	ZC130□, ZC153□		CS5T□, CS11T□	
	Operating range $\ell$	Response differential $C$	Operating range $\ell$	Response differential $C$
1/4 (6)	0.079 ~ 0.118 (2.0 ~ 3.0)	0.012 (0.3) max.	0.188 ~ 0.283 (4.8 ~ 7.2)	0.051 (1.3) max.
3/8 (10)	0.079 ~ 0.118 (2.0 ~ 3.0)	0.012 (0.3) max.	0.228 ~ 0.327 (5.8 ~ 8.3)	0.063 (1.6) max.
5/8 (16)	0.098 ~ 0.157 (2.5 ~ 4.0)	0.012 (0.3) max.	0.295 ~ 0.370 (7.5 ~ 9.4)	0.075 (1.9) max.



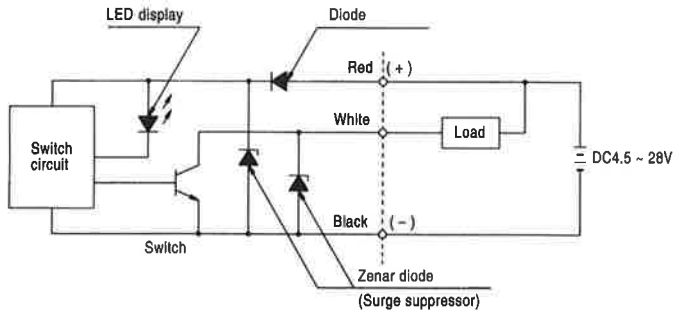
## CIRCUITRY

### Hall effect (solid state) type

ZC130□

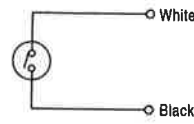


ZC153□

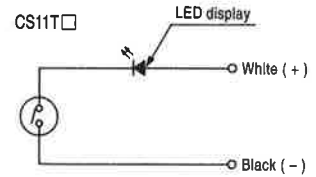


### Reed switch types

CS5T□

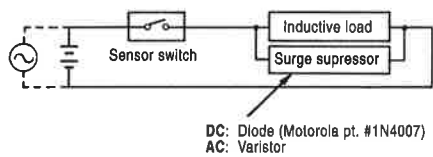


CS11T□

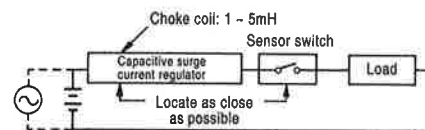


## RECOMMENDED PROTECTION FOR REED SWITCH SENSORS

Use with inductive loads (magnetic relays, etc.).



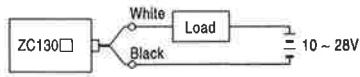
Use with long lead wires (>32'/10m) between sensor switch and load.



