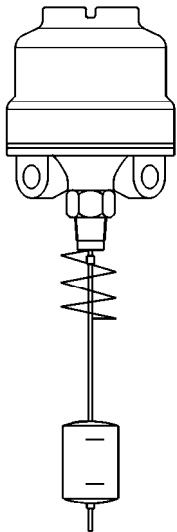
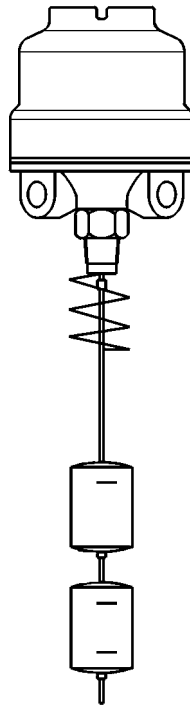


Mobrey

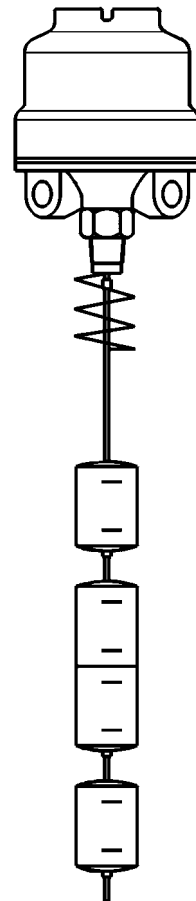
Displacer controls



Type : 11DS



Types : 12DS 18DS



Type : 13DS

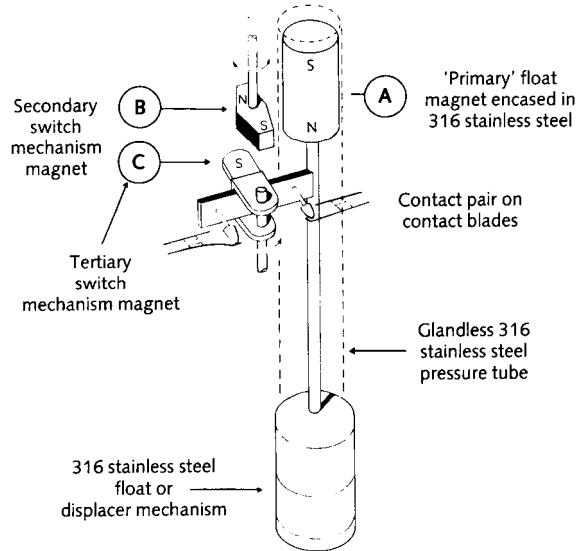
For instructions specific to ATEX approved flameproof models in hazardous area installations, refer to accompanying leaflet IP152/SI Exd

Level

Mobrey displacer operated level controls

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.



Diagrammatic detail of three magnet system

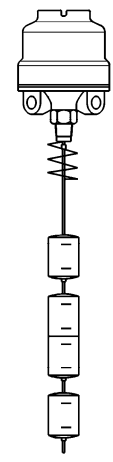
Identifying your control

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 / 13DS 7A 2 D8/60

- Series _____
- Mounting flange material _____
- Displacer module _____
- Enclosure module _____
- No. of switch mechanisms _____
- Type of switch mechanisms _____
- Flange module _____



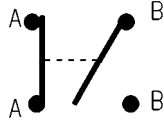
Controls manufactured to customers requirements outside of our standard range will be numbered 707**/**/* and may be identified according to the pictures above.

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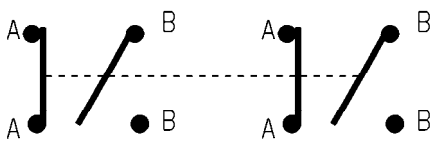
Level

4 Contact Type : D4, X4, P4, H4



2x independent SPST
AA make on rise : BB make on fall

8 Contact Type : D8, X8, P8, H8



Double pole double throw
(4x independent SPST)
AA make on rise : BB make on fall

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 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
H8, 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

1. 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.
2. 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.
3. A sufficient length of flexible cable should be fitted to allow easy removal of the switch head and displacer assembly at any time.
4. 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, and should 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.

Level

P4, P8, H4, H8 Switch Mechanisms - Simple Apparatus

These Switch Mechanisms in a standard switch housing are classified as "Simple Apparatus" when used in Intrinsically Safe circuits. They comply with the requirements of EN50014:1997, General Requirements and EN50020:2002, clause 5.4 'Simple Apparatus' and are not considered as a potential source of ignition for an explosive atmosphere.

They do not fulfill the definition of equipment in Article 1 (3) of Directive 94/9/EC (Equipment Explosive Atmospheres (ATEX)) and are therefore outside the scope this Directive and do not have a Declaration of Conformity or CE mark related to this Directive.

