INSTRUCTION MANUAL

FOR

Remote Drum Level Switch

MODEL : SDS-3000

Revision 2016-04-04

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1. GENERAL INFORMATION ==========

1.1 ABOUT THIS MANUAL

First and foremost it is essential that this manual be read and understood before installation and start of the Remote Drum Level Switch (SDS-3000). The SDS-3000 requires high temperature and pressure electrodes to make a working system.

ABOUT THE REMOTE DRUM LEVEL SWITCH (SDS-3000)

The Remote Drum Level Switch is to be used only in the manner

outlined in this instruction manual.

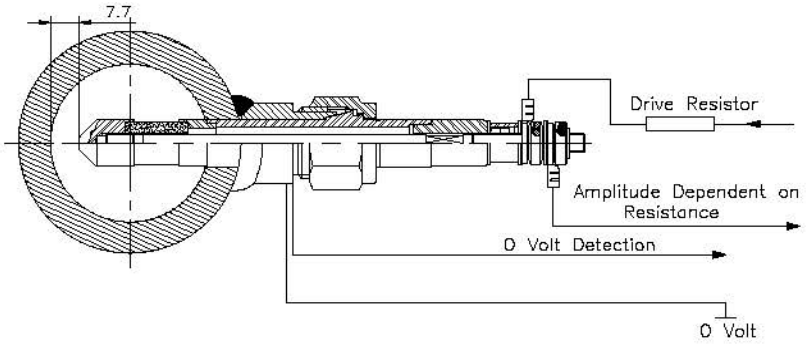
1.2. INTRODUCTION

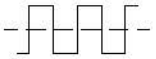
Steam/water interface in the various high pressure and high temperature steam drums operated in electricity-generating power plants, glass, cement, petrochemical, iron & steel, and paper making plants requires close switching and controlling for safe, efficient and reliable operation. Since most of these steam drums normally operate at very high pressure and temperature, any malfunction of the level measuring and controlling instruments must be prevented so that serious interruptions and costly damages to the process or equipment can be precluded.

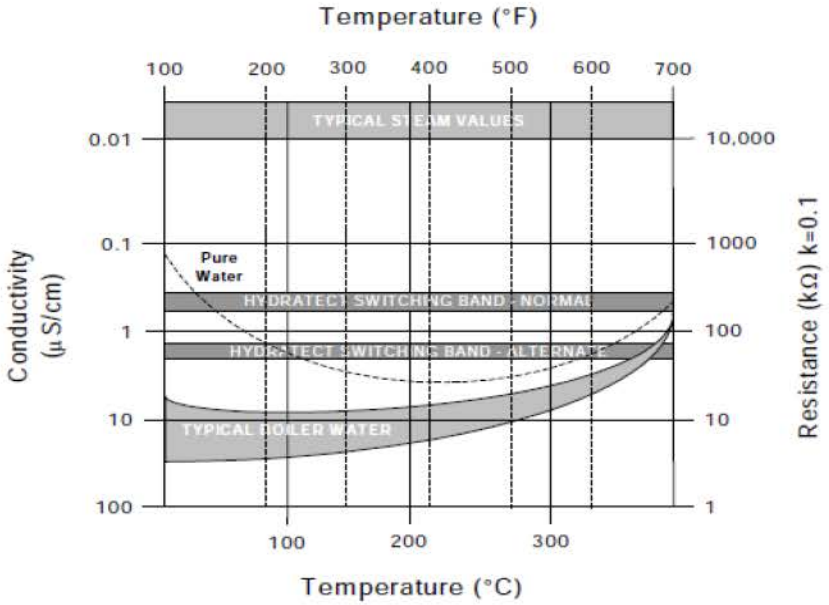
In spite of the importance of close switching and controlling of the drum levels, industries in the past have relied on such devices as glass and float-type level switches. But they often malfunctioned, and required service or replacement interrupting the normal operation and processes. Based on many years of experience as the leading supplier of level and flow sensing instruments and in-company technological innovation, Seojin Instech has succeeded in developing this electrode-type steam drum interface switching system that operates reliably in the extremely high pressure and temperature environment of up to 300 bar(4350psi) and 560℃(1040℉).

Modern boilers provide clean dry steam. Incorrect water level in the drum must be detected: too high a level can lead to turbine blade erosion by wet steam, and too low a level can cause explosion due to the boiler tube overheating. Therefore, indication of water level in steam generating plant and drum level control in the main control room are required by law in every country.

1. 3. PRINCIPLE OF OPERATION



Electrode Point	Received Resistance (at 300°C) (Resistance-KΩ/Dielectric Constant-μS/cm)	
Steam		High Resistance (More than 10,000Ω/Less than 0.01)
Water		Low Resistance (15~40 / 6~9)



<FIG 1> PRINCIPLE OF OPERATION

Two wires are connected to each electrode, one for the signal drive and one for the signal return. A low frequency AC square wave is used to drive the electrodes through drive resistors. A separate wire is used for the signal return from the electrode and at least two further wires are used for the ground connection. When the electrode is in steam a high resistance to ground(water column wall) is presented, and therefore a large signal is returned. When the electrode is in water a low resistance to ground is presented and therefore a small signal is returned. If no signal is returned or only a very small amplitude is returned then either a short circuit to ground is present or a wire has been broken or disconnected. If all the connections to ground become broken or disconnected then the large signal will be returned (equivalent to steam).

