Revision Date: 2009-11-15

HIGH LEVEL AND TANK OVERFILL ALARM SYSTEM
Magnetic Float Reed Switch Type

OPERATING MANUAL

MODEL: SMA 2000D

November 2009

Contents

1. Introduction

1.1 General Description

SCANJET MACRON SMA-2000 series is ready to be supplied as a complete system, i.e. either as a single or a dual point system. The system is uniquely developed in order to cope with the latest high environmental requirements from USCG, IMO and classification societies.

- SMA-2000D consists of dual alarm point as High Level and Tank Overfill Alarm System
- SMA-2000S consists of single alarm point as Tank Overfill Alarm system

SMA-2000D is especially approved as two independent power sources, main source for 115/230 VAC and backup source for 24 VDC supply as described in the relevant rule and regulation.

The system comprise of the sensors as magnetic float reed switch and electric cabinet with Alarm Display Unit.

The level switch of system can be tested on the top of the tank by lifting test device independently for both alarms.

FND (**F**lexible **N**umeric **D**isplay) is located on the top of the alarm display unit

When the alarm LED is activated, the FND will show the relevant tank name flashing at the same time.

All signals from the level switches are connected directly to the input sides of IS repeaters and signal monitoring takes place for each alarm in these alarm units

The external relay output with power failure and common alarm can be connected to AMS.

2. Main Components of the system

The system consists of following equipments.

- Electric Cabinet

This cabinet must be located in CCR as safe area, and alarm panel, all electrical components such as I.S repeater, power supply and relays are mounted inside cabinet.
The cabinet will be mounted as wall mounting type generally.

In case each components has to be separately mounted in cargo control console as flush mounting type, the alarm panel and mounting plate without electric cabinet will be delivered to shipyard

- Electric Horn with Lighter

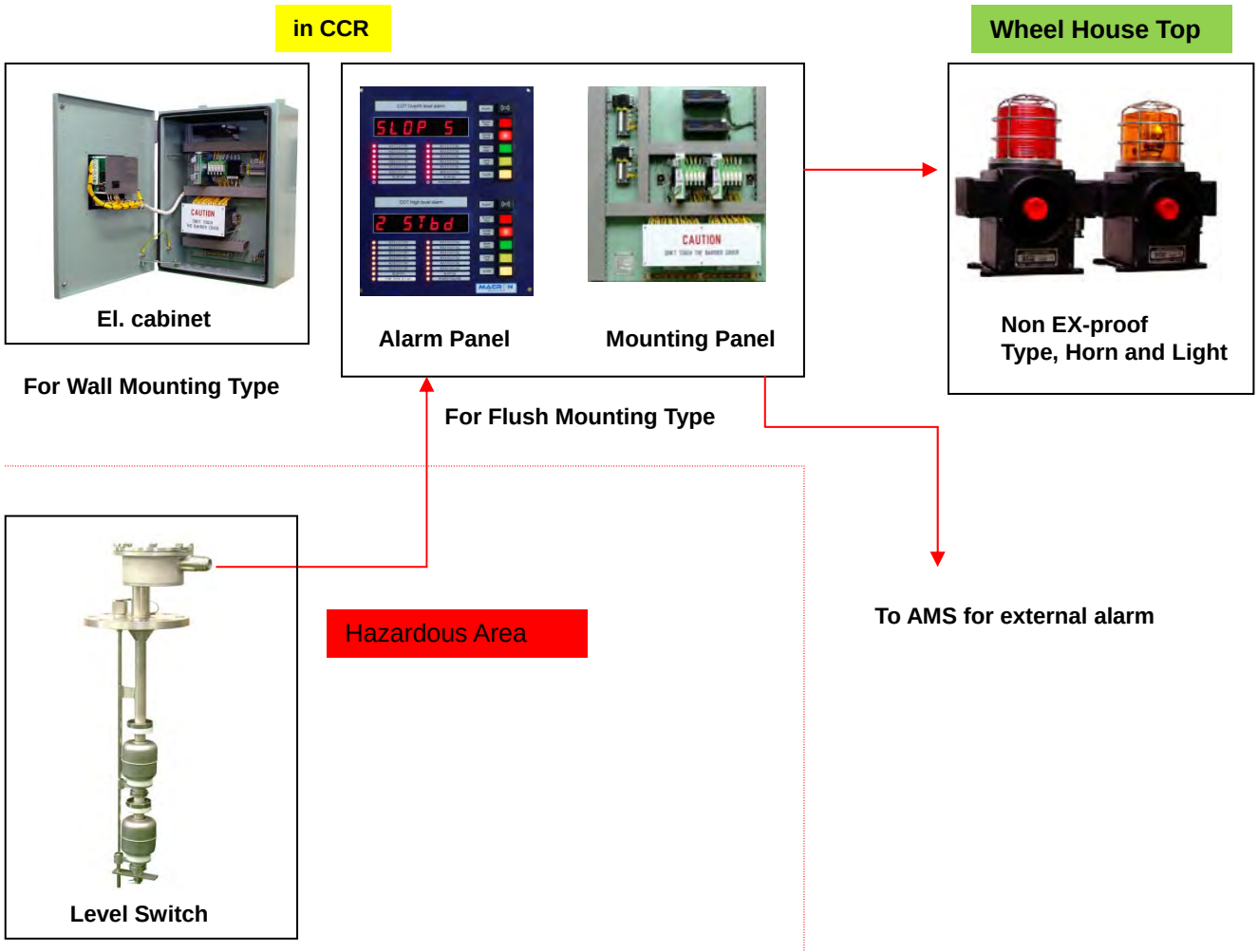
There are two types can be supplied on request, one is strobe type, and one is rotating type for Lighting Generally, this equipment should be mounted on wheel house top as non-ex proof type

