

INSTRUCTION MANUAL

FOR

Remote Drum Level Indicator

MODEL : SDG-3000

Revision 3 [2019-02-11]

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I . GENERAL INFORMATION =====

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 Indicator (SDG-3000). The SDG-3000 requires high temperature and pressure electrodes to make a working system.

ABOUT THE REMOTE DRUM LEVEL INDICATOR (SDG-3000)

The Remote Drum Level Indicator is to be used only in the manner outlined in this instruction manual.

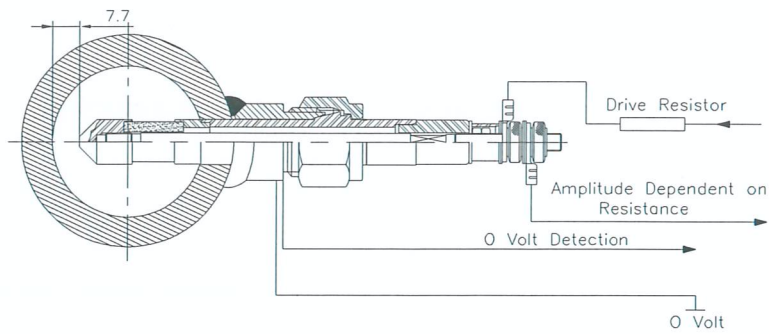
2. INTRODUCTION

Steam/water interface in the various high pressure and high temperature steam drums operated in electricity-generating power plants, glass, cement, petro-chemical, iron & steel, and paper making plants requires close monitoring 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.

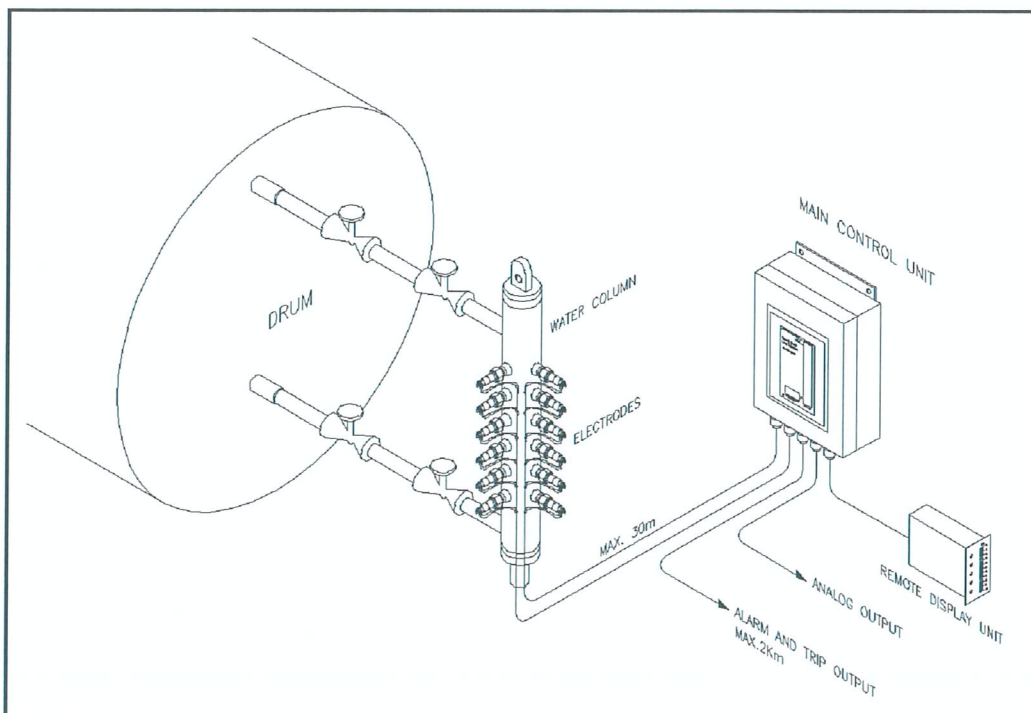
In spite of the importance of close monitoring and controlling of the drum levels, industries in the past have relied on such devices as glass and float-type level switches. But they often malfunctioned, and required service or replacement interrupting the normal operation and processes. Based on many 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 monitoring system that operates reliably in the extremely high pressure and temperature environment of up to 300 bar(4350psi) and 560°C(1040°F).

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 indication in the control room are required by law in every country.

3. PRINCIPLE OF OPERATION



Electrode Point	Received Resistance (at 300°C) (Resistance-KΩ/Dielectric Constant-μS/cm)	
Steam		High Resistance (More than 10,000/Less than 0.01)
Water		Low Resistance (15~40 / 6~9)
Fault		Very Low Resistance (Less than 1/More than 50)



SYSTEM CONFIGURATION DRAWING

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 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 a large signal will be returned (equivalent to steam).

The cell constant for the water column is set such that typical boiler water ($50\mu\text{S}/\text{cm}$) has a resistance value of between $2\text{K}\Omega$ and $100\text{K}\Omega$, while the typical steam value is greater than $10\text{M}\Omega$. A short circuit/broken wire fault is declared if a resistance of less than 960Ω (conductivity greater than $104\mu\text{S}/\text{cm}$) is measured. An alternate value of 333Ω ($300\mu\text{S}/\text{cm}$) is also available.

The drive to the electrode is true AC to prevent electrolytic action, and low frequency so that the electrode cable capacitance does not affect the resistance measurement.

The normal steam/water switching threshold is set at $0.6\mu\text{S}/\text{cm}$. A second threshold of $1.6\mu\text{S}/\text{cm}$ is also available where wet steam conditions are likely (i.e at relatively low temperature, $<200^\circ\text{C}$).

II. SPECIFICATIONS =====

1. REMOTE DRUM LEVEL INDICATOR < MODEL: SDG-3000 >

- ▶ Power Supply: AC 100-240 V 50/60Hz 1.3A Free Voltage
- ▶ Power Consumption: 20W.
- ▶ Environment: Ambient Temp. : -20°C ~ 70°C
(-4°F ~ 158°F)

Relative humidity: Suitable for outdoor /
Up to 100%
(IP65 enclosure)

- ▶ Interface conductivity: 0.6 ~ 1.6μS/cm depending on purity
(Water / steam)
- ▶ Number of electrodes: 8 ~ 16 ea.
(Generally used 8, 10, 12, 16)

▶ Signal output:

Analog output range: 4 ~ 20 mA , 20 ~ 4mA,
0 ~ 20mA , 20 ~ 0mA

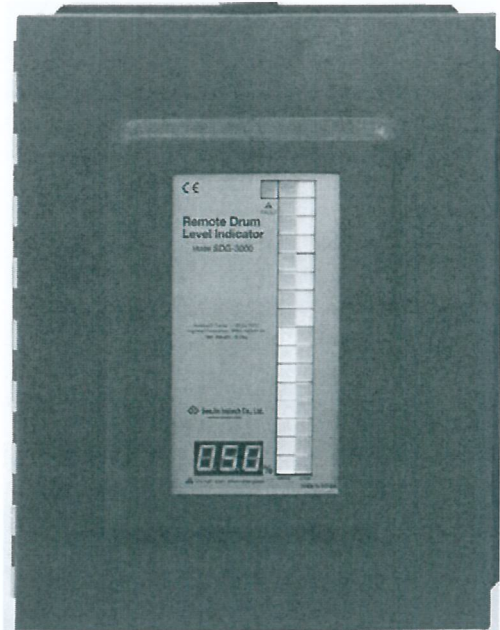
- ▶ Drive capacity: 600Ω at nominal supply voltage
- ▶ Relay Output : 5 SPDT, Alarm/Trip relays
- ▶ Relay Specification:

Max. Voltage: 250V AC
Max. Current: 5A
Max. Contact Rating: 1500VA

▶ Enclosure:

Stainless Steel case and epoxy-coated, (4point wall mount). - mount brackets included
Dimension: 386(H)×270(W)×105(D)mm
Mounting Size: 366(H)×170(W)mm 4-M8 bolts & nuts
Protection Class: NEMA 4X. IP65 / Net weight: 5.6 Kg
Cable Gland plate Material: PF(Bakelite) - 220×70mm(7.87"×3.15")

- ▶ Display : LED bar graph 2 rows ×16 Red/Green LEDs and 1 Red LED
Status: Steam (Red LED), Water (Green LED)
Leaky Electrode = Blinking red/green LED
Abnormal operation = Red LED for Fault
Digital meter: 20mm(H) × Three digit FND for % indication

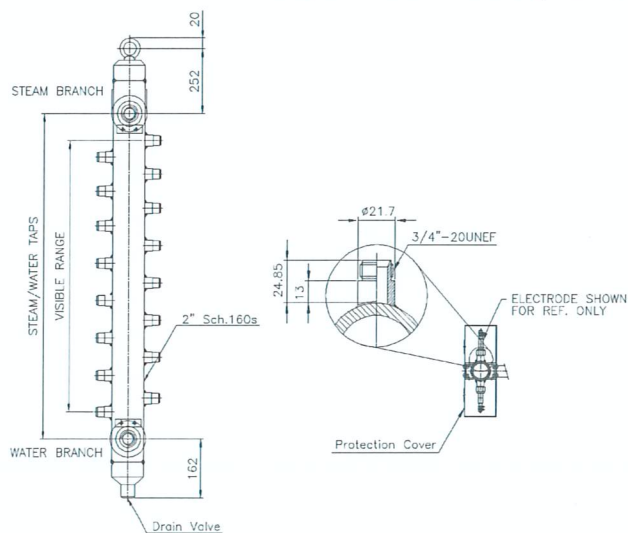


2. WATER COLUMN

Water Column Model Number	Maximum Pressure	Maximum Temperature	pH Range	Application Electrodes	Application
HPC-3056	300 bar (4350psi)	560°C(1040°F)	7-11	SHE-56 (HP Drum)	For High temp. / High pressure
LPC-2137	50 bar (725psi)	260°C(500°F)	11-13.5	SLE-26 (IP & LP Drum)	For Low temp. / Low pressure

A. FOR HIGH TEMP. HIGH PRESSURE APPLICATIONS <MODEL: HPC-3056>

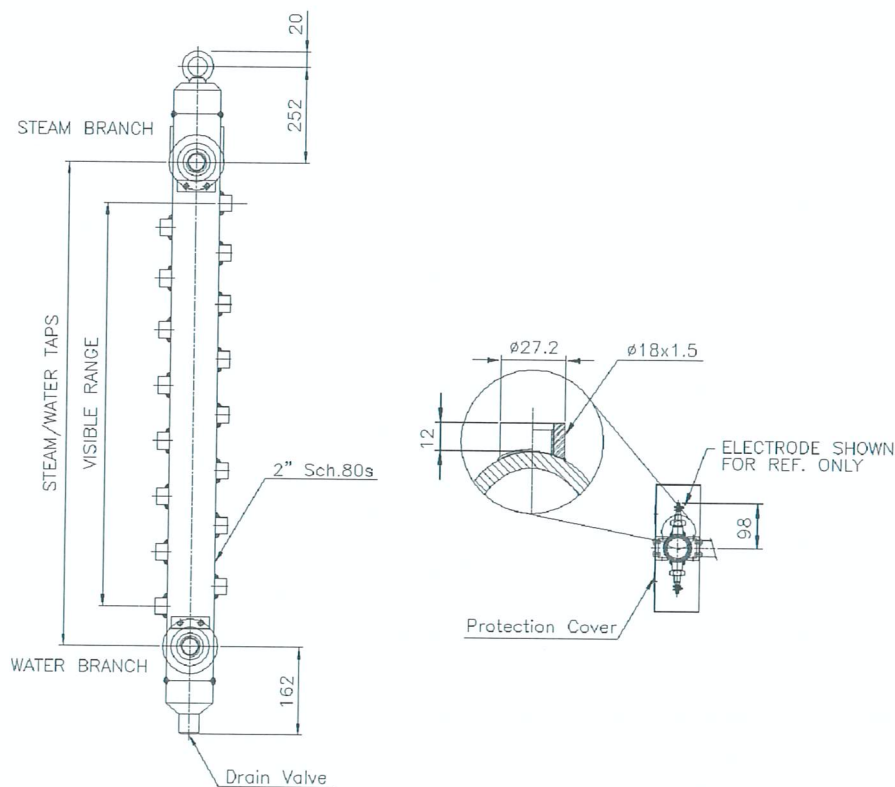
- ▶ Design code: : ASME IX. / ASME 31.1
- ▶ Material: 2" Sch. 160, A105/106. Gr.B (carbon steel) - Std.
- ▶ Optional: A335-P11/A182-F11, A335-P91/A182-F91, A335-P12/A182-F12, A335-P22/A182-F22 A105/106. Gr.C, 304SS, 316SS, etc.
- ▶ Application pressure limit: 300 bar(306Kg/cm², 4350psi)
- ▶ Design & test pressure: Hydrostatic test at 450 bar(459Kg/cm², 6525psi) at
- ▶ Application temp. Limit : 560°C (1040°F)
- ▶ Min. electrodes space: For SHE-56 electrodes: Min. 19mm (0.75") (Center to center)
- ▶ Process connection: Two way 1" or 1.5", Socket weld
- ▶ Accessories: Electrodes protection cover (Door type / 304ss)
- ▶ Optional accessories: Drain valve: 1/2", 3/4" or 1" Socket or butt weld. ANSI #600, #1500, #1500 Special, #2500 lb. Globe or Gate Valve. (One or Two)



WATER COLUMN AND PROTECTION COVER

B. FOR LOW TEMP. PRESSURE APPLICATIONS < MODEL: LPC-2137 >

- ▶ Design code: ASME IX. Welding / ASME B31.1 POWER PIPING
- ▶ Material: 2" Sch. 80, A105/106. Gr.B (carbon steel) - Std.
- ▶ Optional: A335-P11/A182-F11, A335-P91/A182-F91,
A105/106. Gr.C, 304SS, 316SS, etc.
- ▶ Application pressure limit: < 50 bar (51Kg/cm², 725psi)
- ▶ Design & test pressure: < Hydro test at 20°C/100 bar(102Kg/cm², 1450psi)
- ▶ Application temp. Limit : < 260°C (500°F)
- ▶ Min. electrodes space: For SLE-26 electrodes: Min. 25mm (1")
(Center to center)
- ▶ Process connection: Two way 1" or 1.5", Socket weld.
- ▶ Accessories: Electrodes protection cover (Door type / 304ss)
- ▶ Optional accessories: Drain valve: 1/2", 3/4" or 1" Socket or butt weld.
ANSI #150, #300, #600 lb.
Globe or Gate Valve. (One or Two)