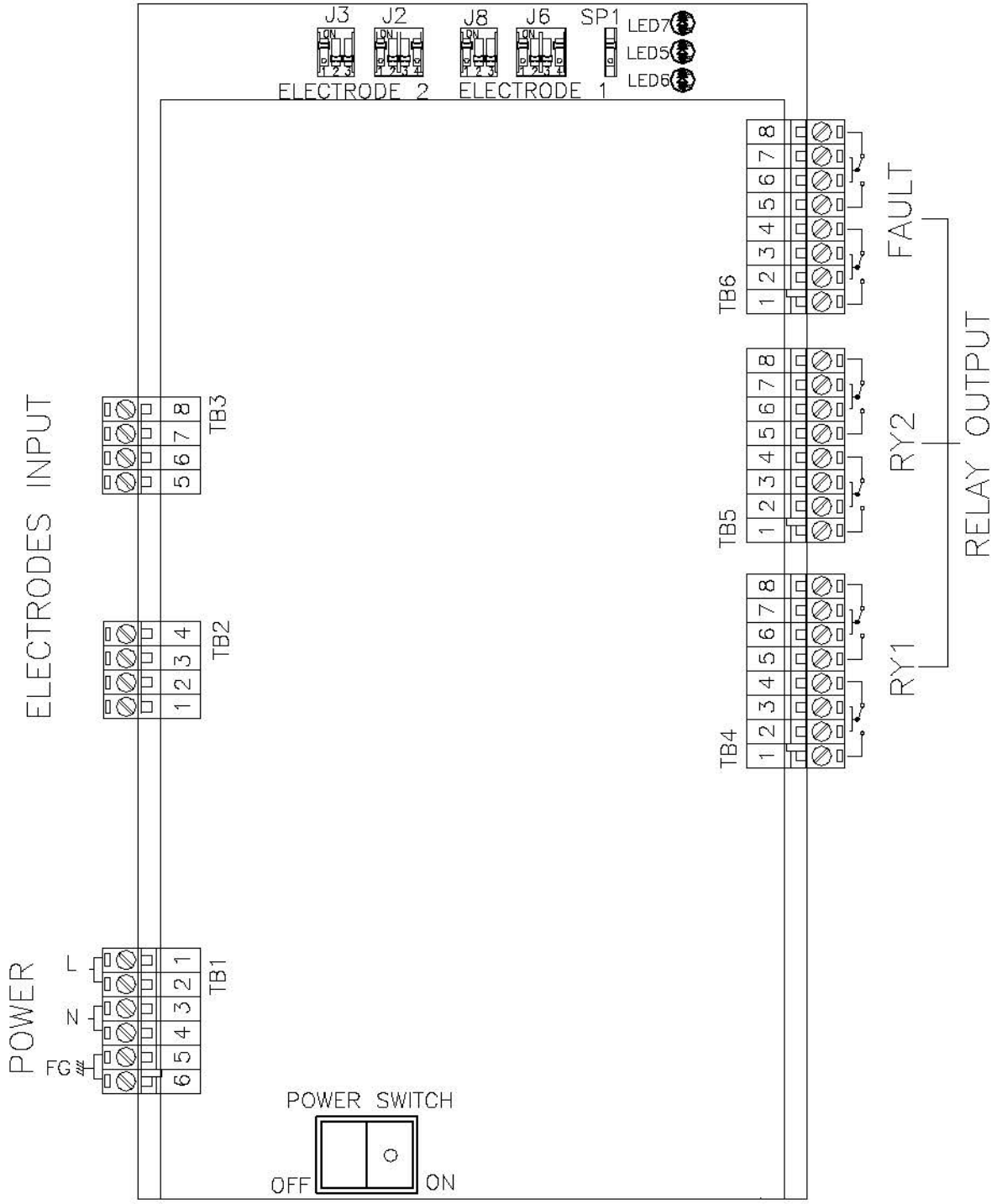
The cell constant for the water column is set such that typical boiler water(has a resistance value of between 2KΩ and 100KΩ, while the typical steam value is greater than 10MΩ.

2. . SPECIFICATIONS ==========

2.1. Remote Drum Level Switch

MODEL : SDS-3000

Power Supply	Free voltage – constant voltage and constant frequency (86..265V AC / 48..65 Hz)
Power Consumption	< 15W
Environment	Location : Indoor / Outdoor Altitude : 2000 m max. Ambient temp.. : < -20℃ ~ 70℃(-4℉ ~ 158℉) Relative humidity : Suitable for outdoor / up to 100% Type 4X / NEMA 4X / IP65 enclosure) Installation category: Ⅲ Pollution degree : 4
conductivity	< 0.6 ~ 1.6μS/cm for pure water (Water / steam)
Electrode channels	< 1 ~ 2 pieces.
Outputs	< 3 DPDT, , Alarm/Trip and Fault relays
Relay contact rating	< Max. voltage : 250V AC / 24V DC < Max. current : AC/DC 5A < Max. switching power : 1500VA / 240W < Electrical connections : Plug-in screw terminals
Enclosure	Stainless Steel case and epoxy-coated 4 point wall mount.(std./with mount brackets) < Dimensions : 388(H)×270(W)×105(D)mm < Mounting size : 366(H)×200(W)mm 4-M8 bolts & nuts < Protection Class: NEMA 4X. IP65 < Net weight : 5.6 Kg < Cable grand Plate Material: PF(Bakelite) - 200×80mm(7.87"×3.15")