In case the location of horn with light is the middle of ship as Ex-area, our standard model cannot be installed in EX-area. But, the EX-proof type Horn/Light with certificate can be supplied as option

- Magnetic Float Level Switch

The number of level switches are delivered depend on tank numbers, and each switch is specified according to tank volume/height specification (95% and 98% volume or level) and it must be identified before installing switches.

As option, air horn with accessories can be used instead of electric horn



1.3 Factory tests

The system is completely assembled, calibrated and tested at the factory. All internal wiring is ready finished. The inspection report with certificate number is included. The check sheet and FAT report will be attached in final documentation.

2 Installation Description

2.1 Electrical Parts

External cables for power supply and Relay out signal are connected to terminal block in electric cabinets according to the electrical wiring drawing.

All cables from level switches on deck should be directly connected to IS repeater terminal connector, and the channel address with tank name of each IS repeater are shown on the drawing (SEE Final Document)

Installation requirements are ordinary standard electrical precautions. Special tools and instruments are not required during installation.

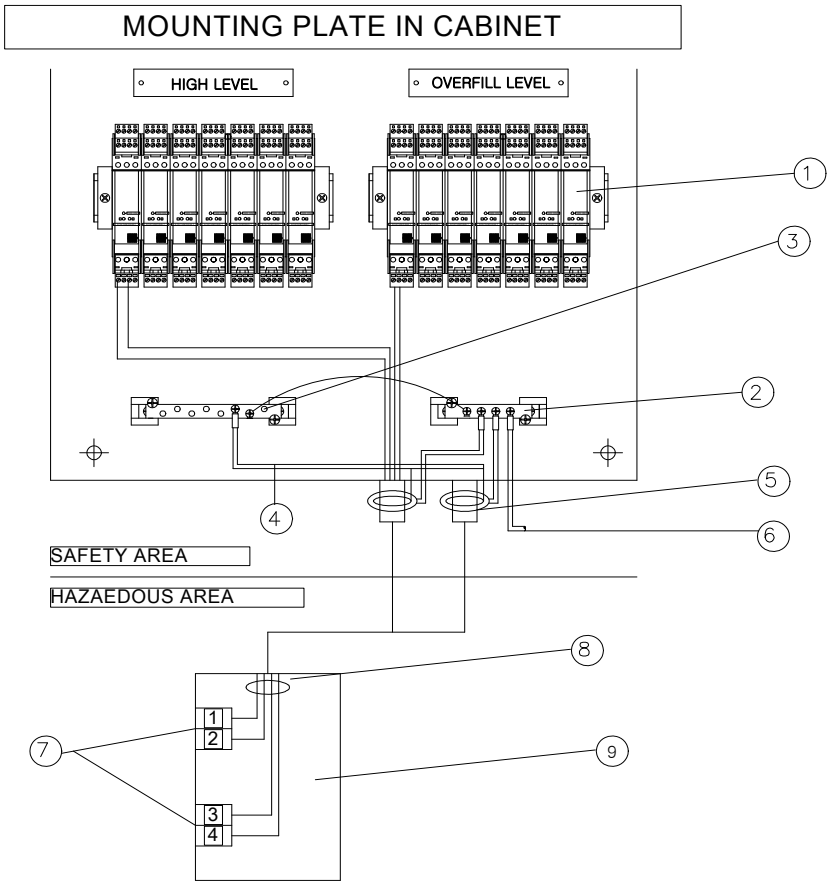
The following type of cables should be recommended with Marine approved:

No.	Description	Cable Type	System
1	SMA-2000S (Single Float), Level Switch	2 x 0.75 mm^2	Overfill Alarm
2	SMA-2000D(Dual Float), Level Switch	4 x 0.75 mm^2	High and Overfill
3	Main Power 115~220 VAC	3 x 1.5 mm^2 with earth	
4	DC 24V Backup Power	2 x 2.5 mm^2	

There are separated cable entrance areas for level switches (Hazardous) and all other cables
(Power cables and External signal cables)

The cable glands on Electric cabinet and level switches should be tighten completely

2.2 Electrical installation on the system



① D1030D or D1030S
Intrinsically Safe Repeater of system zener barrier with isolation between input and output circuit.

