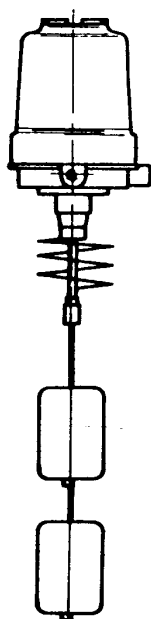
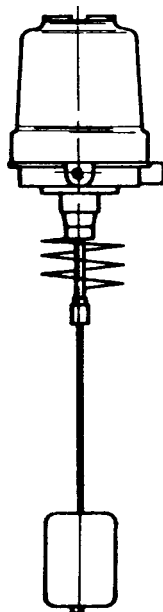


# Displacer Controls

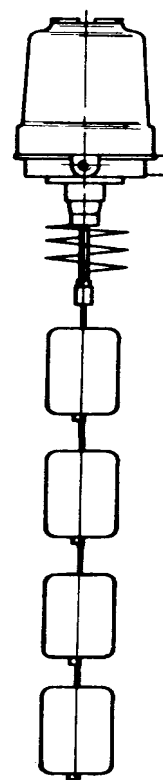
## Operation Installation & Maintenance



Types: 1DS



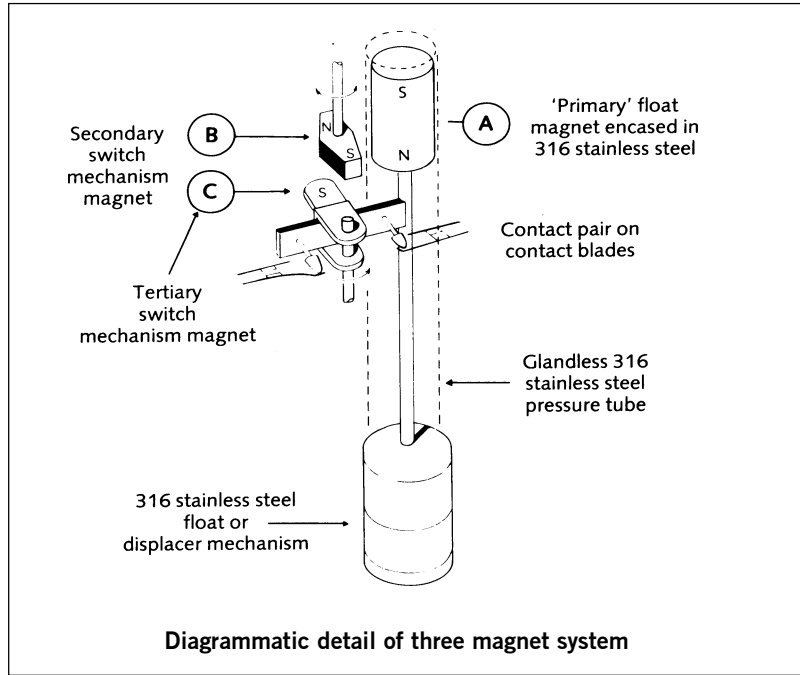
Types: 2DS 8DS  
5DS 9DS



Types: 3DS  
6DS

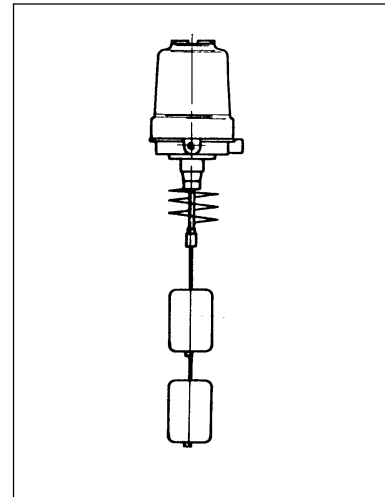
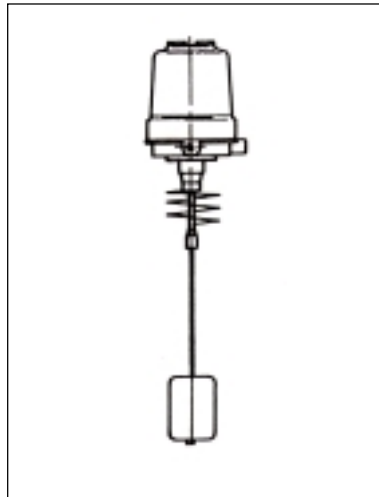
### Principle of Operation