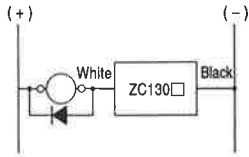
# CONNECTING PROCEDURES FOR HALL EFFECT (SOLID STATE) SENSOR SWITCHES

## ZC130 □

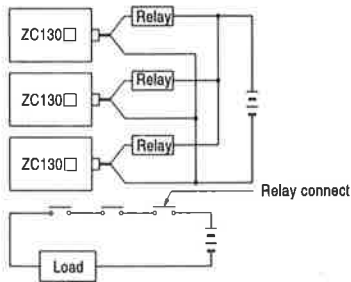
### Basic connection



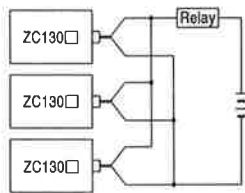
### Connection to relay



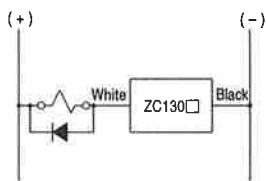
### AND Connection



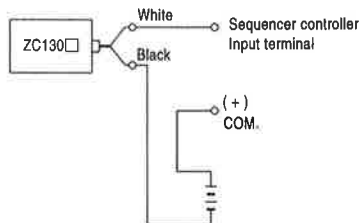
### OR Connection



### Connection to solenoid

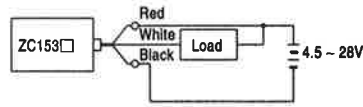


### Connection to sequencer

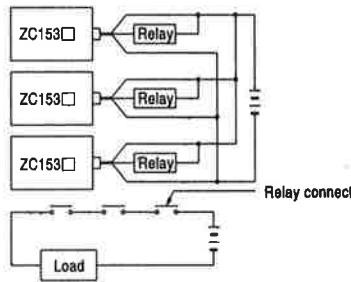


## ZC153 □

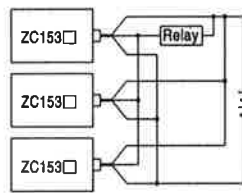
### Connection to relay



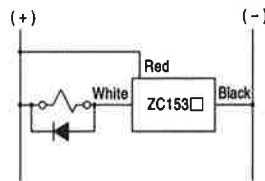
### AND Connection



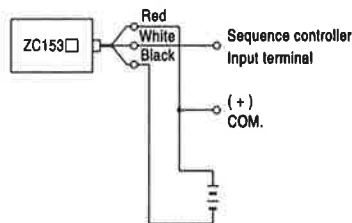
### OR Connection



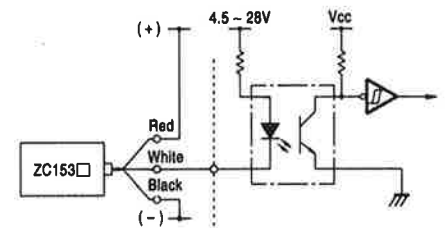
### Connection to solenoid



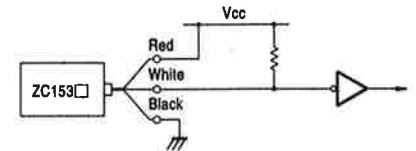
### Connection to sequencer



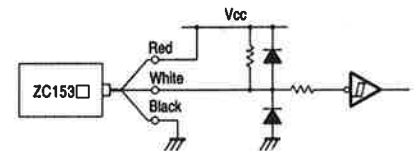
### TTL Connection



### Direct connection



### CMOS connection

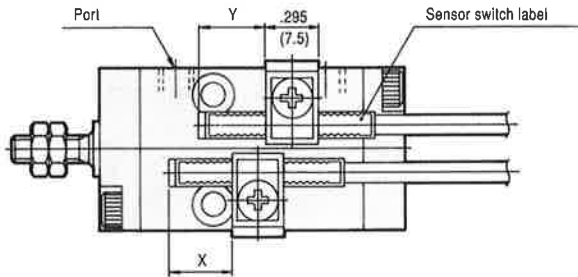


### CAUTIONS:

1. Follow wire color code for proper connection; otherwise switch will malfunction or may be damaged.
2. Do not use Model ZC130 in TTL or CMOS circuits.
3. Use of a surge protection diode is recommended.
4. Avoid using sensor switches in places where other strong magnetic forces are present (switches are actuated by magnetism).
5. Use care with lead wires. Do not pull or bend lead wires excessively.
6. Do not use sensor switches in areas where chemically active agents are present.
7. Consult factory before using sensor switches in oily or wet surroundings.

# SENSOR SWITCH MOUNTING LOCATION FOR END OF STROKE POSITIONING

## Standard cylinders



DOUBLE ACTING (Includes double rod end models) in. (mm)

Bore size in. (nom.) mm (actual)	Mounting location	Sensor switch model		
		ZC130□ ZC153□	CS5T□	CS11T□
1/4 (6) 3/8 (10)	X	0.512 (13.0)	0.453 (11.5)	0.591 (15)
	Y	0.315 (8.0)	0.256 (6.5)	0.394 (10)
5/8 (16)	X	0.551 (14.0)	0.492 (12.5)	0.630 (16)
	Y	0.354 (9.0)	0.295 (7.5)	0.433 (11)

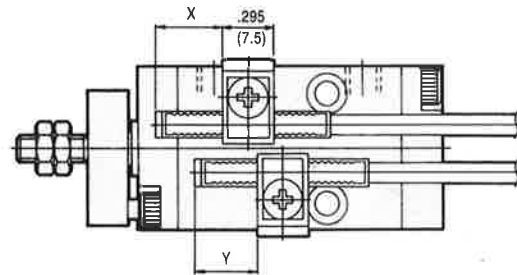
SINGLE ACTING – PUSH in. (mm)

Bore size in. (nom.) mm (actual)	Mounting location	Sensor switch model		
		ZC130□ ZC153□	CS5T□	CS11T□
1/4 (6) 3/8 (10)	X	0.315 (8.0)	0.256 (6.5)	0.394 (10)
	Y	0.315 (8.0)	0.256 (6.5)	0.394 (10)
5/8 (16)	X	0.354 (9.0)	0.295 (7.5)	0.433 (11)
	Y	0.354 (9.0)	0.295 (7.5)	0.433 (11)