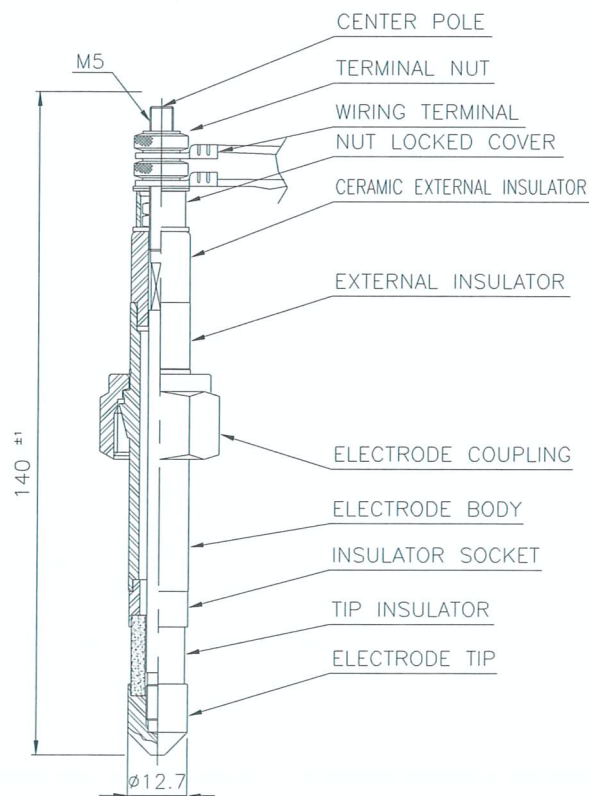


WATER COLUMN AND PROTECTION COVER

3. ELECTRODES

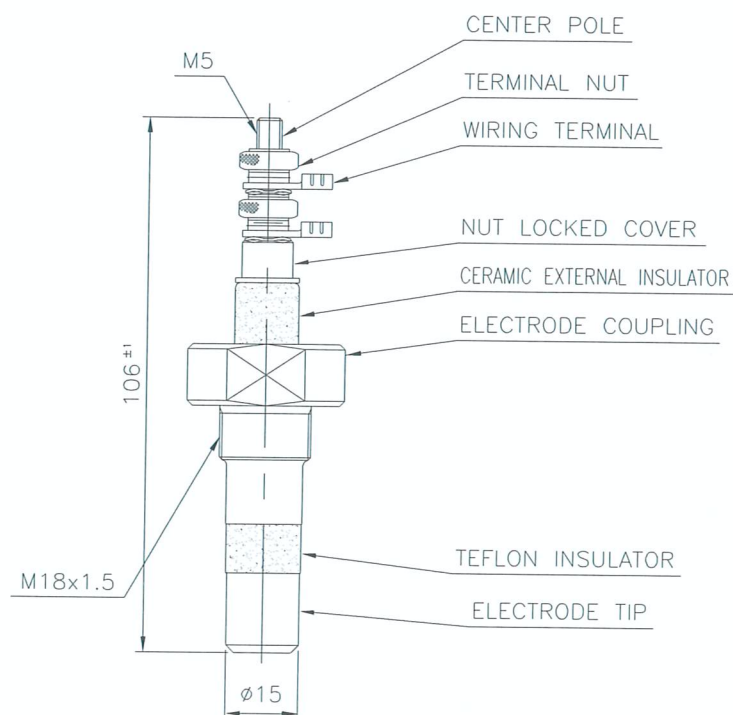
A. FOR HIGH TEMP. HIGH PRESSURE APPLICATIONS < MODEL: SHE-56 >

- ▶ Pressure rating: 300 bar (303Kg/cm², 4350psi)
- ▶ Design & test pressure: Hydrostatic test at 450 bar(459Kg/cm², 6525psi) at ambient temp.
- ▶ Application temp. : 560°C (1040°F)
- ▶ Body material: Special alloy (Titanium) and 316SS
- ▶ Insulator material: Ultra high purity alumina ceramic
- ▶ pH range: 7 ~ 11
- ▶ Fittings: 22mm A/F nut. 3/4"×20 UNEF.
- ▶ Sealing: Complete with ferrule sealing
- ▶ Min. electrodes space: Min. 19mm (0.75") - Anti-interference distance
- ▶ Net weight: 120g (2.6 lb.)



B. FOR LOW TEMP. LOW PRESSURE APPLICATIONS < MODEL : SLE-26 >

- ▶ Pressure rating: 50 bar (51Kg/cm², 725psi)
- ▶ Design & test pressure: Hydrostatic test at 100 bar(102Kg/cm², 1450psi) at ambient temp.
- ▶ Application temp. : 260°C (500°F)
- ▶ Body material: 316SS
- ▶ Insulator material: PTFE
- ▶ pH range: 7 ~ 13.5
- ▶ Fittings: M18×1.5 screw in type.
- ▶ Sealing: Complete with metal sealing gasket.
 - Rolled ring for type PILLAR 2600-GOO (parts No.)
- ▶ Min. electrodes space: Min. 25mm (1") - Anti-interference distance
- ▶ Net weight: 120g (2.6 lb.)



4. CABLE SPECIFICATIONS

A. Electrodes to Main Control Unit SDG-3000(Level gauge) Special cable for Electrodes to Control Unit (High temp.)

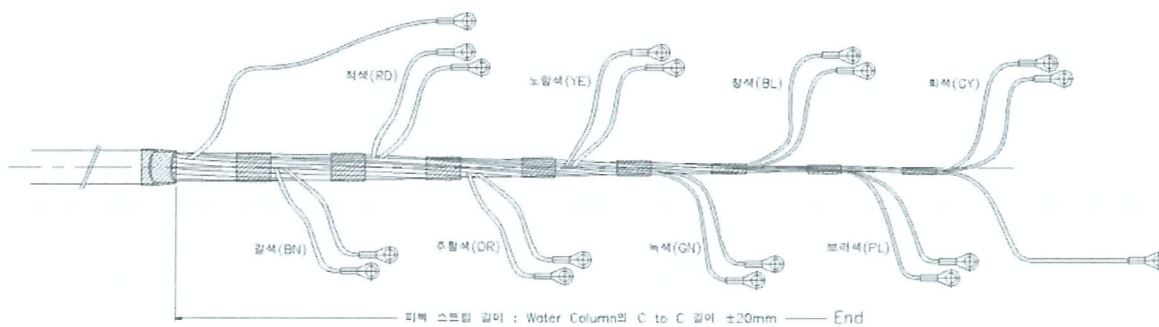
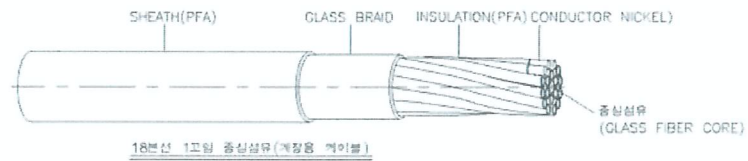
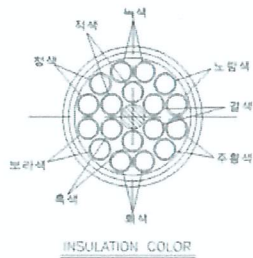
< MODEL: SC-1826 >

- ▶ Supplied length: 3m STD. 5m, 10m, 20m, 30m max.
- Direct connect to Main control unit

▶ Cable dimension :

Conductor		Center Filler		1st CORE			Braid thickness (mm)	Sheath thickness (mm)	Finished overall diameter (mmΦ)
Cross sectional area (mm ²)	Outside diameter (mmΦ)	Color	Outside diameter (mmΦ)	Color	Insulation thickness (mm)	Outside diameter (mmΦ)			
0.37	0.78	BK	1.50	BR	0.36	1.50	0.15	0.60	9.00 ± 0.50
				BK					
				RD					
				GN					
				YL					
				OR					
				BL					
				VO					
GR									

- ▶ Cable spec. : 18 core special cable.
(Nickel coated copper, PFA insulator)
- ▶ Cable color : Jacket : Black or White
Buffer tube : Brown, Red, Orange, Yellow, Green, Blue, Purple, Gray, Black(Each pair)
Cable connection electrode number : Max. 8ea



Special cable assembly for high temperature is cut to the appropriate length depending on the distance of the

length of the electrode of the water column is designed as the illustration above. Each of the wires is pressed to the O-type terminal of the 304SS material to withstand high temperature degradation and working with shrinkable tube is working in factory. Therefore, the generic cables cannot be used and the terminal box or extra wiring must not use for extension. It should be connected directly to a supplied cable assembly. (If the length is short, it must rework orders to the factory.)

5. Remote Display Unit (OPTION) < MODEL: SRD-32 >

- ▶ Power Supply : Derived from Main Control Unit (SDG-3000) or Local Power
20 ~ 36V DC. 240mA.

- ▶ Indication: LED bar graph: 6×3mm, 2rows×16 Red/Green
 - Status: Steam = Red LED
 - Water = Green LED
 - Leaky electrode = Blanking Red/Green LED
 - Abnormal Operation = Red LED
 - Digital meter: Three digits FND for % indication

- ▶ Enclosure Type : Panel Mounting
 - Material: PPO & PC

- ▶ Dimension: 144(H)×72(W)×167(D)mm. (5.67"×2.83"×6.57")

- ▶ Panel Cut-out Size: 137(H)×67(W)mm ±1mm. (5.39"×2.64" ±0.04")

- ▶ Electrical connections: Plug-in screw terminals

- ▶ Net weight: 1.4 Kg (3.1 lb.)

- ▶ Model name : Input/output board = SRD-32-I/OB
Display board = SRD-32-DB

B. Control unit SDG-3000 to optional Remote Display Unit SRD-32

B-1) locally powered (CCR) unit

Up to 1000m from main unit: ① **BELDEN type No. 8723**
 #22-2pr, PO, Indiv. Foil, PVC Jkt, CM
 Shielded. Two pair twisted.

② **BELDEN type No. 8777**
 #22-3pr, PO, Indiv. Foil, PVC Jkt, CM
 Shielded. Three pair twisted.

B-2) Powered from main unit (SDG-3000)

Up to 250m from main unit: **BELDEN type No. 8723 (표준형)**
 #22-2pr, PO, Indiv. Foil, PVC Jkt, CM
 Shielded. Two pair twisted.

Up to 500m from main unit: ① **BELDEN type No. 8777**
 #22-3pr, PO, Indiv. Foil, PVC Jkt, CM
 Shielded. Three pair twisted.
 22AWG. 0.324sq. 7×0.25mm shielded. Three pair twisted (6C)

② **BELDEN type No. 8778**
 #22-6pr, PO, Indiv. Foil, PVC Jkt, CM
 Shielded. Six pair twisted.

Up to 1000m from main unit: ① **BELDEN type No. 9773**
 #18-3pr, PO, Indiv. Foil, PVC Jkt, CM
 Shielded. Three pair twisted.

② **BELDEN type No. 9774**
 #18-6pr, PO, Indiv. Foil, PVC Jkt, CM
 Shielded. Six pair twisted.

▶Part Number: 8723

22 AWG stranded (7x30) tinned copper conductors, polypropylene insulation, twisted pairs, individually Beldfoil® shielded (100% coverage), 24 AWG stranded tinned copper drain wire, PVC jacket.

**▶Part Number: 8777**

22 AWG stranded (7x30) tinned copper conductors, polypropylene insulation, twisted pairs individually Beldfoil® shielded (100% coverage), 22 AWG stranded tinned copper drain wire, PVC jacket.

**▶Part Number: 8778**

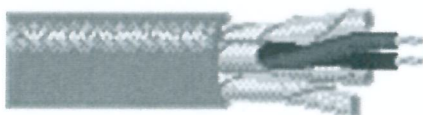
22 AWG stranded (7x30) tinned copper conductor, polypropylene insulation, twisted pairs individually shielded with Beldfoil® (100% coverage), overall PVC jacket and 22 AWG stranded tinned copper drain wire.

**▶Part Number: 9773**

18 AWG stranded (19x30) tinned copper conductors, polypropylene insulation, twisted pairs, individually shielded with Beldfoil® (100% coverage), 20 AWG stranded tinned copper drain wire, PVC jacket.

**▶Part Number: 9774**

18 AWG stranded (19x30) tinned copper conductors, polypropylene insulation, twisted pairs, individually shielded with Beldfoil® (100% coverage), 20 AWG stranded tinned copper drain wire, PVC jacket.



III. INSTALLATION =====

Installation shall only be performed by qualified personnel
and in accordance with local governing regulations.

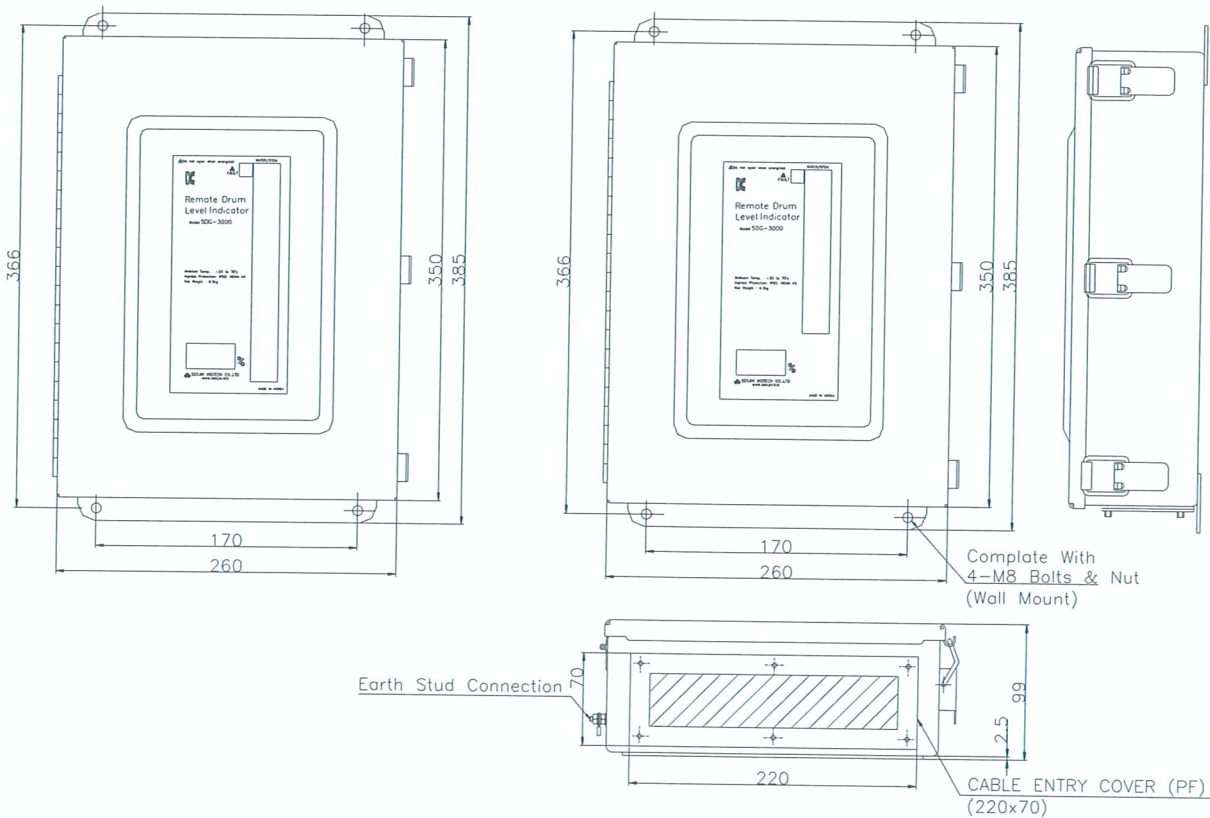
1. MAIN CONTROL UNIT- SDG-3000

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 assumed that the water column is fully installed.