All models utilise the displacer and spring principle. As the liquid level rises and progressively immerses the displacer element the effective weight suspended on the spring reduces and the consequent length of spring change is used to provide magnet movement and operate the switch(es). Vertical movement of the primary magnet A in a glandless pressure tube simultaneously actuates magnets B & C to switch the contacts. The "three-magnet" system enables the primary magnet to pass on and actuate switch mechanisms at other levels. Switch mechanisms already actuated cannot re-set until the return of the primary magnet actuates the magnet system once again.



### Identifying your control

This manual covers the displacer type controls as shown opposite. Your control has a part number stamped on the nameplate, an example of which is shown below. From this number you can identify your control and turn to the relevant pages in this manual. As switch mechanisms are common to all three types, electrical characteristics are given on page 3.



**D C 3D SA7 2 X4 60**

Series \_\_\_\_\_

Mounting flange material \_\_\_\_\_

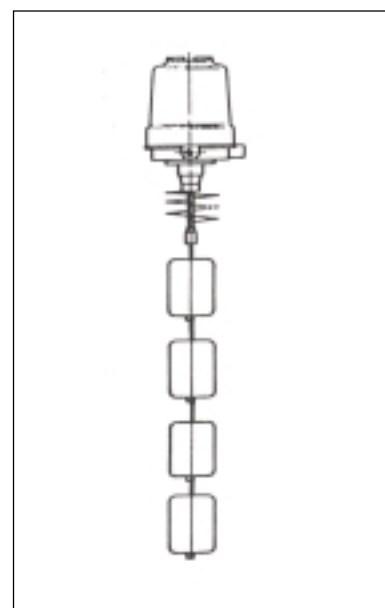
Displacer module \_\_\_\_\_

Enclosure module \_\_\_\_\_

No. of switch mechanisms \_\_\_\_\_

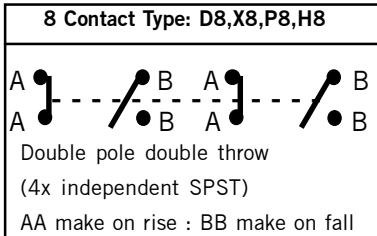
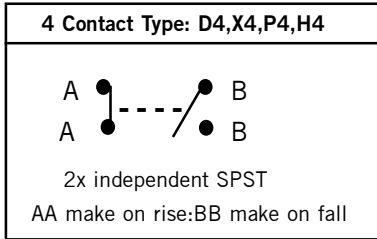
Type of switch mechanisms \_\_\_\_\_

Flange module \_\_\_\_\_



Controls manufactured to customers requirements outside of our standard range will be numbered 707\*\*/\*\*/\* and may be identified according to the pictures above.

## Electrical characteristics



**Note:** For DPDT operation, installer must common any one pair of A and B wires in the terminal block for each of the two ends of the switch mechanism.

### Calibration

All Magne-sonics displacer controls are factory set to operate correctly at the specific gravity and operating temperature stated at the time of ordering. These operating conditions are shown on a label inside the switch head enclosure. The switch mechanisms inside the enclosure are locked onto the pressure tube and should not be moved. Any adjustment of switching point is made by moving the elements on the displacer cable as detailed on the following pages.

If this equipment is used in a manner not specified by the manufacturer the performance may be impaired.

Each switch mechanism has flying leads which are factory wired to ceramic terminal blocks fixed in the switch enclosure.