When used as "Simple apparatus" within a hazardous atmosphere the following should be noted:

1. The product should be installed by suitably trained personnel, in accordance with the applicable code of practice.
2. As the product has no source of internal heating, the temperature classification is dependent on the ambient air temperature and the temperature of the process vessel to which it is attached.
3. Materials of construction : Refer to product catalogue or customer drawing for actual material of level switch concerned.

Housing and Cover : Carbon Steel, or Stainless Steel 316 type, or Aluminium Alloy LM25 or LM24 or B85 grd 360, or Cast Iron grd 250, or Gunmetal LG2

Pressure Tube & Union : Stainless Steel types 316, 321 or 304, or Carbon Steel 220M07, or Alloy NA18, or Alloy C-276 (UNS N10276) or Alloy 625, or Alloy 825

If the equipment is likely to come into contact with aggressive substances, it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised.

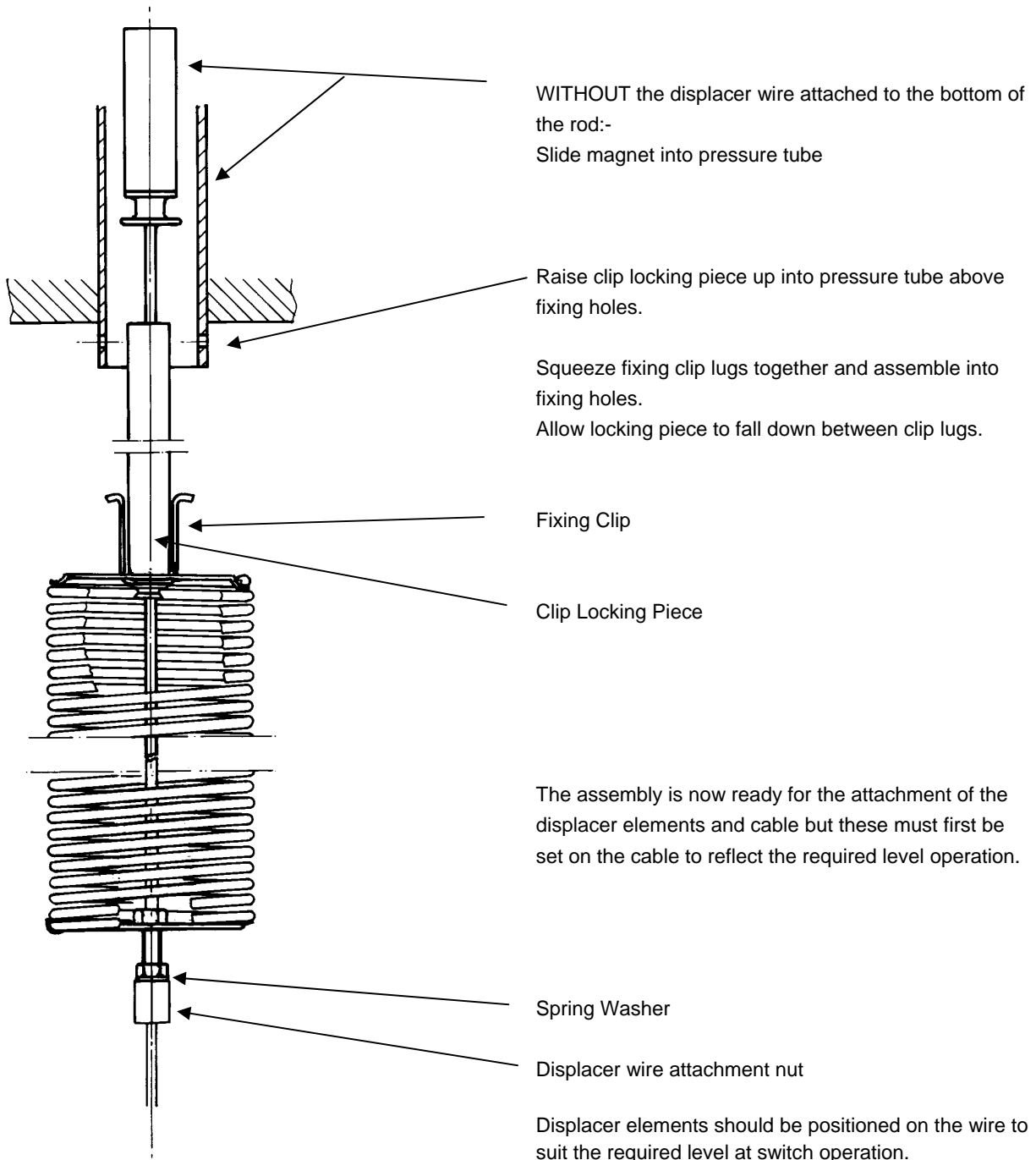
Aggressive substances : e.g acidic liquids or gases that may attack metals or solvents that may affect polymeric materials.