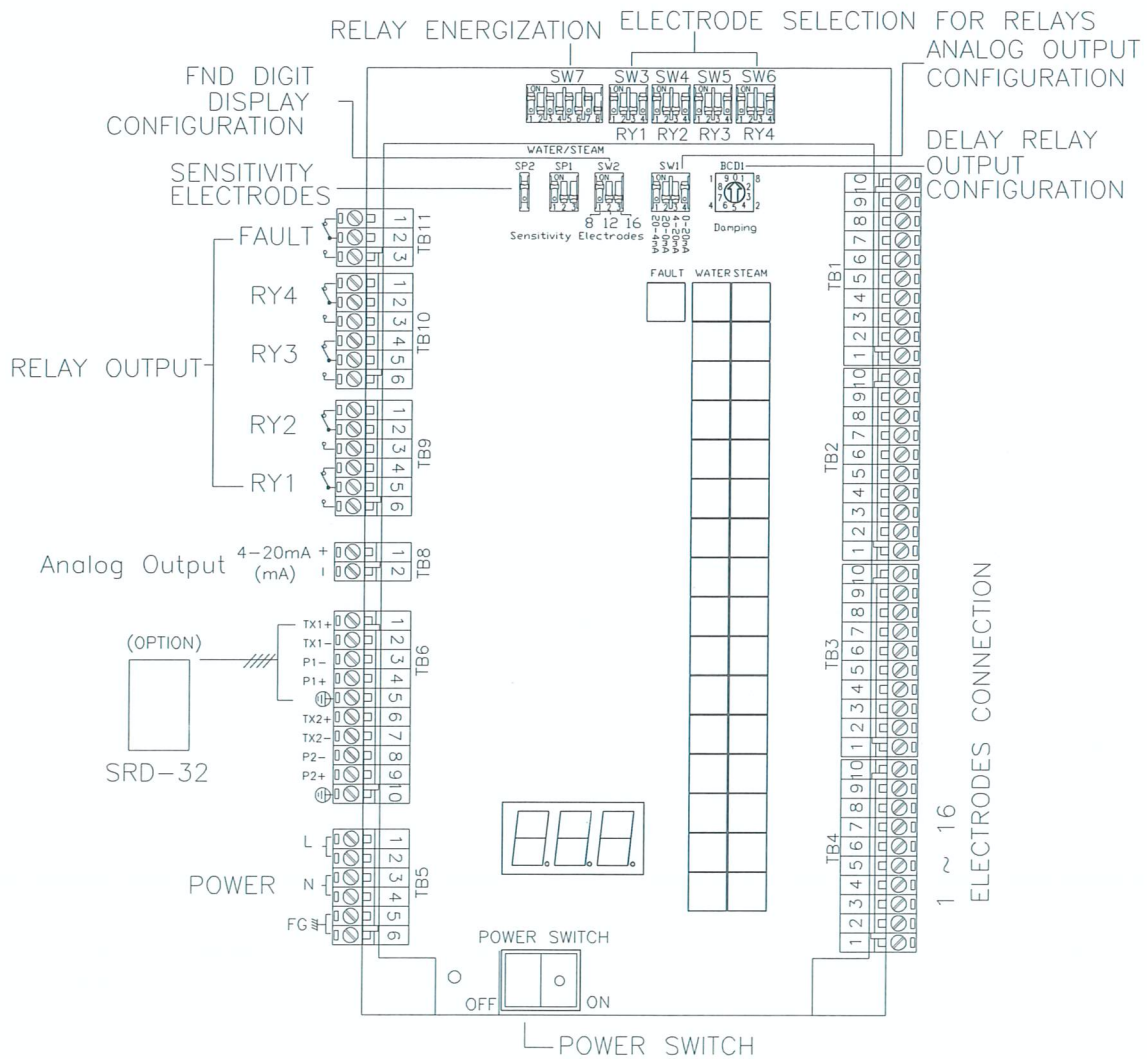
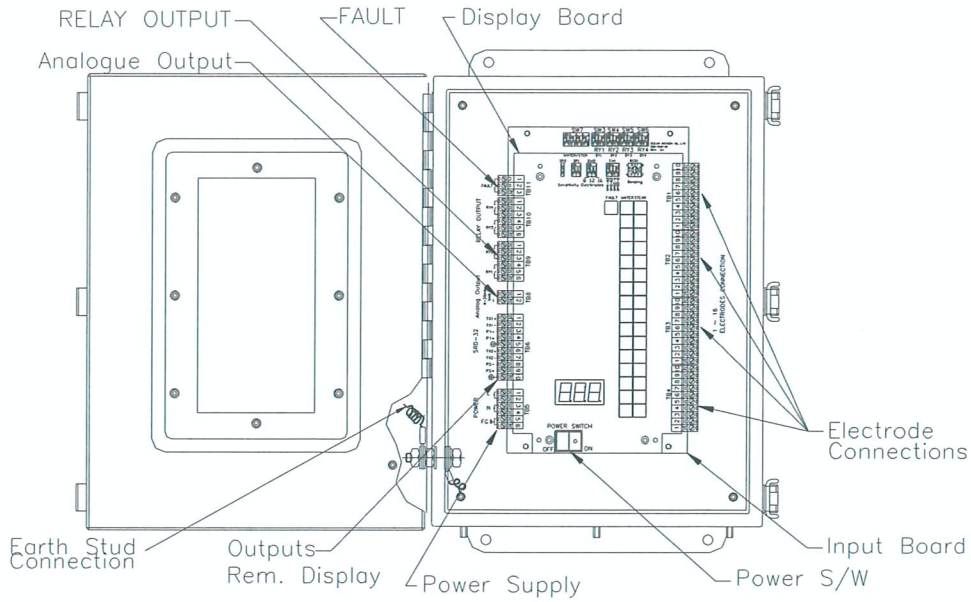
A. OUTLINE AND MOUNTING

Electrode 16 TYPE
Electrode 8 TYPE

Electrode 12 TYPE
Electrode 10 TYPE













B. LAYOUT of MAIN CONTROL UNIT



2. ELECTRICAL INSTALLATION

A. ELECTRICAL INSTALLATION

The BLACK line, which is included in each cable, is used for the EARTH connection and the remaining 8 pairs with different colors are used for the connection of electrodes. 4 electrodes are connected to one terminal with 10 pins1, from the bottom to the top in order of the number of electrodes. Please also be noted that an electrode will need to be connected to every two terminal pins since all even numbers of electrodes need to be on one side of a water column whereas all odd numbers of electrodes will need to be on the other side of the water column.

Pin Number		Function TB1, TB2, TB3, TB4(Main Board)	
10		10	Electrode drive
9		9	Electrode pick-up
8		8	Functional earth
7		7	Electrode drive
6		6	Electrode pick-up
5		5	Electrode drive
4		4	Electrode pick-up
3		3	Functional earth
2		2	Electrode drive
1		1	Electrode pick-up

A full set of electrode connection diagrams is included at the pin-by-pin pairings for all electrodes system mentioned.

► Connecting Cables to Water Column Electrodes (16 Electrodes System)

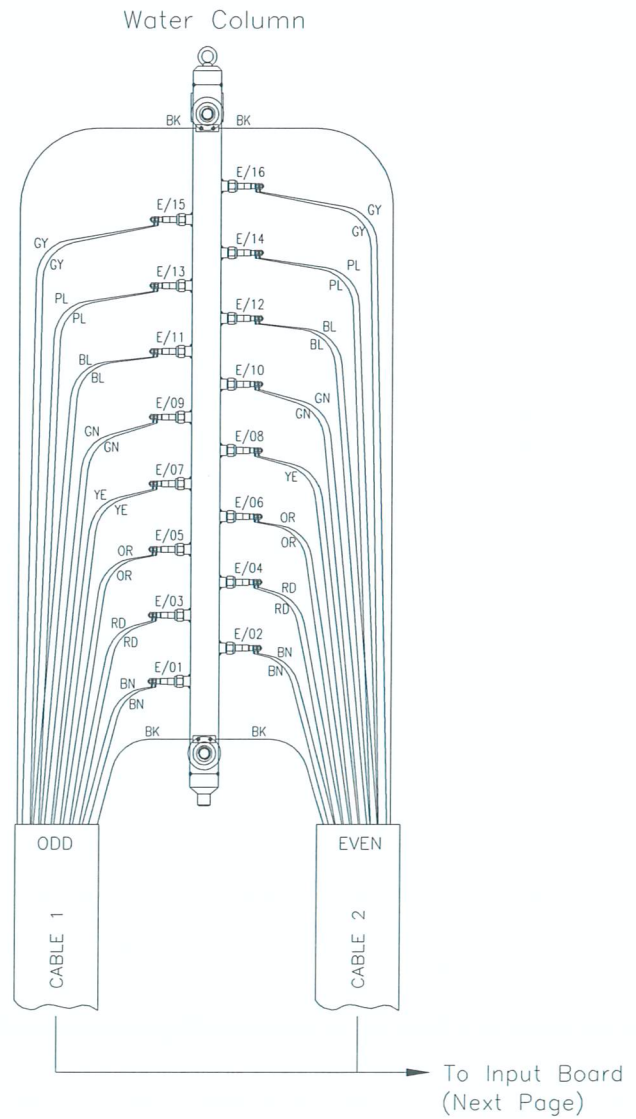
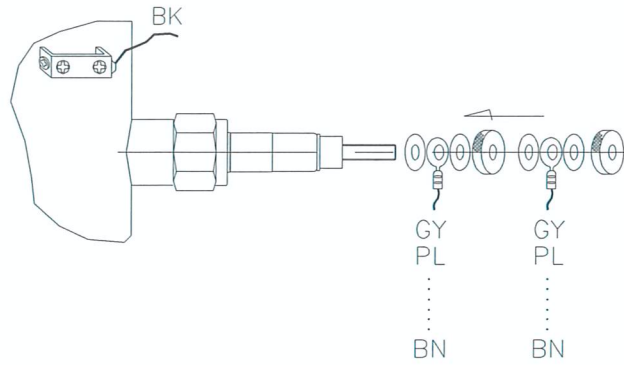
1. Gain access to the electrodes mounted on the water column.
2. Unscrew both nuts on the stud of the bottom electrode (E/01) and remove both the nuts and washers.
3. The first connect the black (BK) two-wire grounding wire to the grounding connection screw located on the top and bottom of the water column
4. Take one of the brown(BN) conductors in **Cable 1** and fit the ring clamp of the conductor over the stud, followed by a washer and a hexagonal nut. Tighten the nut to form a good secure contact, ensuring the conductor run to the cable-form clamping bar is free from snags and sharp bends. Repeat the operation for the remaining brown(BN) conductor of **Cable 1**.

Caution: Tighten the LUG clamping nuts only with your hands without using any tools such as spanner. Be mindful not to lose the nuts. Tightening with tools can damage the electrodes

5. Take the next electrode up, referenced E/02 on the drawings, and repeat the operations detailed in paragraph 2 above.
6. Take the brown(BN) conductors of **Cable 2** and repeat the fitting instructions detailed in paragraph 3 above.
7. Repeat the operations of paragraphs 2 and 3 for the remaining tabulated conductor/electrode pairings on the next page and connect as detailed in figure.
8. Check that all conductor runs affecting **Cables 1** and **2** on the water column are satisfactory then clamp the cable securely to its clamping bar.
9. Refit any Electrode Protection Cover to the water column.

► Water column connections for 16 electrodes

Conductors to be connected		Target Electrode Reference
Color	From Cable	
Black (BK)	2	Earth point
Black (BK)	1	Earth point
Gray (GY)	2	E/16
Gray (GY)	1	E/15
Purple (PL)	2	E/14
Purple (PL)	1	E/13
Blue (BL)	2	E/12
Blue (BL)	1	E/11
Green (GN)	2	E/10
Green (GN)	1	E/09
Yellow (YE)	2	E/08
Yellow (YE)	1	E/07
Orange (OR)	2	E/06
Orange (OR)	1	E/05
Red (RD)	2	E/04
Red (RD)	1	E/03
Brown (BN)	2	E/02
Brown (BN)	1	E/01
Black (BK)	2	Earth point
Black (BK)	1	Earth point

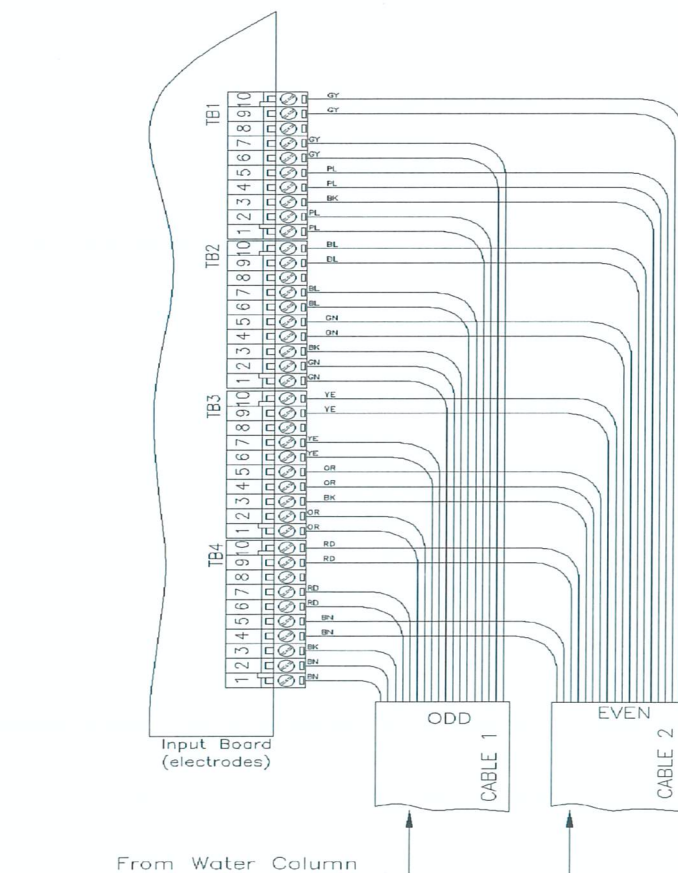


There are two conductors of each color per cable

► Connecting the Electrodes Cable Assemblies to SDG-3000 Enclosure.