② PE Earth Bar
PE bar should be grounded to the hull.
Earth wire (Armour) of power supply cable and external relay output cable

③ IS Earth Bar
The screen of cable for level switches should be connected to IS earth bar.

④ Screen Wire of cable: Inner Shield

⑤ Earth Wire of cable: Armour

⑥ The cable must be connected to hull for grounding

⑦ Terminal Block in Connection box of Level switch

⑧ The cable earth wire/Armour and screen(inner shield) must be insulated in connection box

⑨ Level Switch Connection Box

Do not use insulation testers or megger on any part of the system or on the level switches.

2.3 Float Level Switches

The following description for level switches installation should be observed carefully.

Storage preparations

The system must be protected against corrosion and external damage if it will be stored for a long time before installation

Installation

- ✓ When installing the level switch in the tank, please make sure that there is no outside damaged (e.g. Floats and Float guides) and every protection material must be removed.
- ✓ When mounting the deck flanges, make sure that the installation hole into the tank is at least 80 mm in diameter.
- ✓ The level switch is to be mounted after the tank has been acid cleaned and painted, if relevant.
- ✓ Each level switch is marked with tank name on top cover and it should match with each cargo tank.
- ✓ If test device movement is too hard, the physical inspection should be carried out before tightening the nuts.

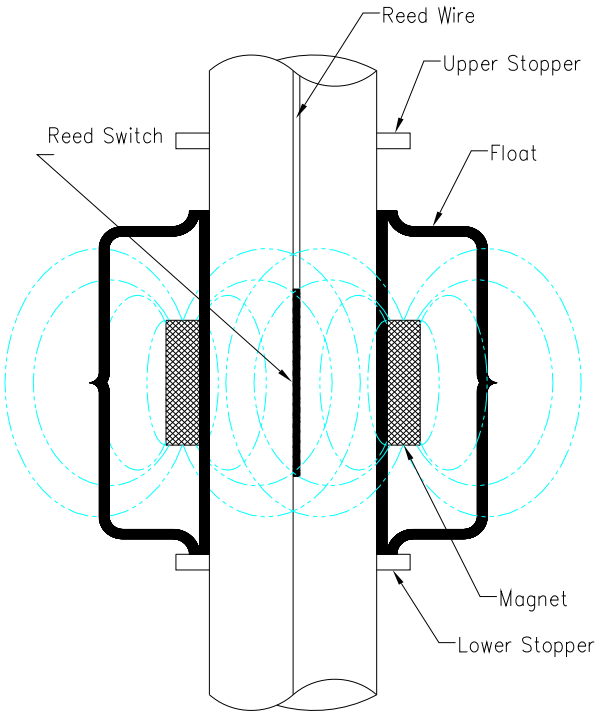
Notice that the **GASKET** must be installed before switch is mounted on tank penetration flange

3 Technical Description

3.1 Magnetic Float Level Switch

The level switch is equipped with one or two floats, with built-in permanent magnets in each float.

Float Actions	Alarm Condition	Reed Switch	Digital Multi-tester
Float shift upwards	98% or 95% alarm	De-activated, open position	0 ohm
Float shift downwards	No alarm(Normal)	Activated, closed position	"OL"



3.2 Switch/Proximity Detector Repeater

General Description

There are two repeater models, D1030D for dual channel and D1030S for single channel. These both are easy installable due to DIN rail. The unit can be configured for contact or proximity detector, NO or NC and for NE or ND SPDT relay output contact.
Each channel enables a Safe Area load to be controlled by switch, or a proximity detector, located in Hazardous Area.

D1030D dual channel type has two independent input channels and actuates the corresponding output relay. Two actuation modes can be independently DIP switch configured on each input channel: NO In/NE relay or NO In/ND relay.

Code	D1030D
Name	2 Ch, DC Power Switch/Proximity Detector Repeater, Relay Out.
Type	Digital Input
Supply	24VDC
Field Device	 Switch Proximity
Channels	2
Description	The D1030D isolates and repeats two contacts or two proximity detectors in Hazardous Location providing two independent SPDT Relay Outputs to drive Safe Area Loads. The unit can be configured for NO/NC contact or proximity detector input and for NE or ND relay output.
Hazardous area	Dry contact, Proximity Switch.
Safe area	2 SPDT (relay contact) 2 A / 250 V, plus LED for line fault detection
Function	2 channels I.S. switch repeater for contact or EN60947-5-6 Proximity Switches. Provides 3 port isolation (input/output/supply)
Features	High density with 2 independent channels. Field Configurable via Dip-Switches

D1030S single channel type has one input channel and two output relays.