### Electrical rating

Type	Temp wetside °C	Low temp use	AC max. values			AC max. values			
			VA	Volts	Amps	Watts	Volts	Res amps	Ind amps
D4, D8	400	Amp.	2000	440	5	50	250	5	0.5
X4, X8	250	Amb.	2000	440	10	50	250	10	0.5
P4, P8	400	Amb.	6	250	0.25	3.6	250	0.25	0.1
H4, H8	250	-100°C	2000	400	10	50	250	10	0.5
Power factor 0.4 mm						Time constant 40ms max.			

### Warning

Gold plating on the contacts of the P4 and P8 switch mechanisms may be permanently damaged if the mechanisms are used to switch circuits with values greater than those shown above.

### Important wiring notes

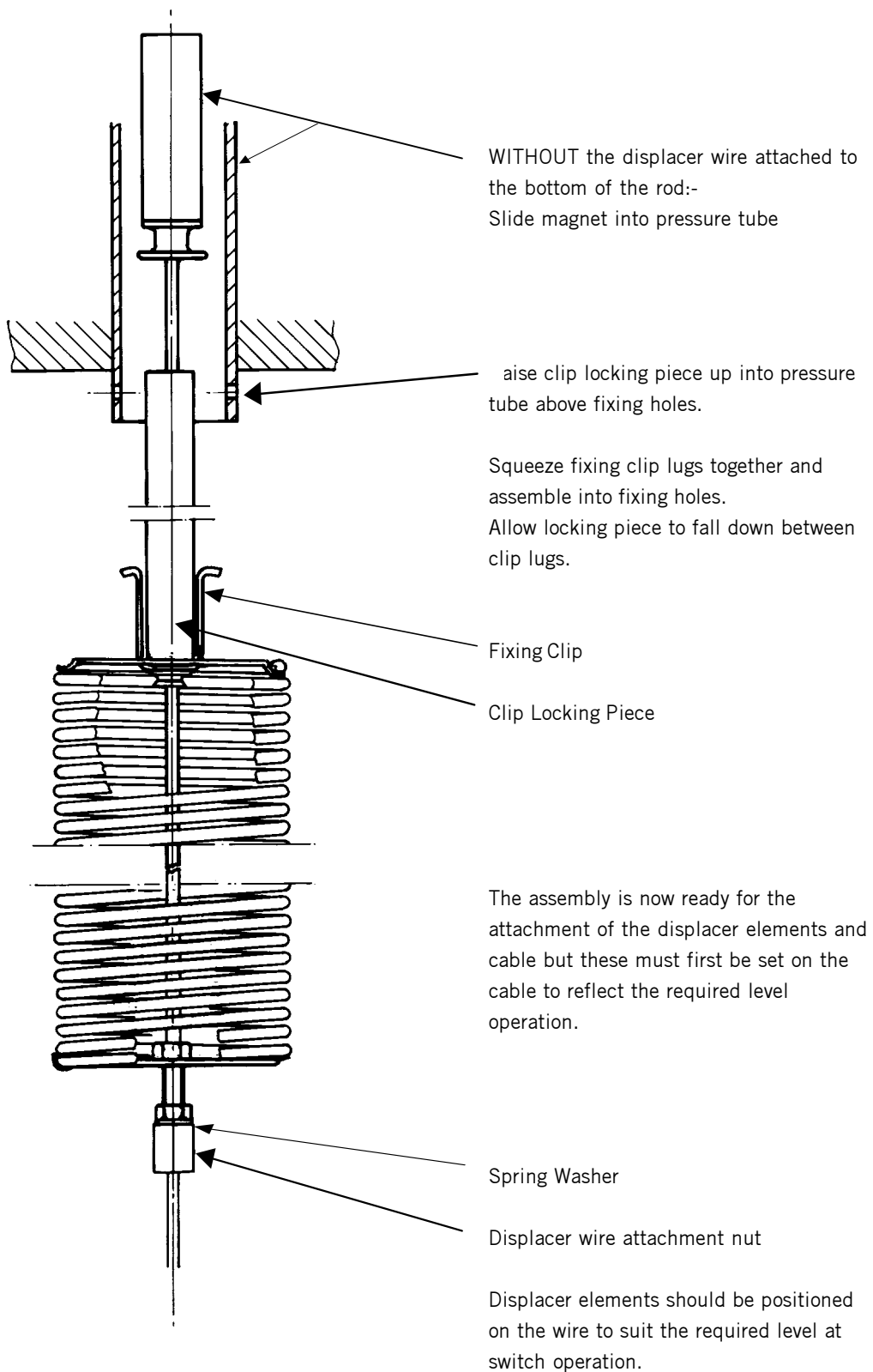
- Switches must not be used for the direct starting of motors. Contacts should be wired in series with the operating coils of relays, contactor starters or solenoid valves, and fused separately.
- The temperature of the switch enclosure may at times approach the temperature of the process and suitable heat resisting cables should therefore be used, together with appropriate cable glands.
- A sufficient length of flexible cable should be fitted to allow easy removal of the switch head and displacer assembly at any time.
- The equipment should be earthed.