Four 10-way plugs are provided on each PCB 1 to terminate all the necessary connections from the electrode cable.

1. Ensure power is removed from electronic enclosure and open the front cover.
2. Feed Cables 1 and 2 into the enclosure through its flexible tube(if applicable).
Prepare the cable screens and terminate the screens at the gland plate.
3. Prepare the individual conductor lengths to suit their orientation in the terminal blocks TB1 and TB2, TB3, TB4 on their respective PCB SDG-3000
Ensure that the cables run along the sides of the box at or below base plate level.
4. Separated Terminal sockets from terminal block(TB1, TB2, TB3, TB4).
Connect electrodes No. 13,14,15,16 to TB1
Connect electrodes No. 9,10,11,12 to TB2
Connect electrodes No. 5,6,7,8 to TB3
Connect electrodes No. 1,2,3,4 to TB4
5. Prepare the conductor core ends, fit the crimp terminals and connect the conductors to their respective free sockets.
6. Ensure that both cables have a stress-free run inside the enclosure.



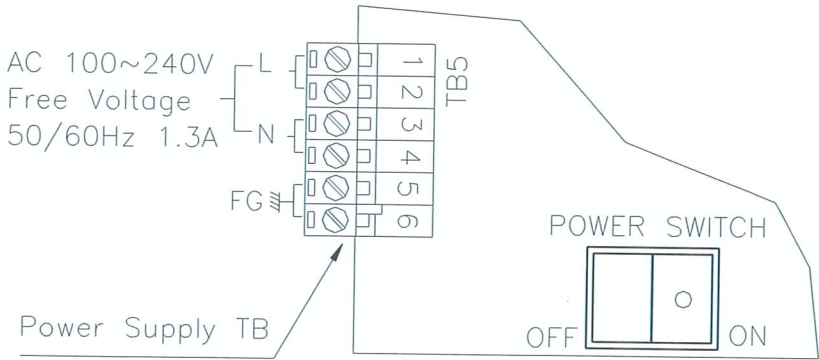
B. SDG-3000 POWER SUPPLY CABLES

*** Warning: Main voltages are present in this instrument when power is connected
De-energize before opening front cover.**

- AC powered unit(Board No. SDG-3000)

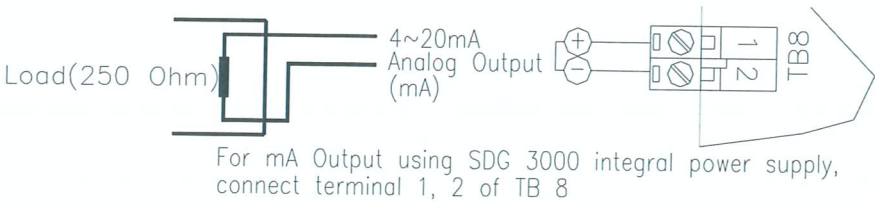
The AC power supply must be either earth or fully isolated from plant ground.

- 1. Live is connected to the terminal 1,2 and negative is connected terminal 3,4 of TB 5
- 2. A separate ground wire is required which must be connected to the earth stud on the enclosure



C. ANALOG OUTPUT CONNECTION

- ▶ Plug TB 8 on PCB board is used for the analog output.
 - ▶ 2-core screened cable is required and is connected into a 2-way terminal blocks such that:
 - ▶ The general type analog output is 4 ~ 20, 20 ~ 4mA or 0 ~ 20, 20 ~ 0mA.
1. Pass the analog output cable through its gland and into the enclosure.
 2. Prepare the cable to give a stress-free run to TB 8 on PCB SDG-3000
 3. Screens must be terminated at the gland plate.
 4. Prepare the conductor ends, fit the clamp connectors and connect the cores into their respective socket terminals.

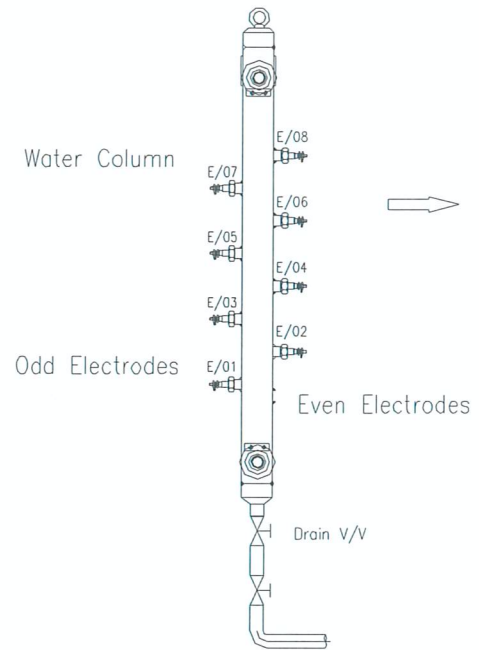


Signal output simulation data

▶ 8 Electrodes system

- In the case electrodes are installed at regular intervals

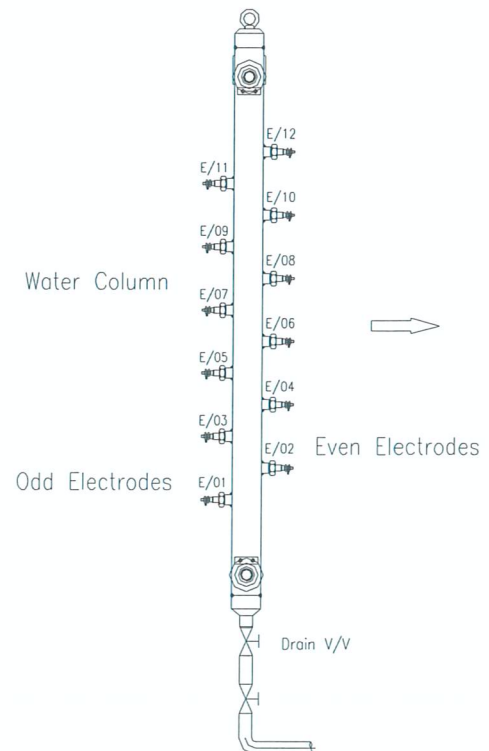
Electrode No.	Indicating Value	0 ~ 20mA Output	4 ~ 20mA Output	Nominated LEDs Indicator
E/08	100%	20	20	15 - 16
E/07	87%	17.5	18	13 - 14
E/06	75%	15	16	11 - 12
E/05	62%	12.5	14	9 - 10
E/04	50%	10	12	7 - 8
E/03	37%	7.5	10	5 - 6
E/02	25%	5	8	3 - 4
E/01	12%	2.5	6	1 - 2
E/00	0%	0	4	0



▶ 12 Electrodes system.

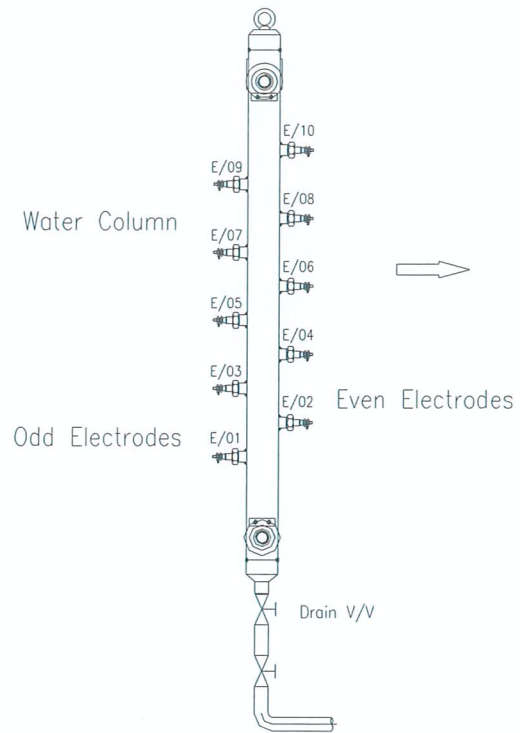
- In the case electrodes are installed at regular intervals

Electrode No.	Indicating Value	0 ~ 20mA Output	4 ~ 20mA Output	Nominated LEDs Indicator
E/12	100%	20	20	12
E/11	91%	18.26	18.6	11
E/10	83%	16.6	17.3	10
E/09	75%	14.94	15.97	9
E/08	66%	13.28	14.64	8
E/07	58%	11.62	13.3	7
E/06	50%	9.96	11.98	6
E/05	41%	8.3	10.65	5
E/04	33%	6.64	9.32	4
E/03	25%	4.98	7.99	3
E/02	17%	3.33	6.66	2
E/01	8%	1.66	5.33	1
E/00	0%	0	4	0



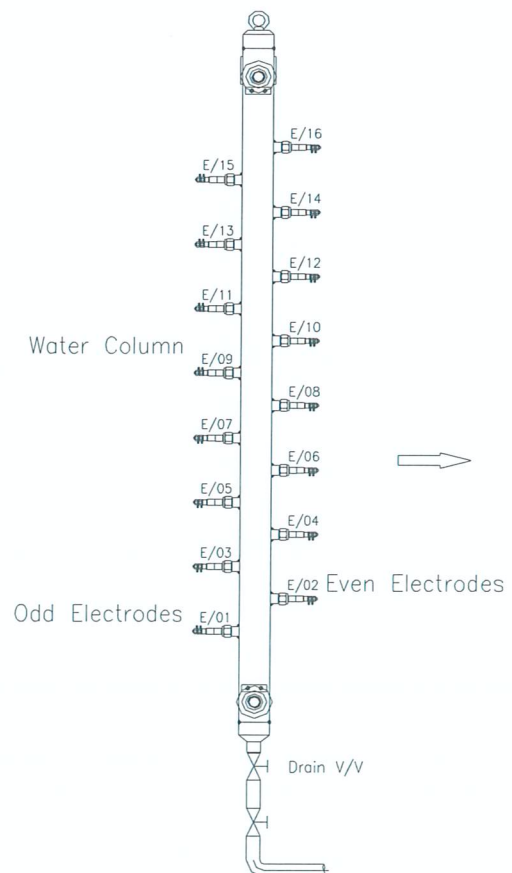
▶ 10 Electrodes system

Electrode No.	Indicating Value	0 ~ 20mA Output	4 ~ 20mA Output	Nominated LEDs Indicator
E/10	100%	20	20	10
E/09	90%	18	18.4	9
E/08	80%	16	16.8	8
E/07	70%	14	15.2	7
E/06	60%	12	13.6	6
E/05	50%	10	12	5
E/04	40%	8	10.4	4
E/03	30%	6	8.8	3
E/02	20%	4	7.2	2
E/01	10%	2	5.6	1
E/00	0%	0	4	0



▶ 16 Electrodes system.(Standard type)

Electrode No.	Indicating Value	0 ~ 20mA Output	4 ~ 20mA Output	Nominated LEDs Indicator
E/16	100%	20	20	16
E/15	93%	18.75	19	15
E/14	87%	17.5	18	14
E/13	81%	16.25	17	13
E/12	75%	15	16	12
E/11	68%	13.75	15	11
E/10	62%	12.5	14	10
E/09	56%	11.25	13	9
E/08	50%	10	12	8
E/07	43%	8.75	11	7
E/06	37%	7.5	10	6
E/05	31%	6.25	9	5
E/04	25%	5	8	4
E/03	18%	3.75	7	3
E/02	12%	2.5	6	2
E/01	6%	1.25	5	1
E/00	0%	0	4	0



D. RELAY OUTPUT < MODEL: SDG-3000-RB >

The relay outputs can be taken out of the enclosure via gland plate or along with the other cables in suitable trunk. One or more cables can be used at the discretion of the user, however the cables must be screened and the screens terminated at the gland plate.

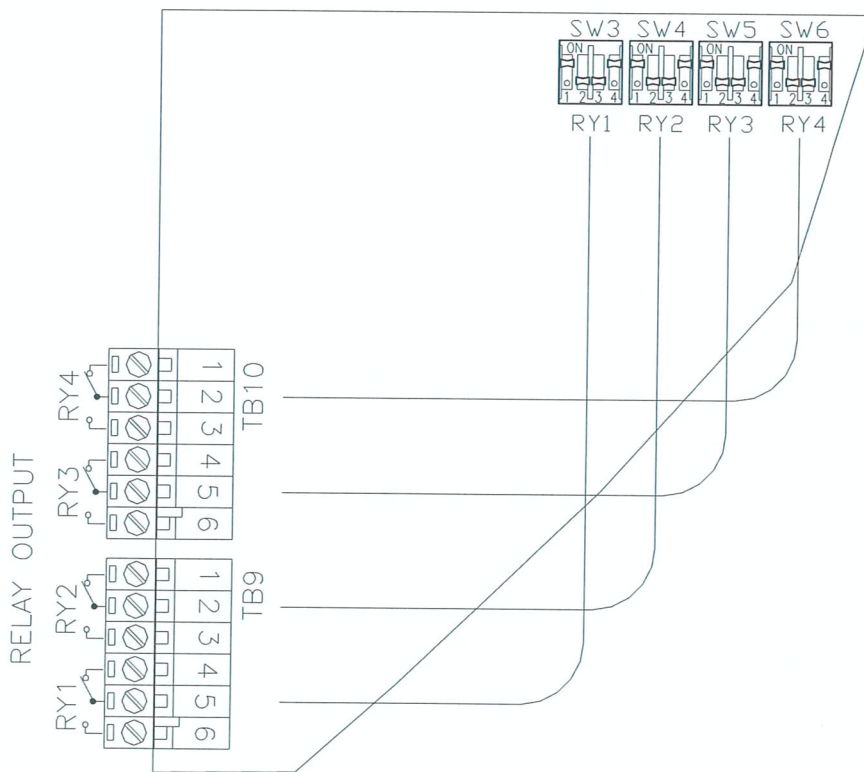
D.1 Configuration

The Relay Output Board has four configuration switch.