Suitable precautions : e.g. regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific chemicals.

Note : The metallic alloy used for the enclosure material may be at the accessible surface of this equipment; in the event of rare accidents, ignition sources due to impact and friction sparks could occur. This shall be considered when the switch is being installed in locations that specifically require group II, category 1G equipment.

4. It is the responsibility of the user to ensure :
 - a. The joint requirements between the switch housing and vessel are compatible with the process media.
 - b. The joint tightness is correct for the joint material used.
 - c. That suitable temperature rated cable is used. **Note** : The cable entry temperature may exceed 70°C
 - d. The float is protected from impact or friction, or static electrical build-up from fast flowing non-conductive fluids, that could generate an ignition source.

Assembly details : all types



Level

Single switch models: Types 11DS (alarm)

Type 11DS: Stainless steel element

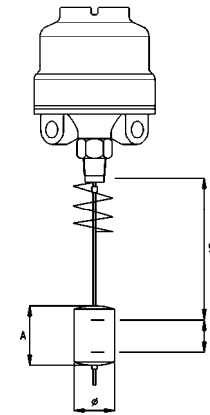
Application

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

Operating and dimensional data

11 DS St. Steel : A = 200 Ø = 60.3

Switch Types	4 Contact				8 Contact			
	D4	P4	X4	H4	D8	P8	X8	H8
S.G.	0.6	0.75	1.0	1.2	0.75	1.0	1.2	
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		
11DS	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.

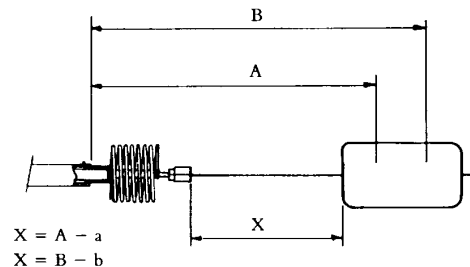
A is for High Level Alarm. Dimension X can be determined from the table below.

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 5 for assembly details and page 10 for installation details.

Type 11DS : Stainless Steel Elements

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



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.

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Level

Single switch models: Types 12DS (pump control)

Type 12DS: Stainless steel elements

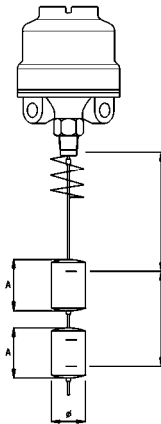
Application

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

12 DS St. Steel : A = 200 Ø = 60.3

Switch Types	4 Contact				8 Contact			
	D4	P4	X4	H4	D8	P8	X8	H8
S.G.	0.5	0.8	1.0	1.2	0.75	0.8	1.0	1.2
S min	415	430	430	425	390	390	400	400
E min	165	110	95	80	205	200	165	140



S min = Adjustable distance to upper switching level
E min = Differential.

Displacer Type	S.G. Range		Operating Temp. Range	Maximum Pressure 20°C
	4 Contact	8 Contact		
12DS	0.5 to 1.2	0.75 to 1.2	-50°C to +300°C	102 bar

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.

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.

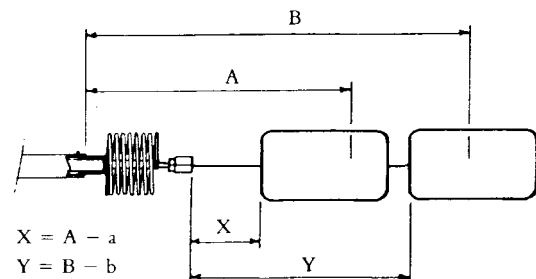
This figure illustrates dimensions A & B, the relevant switching levels. A is for High Level Alarm. Dimension X & Y can be determined from the table below.

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 5 for assembly details and page 10 for installation details.

Type 12DS : Stainless Steel Elements

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

Level

Two switch models: Types 13DS (2 pump control)

Type 13DS: Stainless steel elements

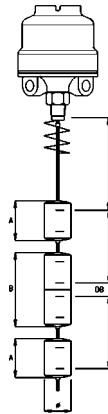
Application

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

Operating and dimensional data

13 DS St. Steel : A = 143 B = 286 Ø = 60.3

Switch Types	4 Contact				3 Contact			
	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	



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

Displacer Type	S.G. Range		Operating Temp. Range	Maximum Pressure 20°C
	4 Contact	8 Contact		
13DS	0.6 to 1.2	0.8 to 1.2	-50°C to +300°C	102 bar

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.