Code	D1030S
Name	1 Ch, DC Power Switch/Proximity Detector Repeater, Relay Out.
Type	Digital Input
Supply	24VDC
Field Device	 Switch Proximity
Channels	2
Description	The D1030S isolates and repeats one contact or one proximity detector in Hazardous Location providing two independent SPDT Relay Outputs to drive a Safe Area Load. One of the relay output can be configured to remotely signal Lead Breakage/Fault Detection. The unit can be configured for NO/NC contact or proximity detector input and for NE or ND relay output.
Hazardous area	Dry contact, Proximity Switch.
Safe area	1 SPDT (relay contact) 2 A/250 V, plus 1 SPDT (fault detection contact) 2 A/250 V for line fault detection and LED.
Function	1 channels I.S. switch repeater for contact or EN60947-5-6 Proximity Switches. Provides 3 port isolation (input/output/supply)
Features	Field Configurable via Dip-Switches. Remote signaling of fault detection

Function:
1 or 2 channels I.S. switch repeater for contact or EN60947-5-6 Proximity Provides 3 port isolation. (Input/output/supply)

Signalling LEDs:
Power supply indication (green), Output status (yellow), Line fault (red).

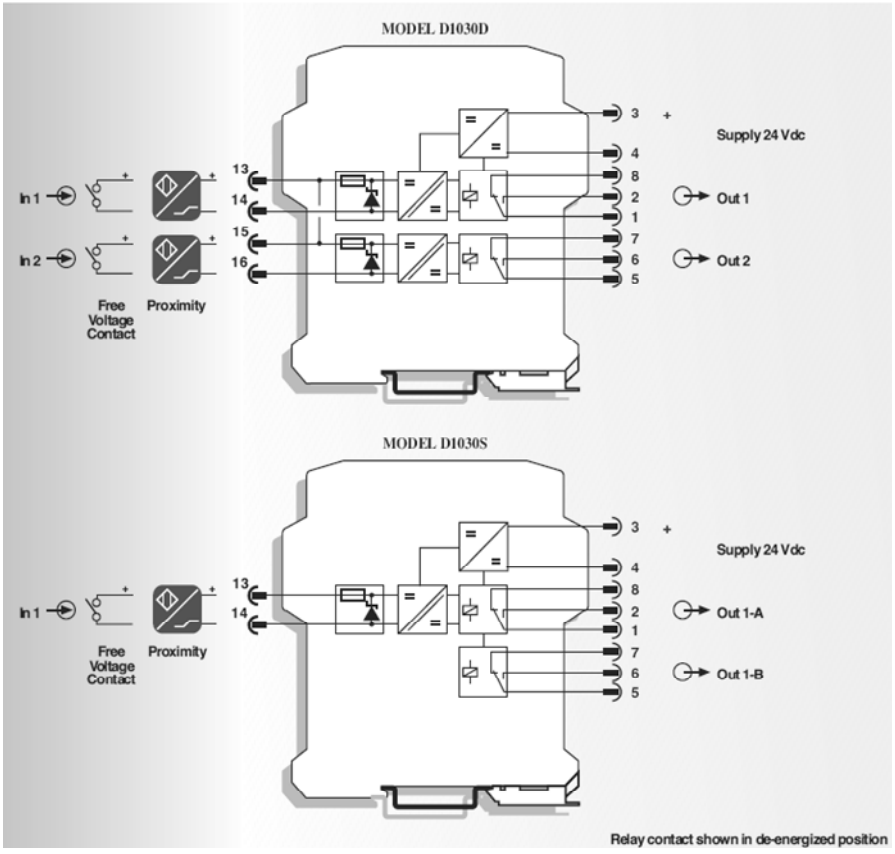
Field Configurability:
NO/NC input for Contact/Proximitor, NE/ND relay operation and Fault detection enable/disable.

EMC:
Fully compliant with CE marking applicable requirements

Front Panel and Features:

NO/NC Contact/Proximity Detector Input
Two SPDT Relay Output Signals.
SPDT Relay Output for fault detection on 1 channel version.
Three port isolation, Input/ Output/Supply.
EMC Compatibility to EN61000-6-2, EN61000-6-4
Field programmability by DIP Switch
ATEX, UL & C-UL, Russia and Ukraine Certifications
High Reliability, SMD components
High Density, two channel output per unit.
Voltage applied to the instruments requires associated zener barrier.
Simple installation using standard DIN rail plug-in terminal blocks.
250 Vrms (Um) max.

Function Diagram:



3.3 Alarm Display Unit

1 FND: Tank name will be shown when new alarms occur

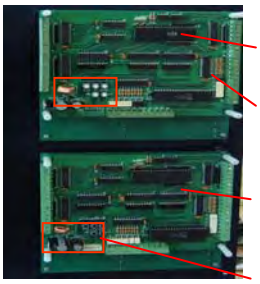
2, 3 Alarm LEDs: Overfill 98% is RED color and High 95% is Yellow

4 Alarm LED for Power failure

5, 6, 7, 8, 9 Buttons and Buzzer

"Buzzer Stop", "Accept/Reset", "Alarm Hold", "Lamp/Function Test" and Power ON/OFF button

<ADU in front>



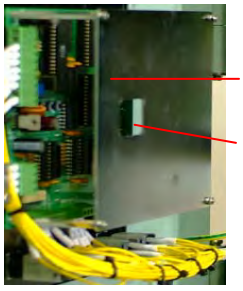
1. PCB for Overfill Alarm

2. Terminal Block

3. PCB for High Alarm

4. Programming Key

<ADU from back>



1. Protection plate for PCB

2.Access Hole for User programming Key

<ADU from side>

Alarm display unit (ADU) will make different signals by giving pulsing sound for the Horn for High level and continuous sound for Overfill alarms. Function can be configured in programming.
The alarm display unit can be mounted on the electric cabinet's door or on the cargo control console.
If the system is console mounting type, the mounting plate with safe alarm repeaters, external relays and power supply unit to be located inside the console.