★ Selecting the relay to be applied to be the electrode (Relays RY1, RY2, RY3, & RY4) - SW3,SW4,SW5,SW6

"Simulation of the description assumes the system of 16 electrodes system."

*SW3 is allocated to a set of electrodes to RY1



Four identical slide switches are provided on the relay board for electrode selection.

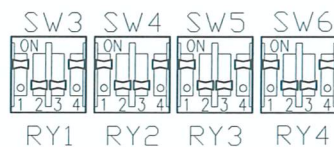
Any of the electrodes, connected to the input board on which the relay board is mounted, can be selected as the input for any of the relays.

With main board installed, any electrode connected to the system can be used as the source for any of the four relays.

Electrode selection	Switch SW3,SW4,SW5 or SW6 Setting for RY1 to RY4 respectively			
Electrode No.	Switch Contact			
	1	2	3	4
1	OFF	OFF	OFF	OFF
2	OFF	OFF	OFF	ON
3	OFF	OFF	ON	OFF
4	OFF	OFF	ON	ON
5	OFF	ON	OFF	OFF
6	OFF	ON	OFF	ON
7	OFF	ON	ON	OFF
8	OFF	ON	ON	ON
9	ON	OFF	OFF	OFF
10	ON	OFF	OFF	ON
11	ON	OFF	ON	OFF
12	ON	OFF	ON	ON
13	ON	ON	OFF	OFF
14	ON	ON	OFF	ON
15	ON	ON	ON	OFF
16	ON	ON	ON	ON

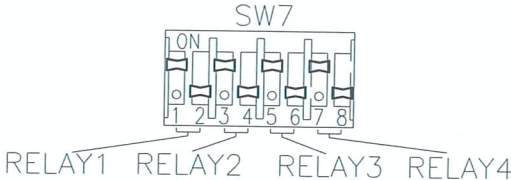
TABLE 1. Electrode selection for relays RY1, RY2, RY3 and RY4

- For example of electrode No. 10. Selected



D.2 Relay Energization (In Steam or In Water) SW7

This is a four-channel slide switch, one channel allocated per relay. The switch selects whether the relay is energized when the selected electrode is **In water** or **In steam**. (identically normally closed or normally open)

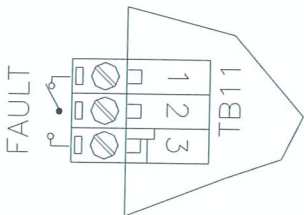


If the function to operate the contrary, that is set to Normal Open relay switch is ON(Contact), the switch status is as follows.

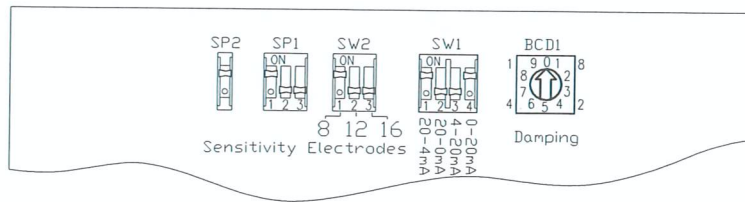


E. System Fault Output

Fault Relay outputs only the "fault" signal is detected on the PCB board. (More separate adjustment is not necessary),



IV. SYSTEM CONFIGURATION =====



1. Switch configuration (MODEL: SDG-3000-IB)

FND DISPLAY: The three digit display indicates the drum water level between 0 and 100%,

SP2 -- Electrode error configuration "Sensitivity"

Measured electrode resistance at water contacted		Remark
Fault On	Under 0.6k Ohm	
Fault Off	Under 1.2k Ohm	Factory standard settings

SP1 -- Boiler water configuration "Sensitivity"

SP1 (Switch)			Measured electrode resistance at water contacted	Remark
1	2	3		
On	Off	Off	(2k ~ 24k Ohm)	Insensitivity
Off	On	off	(2k ~ 30k Ohm)	Factory standard settings
Off	Off	On	(2k ~ 72k Ohm)	High sensitivity

SW2 -- Number of Electrodes – You can choose the number of electrodes when driving the slide switch on each marked 8, 12, 16 electrodes

SW2 (Switch)			Number of Electrodes	Remark
1	2	3		
On	Off	Off	8	
Off	On	Off	12	
Off	Off	On	16	Factory settings
Off	Off	Off	10	

SW1 -- Analog Output Configuration (0-20mA, 4-20mA, 20-4mA, 20-0mA)

SP2 (Switch)				Configuration	Remark
1	2	3	4		
On	Off	Off	Off	20-4mA	
Off	On	Off	Off	20-0mA	
Off	Off	On	Off	4-20mA	Factory settings
Off	Off	Off	On	0-20mA	

BCD1 -- Delay Relay Output Configuration

By means of rotary switch BCD1 links incorporated in each of the relay delay circuits. Delays can be introduced or bypassed – and the following delays are made available. (Numeric is seconds : 1- 9 sec.)

V. FAULT ANALYSIS & CORRECTIVE ACTION =====

Fault in the system will generally be indicated by the red LED on the front panel and by the fault output on the display board.

The main fault which is catered for are:

- ★ **Water above steam condition**
- ★ **Electrode or Wiring fault**
- ★ **Detection of an internal circuit fault**

When any of the above mentioned conditions exists within the SDG-3000 system, the red LED for "FAULT" is illuminated to indicate the FAULT state. Since the electrode input are split between the input boards, the ALARM indicator is configured to differentiate between ODD and EVEN electrode faults. Normally short-circuit, becomes open-circuit on a FAULT state, providing an ALARM indication output for external use.

A further FAULT is indicated when the number of electrodes switch on the display board is set to an invalid number. This error brings up an alternate LED illumination display that is a checkered display of GREEN and RED LED on the two front panel columns.

Some parts of the water column and electrodes may be very hot!!

Please ensure parts are adequately cooled or that suitable precautions are taken before handling.

Indication	Fault(s)	Analysis and Corrective Action
<p>State 1 fault LED illuminated</p>	<p>Water Resistance is less than 1 kΩ</p>	<p>Check A.C. voltage on all electrodes immersed in water with a true r.m.s. voltmeter. If several of the immersed electrodes show a voltage of less than 0.1V A.C. then very high water conductivity is probable.</p>
<p>One or more LED pairs alternating between water side and steam side</p>	<p>All LED pairs in water alternating between water side and steam side.</p>	<p>Check the suspect electrode(s) has the correct pair of conductors connected, check the connections to the input board. Rectify if incorrect. Check water column installation is correct; sloping pipe work and insulation details. Make sure that there is sufficient condensate flow through the column. If the normal water conductivity less than 0.1V A.C then the electrode error circuit must be disabled</p>
	<p>Water above steam, caused by electrode wiring or internal fault Electrode connection open-circuit or short-circuit to earth</p>	<p>The electrode channel(s) causing the problem will be evident from the unit display by an alternating indication in the steam area. Check the suspect electrode(s) has the correct pair of conductors connected, check the connections to the input board. Rectify if incorrect.</p>

Indication	Fault(s)	Analysis and Corrective Action
<p>State 1 (contd.)</p> <p>fault LED illuminated</p> <p>One or more LED pairs alternating between water side and steam side</p>	<p>Incorrect wiring, broken connection or damaged cable assembly</p> <p>Affected electrode(s) alternate between water and steam.</p>	<p>Check AC voltage on electrodes with a true r.m.s. voltmeter. A voltage of less than 0.1V AC indicates a fault condition.</p> <p>If wiring to the electrode is correct and the electrode gives a voltage reading of greater than 0.1V AC and a fault is still indicated, carry out the following procedure:</p> <ol style="list-style-type: none"> 1. Remove both conductors from the suspect electrode. <p>With the conductors isolated from each other, the level display should show the electrode as alternating between water and steam (green and red.)</p> <ol style="list-style-type: none"> 2. With the conductors touching each other, the level display should show electrode as being in steam. <p>The above procedure checks the electrode wiring. If the display does not show the correct results, then check for a break in either of the suspect electrode conductors.</p> <p>Carry out repair to any faulty connection or substitute a new conductor or cable assembly in place of the defective item.</p>
	<p>Dirt on electrode</p> <p>Affected electrode(s) alternating between water and steam.</p>	<p>If the wiring checks carried out as described above have not located a fault, then dirt on an electrode insulator may be the cause of the problem giving an effective short-circuit to ground.</p> <p>Check the electrodes for dirt over the external insulator and clean with a cloth as required.</p> <p>Checking for dirt on the internal insulator of the electrode requires the draining of the water column</p> <p>Once the water column is drained, check the AC voltage on each electrode using a true r.m.s. voltmeter. Any electrode showing a voltage of less than 3V AC needs cleaning or replacement. Electrodes must be removed from the column for inspection and cleaning.</p> <p>Note: The electrode insulator can be cleaned using a clean cloth.</p>
	<p>Internal fault</p>	<p>If the wiring checks carried out as described above have not located a fault, then it is possible an internal fault exists.</p> <p>If this does not occur an internal fault exists.</p> <p>The circuit fault may be on either input board or the display board. If spares are available, change the input board first and if the fault is not rectified change the display board. If spares are not available, call the service engineer.</p>

Indication	Fault(s)	Analysis and Corrective Action
<p>State 2 fault LED illuminated No LED pairs alternating between water and steam</p>	Internal fault	<p>This state is indicating a fault which is not related to an electrode error because no LED pairs are alternating between water and steam. It is therefore likely that an internal fault exists.</p> <p>Follow same procedure as above</p>
	<p>Dirt on electrode Affected electrode(s) alternating between water and steam</p>	<p>If the wiring checks carried out as described above have not located a fault, then dirt on an electrode insulator may be the cause of the problem giving an effective short-circuit to ground. Check the electrodes for dirt over the external insulator and clean with a cloth as required.</p> <p>Checking for dirt on the internal insulator of the electrode requires the draining of the water column</p> <p>Once the water column is drained, check the AC voltage on each electrode using a true r.m.s. voltmeter. Any electrode showing a voltage of less than 3V AC needs cleaning or replacement. Electrodes must be removed from the column for inspection and cleaning.</p> <p>Note: The electrode insulator can be cleaned using a clean cloth</p>

V-1. 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 is no danger of water drops in the controller.
6. Do not allow the power cord to trail on the ground.

FIRE HAZARDS

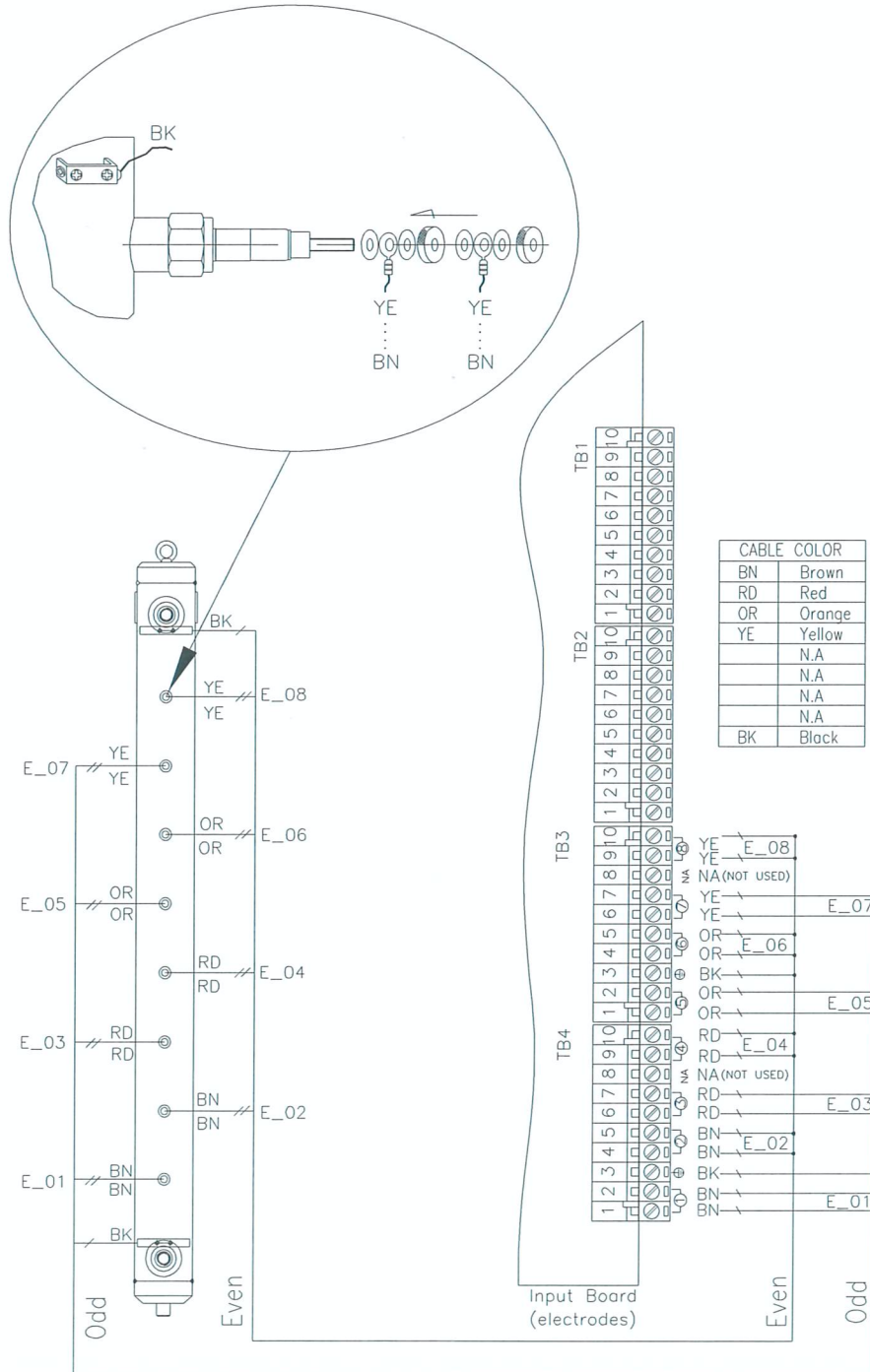
7. To avoid fire hazard, use only a circuit fuses of the correct type, voltage rating and current rating as specified in this manual.