### Explosionproof/flameproof models

5. Cable entry must be fitted with a flameproof cable entry device, with or without thread adaptor, approved by BASEEFA for IIc enclosures and which, together with the cable, are suitable for the conditions of use according to Code of Practice BS5345: Pt. 1979 or equivalent. For non-UK installations, cable entry devices suitably approved by other approval authorities which equally maintain the integrity of the flameproof enclosure by providing a minimum of 5 threads engagement as required by EN 50018, may be used in accordance with a local Code of Practice subject to agreement by the local Inspecting Authority.

6. U.L. Approved Applications: Use copper conductors 60°/75°C: 140°/167°F ONLY. Torque terminals to 6kg/cm: 7lb/in.

## Assembly details: all types



## Single switch models: Types 1DS (alarm)

### Type 1DS: Stainless steel element

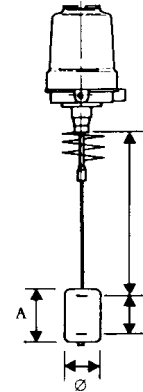
#### Application

These models are intended for single switch narrow differential applications such as High Level Alarm or Low Level Alarm.

#### Operating and dimensional data

1DS St. Steel:      A = 200       $\varnothing = 60.3$

Switch types	D4	P4	X4	H4	D8	P8	X8	H8
S.G.	0.6	0.75	1.0	1.2	0.75	1.0	1.0	
S min	400	425	450	460	350	390	415	
E min	90	70	60	55	135	105	90	



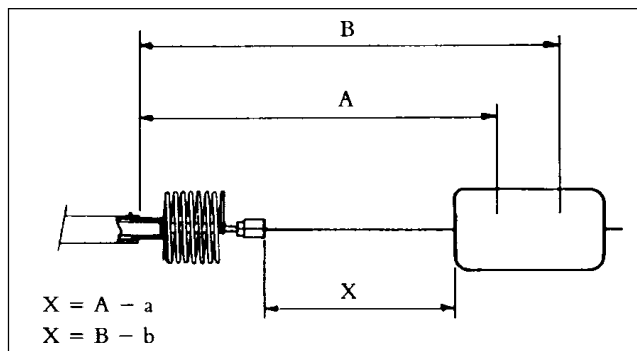
Displacer Type	S.G. Range		Operating Temp. Range	Maximum Pressure 20°C
	4 Contact	8 Contact		
1DS	0.6 to 1.2	0.75 to 1.2	-50°C to +300°C	102 bar

#### Setting the displacer elements on the cable

For accurate setting of displacers it is necessary to know the liquid specific gravity, the required switch function (with any liquid rising or liquid falling) and the required distance from the end of pressure tube to the relevant switching levels (A & B). The following assembly and adjustments should be carried out with the displacer assembly laid on the ground where there is adequate free and clean space.

This figure illustrates dimensions A & B, the relevant switching levels. A is for High Level Alarm. Dimension X can be determined from the table below. The displacer element is positioned to provide the required operating level by holding the cable taut and measuring the distance X to the top of the displacer element, then locking the adjustable stop beneath the displacer element. Any excess cable should be coiled underneath the displacer or removed by cutting.