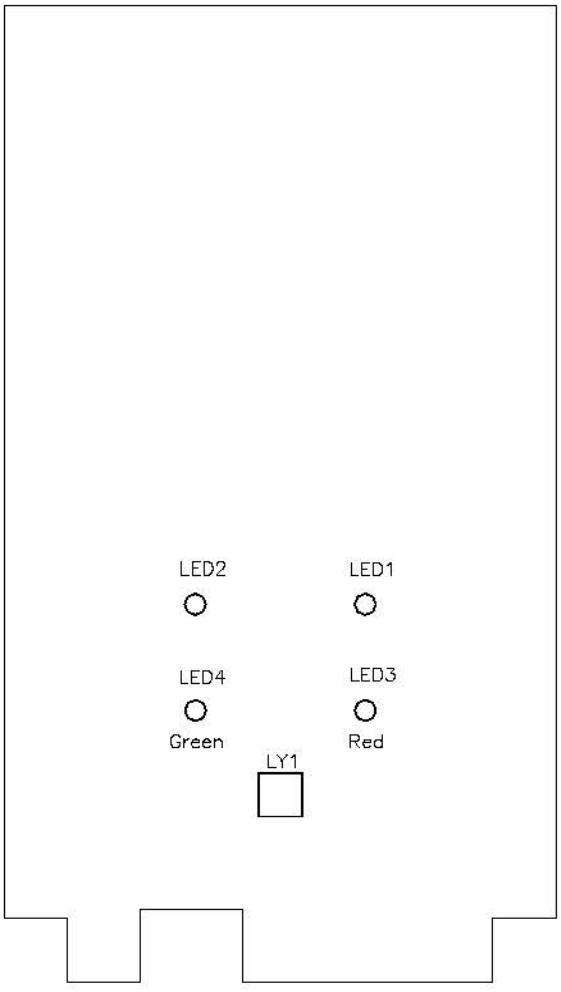


<FIG 2> Main Board LAYPUT

2.2 DISPLAY BOARD

MODEL : SDS-3000-DB

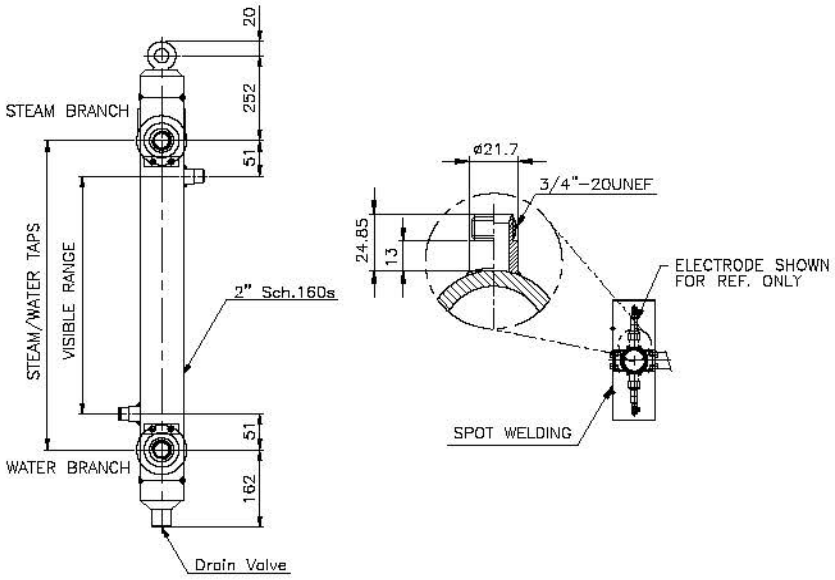
Level Indication	Red/Green LEDs(Circle : LED1~4) Normal status : Green LED on, Event status : Red LED on
Fault Indication	Red LED(Quadrangle: LY1) on status : Impure material built in electrode, Separated wire, Brocken electrode.



<FIG 3>DISPLAY BOARD

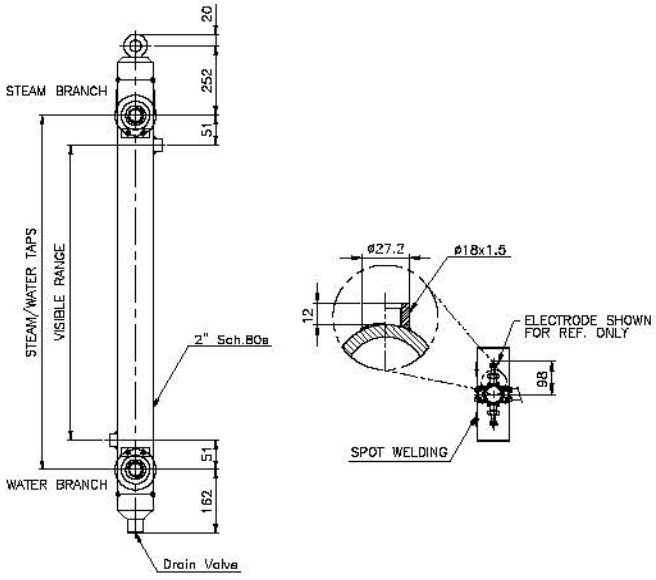
2.3 WATER COLUMN

Part Number	Maximum Pressure	Maximum Temperature	pH Range	Application Electrodes	Application
SM-3056	300 bar(4350psi)	< 560℃(1040℉)	7-11	SHE-56	For High Temp, High Pressure
SM-1234	50 bar (725psi)	< 260℃(500℉)	11-13.5	SLE-26	For Nor. temp, Nor. pressure



WATER COLUMN AND ELECTRODE COVER

SM-3056



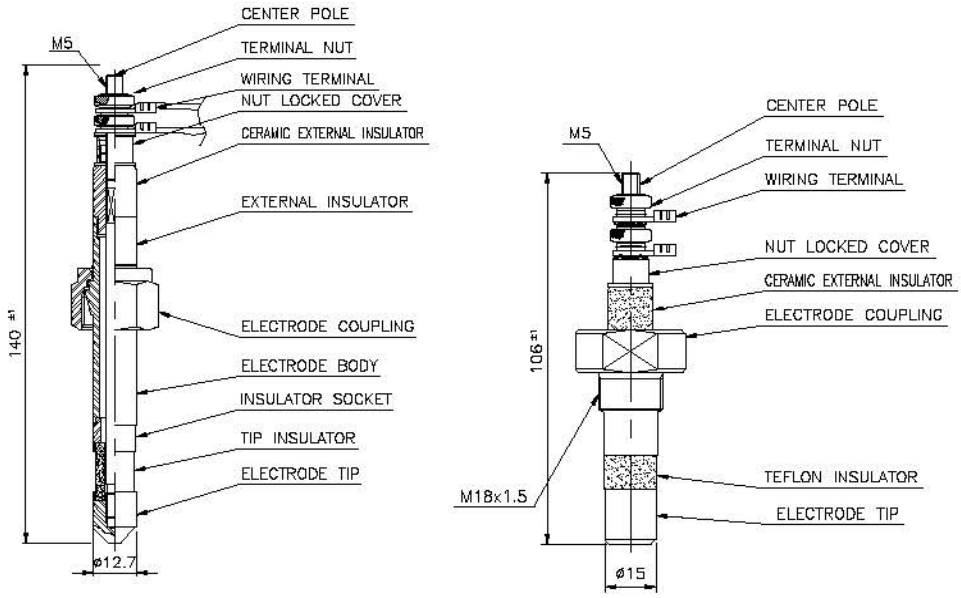
WATER COLUMN AND ELECTRODE COVER

SM-1234

<FIG 4> WATER COLUMN

2.4 ELECTRODES

Part Number	Maximum Pressure	Maximum Temperature	pH Range	Insulation Type	Application
SHE-56	300 bar(4350psi)	< 560℃(1040℉)	7-11	Pure Alumina Ceramic	For High Temp, High Pressure
SLE-26	50 bar (725psi)	< 260℃(500℉)	11-13.5	PTFE	For Nor. temp, Nor. pressure