EXPLOSION HAZARDS - Do not operate in explosive atmospheres

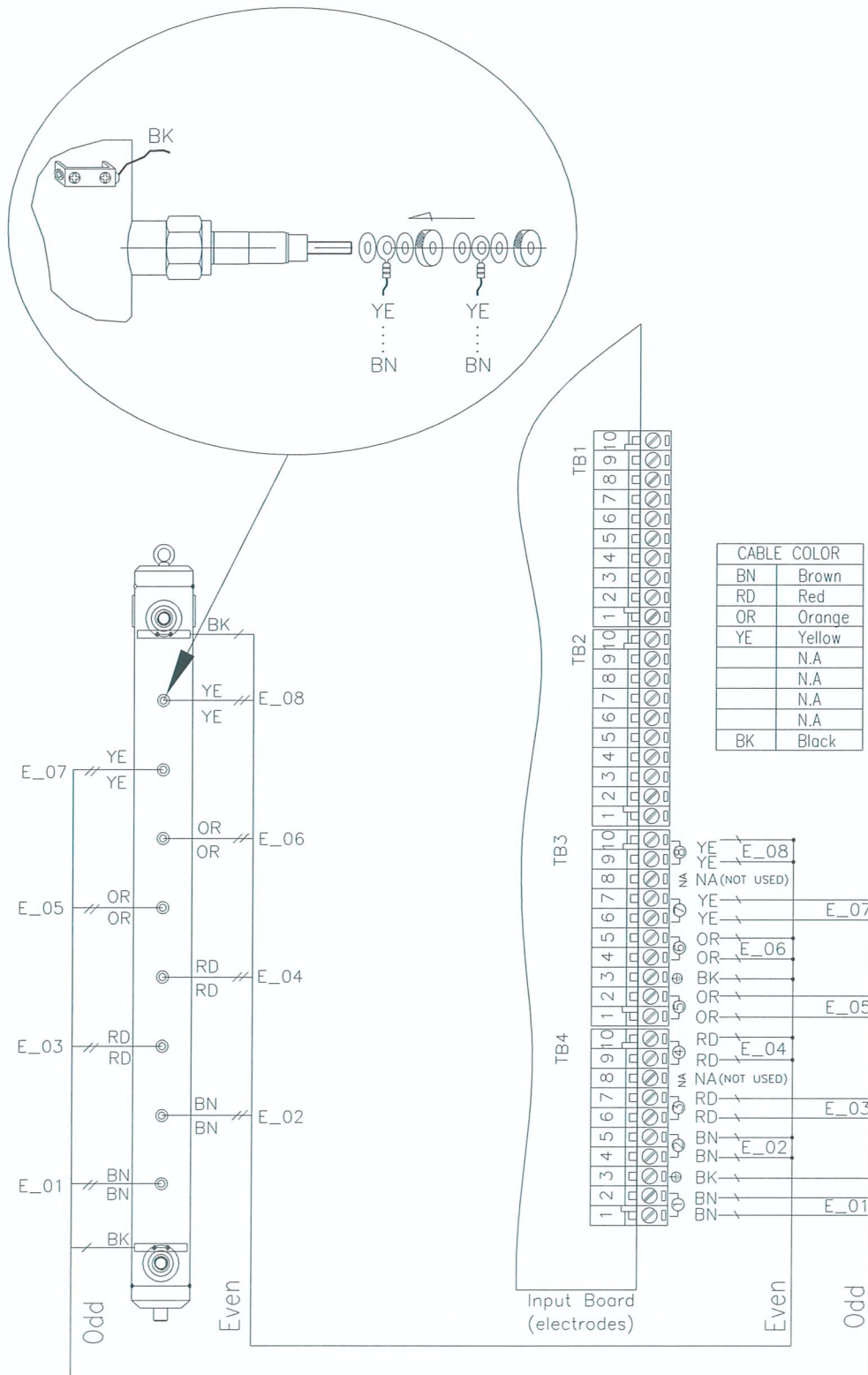
8. To avoid explosion, do not operate this controller in an explosive atmosphere unless it has been specifically certified for such operation.

VI. WIRING DIAGRAMS =====

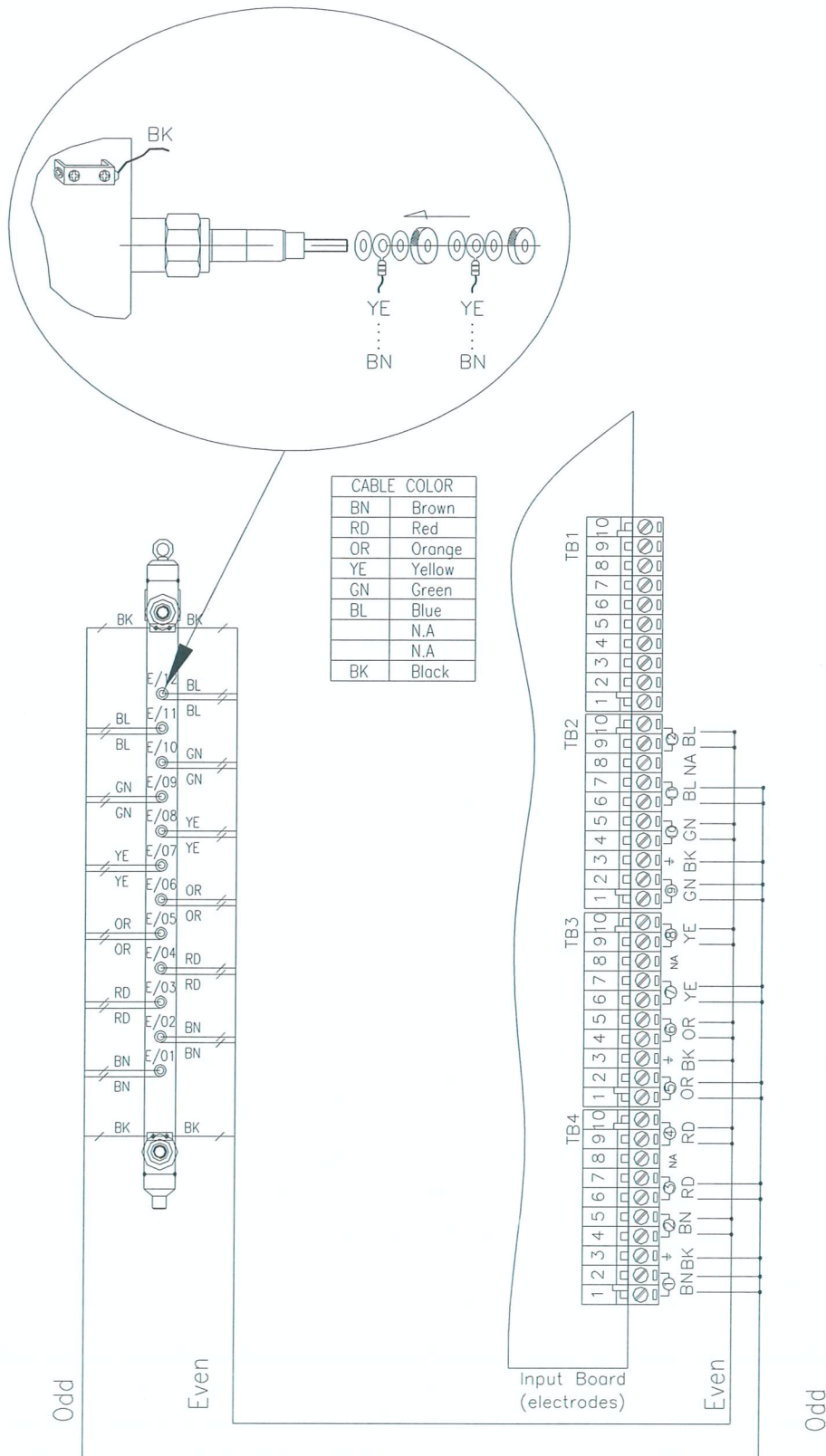
A. 8 electrodes connection of water column



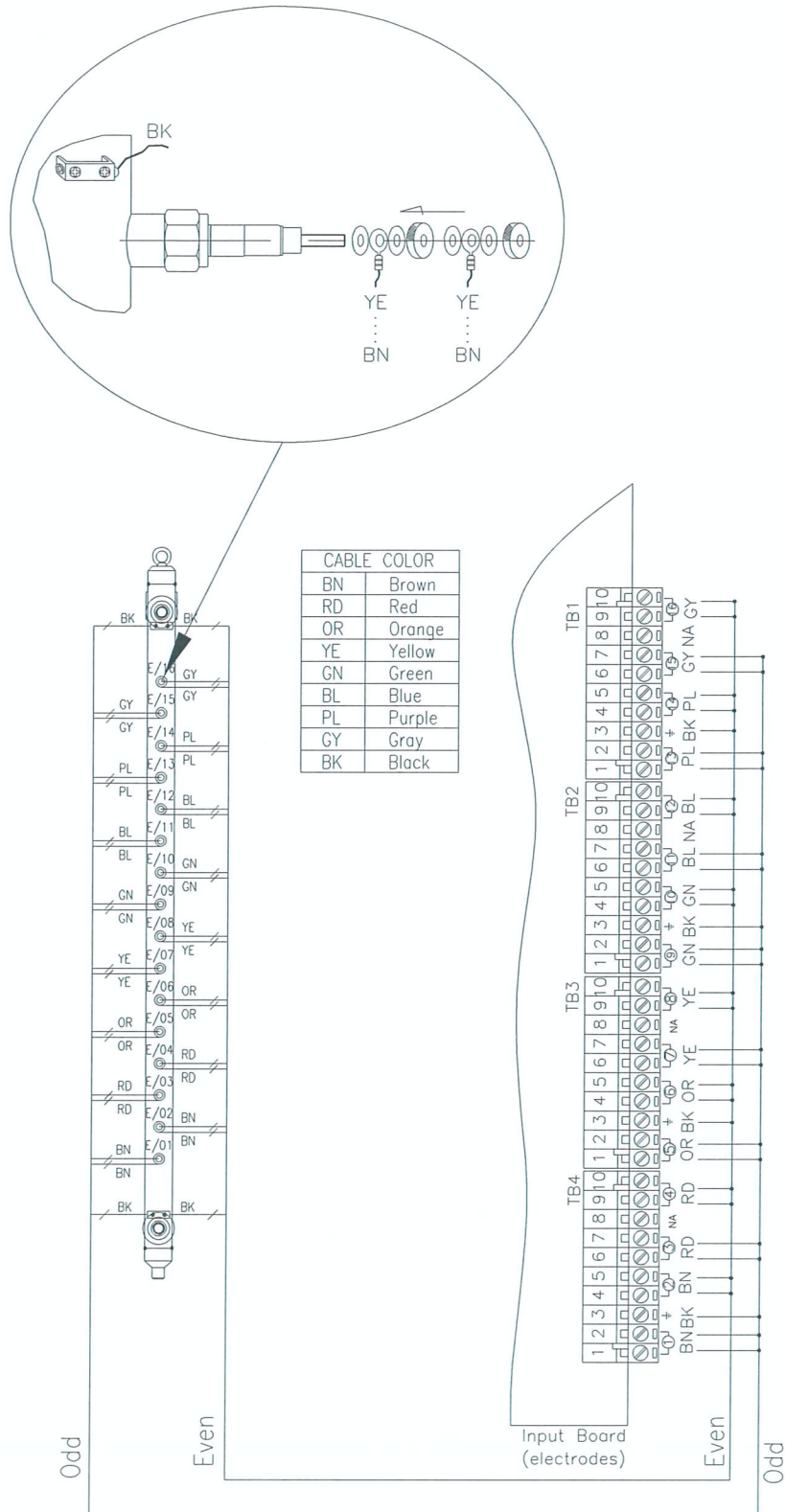
B. 10 electrodes connection of water column



C. 12 electrodes connection of water column



D. 16 electrodes connection of water column



VII. Remote Display Unit (OPTION) <MODEL : SRD-32>

1. GENERAL DESCRIPTION

The Remote Display Unit gives a repeat display of the water level state and fault alarm state of the SDG-3000 Electronic Gauging System.

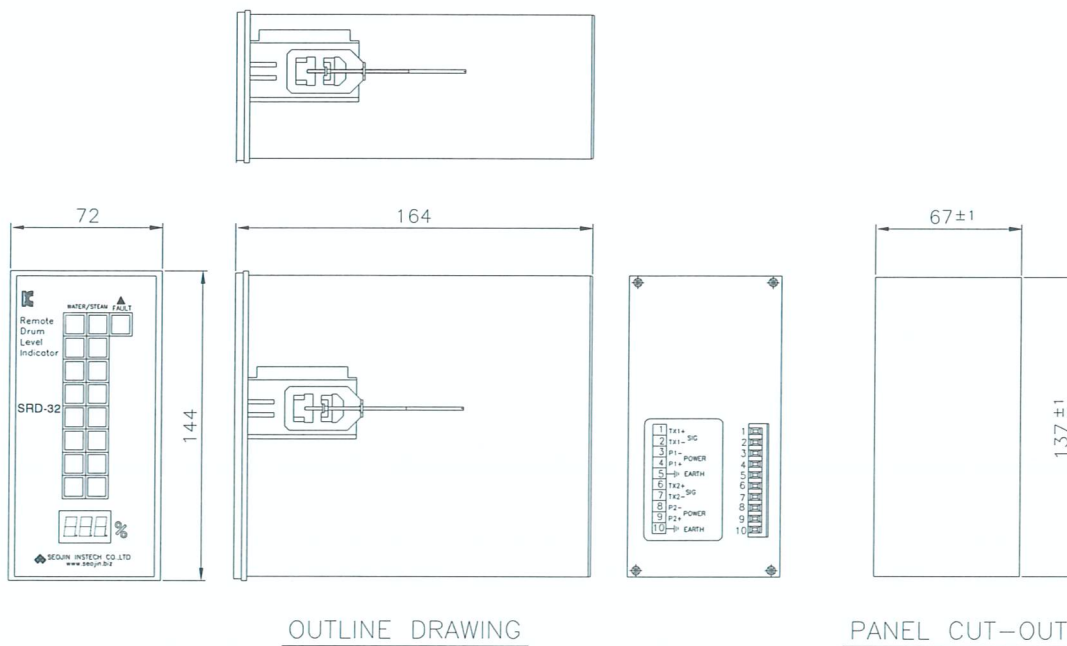
The Remote Display unit is designed for panel mounting, measures 144mm(5.67") high, 72mm(2.83") wide, 164mm(6.46") deep and comes with two knurled clamping nuts which engage on set screw studs in the rear panel for the holding bar fixture. An extra 15mm(0.59") clearance is required at the rear when the panel clamping action is used.