The displacer is now ready for attachment to the displacer spring/rod using the spring washer provided. (Attached to the coil of wire for transport purposes). **Take care that the weight of the elements does not hang at an angle to the head, thereby bending the rod. Any bending of the rod will cause sticking and possible malfunction.** See page 4 for assembly details and page 9 for installation details.



Due to component tolerances, values of a, b, E & S are approximate and may vary on each particular control by up to  $\pm 20$ mm. Setting the control to operate at the required levels can be finally achieved by adjusting the element up or down on the cable as necessary.

#### Type 1DS : Stainless Steel Elements

S.G.		0.6	0.75	1.0	1.2
4 contact switch	a	400	425	450	460
	b	475	485	495	505
8 contact switch	a	X	350	390	415
	b	X	485	495	505

# Single switch models: Types 2DS

## (pump control)

### Type 2DS: Stainless steel elements

#### Application

These models are intended for single switch wide differential applications such as pump control, where the differential can be site adjusted by re-positioning the displacer elements on the cable.

#### Operating and Dimensional Data

Switch types	D4	P4	X4	H4	D8	P8	X8	H8
<b>S.G.</b>	0.5	0.8	1.0	1.2	0.75	0.8	1.0	1.2
<b>S min</b>	415	430	430	425	390	390	400	400
<b>E min</b>	165	110	95	80	205	200	165	140

**2DS St. Steel: A = 200      Ø = 60.3**

S min = Adjustable distance to upper switching level  
 E min = Differential.  
 D = Minimum dead band

The two displacer elements are positioned at any point on the cable to correspond to the switching levels required. When the liquid level drops to the lower displacer the switch is actuated and starts (or stops) a pump; when the liquid rises to the upper displacer the switch is again actuated to stop (or start) the pump.

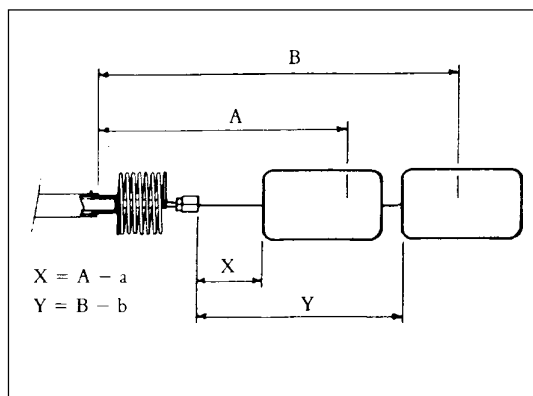
Displacer Type	S.G. Range		Operating Temp. Range	Maximum Pressure 20°C
	4 Contact	8 Contact		
2DS	0.5 to 1.2	0.75 to 1.2	-50°C to +300°C	102 bar

#### Setting the displacer elements on the cable

For accurate setting of the displacers it is necessary to know the liquid specific gravity, the required switch function (with any liquid rising or liquid falling) and the required distance from end of pressure tube to the relevant switching levels (A & B). The following assembly and adjustments should be carried out with the displacer assembly laid on the ground where there is adequate free and clean space. This figure illustrates dimensions A

& B, the relevant switching levels. A is for High Level Alarm. Dimension X & Y can be determined from the table below. The displacer elements are positioned to provide the required differential by holding the cable taut and measuring the distances X & Y to the top of the displacer elements, then locking the adjustable stop beneath each element. Any excess cable should be coiled underneath or removed by cutting.

The displacer is now ready for attachment to the displacer spring/rod using the spring washer provided. (Attached to the coil of wire for transport purposes). **Take care that the weight of the elements do not hang at an angle to the head, thereby bending the rod. Any bending of the rod will cause sticking and possible malfunction.** See page 4 for assembly details and page 9 for installation details.