SINGLE ACTING – PULL in. (mm)

Bore size in. (nom.) mm (actual)	Mounting location	Sensor switch model		
		ZC130□ ZC153□	CS5T□	CS11T□
1/4 (6) 3/8 (10)	X	0.512 (13.0)	0.453 (11.5)	0.591 (15)
	Y	0.512 (13.0)	0.453 (11.5)	0.591 (15)
5/8 (16)	X	0.551 (14.0)	0.295 (7.5)	0.433 (11)
	Y	0.551 (14.0)	0.295 (7.5)	0.433 (11)

## Non-rotating cylinders



DOUBLE ACTING (Includes double rod end models) in. (mm)

Bore size in. (nom.) mm (actual)	Mounting location	Sensor switch model		
		ZC130□ ZC153□	CS5T□	CS11T□
1/4 (6) 3/8 (10)	X	0.236 (6.0)	0.177 (4.5)	0.315 (8)
	Y	0.039 (1.0)	-0.020 (-0.5)	0.118 (3)
5/8 (16)	X	0.276 (7.0)	0.217 (5.5)	0.354 (9)
	Y	0.079 (2.0)	0.020 (0.5)	0.157 (4)

SINGLE ACTING – PUSH in. (mm)

Bore size in. (nom.) mm (actual)	Mounting location	Sensor switch model		
		ZC130□ ZC153□	CS5T□	CS11T□
1/4 (6) 3/8 (10)	X	0.039 (1.0)	-0.020 (-0.5)	0.118 (3)
	Y	0.039 (1.0)	-0.020 (-0.5)	0.118 (3)
5/8 (16)	X	0.079 (2.0)	0.020 (0.5)	0.157 (4)
	Y	0.079 (2.0)	0.020 (0.5)	0.157 (4)

SINGLE ACTING – PULL in. (mm)

Bore size in. (nom.) mm (actual)	Mounting location	Sensor switch model		
		ZC130□ ZC153□	CS5T□	CS11T□
1/4 (6) 3/8 (10)	X	0.236 (6.0)	0.177 (4.5)	0.315 (8)
	Y	0.236 (6.0)	0.177 (4.5)	0.315 (8)
5/8 (16)	X	0.276 (7.0)	0.217 (5.5)	0.354 (9)
	Y	0.276 (7.0)	0.217 (5.5)	0.354 (9)

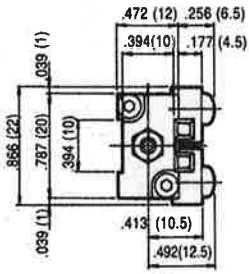
NOTE 1: Additional details, including most sensitive area of sensor switch, are shown on the following page.

NOTE 2: Mount sensor switch so that label is visible.

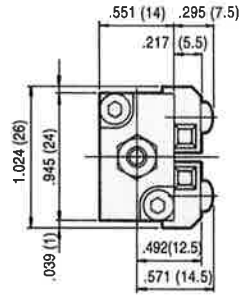
NOTE 3: When using two CS5T or two CS11T switches per multi-mount cylinder, the recommended minimum stroke is 1/2".

# SENSOR SWITCH MOUNTING DIMENSION DIAGRAMS

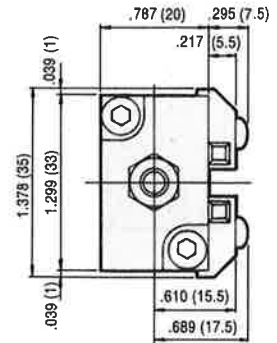
1/4 (6)



3/8 (10)

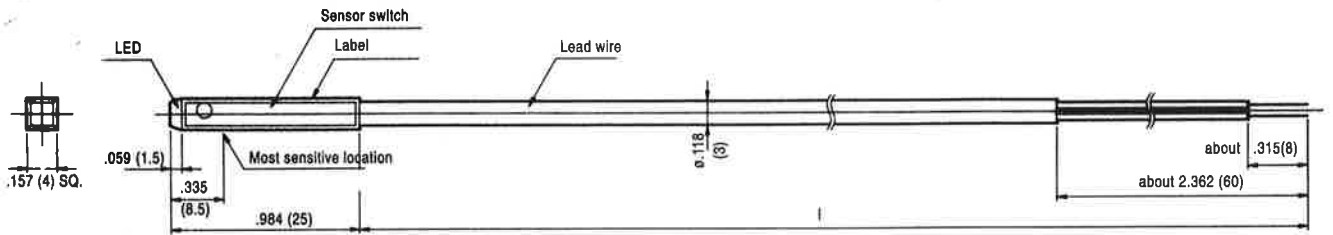


5/8 (16)