① FND Flexible Numeric Display
Tank name indication

② Alarm LEDs, RED Color for 98% Overfill alarm
When upper float moves upward to alarm set point, the relevant alarm LED will light up

③ Alarm LEDs, Yellow Color for 95% Tank High alarm
When lower float moves upward to alarm set point, the relevant alarm LED will light up

④ Alarm LED, RED color for Power Failure
When power supply is insufficient, the LED will light

⑤ Push button Lock type, White Color for Power ON/OFF
For start-up the system

⑥ Push button, RED Color for "Buzzer Stop" and "Accept/Reset"
Sound stop and Alarm accept/reset

⑦ Push button Lock type, Green Color for "Alarm Hold"
Normally, this function can be used at sea going mode by pressing “Alarm Hold” button.

If the function is already activated prior to cargo loading, it must be de-activated and green lamp should be off.

The first alarm from each tank will activate the alarm horn and light on deck as well as the buzzer on the alarm panel even if alarm hold button pressed down. After that the alarmhorn/light on deck and the buzzer on alarm panel will not be repeated due to alarm hold function. But, the LED and FND on alarm display unit will work normally. In condition of cargo full loading, the alarm should be repeated with alarm horn and light
on deck according to cargo surface movement unless alarm hold function is not activated.

⑧ Push button, Yellow Color for "Lamp/Function Test”

The system is provided with “Function Test” and lamp test at the same time by pressing it.
The system will start the programming to confirm the components status on alarm display unit such as alarm LEDs, buzzer, FND with tank name by programmed tank order/channel order. It takes times about 20 seconds until function test is completed.

FND (**F**lexible **N**umeric **D**isplay) is located on the top of alarm display unit.
When the alarm LED is activated, the FND will show the relevant tank name flashing at the same time.

Flashing tank name will turn steady when pressing “Accept/Reset” button.Latest alarm tank name will be indicated unless the alarm condition disappeared.In case of the latest alarm is disappeared. The FND will show the tank name with firsttank channel (no.1P tank).
The test will be cancelled and system returned to normal condition if button is not pressed constantly.The function test can be carried out to check the status of alarm display unit before start cargo loading.

It is important that the system will not watch up sensor’s activation in function test.
Do not use “Function test” during cargo loading.

⑨ Buzzer
When any alarms are detected, the buzzer will be worked with other visible parts (LED and Lamps)

According to the regulations, the system must be tested by lifting test device rod in each tank prior to cargo loading.

Notice! Test device must be in working position after testing is completed. Alarm hold function must be also de-activated.

4 Operating

4.1 Before starting the system

The following installation for the system should be checked.

i. Make sure that earth wire and screen (shield) are isolated from the ground properly in the level switch connection box.
ii. Make sure that Main power supply and backup power supply are connected to correct power source according to electrical cabling diagram.
iii. Make sure that all signal cables are connected to the correct IS repeaters.
iv. Make sure that earth wire and screen of cables in cabinet are connected to earth bar correctly. Refer to section 2.2 Electrical Installation on the system

4.2 Starting-Up

i. Press “Power ON/OFF” button on Alarm Display Unit
ii. Green LED on the IS repeaters should be light up if tank is empty
iii. All alarm LEDs are off with “No ALM” (No Alarms) on FND.
iv. In order to check all components on alarm display unit, please press the “Lamp/Function Test” button and hold it until completed.

4.3 How to test the system

i. Make sure that “Alarm Hold” function is de-activated
ii. Make sure that each level switches input signals are correct on IS repeaters and alarm display unit corresponds with tank name when test device is lifting.
iii. Make sure that alarm horn and light are working properly with step ii).
iv. Make sure that all alarms are disappeared by pressing “Accept/Reset” button on the unit when float is in downward position.
v. Make sure that “Alarm Hold” function is working according to the section 3.3,⑦
vi. Make sure that external relay out is working for power fail on Alarm monitoring system if connected.
vii. Make sure that system failure alarm is activated when testing electric circuit loop failure with disconnected wire from system.

When disconnect cable wires on any circuit, the alarm LED will be light up and flashing tank name will be indicated on FND. After re-connection red alarm LED will go off while pressing “Accept/Reset” button.