#### Type 2DS : Stainless Steel Elements

S.G.	0.5	0.75	1.0	1.2	
4 contact switch	a	415	430	430	425
	b	370	310	295	275
8 contact switch	a	390	400	400	400
	b	325	325	325	305

Due to component tolerances, values of a, b, E & S are approximate and may vary on each particular control by up to ±20mm. Setting the control to operate at the required levels can be finally achieved by adjusting the element up or down on the cable as necessary.

## Two switch models: Types 3DS

### (2 pump control)

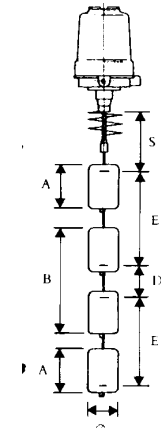
Type 3DS: Stainless steel elements

#### Application

These models are intended for either two pump control or one pump and one alarm applications.

#### Operating and dimensional data

3DS St. Steel: A = 143      B = 286      Ø = 60.3								
Switch types	D4	P4	X4	H4	D8	P8	X8	H8
S.G.	0.6	0.8	1.0	1.2	0.8	1.0	1.2	
S min	390	385	375	365	355	350	345	
E min	135	110	95	80	200	145	140	
Dead Band	220	255	285	310	165	215	250	



A pump is controlled between the middle and the lower displacers positioned on the cable at the required levels. Should the level rise to the upper displacer this actuates the upper alarm switch which remains actuated until the level drops to the middle displacer.

Alternatively the upper switch could control a second pump.

Displacer Type	S.G. Range		Operating Temp. Range	Maximum Pressure 20°C
	4 Contact	8 Contact		
3DS	0.6 to 1.2	0.8 to 1.2	-50°C to +300°C	102 bar

#### Setting the displacer elements on the cable

For accurate setting of displacers it is necessary to know the liquid specific gravity, the required switch function (with any liquid rising or liquid falling) and the required distance from end of pressure tube to the relevant switching levels (A,B,C, & D). The following assembly and adjustments should be carried out with the displacer assembly laid on the ground where there is adequate free space.

This figure illustrates dimensions A, B, C & D, the relevant switching

levels. The upper switch operates between levels A & B (rising and falling level), and the lower switch operates between levels C & D (rising and falling levels).

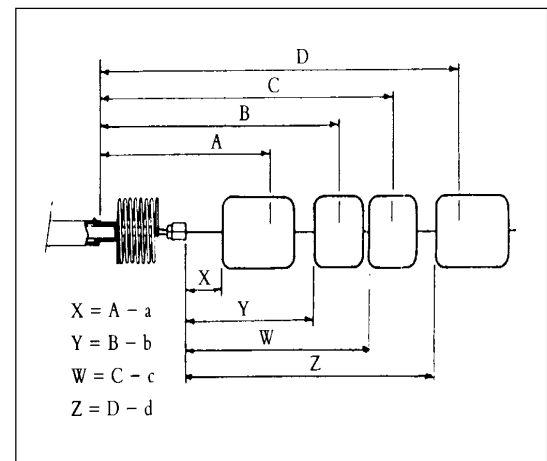
Dimensions X, Y, W & Z can be determined from the table below. The displacer elements are positioned to provide the required differential by holding the cable taut and measuring the distances X, Y, W & Z to the top of the displacer elements, then locking the adjustable stops beneath each

element. Any excess cable should be coiled underneath or removed by cutting.

The displacer is now ready for attachment to the displacer spring/rod using the spring washer provided. (Attached to coil of wire for transport purposes). **Take care that the weight of the elements does not hang at an angle to the head, thereby bending the rod. Any bending of the rod will cause sticking and possible malfunction.**

#### Type 3DS : Stainless Steel Elements

S.G.		0.6	0.8	1.0	1.2
4 contact switch	a	380	375	365	355
	b	375	345	320	295
	c	415	425	425	425
	d	395	375	365	350
8 contact switch	a		345	340	335
	b		395	360	325
	c		375	385	395
	d		430	405	385



Due to component tolerances, values of a, b, c, d, E, S & Dead Band are approximate and may vary on each particular control by up to  $\pm 20$ mm. Setting the control to operate at the required levels can be finally achieved by adjusting the element up or down on the cable as necessary.