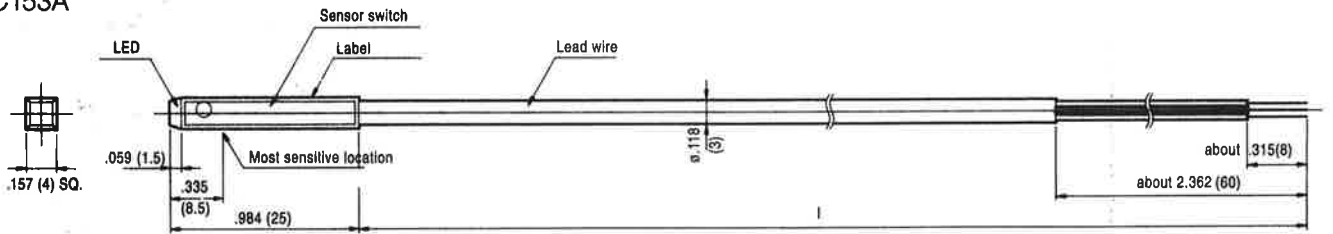


# SENSOR SWITCH DIMENSION DIAGRAMS

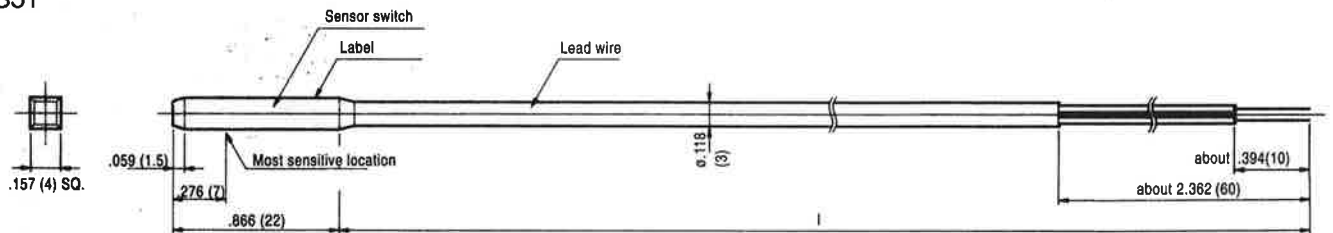
ZC130A



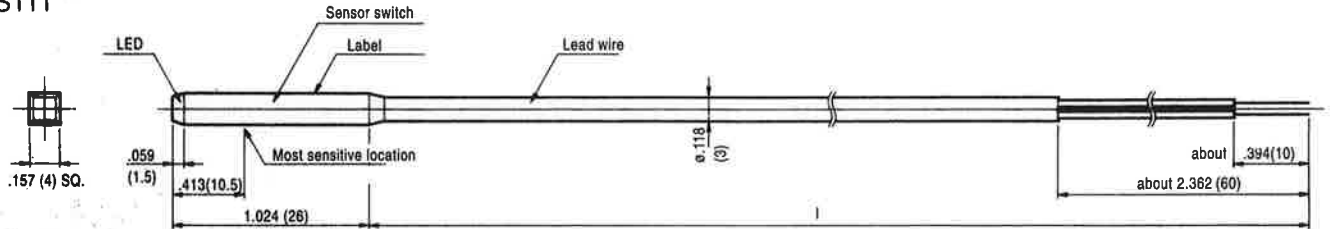
ZC153A



CS5T



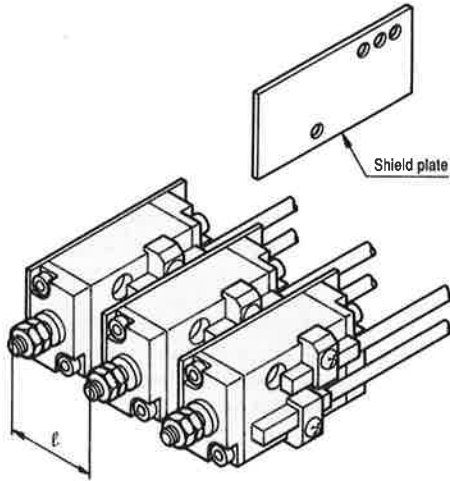
CS11T



Lead wire length: A - 39 in. (nom.) 1000 mm actual  
 B - 118 in. (nom.) 3000 mm actual  
 C - 196 in. (nom.) 5000 mm actual

## CAUTIONS WHEN MOUNTING CYLINDER WITH SENSOR SWITCHES

When mounting multi-mount cylinders with sensor switches in close proximity, install shield plate/s to prevent unintended actuation of a sensor by a neighboring cylinder.