The level display consists of two columns of LEDs, a red column to indicate steam and a green column to indicate water. This provides a clear indication of the water level in the monitored system. The number of LEDs that may be illuminated depends on the number of electrodes being used. To mask the unused LEDs, a blanking panel is provided: this should be fitted on the inside of the front panel. An electrode fault, or a wiring or circuit fault, is indicated by a RED LED.

Note: The blanking label is fitted on the inside face of the front panel.

The SDG-3000 will drive a maximum of six Remote Displays, using star or daisy chain connections. One Remote Display can be powered from the SDG-3000. All other Remote Displays must be locally powered.

The Remote Display unit is connected to the main unit via a 10-way screw clamp terminal block. Access to the terminal is provided through a cut-out in the rear of the remote display unit.



OUTLINE DRAWING

PANEL CUT-OUT

2. MECHANICAL INSTALLATION

The panel related dimensions for the SRD-32 are ;

★ Panel thickness = 2mm ~ 20mm(0.08 ~ 0.78")

★ Panel cut-out size = 137(H)×67(W)mm ±1mm.(5.39"×2.32" ±0.04")

The installation procedure is :

1. Ensure the panel support structure provides easy access to the electrical connections and is a good viewing position.
2. Prepare the panel by cutting the required aperture to the dimensions given above and remove any burrs.
3. Remove the clamps(if fitted) from the Remote Display unit and fit the unit into the slot from the front of the panel.
4. Refit the clamps to the display unit and secure the unit to the panel.
The two clamps on the Remote Display unit are held in place by knurled nuts.
Tighten the nuts so that the clamps press firmly against the panel to hold the unit in place.
5. Check the front view of the panel/display unit for correct orientation, adjust if necessary.

3. CABLE INSTALLATION

One Remote Display can be powered by the main unit. All other displays must have a local power supply. When the Remote Display is locally powered, a 6 wire connection can be used, and when powered by the main unit a minimum of 8 wires are required. All cables used must be screened to ensure compliance with the EMC directive.

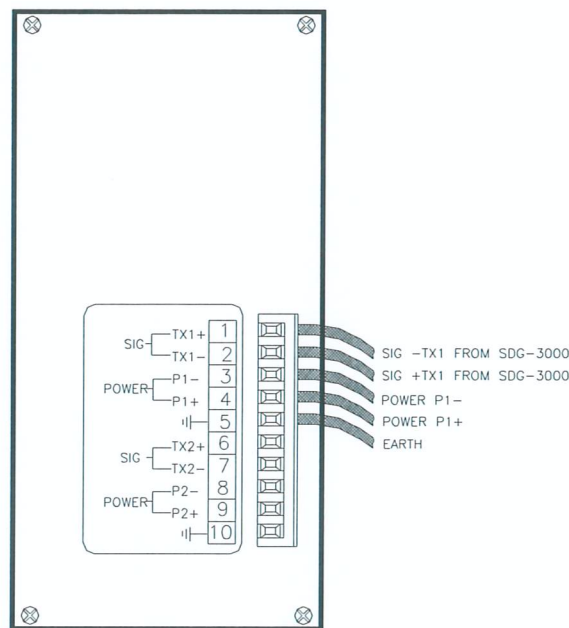
When the main unit is providing power for a Remote Display, the loop resistance of the power conductors must be less than 27Ω for an AC powered main unit. To allow the maximum distance of 1000 meters to be achieved without using very heavy cable, the main unit and the remote unit provide multiple terminals(internally linked) for the power and ground connections so that these lines may be doubled or tripled to reduce loop resistance of the power conductors.

4. WIRING THE SRD-32 REMOTE DISPLAY UNIT

The following procedure covers the wiring of a single display unit.

1. Gain access to the rear of the display unit case, see connection detail.
2. Prepare the cable ends and fit identity sleeves to the conductors. Prepare cable screen.
3. Connect terminals 10 to Earth.

4. Fit the conductors into their respective terminals and tighten screws.
See interconnections shown in examples.
5. Connect the cable screens together but do not connect to earth.
6. Ensure a stress-free exit from the panel support structure by providing any necessary cable support.



5. CONNECTING THE REMOTE DISPLAY UNIT TO THE SDG-3000 MAIN UNIT

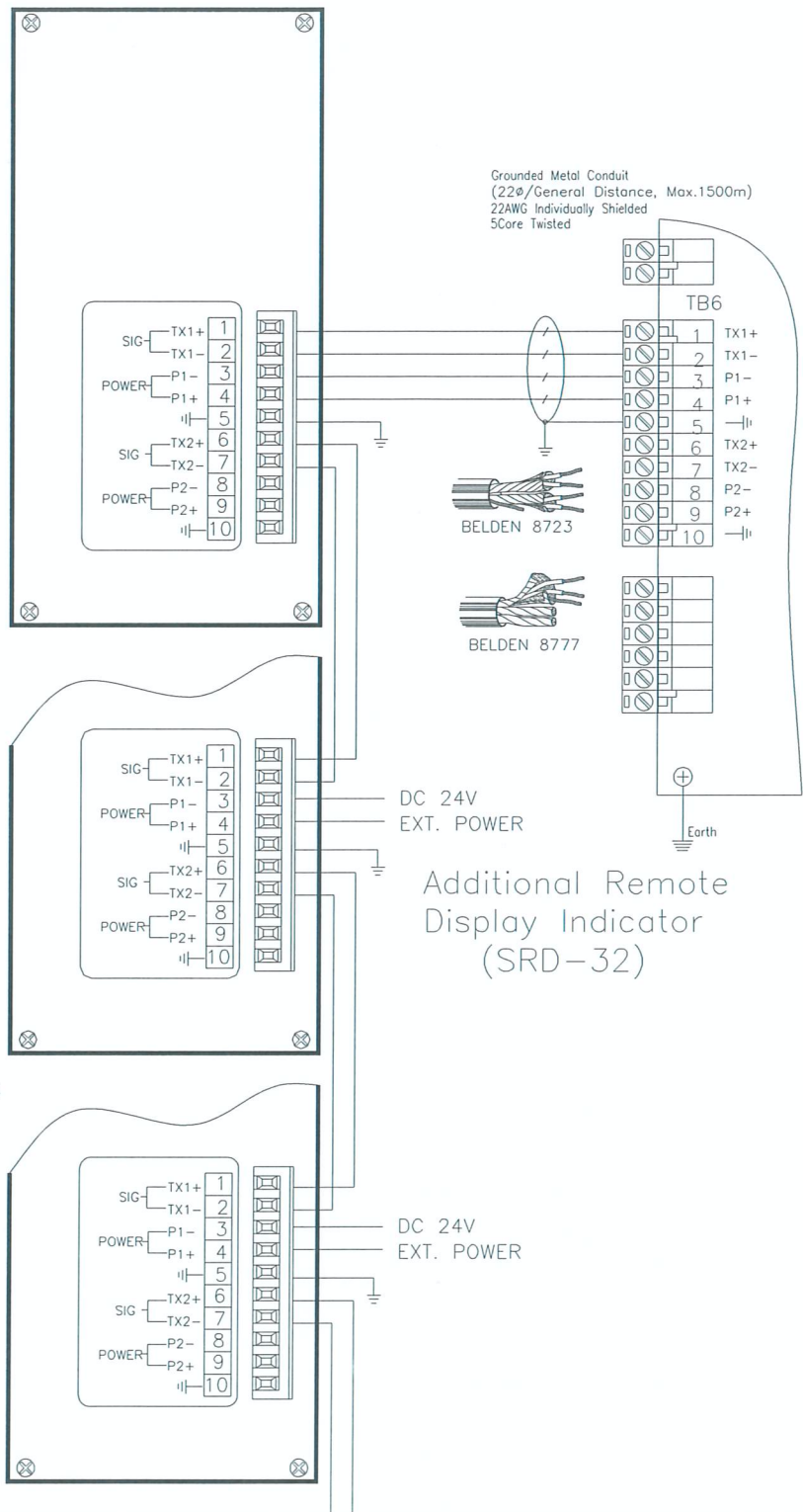
Warning : Main voltages are present in this instrument when power is connected.

De-energize before opening front cover.

Maximum distance is 1000m(3280ft) from Main unit to Remote display unit.

1. Ensure a stress-free cable run between the Remote Display station and the SDG-3000 main unit fixture.
2. Gain access to the display board in the SRD-32. The cable from the Remote Display requires connecting to plugs TB1 and TB2 on main unit display board PCB SDG-3000.
3. Enter the cable through the gland port in the SRD-32 enclosure(if applicable) and ensure a stress-free run inside the enclosure.
4. Prepare the cable end and fit identity sleeves to the conductors and connect them to their respective terminal's free socket in the SRD-32.

Remote Display Indicator
(SRD-32)



Additional Remote
Display Indicator
(SRD-32)

Max. 7Units

Additional Remote
Display Indicator
(SRD-32)

Additional Remote
Display Indicator
(SRD-32)

6. FAULT ANALYSIS & CORRECTIVE ACTION

Indication	Fault	Analysis and Corrective Action
<p>No display of ODD/EVEN LEDs (including top/bottom half of Fault LED)</p>	<p>Loss of power to remote display unit.</p>	<p>Check the wiring to the remote display unit connector is correct.</p> <p>Check that power is present at the remote display unit connector with a suitable meter.</p> <p>Ensure that the voltage present at the connector is between 15V and 36V DC. If no power is present at the connector, then if the unit is locally powered, check the power at the local power supply source.</p> <p>If powered by the main SDG-3000 unit, check the voltage between pins 3 and 4 of TB6 on the main SDG-3000 unit . A value of less than 15V DC indicates a likely short circuit on the power lines or a display board fault.</p>
<p>Fault LED illuminated</p>	<p>Powered present but loss of signal data</p>	<p>Check the wiring to the remote display unit connector is correct.</p> <p>If wiring is correct, carry out the following procedure:</p> <ol style="list-style-type: none"> 1. confirms that Terminal 1, 2 wire polarity is correct and if It's connection is the correct, disconnect the wires. 2. Place the suitable multi meter to resistance measurement mode to measure the resistance of two wires. <p>If the resistance is less than 100 Ohm It is normal and if the resistance is open when the connection is damaged state or it represents the failure of the Main PCB</p>

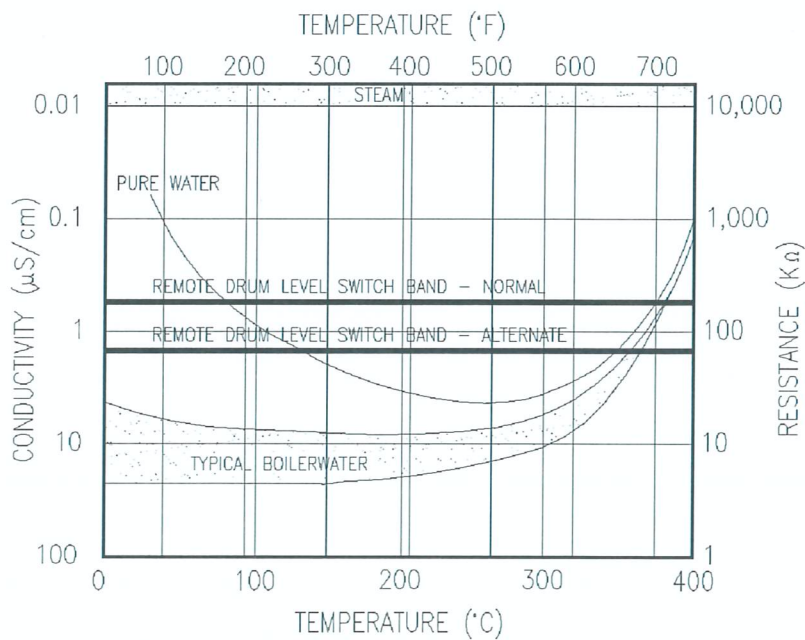
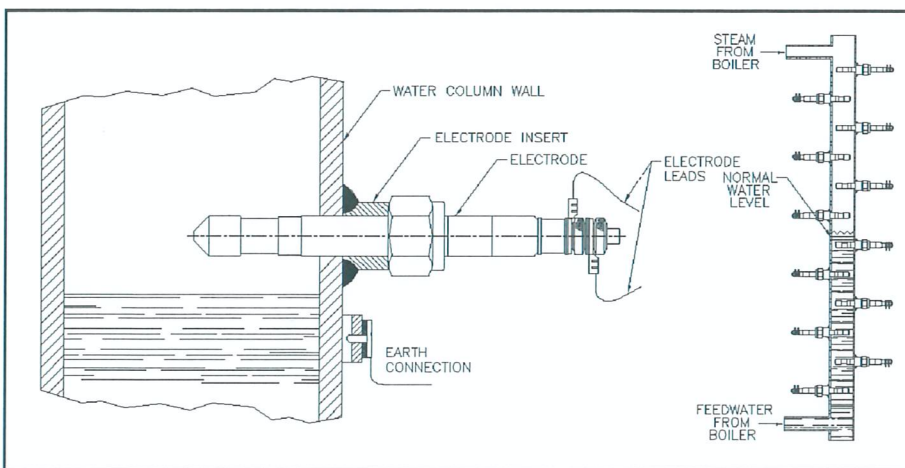
Indication	Fault(s)	Analysis and Corrective Action
Flickering Display LED	Corruption of signal data	<p>Most probably caused by bad shielding (screening) of the remote display cabling or by shield connections to earth.</p> <p>Check shielding and shield connections, ensure only one end of the cable shield is connected to earth.</p> <p>If using a `daisy chain' connection system with several remote displays then a termination resistor may be required on the end remote display.</p>
Abnormal pattern on RED & GREEN level display	Wrong setting of Number of Electrodes switch on SDG-3000 display board	<p>Ensure that the switch is set correctly on the SDG-3000 display board.</p> <p>If the display still shows a checked pattern, then a circuit fault exists on the SDG-3000 display board which will need replacing.</p>

VIII. PRESSURE PARTS

1. GENERAL INFORMATION

Water Level Indication

Each electrode is connected to its own electronics measurement channel where the resistance value measured decides which of 2 LEDs drive circuits is energized. The LEDs are presented in 2 columns, one column of **green** LEDs (illuminated for water) and one column of red LEDs (illuminated for steam) indicating the water level.



2. INSTALLATION OF WATER COLUMN

The Water Column is delivered with all electrode ports fitted with mechanical seal type blinded end caps. These end caps should not be removed until the electrodes are due to be installed.

The water column is delivered along with the correct number of electrodes of the relevant pressure type (high or low) and complete with gaskets or ferrules and fixing nuts, where applicable. The electrodes should only be fitted to the column after all electrical work is completed and the water column is ready to be commissioned.