## Two switch models: Types 8DS (2 alarm)

### Type 8DS: Stainless steel elements

#### Application

These models are intended for two alarm duty, one switch for a High Level alarm and one switch for a Low Level alarm.

#### Operating and dimensional data

**8DS St. Steel: A = 200     $\varnothing = 60.3$**

Switch types	D4	P4	X4	H4	D8	P8	X8	H8
S.G.	0.6	0.8	1.0	1.2	0.8	1.0	1.2	
S min	390	385	375	365	355	350	345	
E min	90	70	60	55	135	105	90	
Dead Band	200	230	255	310	165	215	250	

**S min = adjustable distance**  
**E min = differential**  
**D = Minimum dead band**

The two displacer element assemblies are positioned on the cable such that two alarm points may be given. This arrangement is typical of sump application.

Displacer Type	S.G. Range		Operating Temp. Range	Maximum Pressure 20°C
	4 Contact	8 Contact		
8DS	0.6 to 1.2	0.8 to 1.2	-50°C to +300°C	102 bar

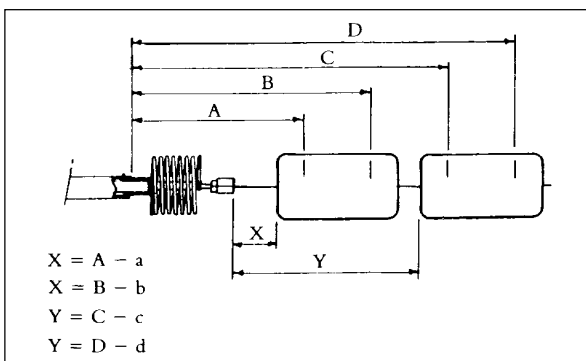
#### Setting the displacer element on the cable

For accurate setting of displacers it is necessary to know the liquid specific gravity, the required switch function (with any liquid rising or liquid falling) and the required distance from end of pressure tube to the relevant switching levels (A, B, C & D). The following assembly and adjustments should be carried out with the displacer assembly laid on the ground where there is adequate free space.

The figure illustrates dimensions A, B, C & D, the relevant switching levels. The upper switch operates between levels A & B (rising and falling level), and the lower switch

operates between levels C & D (rising and falling levels). Dimensions X, Y can be determined from the table below. The displacer elements are positioned to provide the required differential by holding the cable taut and measuring the distances X, Y to the top of the displacer elements, then locking the adjustable stops beneath each element. Any excess cable should be coiled underneath or removed by cutting.

The displacer is now ready for attachment to the displacer spring/rod using the spring washer provided. (Attached to the coil of the wire for transport purposes). **Take care that the weight of the elements does not hang at an angle to the head, thereby bending the rod. Any bending of the rod will cause sticking and possible malfunction.**



#### Type 8DS : Stainless Steel Elements

S.G.		0.6	0.8	1.0	1.2
4 contact switch	a	395	380	360	340
	b	490	455	425	395
	c	445	445	445	440
	d	540	520	510	495
8 contact switch	a		355	340	320
	b		470	430	400
	c		420	425	425
	d		535	505	500

Due to component tolerances, values of a, b, c, d, E, S & Dead Band are approximate and may vary on each particular control by up to  $\pm 20$ mm. Setting the control to operate at the required levels can be finally achieved by adjusting the element up or down on the cable as necessary.



## Installation of displacer controls

Installation of the displacer must be carried out with extreme care in order to avoid damage to magnet rod or spring. This is best achieved using two people with one holding the switch head whilst the other lowers the displacer element.

The displacer control should be sited vertically on the vessel such that any turbulence or movement of the vessel contents does not cause excessive movement of the elements. Be particularly aware of inlet and outlet points. If there is excessive movement, the displacer elements should be mounted within a stilling tube of 80mm minimum inside diameter, free from weld beads or other protrusions that may cause snagging.