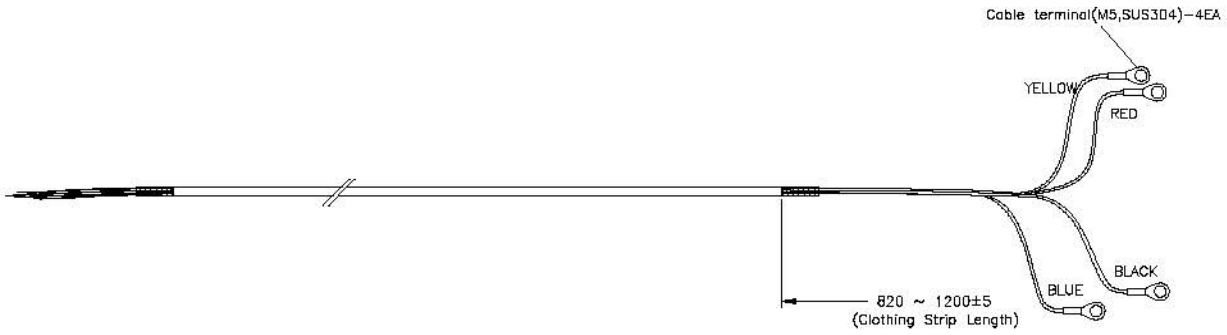
SHE-56 **SLE -26**

<FIG 5> ELECTRODE

2.5 CABLE

Electrodes to Main control unit (SDS-3000)

Part Number	Cable length(in meters)
MODEL: SC-526	3m, 5m, 10m, 20m, 30m max.



<FIG 6> CABLE.

3. INSTALLATION

Installation shall only be performed by qualified personnel

and in accordance with local governing regulations..

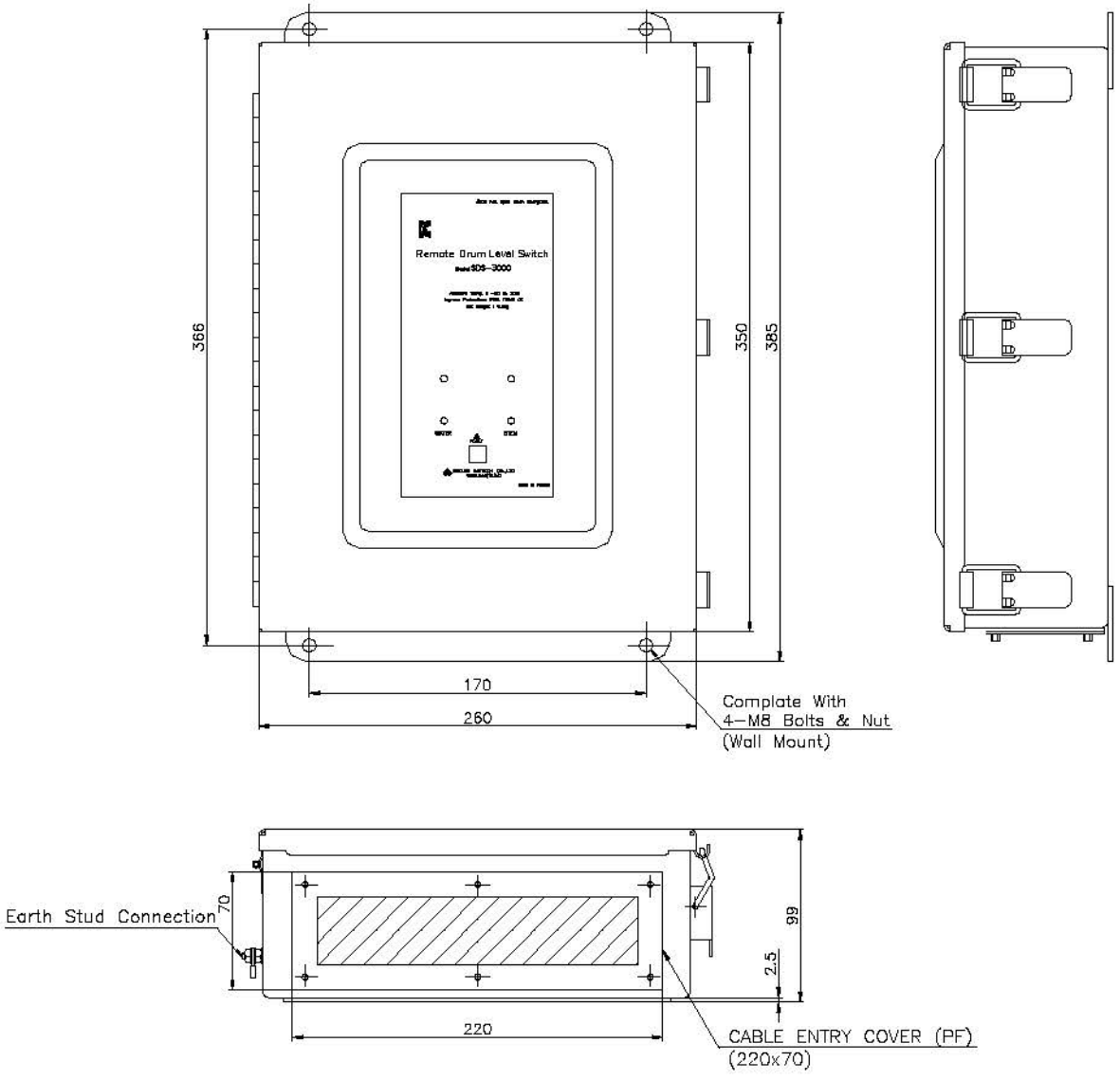
3.1 SYSTEM INSTALLATION

3.1.1 MAIN CONTROL UNIT

The electronic enclosure must be sited within electrode cable length of the water column fixture.