CAUTION : It is essential that the electrodes are NOT fitted until the acid and steam purging of the boiler drum has been completed. However, if it is essential that the SDG-3000 be used to gauge the water level during acid cleaning, a new set of electrodes can be provided for installation before normal operation is started.

Sacrificial electrodes should be discarded.

The water column is provided with a lifting-eye at its upper end to be used for support from the local site superstructure.

The Steam and Water connections on the water column must be set to position the water column at the correct level before they are welded in place. Normally, the water level of the drum will be between electrodes 8 and 12 for a 16 port water column. However, due to the physical or operating conditions, this could be offset. The steam leg must slope downwards to the water column with a minimum grade of 1 in 50 to ensure condensate circulation. The water leg must slope downwards to the drum to prevent water from being trapped at the water column.

CAUTION : Care must be exercised to ensure that the pipe-work is not allowed to take the unsupported weight of a standard water column.

Installation should commence with the support of the column. The water column is attached to the supports which will carry the weight of the water column and allow it to be accurately aligned with the drum steam and water connections before and during the welding operation.

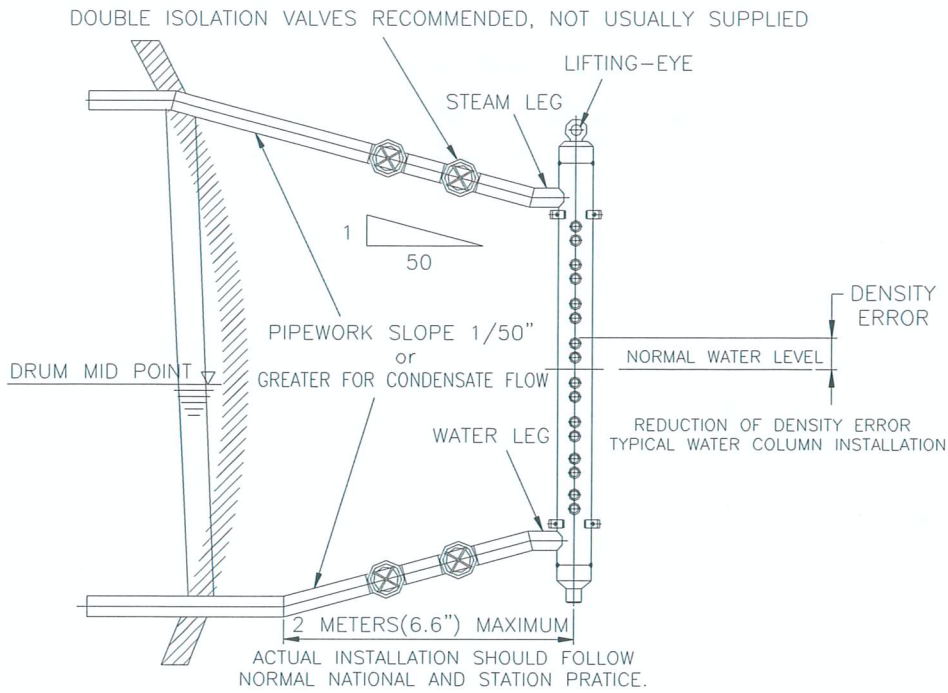
After the welding to the connecting pipe-work, valves and the fitting of the drain pipe-work is complete, a further check on the level alignment must be carried out and adjustments made, if necessary.

NOTE : The water connection to the water column must be fully insulated by lagging. The steam connection must also be lagged, but a minimum length of 0.5 meter of the steam leg must be left unlagged where the steam leg joints the water column. Water columns of one meter or more in length must also be lagged to reduce the density error.

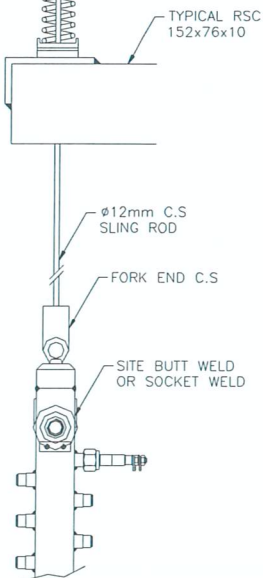
When the installation of the water column has been completed, precautions must be taken to protect it against damage during the installation of adjacent plant and pipe-work.

3. INSPECTION OF MECHANICAL INSTALLATION WORK

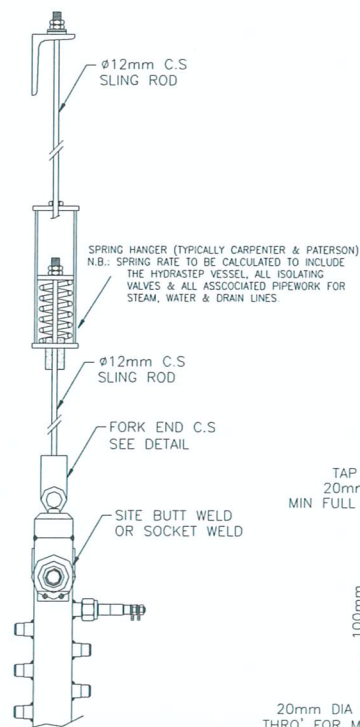
When the mechanical installation work has been completed, the site surveillance staff may be required to inspect the work and the equipment, such as the installation of the electronics unit and the installation of the water column, checking particularly the level relative to the drum, before releasing it for electrical work and cabling.



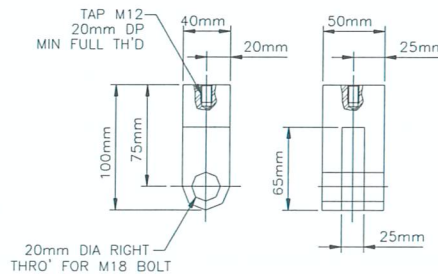
TENSION UNIT
N.B.: SPRING RATE TO BE CALCULATED TO INCLUDE THE HYDRASSTEP VESSEL, ALL ISOLATING VALVES & ALL ASSOCIATED PIPEWORK FOR STEAM, WATER & DRAIN LINES.



TYPE 'A'



TYPE 'B'



DETAIL OF FORK END

TYPICAL WATER COLUMN SUSPENSION (SHOCK ABSORBER)

IX. BACKGROUND

With any steam/water detection gauge, a partial blockage or leak within the pressurized system may result in incorrect water level indication. The SDG-3000 water column design is such that density errors in water level indication (due to the water temperature in the column being lower than the water temperature in the boiler drum) are minimized for the temperatures and pressures specified. This is achieved by stimulating condensate flow in the upper part of the column by omitting lagging on the column steam pipe. The flow of condensate maintains the temperature of the water column close to that of the boiler drum.

Caution: If a serious "blow" occurs, immediate attention is required. Ensure that the column or manifold is VALVED OFF AS SOON AS POSSIBLE otherwise any resulting electrode seat erosion may require the removal of the column or manifold for re-machining of the ports. Site machining of the water column is possible and satisfactory results can usually be obtained (for small leak damage).

1. SAFETY PRECAUTIONS

- ★ Ensure that tripping, where fitted, is disabled and that the operators are briefed to expect erroneous indications or alarms.
- ★ Ensure that you know the valve positions and other procedures BEFORE working on the water column.
- ★ Allow the water column to cool before changing electrodes and check for signs of steam at the drain to ensure complete isolation.
- ★ Wear industrial gloves to change electrodes.
- ★ On Low-Level Tripping Schemes, either electro-mechanical interlock or recognized procedures MUST be applied to ensure that draining the column does not cause a spurious trip.
- ★ Refit the electrode covers before pressurizing the column.

2. WATER COLUMN ISOLATION

After obtaining authority to isolate the column:

- ★ Close off the steam and water isolating valves.
- ★ Where the column is connected to a closed drain, open the drain valve and, when the pressure equalize, close the drain valve.
- ★ Check for **no-pressure** condition of water column. A failure to cool and a re-filling of the water column would indicate a pressure condition. Alternatively, carefully unscrew the first electrode and look out for the presence of steam.

Warning: Great care is required during the check on the first electrode.

Where a separate atmospheric drain is used, open the drain valve and leave it open.

- ★ Proceed with the work required.

3. ELECTRODE AND ELECTRODE SEAL LEAKS

The distinction between electrode / insert and electrode / insulator leaks is often difficult to determine prior to removal of the electrode, unless the leak is small. Steam wisps which appear to come from between the outside of the electrode body and the gasket indicate a seal leak, steam appearing through the external ceramic insulator suggests that the electrode itself is faulty.

Even if the electrode is in water, the water temperature in an operating system will cause the water to flash off to steam as atmospheric conditions are reached.

Caution: Do not attempt to cure a leaking seal on low pressure electrode by overtightening the electrode clamping nut. The most probable fault for low pressure electrodes lies in damage to the sealing washer. The correct degree of compression on this washer is inherent in its design. Tightening beyond this point will only cause damage to the electrode or to the water column.

LOW PRESSURE ELECTRODES

The correct procedure on low pressure electrodes for repairing either a seal or an electrode failure is to remove the hexagon nut(s) and disconnect the electrode lead(s). Next, remove the electrode complete with its sealing metal gasket from the column. A thorough examination of the electrode and metal gasket is likely to give a more positive identification of the cause of the leak. However, unless it can be definitely established that the electrode was not at fault, it is advisable to fit a new electrode at this stage. To assist in identifying a seal leak, this may be caused by:

- ★ Failure to remove the old washer on a previous occasion before inserting the replacement washer and electrode.
- ★ Re-using an old and already compressed washer instead of a new one.
- ★ Failing to ensure that the land and the recess in the electrode port were clean and undistorted at the last inspection.

Note: When installing low pressure electrodes, ensure that the threads in the electrode port are free of loose particles. Insert the electrode ensuring that the new gasket is centered in the electrode groove. (For electrode types SLE-26, the lap face of the metal gasket must be butting against the electrode body). Lightly coat the electrode threads with P.B.C. compound or *Copperslip Grease* and tighten with a torque wrench to 6.9kg-m (50 lbft/68Nm). After 15 minutes, re-tighten with torque wrench set to 6.9kg-m (50 lbft/68Nm). The maximum torque is 6.9kg-m(50 lbft/68Nm) so DO NOT OVER-TIGHTEN.

ABOUT ELECTRODE'S LIFE(SHE-56/SLE-26)

The expected life span of High & Low Pressure Electrodes is one year or 8,760Hrs from normally work at start up the gas turbine.

(Included commissioning test run of gas turbine before construction & handling over.)

HIGH PRESSURE ELECTRODES

In the case of high pressure electrodes, sealing is performed by ferrules which are swaged on to the electrode during the manufacturing process. These ferrules are a swaged fit on to the electrode body and during the fitting of the electrode into the column port, the act of tightening the electrode clamping nut compresses the ferrules between the electrode body and the port sealing taper, thereby effecting a pressure seal. For these electrodes, the condition of the electrode port sealing surface is of great importance, and the tightening procedure is given to prevent damage to the electrode or the water column electrode port. Should a leak develop, the electrode must be removed and both the port and ferrule sealing surfaces examined for signs of surface deterioration.

Tightening Procedure for High Pressure Electrode Installation

- ★ Ensure the electrode is clean and the electrode port bore is clean and free of debris.
- ★ Lightly coat the column port thread with P.B.C compound or *Copperslip Grease.(Molycoat)*
- ★ Assemble the electrode to the column port and tighten the electrode nut until the electrode will not rotate in its seat.
- ★ Finally, tighten the electrode nut a further 1/4 to 1/2 turn to complete the procedure.

Note: This 1/4 to 1/2 turn operation will approximately equate to a tightening torque of 6.2kg-m (45 lbft/57Nm) ~ 6.5kg-m(47 lbft/85Nm) maximum. **It Is Included for guidance only, DO NOT EXCEED MAXIMUM TORQUE.**

If necessary, where the sealing surfaces can be recovered by simple cleaning practices, the old electrode can be refitted and tightened to within the maximum torque value given and the system pressure tested. However, it is recommended that the best solution to minimize the system 'down time' is to fit a new electrode.

4. PROCEDURE FOR CHANGING THE LOW PRESSURE ELECTRODES AND GASKETS

- ★ Open the electrode protection cover guard, taking care to avoid knocking the electrodes.

Note: Remove only one electrode at a time (avoids risk of incorrect reconnection).

- ★ Disconnect the leads, extract the electrode and the gasket carefully without damage to the seat face.
- ★ Inspect the column seat, making sure that it is free loose particles and is not pitted or corroded.
- ★ Carefully unpack the new electrode and check that there is no damage to the ceramic insulators or to the sealing gasket.
- ★ Assemble the new electrode to the water column as detailed in sub-paragraph 3 for low pressure electrodes.
- ★ Refit the electrical lead(s) and guard, re-commission as detailed later in this Chapter.

5. PROCEDURE FOR CHANGING HIGH PRESSURE ELECTRODES

Carry out the isolation procedure as detailed in sub-section 2. Ensure that the tripping is disabled (see 'Safety Precautions, sub-section 1). There is no need to switch off the SDG-3000 electronic equipment; **all system about 20 minutes to cool down**, then:

★ Open the electrode cover guard, taking care to avoid knocking the electrodes.

Note: Remove only one electrode at a time (avoids risk of incorrect reconnection)

★ Disconnect the leads, extract the electrode carefully without damage to the seat face.

★ Inspect the column seat, remove any scaling or residue taking care not to damage the seat.

★ Carefully unpack the new electrode and check that there is no damage to the ceramic insulators or to seating ferrules.

★ Lightly coat the electrode threads with P.B.C compound or *Copperslip(molycoat) Grease*.

Note: At the first pressure/temperature test, check for leaks and tighten electrode nut as necessary but not exceeding 1/2 turn from the 'nipped electrode' condition, 6.5kg-m(47 lbft/60Nm) maximum.

★ Refit the electrical lead(s) and guard.

6. WATER COLUMN COMMISSIONING OR RECOMMISSIONING

The method given allows the column to fill slowly with condensate from the steam leg through a 'cracked' steam valve and for subsequent warming to continue at a controlled rate as the water is forced back through the 'cracked' water valve.

Caution : DO NOT BLOW WATER COLUMN DOWN

★ Notify the operator of the intention to commission the column, in accordance with recognised procedures.

★ Check that the electrode guard is in place.

★ Close the drain valves.

★ Crack open the steam valve. Check with the display or the unit operator that the column fills with condensate slowly (10 to 15 minutes).

★ Crack open the water isolating valve. Check with the unit operator that the water level is falling (1 to 2 minutes) to approximately normal water level and allow to stabilize and heat up for 15 minutes.

★ Open the water valve fully.

★ Open the steam valve fully.



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