If the displacer control is being fitted to a 1" NPT Mounting point, the displacer elements, spring and rod assembly must be mounted to the head from inside or the underside - refer to page 4.

Use only the hexagonal union nut directly under the base to tighten the switch head to its flange or mounting point.

1. Remove all sealing tapes, tie strings and packing from the control prior to installation.
2. Remove switch head cover to reveal terminal block(s) to which electrical connections are to be made:-

Flameproof models: Locate and slacken off M5 socket head grub screw in side of cover adjacent to base joint. Place a bar across the top of the cover, locating in the castellations. The cover can now be unscrewed from the base using the bar as a lever.

Weatherproof models: The cover can be removed by unscrewing the single hexagon bolt at the crown of the cover.

3. Connect electrical wiring via the conduit entries using a suitable cable gland.

Note that the base of the enclosure is rotatable on the pressure tube to allow the most convenient orientation of the conduit entry.

The switch mechanisms are factory set on the pressure tube to ensure correct operation at the S.G. and temperature stated at the time of ordering, **and should not be moved**. If for any reason it is necessary to slacken the locking screw and move the switch mechanism, it's position on the pressure tube must first be clearly marked so that it can be re-set correctly.

4. The lugs of the tab washer directly underneath the base must now be bent over to locate on the the most appropriate flats of the hexagon union. This prevents further rotation of the switch head, and is particularly important as it will prevent rotation when the cover is removed or re-fitted.

5. Replace cover, ensuring cover seals are in position. Ensure cover locking grub screw is replaced and tightened on flameproof models. The fibre sealing washer at the crown bolt of the weatherproof cover must be re-fitted to maintain weatherproof seal.

## Maintenance of Magne-Sonic Displacer Controls

Magne-Sonic displacer controls are mounted directly on to the process vessel.

1. Isolate electrical circuits to control and disconnect wiring as necessary.
2. Ensure the vessel is vented to atmosphere, or isolate any chamber from the vessel by closing the isolating valves, and open the valve of the drain connection.
3. Remove nuts holding control to chamber or vessel. Carefully withdraw switch head and displacer assembly taking extreme care NOT TO BEND THE ROD OR DAMAGE THE SPRING MECHANISM.

4. Separate displacer assembly from switch head by removing spring clip.

5. Inspect the chamber or stilling tube and remove any deposits.

6. Check displacer element spring, rod and magnet for excessive wear, clean and replace as necessary.

7. Fit replacement joint and reassemble, taking care not to bend the rod.

**Note:** If the rod is bent, sticking will occur and the displacer control could malfunction.

8. Remove the switch head cover and examine the switch

mechanism body for any damage. Ensure that wiring is in good order and that all screws are tight. **Dismantling of switch units is not recommended and replacement of the complete switch unit will be found to offer the quickest and most economical solution in event of faulty operation.**

9. Check sealing gaskets/'O' ring and replace if necessary. Replace cover, ensuring cover seals are in position. Ensure cover locking grub screw is replaced and tightened on flameproof models. The fibre sealing washer at the crown bolt of the weatherproof cover must be re-fitted to maintain weatherproof seal.

## When fitting a spare or replacement switch mechanism

### Important note

If a spare switch mechanism is fitted at any time, it is vitally important that the magnet system is left in the correct mode.

After installation of a replacement switch mechanism, always check that B-B contacts are made, assuming the chamber is empty of liquid. If the chamber is full of liquid, then A-A contacts should be checked to ensure they are made.

If it is found that a switch mechanism is not in the correct mode, then the liquid level in the chamber should be raised such that the primary displacer magnet passes through the switching point. Lowering the liquid level will then cause the displacer to fall back through the switching point, thus leaving the mechanism in the correct operating mode. (For a control operating as Low Level

alarm, the liquid level should be first lowered then raised back to ensure the switch mechanism is in the correct operating mode).

Full Fitting instructions are supplied with each spare switch mechanism.