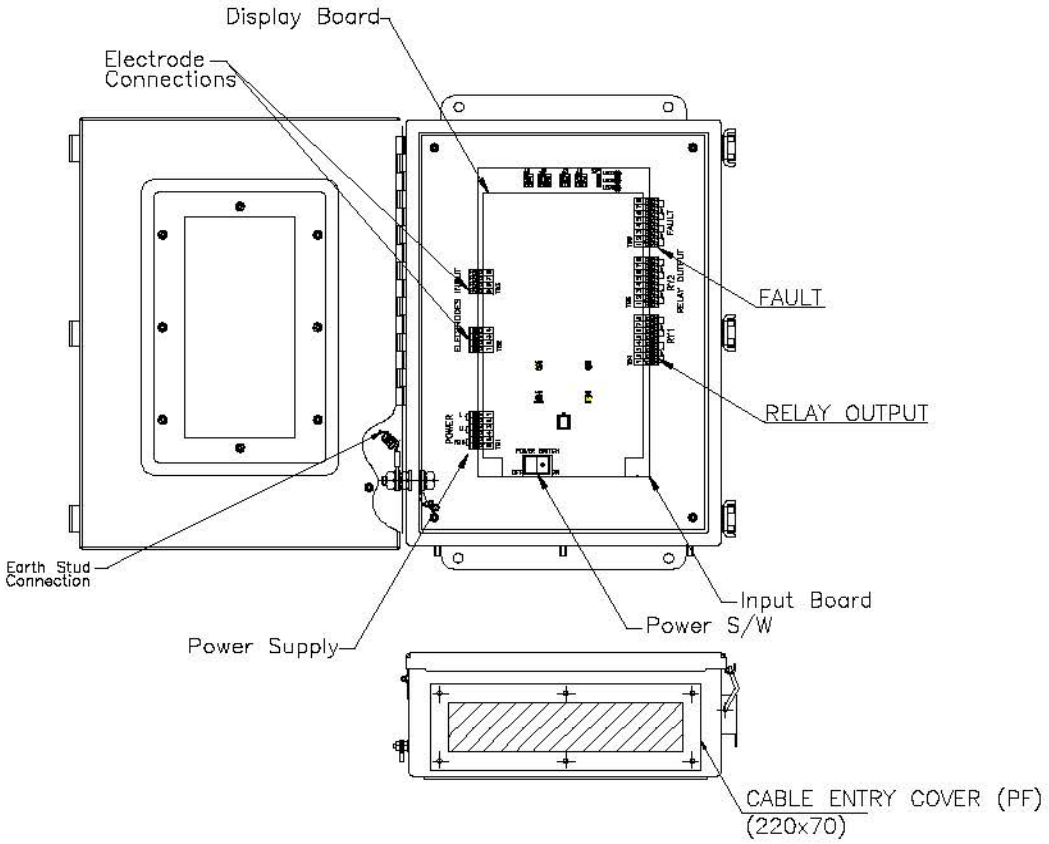
The preferred site for the electronic enclosure is a wall or vertical bracket structure where easy access is available for viewing and servicing. It is also to be provided, such as SUN-VISOR to be shielded from direct sunlight in a main controller. It is assumed that the water column is fully installed.

OUTLINE AND MOUNTING



<FIG 7> MAIN CONTROL UNIT

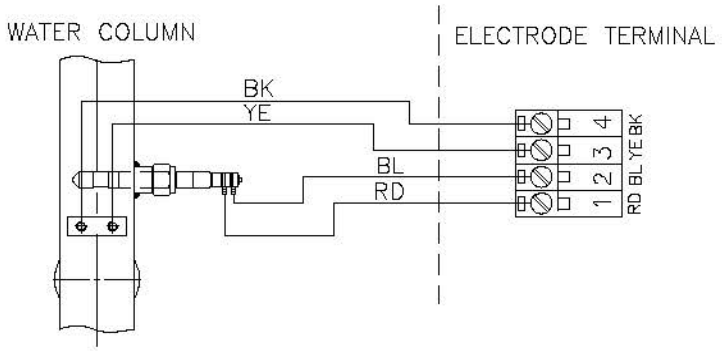
회로 보드 **LAYOUT**



3.1.2 ELECTRICAL INSTALLATION

ELECTRODE CONNECTIONS

Each electrode is connected to its associated discriminator channel via four terminals on the Control Unit PCB. Two connecting arrangements are used, one for electrodes normally residing in water and one for electrodes normally residing in steam. The cable specified for electrode connections is model number SC-526(pure nickel wire, teflon insulated - red, blue, yellow, black, green(unused).



NOTE :

It is important to used the correct cable and not to exceed the recommended cable run lengths in order to minimize shunt capacitive impedances to earth.

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3.1.3 SYSTEM INSTALLATION

PRE-INSTALLATION PREPARATIONS

3.1.3.1. A drawing template is also included at the rear of this section for reprographic use.

3.1.3.2. Identify the positions of the electrode detection points on the pipe-work if pre-worked or have the necessary work carried out.

Note : Electrodes are preferably mounted horizontally.

3.1.4. ELECTRODE

The electrodes are supplied complete with ferrules and nut, gasket in special boxes and should be kept in their packaging until fitted.

3.1.4.1 Careful unpack the electrode and check that there is no damage to the ceramic(teflon) insulators or to the sealing ferrules(spiral wound gasket).- SHE-56(SLE-26)

3.1.4.2 Ease the electrode into the electrode socket, fit the nut(screw) and tighten to finger-tight compression

3.1.4.3 Tighten the nut with a long reach 22~23mm(27mm) A/F spanner to the required torque of 6.2kg-m.

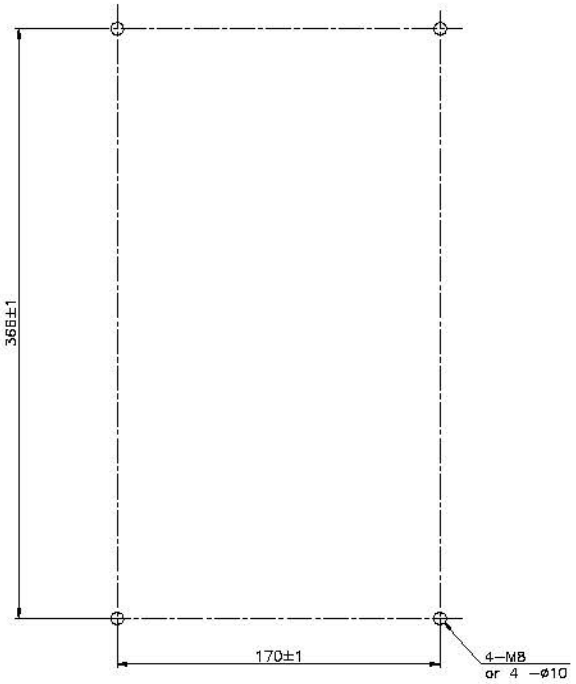
Note: At the first pressure/temperature test, check for leaks and tighten as necessary but **not exceeding** 6.5kg-m.