5 Fault Finding

5.1 Power Failure Alarm

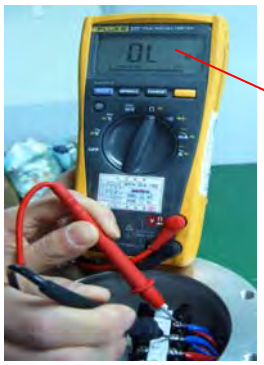
Alarm will be activated if either main 230 VAC or 24 VDC backup power supply is missing. Alarm will be de-activated after supply power is restored.

5.2 Alarm Malfunction

In case the tank alarm LED with buzzer is activated on alarm display unit even though tank is empty or similar case. The following actions have to be taken to find out problem.

i. Inspect testing device correct position.
ii. Check the external wiring to level switch in case of damaged or shorted out connection.
iii. Open/check connection box if any water/moisture
iv. Measure insulation resistance (more than 20Mohm) by digital multi-meter
v. Disconnect Yard cable from terminal block and check reed switch activation by lifting test device

1



2

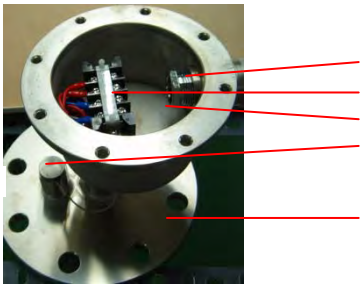
When test device is not lifted, (Normal Operation)

1. The condition of reed switch is normal
2. In case of LCD is showing “OL”, either reed switch or magnet float is broken

When test device moves upward to make alarms,

1. Either reed switch or magnet float is broken
2. It is correct working between reed switch and magnet float

vi. If electrical inspections are OK, the mechanical components (i.e. float and others) must be checked. Float should move free on the guide rods.



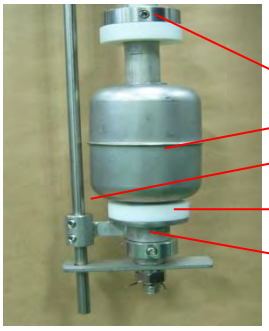
1. Cable Glands
2. Terminal Block
3. Connection Box
4. Test device with cap
5. Deck Flange

< View of level switch top>

6. Maintenance and Replacement of Defective Parts

6.1 Magnetic Float

The replacement procedure is carried out as following numbers:

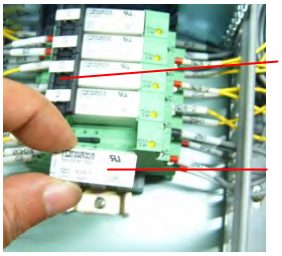


5. Remove screw for upper float replacement
4. Float
3. Seat ring: It is linked with test device rod
2. Stopper
1. Split Pin and Nut

< Float level switch>

< Complete level switch >

6.2 External Relays



1. Pull lock device
2. Pluggable miniature relay

6.3 Electric Horn with Light

i. Switch off power supply from control panel
ii. Open the cover of terminal box
iii. Unscrew Cable gland and two wires from Terminal Block
iv. Unsecure four screws from foundation seat
v. Replace a new one in the opposite manner