Setting the displacer elements on the cable

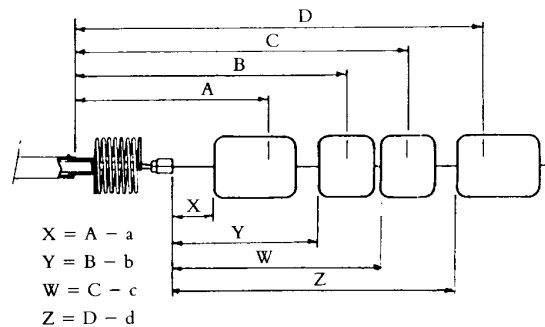
For accurate setting of displacers it is necessary to know the liquid specific gravity, the required switch function (with any liquid rising or liquid falling) and the required distance from end of pressure tube to the relevant switching levels (A,B,C, & D). The following assembly and adjustments should 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.** See page 5 for assembly details and page 10 for installation details.

Type 13DS : Stainless Steel Elements

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



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.

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Level

Two switch models: Types 18DS (2 alarm)

Type 18DS: Stainless steel elements

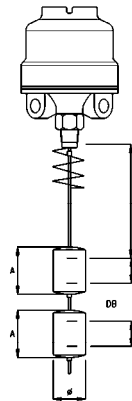
Application

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

18 DS St. Steel : A = 200 Ø = 60.3

Switch Types	4 Contact				8 Contact			
	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 to upper switching level
E min = Differential
D = Minimum dead band

Displacer Type	S.G. Range		Operating Temp. Range	Maximum Pressure 20°C
	4 Contact	8 Contact		
18DS	0.6 to 1.2	0.8 to 1.2	-50°C to +300°C	102 bar

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.

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.

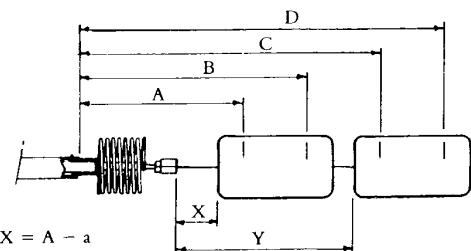
The figure illustrates dimensions A, B, C & D, the relevant switching levels. The upper switch operates between levels A & B (rising and falling level), and the lower switch operates between levels C & D (rising and falling levels). Dimensions X, Y can be determined from the table below.

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.** See page 5 for assembly details and page 10 for installation details.

Type 18DS : Stainless Steel Elements

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



X = A - a
X = B - b
Y = C - c
Y = D - d

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 ±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.

Level

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 5.

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.

Refer to wiring notes on Page 3 at this point.

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 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 displacer controls

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. (See page 5).
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. (See page 5).

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.** See page 12.
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.

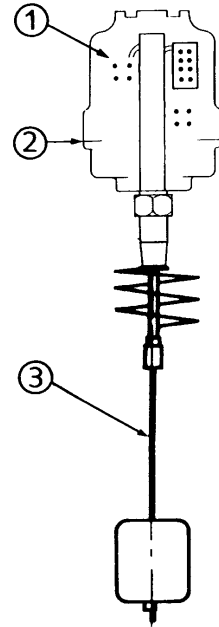
If it is found that a switch mechanism is not in the correct mode, then the liquid level in the chamber should be raised such that the primary displacer magnet passes through the switching point. Lowering the liquid level will then cause the displacer to fall back through the switching point, thus leaving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

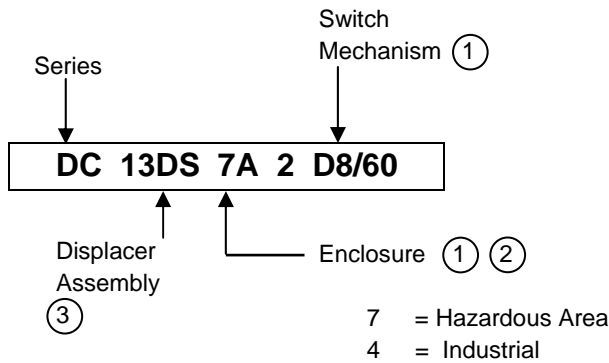
Level

①	Switch Mechanism Kit		Industrial Enclosure S4N	Hazardous Area Enclosure S7A S71
	4 Contact 5 Amp	D4	SK 178	SK 178
4 Contact plated	P4	SK 179	SK 179	
4 Contact 10 Amp	X4	SK 180	SK 180	
4 Contact sealed	H4	SK 181	SK 181	
8 Contact 5 Amp	D8	SK 186	SK 186	
8 Contact plated	P8	SK 187	SK 187	
8 Contact 10 Amp	X8	SK 188	SK 188	
8 Contact sealed	H8	SK 189	SK 189	
②	Seals kit		SK 190	SK 191

③	In the event of damage to any part of the displacer, a complete replacement unit must be fitted. Refer to factory for details, quoting operating pressure temperature and specific gravity of the control	Stainless Steel Types
		11DS
12DS		
13DS		
18DS		



Typical part number



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