3.1.5 ELECTRONIC ENCLOSURE

3.1.5.1 Determine the mist suitable position for the Electronic Enclosure fixture with regards to any restrictions on cable lengths, relative positions of the associated electrode detection points and accessibility for servicing.

3.1.5.2 Drill the required fixing holes for the four securing screws, see drawing for the mounting dimensions of the enclosure.

3.1.5.3 Secure the Electronics Enclosure in position.


366±1
170±1
4-M8
or 4 -ø10

3.1.6. CABLE

3.1.6.1 Determine the requirements for the following cables which must also comply with IP65:

3.1.6.1.1 **Electrode Cables**

The number of conductors required for each electrode is determined by the set-up of the electronics,

Notes:

- The maximum distance from the electrodes to the electronic enclosure can generally be defined such that the capacitance of the cable is less than 8000 picofarad
- Cable terminals will accommodate a maximum of 4㎟(solid conductor) and 2.5㎟ (stranded conductor).
- It is recommended for security reasons that the use of junction boxes be avoided, and single cable runs be used.

3.1.6.2 Pull the cables into the electronic enclosure through the glands in readiness for the refitting of the printed circuit board.

3.1.6.3 Open the electrode cover assembly top plate and cylindrical housing and pull the electrode cable through the gland..

3.1.6.4 Attach the earth conductors to the **grounding screws** provided on the cover base plate, using ring lug connectors. If four connectors are used attach one earth conductor to each **grounding screw.**

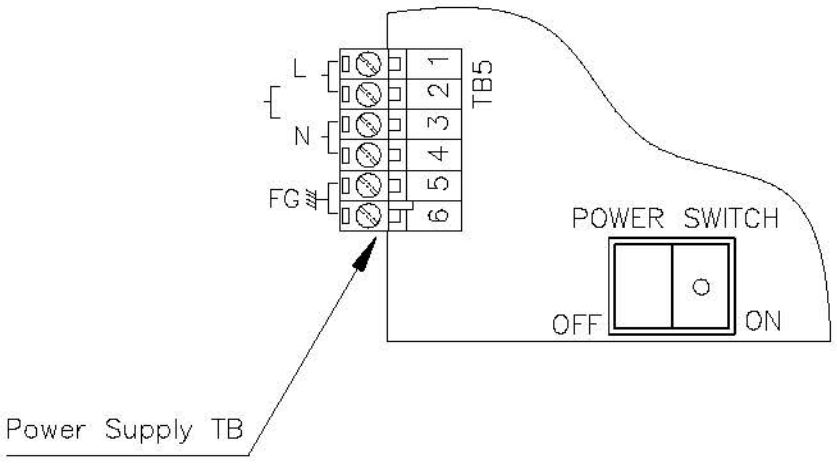
3.1.6.5 Attach the source/sense conductor under both the hexagon nuts for a two conductor cable or the source and sense conductors under separate hexagon nuts in the case of the four conductor cable.

3.1.6.6 Re-assemble the electrode cover assembly ensuring a stress-free run of the cable inside the cylindrical housing before tightening the gland nut. Also ensure the correct orientation of the gland to the pipeline axis is affected.

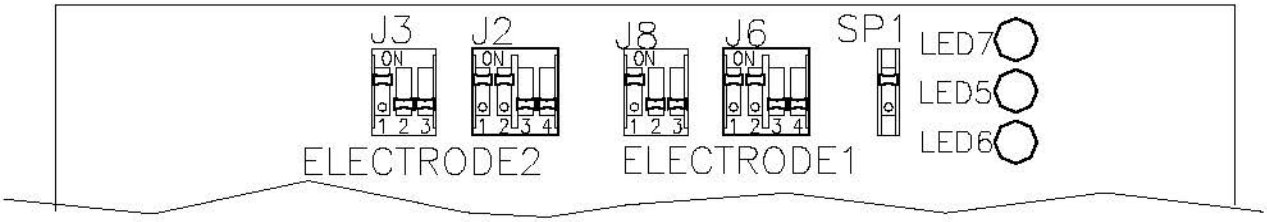
3.1.7. MAIN CIRCUIT BOARD CONFIGURATION

The main circuit board will need setting to the required configuration in order to function correctly for the chosen system. This involves fitting hard wire jumpers to terminal blocks and the on or open circuiting of slide switches.

Withdraw the main circuit board from its storage place and prepare a clean bench for working on. The following wiring and set-ups are required on the PCB:



Power Supply: to be connected terminal N , L .



A series of signaling pathways and adjustment switch for each electrode

Electrode No.	INPUT TERMINAL	SW1,2,3 Sensitivity Adjustment	Inverted Relay output Adjustment	Control Status (H=High, L=Low)			RELAY OUTPUT TERMINAL	DISPLAY
1	TB2	J8	J6	H	L	L-L	TB4	LED6
2	TB3	J3	J2	H-H	H	L	TB5	LED5

3.1.7.1

J3 , J8 Sensitivity Adjustment

J3 , J8 (Switch)			Sensitivity	Remark
1	2	3		
on	off	off	Insensitivity	In the case high water conductivity
off	on	off	Normal	Factory Standard Settings
off	off	on	High sensitivity	In the case low water conductivity

3.1.7.2.

J2, J6 Inverted Relay output Adjustment

	Sw 1,2	Sw 3,4	Status	
J6	on	off	TB4 RY1 (NO) is ON when in contact with Water	Steam Normal
	off	on	TB4 RY1 (NO) is OFF when in contact with Water	Water Normal
J2	on	off	TB5 RY2 (NO) is ON when in contact with Water	Steam Normal
	off	on	TB5 RY2 (NO) is OFF when in contact with Water	Water Normal

SP1 : FAULT Relay Existence decision

SP1	FAULT Relay Status	Remark
OFF	Not used (FAULT Relay NO is OFF	
ON	(TB6) FAULT Relay is ON when an abnormal condition such as ELECTRODE 2 is ON (water detection), ELECTRODE 1 is OFF(steam detection).	Factory Default Settings

3.2. POST INSTALLATION TESTING

Before preparing the system for a fully operational test run it is advisable to simulate water normal and steam normal conditions at the electrodes and ensure the correct indications are displayed at the electronic enclosure. The tests are simple and are as follows:

Note: For this testing procedure, the electrodes must be treated as individual sensors and not configured for any specific validation.