1. Terminal Block
2. Cable Glands

< Terminal Box>

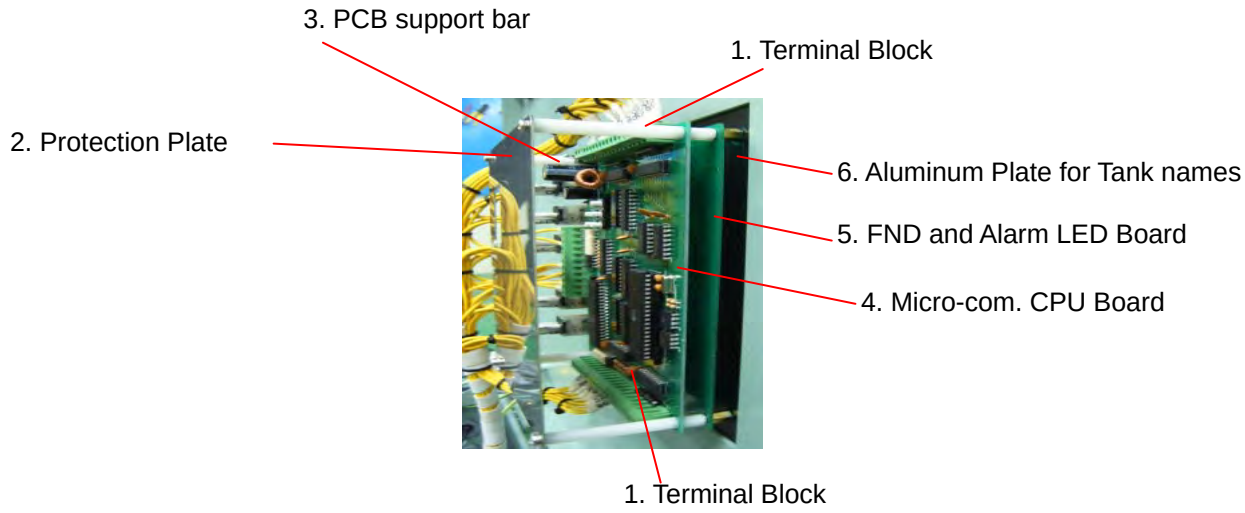
< External View>

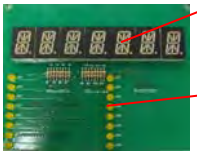
6.4 Lamp and Switch for Buttons

1. There is a lamp in socket
2. There are two kinds of switch (lock type and unlock type)
3. Cable with quick terminal

< View from backside of Alarm Display Unit>

6.5 Printed Circuit Board





< FND and Alarm LED Board >

< CPU Board >

6.6 Magnetic Reed Switch

If reed switch is not working properly, the cable with reed switch can be replaced. The reed switch with cable must be delivered according to tank alarm limit specification

i. Disconnect wires from the reed switch in connection box then loosen and remove cable gland
ii. Place the new reed switch with cable in the guide rod.
iii. Make sure that the new reed switch is activated correctly by test device before tightening
iv. Connect the wires to correct terminals in the junction box

7 User Programming for Alarm Display Unit

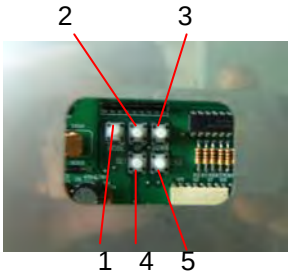
7.1 General Description

The PCB of Alarm Display Unit is set up at the factory to suit different applications. Alarm settings can be adjusted by programming switches onboard.

The switches for changing of factory setting values are easily accessible without any need to disconnect cable gland materials at the back side of PCB. The operator can touch the switches without dismounting the protection plate because there is a small square hole.

There are five switches on PCB as below, refer to below photos.

1. S1 MODE
2. S2 UP
3. S3 DOWN
4. S4 SET
5. S5 EXIT



< View of ADU back>

<User-programming switches>

7.2 How to do programming?

Refer to abbreviation and denomination for user-programming before starting-up. There are 6 parameters in each display for programming as follows:

a. CH-24 or CH-16
   The number of alarm channel. It can be adjusted for the number of channels according to scope of supply or additional supply

b. NO-NC
   Either NO or NC for each channel can be selected in programming.

c. Delay
   Adjust alarm delay time. 0~60 sec.

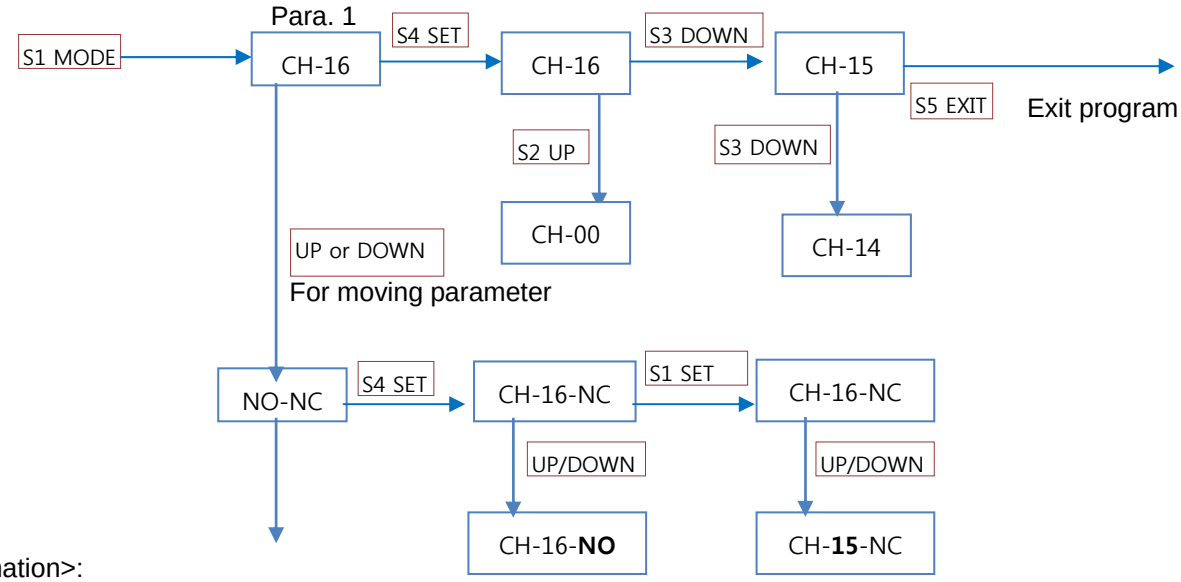
d. Relay
   Select relay group 0,1 and 2 for each channel on PCB.
   There are three relay groups which are mounted on PCB and can be chosen by programming
   Each relay groups give output signal to external for common and Horn/Light.

e. BZ
   Select Buzzer sound, Continuous or Pulse

Programming chart is described in section 7.3. You can find information on how to operate switches and change the default value to new ones.