Bore size in. (nom.) mm (actual)	Without shield plate – in. (mm)		With shield plate – in. (mm)
1/4 (6)	0.984 (25) min.	0.906 (23) min.	0.866 (22) min.
3/8 (10)	1.142 (29) min.	1.220 (31) min.	0.984 (25) min.
5/8 (16)	1.378 (35) min.	1.535 (39) min.	1.220 (31) min.

NOTE: No limitations to all other mountings.

## SHIELD PLATES (order code) in. (mm)

Bore size in. (mm) mm (actual)	Double acting (Including Double end rod)		Single acting – push, pull	
	Strokes			
	< 3/4	3/4 ~ 1 1/4	1/4	1/2
1/4 (6)	HBS061	HBS062	HBS061	HBS062
3/8 (10)	HBS101	HBS102	HBS101	HBS102
5/8 (16)	HBS161	HBS162	HBS161	HBS162

NOTE 1: Shield plate supplied with two mounting screws.

NOTE 2: Shield plates are sold separately.



# HANDLING TIPS AND POINTS TO BE CONSIDERED

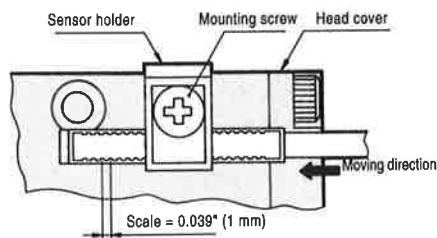
## SENSOR SWITCHES

### METHOD FOR FINDING BEST MOUNTING POSITION

1. Push piston rod into the fully retracted position.
2. Install sensor switch in holder without tightening mounting screw all the way. Move switch from head side to rod side until LED lights up. Then:

Models ZC130 and ZC153: Move switch one notch (0.039 in./1mm) toward rod side and tighten mounting screw.

Models CS5T and CS11T: Move switch two notches (0.079 in./2mm) toward rod side and tighten mounting screw.



### ROD SIDE (end of stroke)

1. Pull piston rod into the fully extended position.
2. Install sensor switch in holder without tightening mounting screw all the way. Move switch from rod side to head side until LED lights up. Then:

Models ZC130 and ZC153: Move switch one notch (0.039 in./1mm) toward head side and tighten mounting screw.

Models CS5T and CS11T: Move switch two notches (0.079 in./2mm) toward head side and tighten mounting screw.

## GENERAL CAUTIONS

### MOUNTING

In applications with high load ratio or under high speed, use externally mounted stopper to prevent direct shock to the cylinder.

### PLUMBING

Before connecting fittings and tubing, blow all foreign material from these components. If using a sealant, take extra care that sealant does not enter cylinder causing malfunction and/or leaks.

### ATMOSPHERE

Protect cylinders when used in contaminated conditions such as excessive dust or where exposed to water or oil particles. Penetration of these materials may adversely affect operation.

When media or atmosphere contain the following substances, Humphrey Multi-Mount cylinders should not be used: organic solvents, phosphoric acid, ester type machine oil, sulfurous acid, gas, chlorine gas, or other acids.

### LUBRICATION

Lubrication is not required. If lubricating oils are used ensure that they are of sufficient viscosity to assure adequate lubrication. Thin or low viscosity oils (spindle oil, machine oil, etc.) do not provide a good residual film of lubrication.

### MEDIA/FILTRATION

Humphrey Multi-Mount cylinders are designed for use with compressed air or inert gases. Consult factory if using any other media. Compressed air should be clean and uncontaminated. When in doubt, install an air filter with filtering capacity of 40 microns. Periodically remove and clean or replace filter element.

### CAUTION

Compressed air is powerful and may be dangerous. Before attempting to remove a component from an air line or system, *always* disconnect the supply air and thoroughly exhaust the line or system. *Never* attempt to construct, operate, or service anything using compressed air unless you have been properly trained to do so. Failure to heed this warning could result in **SERIOUS, EVEN FATAL, PERSONAL INJURY.**