3.2.1. Electrodes Configured to Sense 'Water Normal'

3.2.1. 1. Open the enclosure cover to view the discriminator RED and GREEN indicator LEDs.

3.2.1. 2. Ensure that AC power is present at the electronic enclosure.

3.2.1. 3. Since the pipe-work system is still dry, these electrodes should be registering a high impedance(similar to being in steam) thus the (RED) channel LED will be indicating a **fault** condition.

3.2.1. 4. Gain access to the electrode terminal nuts and short-circuit them to the electrode socket casing. The channel LED indication should change to GREEN, the **normal** condition. Remove the short-circuit and secure the electrode cover assembly.

3.2.1. 5. If no more testing is required, remove the AC power supply from the enclosure and close the cover.

3.2.2. Electrodes Configured to Sense 'Steam Normal'

3.2.2. 1. Open the enclosure cover to view the discriminator RED and GREEN indicator LEDs.

3.2.2. 2. Ensure that AC power is present at the electronic enclosure.

3.2.2. 3. Since the pipe-work system is still dry, the electrodes will be registering a high impedance(similar to being in steam) thus the GREEN channel LED should be illuminated, indicating a **normal** condition.

3.2.2. 4. Gain access to the electrode terminal nuts and disconnect one of the two leads. This should cause a change in channel LED indication from GREEN to RED, a **fault** condition. Refit the lead and the electrode cover assembly.

3.2.2. 5. If no more testing is required, remove the AC power supply from the enclosure and close the cover.

These tests provide a good check on the correct operation of the system.

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3.2.3 Caution & Warning page

⚠ **READ THIS CHAPTER BEFORE USING THE CONTROLLER**

This chapter explains precautions you should observe in order to safely operate the controller. Be sure to read it carefully and follow instructions to the letter so as to prevent harm to you, anyone else, works, the controller or the facility.

Important safety instructions

ELECTRIC-SHOCK HAZARDS-

1. To avoid personal injury, do not remove the controller covers or panels. Do not operate the controller without the covers, switch off power and unplug power cord.
2. To ensure safety, never operate the controller with the ground wire for the power supply removed.
3. Before inserting/removing the power connector, the power switch has to be turned OFF in advance.
4. In time of thunder and lightening, stop your work and disconnect the plug from the receptacle so as to ensure safety.
5. If the controller is suddenly moved from a cold place to a warm place, dew condensation may be observed. In this case, turn ON the power to the controller after you have confirmed that there in no danger of water drops in the controller.
6. Do not allow the power cord to trail on the ground.

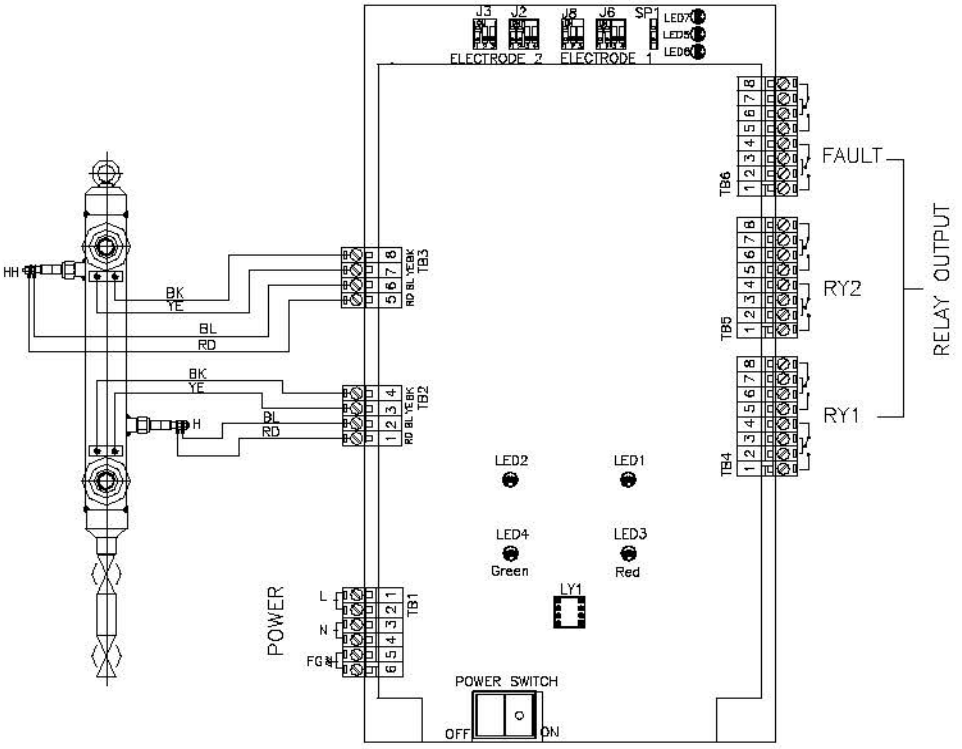
FIRE HAZARDS

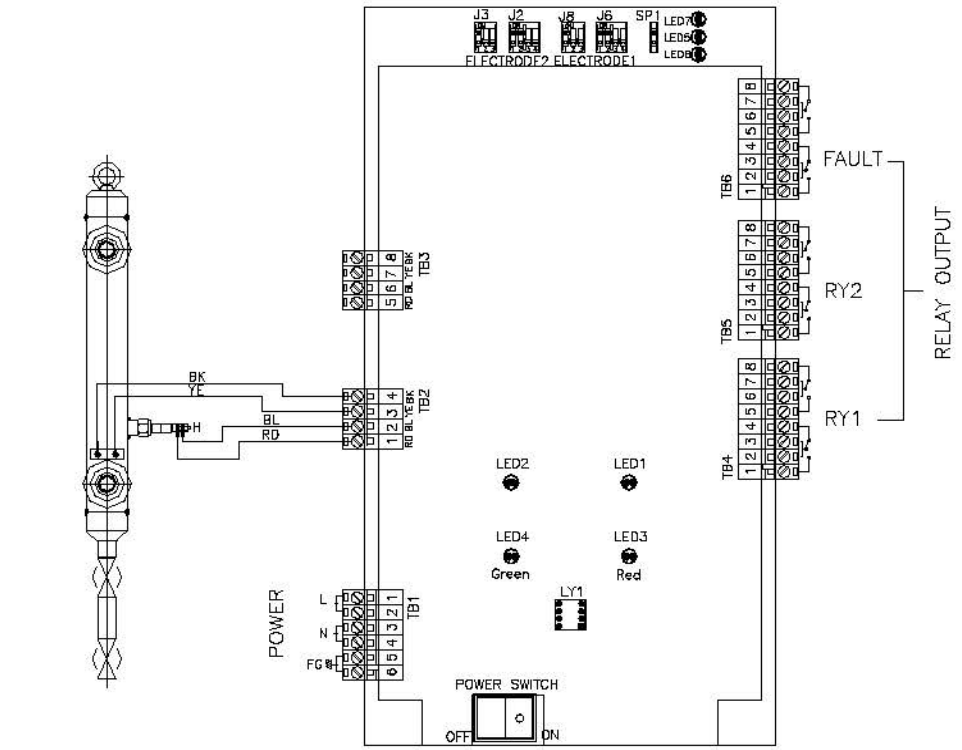
7. To avoid fire hazard, use only a circuit fuses of the correct type, voltage rating and current rating as specified in this manual.