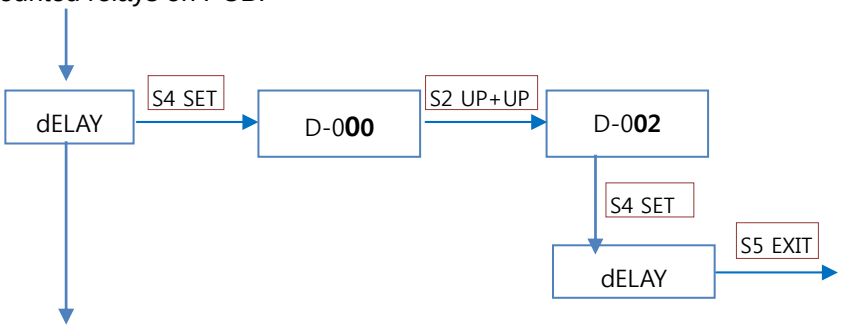
7.3 Programming Chart

In order to access programming after start-up, the MODE key should be pressed as below.



<Information>:

The user can change relay contact in programming of microcomputer from NO to NC or opposite by pressing UP and DOWN key for mounted relays on PCB.

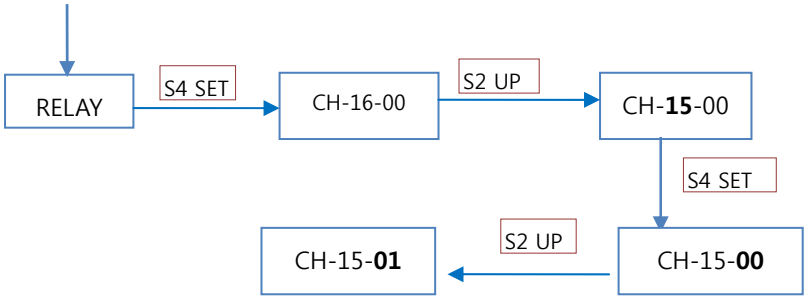


<Information>:

Delay Time: 0~99 sec

The setting method of delay time is same as above parameter.

UP or DOWN key will be used when the desired values are changed



<Information>:

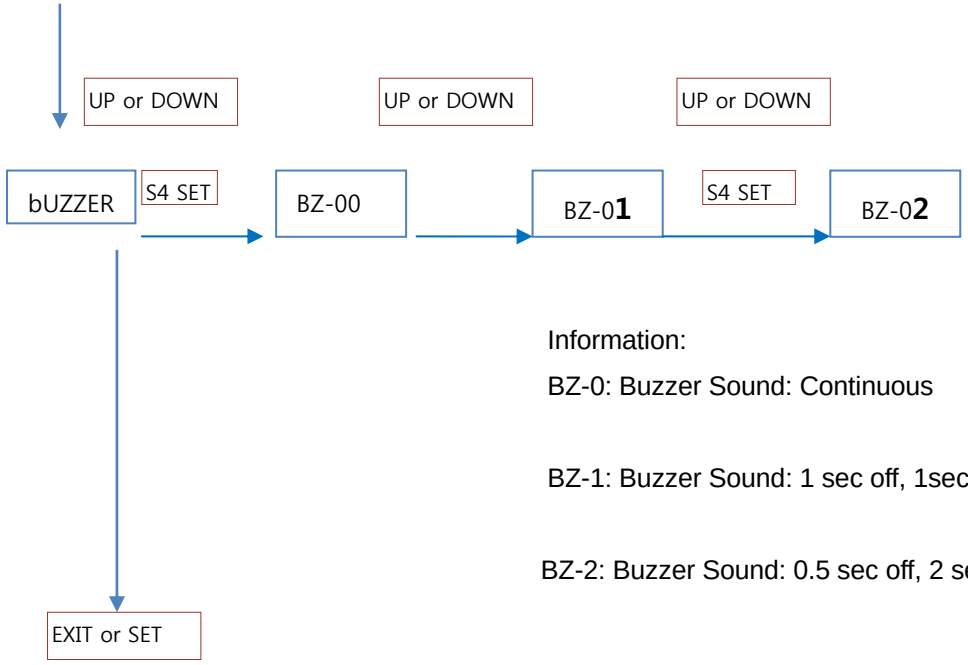
There are three external alarm relay groups on PCB.

Group 0: For COT Horn and Light handling, Terminal number: 40A1B

Group 1: For HFO tank Horn and Light handling, Terminal number: 41A1B

Group 2: For Pump room bilge well Horn and Light handling, Terminal number: 42A1B

If the setting is CH12-0 in this parameter, the external relay group 0 will take care of alarm channel 12.



Information:

BZ-0: Buzzer Sound: Continuous

BZ-1: Buzzer Sound: 1 sec off, 1sec on

BZ-2: Buzzer Sound: 0.5 sec off, 2 sec on

Save & EXIT Programming

8. Appendix

8.1 Replacement of defective float