EXPLOSION HAZARDS - Do not operate in explosive atmospheres

8. To avoid explosion, do not operate this controller in an explosive atmosphere unless it has been specifically certified for such operation.

5. WIRING DIAGRAMS





6. MAINTENANCE

6.1 GENERAL

The maintenance of the pipe-work and electrode sockets and any repair work with accompanying testing should follow existing site practice.

Note: Where operator alarm facilities are incorporated, the operator must be informed by the instrument engineer which alarms will be affected by the test(s) to be carried out and for what period of time. In special cases, where automatic control actions would otherwise be initiated, these actions must be inhibited external to the SDS-3000 system before any maintenance or testing is implemented.
The following routine maintenance on the electrode sockets and electrodes is required.

6.2 MONTHLY CHECK

1. Inspect the electrode socket/electrode assemblies and blow or brush off gently any accumulations of dust or dirt on the external insulators of the electrodes.
   Note: Any electrode showing signs of leakage should be replaced.
2. Check that the connections are in good condition, and are tightly secured to the electrode.
3. Check that the electrode cover assemblies are securely attached to their electrode sockets and that the cable glands are in good condition and secure.
4. Inspect all the electronic units to see that their covers are in place and properly secured. Check that all the cables and cable glands are in good condition and that the cable glands are secure.

6.3 ANNUAL OVERHAUL

Annual overhauls are generally the concern of the plant management and will vary in their content. However, where any work is to be carried out in the vicinity of the SDS-3000 equipment and cabling, it is necessary to protect the SDS-3000 system components against possible damage.

6.3.1 SYSTEM PROTECTION AND POST-OVERHAUL CHECKS

SDS-3000 system equipment should be protected where necessary during annual overhauls by means of temporary shielding made from wooden boxes, packing cases and the like, lashed into place to afford protection against mechanical damage while work is being carried out. Within the electronic unit, check that all terminal connections are tight. Any accumulation of dust is to be brushed out with a soft brush (a small clean paint brush is recommended) and the cover seals inspected before the cover is refitted. Check the cables and cable glands for condition. Replace any damaged seals. Refit the unit cover and check all attachments for security.

6.4. REPAIRS-MECHANICAL

6.4.1. ELECTODE ASSEMBLY

The distinction between ferrule and electrode leaks is often difficult to determine prior to the removal of the electrode, unless the leak is a small one. Wisps of steam which appear to emanate from the electrode nut are indicative of a ferrule leak; whereas steam emanating from the external ceramic insulator (which is

only a spacer and not intended to be pressure resistant) suggests that the electrode itself is faulty. Even if the electrode is immersed in water, the temperature in a pressurized system will cause the water to 'flash' off to steam as ambient pressure is reached.

CAUTION:

Do not attempt to cure a ferrule leak by over-tightening the electrode nut. The correct procedure for rectifying an electrode failure is:

1. Remove the electrode cover assembly to gain access to the electrode for examination.
2. If the steam appears to be coming from the ferrules, it may be that the electrode has not been tightened down to the correct torque loading. However, it is recommended that the electrode be removed for examination of the ferrule and the electrode socket seat for damage in the first instance.

Note: Unless it can be established that the electrode was not at fault, it is recommended that a new electrode be fitted. This is specially recommended in the case of an old electrode.

3. If a serious blow occurs, immediate attention is required. Ensure that the electrode socket is isolated as soon as possible, e.g. within a few hours, since erosion may necessitate the replacement of the electrode socket.

6.4.2 SAFETY

a) PROCEED WITH A REPAIR ONLY AFTER A VALID "PERMIT TO WORK" HAS BEEN OBTAINED. (If it is customary on that plant)

b) Ensure that any tripping action is disabled.

c) Advise the operators of any unusual effects likely during plant repair.

d) Ensure that you know the correct procedures before working on the electrode socket.

e) Wear industrial gloves when changing electrodes.

6.4.3 PROCEDURE FOR CHANGING ELECTRODES

1. Carry out the electrode socket isolation procedure (it is not necessary to switch off the SDS-3000 electronic equipment). Allow the pipe-work/electrode to cool to a temperature which is safe to handle.
2. Slacken off gland nut to allow cable freedom and remove the electrode cover assembly. Disconnect the lead(s) from the electrode and the earth lead from the electrode socket. Remove the leads, cover housing, washers and head nuts.
3. Extract the electrode from its electrode socket using a long-reach 23mm A/F socket spanner.
4. Inspect electrode socket seat for damage to the sealing surface.
5. Inspect the new electrode for any signs of damage, ensure the ferrules are in good condition on the electrode body and fit the electrode into the electrode socket.
6. Tighten down the electrode to a torque loading of 9.7kg-m(95Nm/70 Ibft). Do NOT exceed 11.8kg-m(115Nm/85 Ibft).
7. Reconnect the electrode lead(s) to the electrode and the earth lead to the electrode socket. Where two terminal leads are used, ensure each lead is secured by a washer/nut combination. Refit the electrode

cover, ensuring a tress-free cable run inside the cover and then tighten the cable gland nut.

6.4.4 PIPEWORK BLOCKAGE

If a blockage, either partial or total, is diagnosed; isolate the electrode socket and clear the blockage. In some cases it may be necessary to remove the electrodes to prevent damage.

SeoJin Instech Co., Ltd.
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