REVISION	DATED	DESCRIPTION	AUTHOR	APPROVED
3	01/11/04	Change to new format	PC	TMcL
4	12/12/06	Section 16 Revised	PC	TMcL
5	14/06/07	WIS 1211 Corrected	PC	TMcL
6	21/09/07	Updated Sequences	PC	DF
7	08/02/08	Table of Contents Added	PC	DF
8	05/08/08	EC Declaration added	KU	TMcL
9	15/05/09	Fig 13.4 Corrected	PC	DA
10	26/05/09	Fig 6.1, 6.2 & 13.3 Corrected	PC	DA
11	1/12/09	Baseefa notified body number added and declaration updated	WF	PH
12	24/04/12	D of C updated in line with current standards	BC	WF
13	06/09/2012	Date error in D of C corrected	NG	WF
14	12/11/2012	D of C updated in line with current standards	WF	PH
15	11/12/2012	Input connection drawings updated	DF	BC

TABLE OF CONTENTS

SECTION 1 INTRODUCTION

The LN1000 annunciator is an intrinsically safe process alarm system certified for installation in Zones 0, 1, 2 IIB and IIC hazardous areas.

The annunciator is a totally unique product which provides an ideal solution to alarm monitoring problems where an operator needs additional information on the plant status and control over external parts of the plant.

Being certified to Ex ia means there are no restrictions with regard to maintenance whilst the power is applied as there are with Ex d, Ex p or Ex N equipment.

The annunciator system consists of three parts; the Chassis (12 way or 32 way), the Sequence Card and the Alarm Card.

Each system will consist of the chassis complete with the Sequence Card, which controls the common functions, and as many Alarm Cards as necessary to cover all the alarm points to be monitored.

The power for the annunciator is supplied from the safe area through a single certified isolating interface, which avoids the requirement for a high integrity earth. This single IS interface is sufficient to drive up to 32 alarm channels.

The annunciator functions in a similar manner to a conventional, safe area annunciator, but because of the limited power available the information is displayed using a combination of high efficiency LED's and LCD’s in the place of incandescent lamps.

The system is fully programmable, via DIL switches, for a range of commonly used functions and features. The alarm sequences are based on the sequences listed in the ISA publication "Annunciator Sequences and Specifications" S18.1 -1979.

The operator can respond to alarms using either integral or remote pushbuttons.

The standard system is panel mounting to allow customers to incorporate it into their control systems but if a stand-alone alarm system is required RTK can offer a wall mounting version which is fully self contained in a stainless steel enclosure.

The LN1000 annunciator is available with a range of complementary products, manufactured by RTK; these will allow signal transfer between hazardous to safe areas (DA-149 IS Relays), provide higher volume audibles (DB-5 and DB-7 IS Sounders) and flashing beacons (DA-135 IS LED Beacon).

With this range of products it is very easy to design and configure a comprehensive alarm monitoring package for any hazardous area.

SECTION 2 SYSTEM DESCRIPTION & FEATURES

General

The LN1000 intrinsically safe annunciator is a totally unique product which allows operators to monitor the alarm status of critical parameters in any hazardous area. Not only will the LN1000 give detailed information of the plant alarm status but it can also be used to control sections of the plant both in the hazardous area and, via isolating relays, in the safe area.

Certification

The LN1000 is certified by BASEEFA to Ex ia IIB T4, with the 8 way version being certified by BASEEFA to Ex ia IIC T4. This certification is suitable for use in zones 0, 1 and 2. BASEEFA certify that the product complies to EN60079-0 and EN60079-11

System Sizes

Two chassis sizes are available as standard, a 12 way (size used for 8 way and 12 way units) and a 32 way.

The chassis always contains the Sequence Card which controls the common functions and group outputs.

Each Alarm Card monitors two alarm channels, these are simply added to the chassis to make up the alarm system of the required size.

Complete System

Figure 2.1 on the following page shows a typical system, those parts shown shaded illustrate an alarm system in its simplest form.

All the complementary parts needed to design a more complex system are manufactured by RTK and can be supplied together with interconnection diagrams.

RTK Instruments will help in designing systems and providing all components and details of how the separate products interconnect.

Programmability

The annunciator alarm sequences, functions and features are programmable via the on-board DIL switches.

This covers different alarm sequences, normally open or normally closed alarm contacts, first-up groups, output functions and time delays.

Most features are programmable down to each individual alarm way.

Mounting

The standard system is supplied suitable for panel mounting for customers to incorporate into their control systems.

A wall mounting version is also available for stand-alone systems, these are mounted in IP65 stainless steel enclosures and fully wired to terminals ready for on-site connection via the bottom gland plate.

Servicing

As the LN1000 is certified as intrinsically safe, live inspection and maintenance procedures can be carried out at any time.

All configuration and maintenance is carried out from the front by simply removing the front fascia and withdrawing the cards.

Lightweight

Being constructed from stainless steel and polyurethane mouldings make the LN1000 extremely lightweight in comparison to conventional flameproof and Type 'N' systems. This gives great benefits when space and payload are critical factors, especially offshore.

Group Outputs

A number of outputs are available as standard to drive external audibles and control other parts of the plant in the advent of certain alarms occurring.

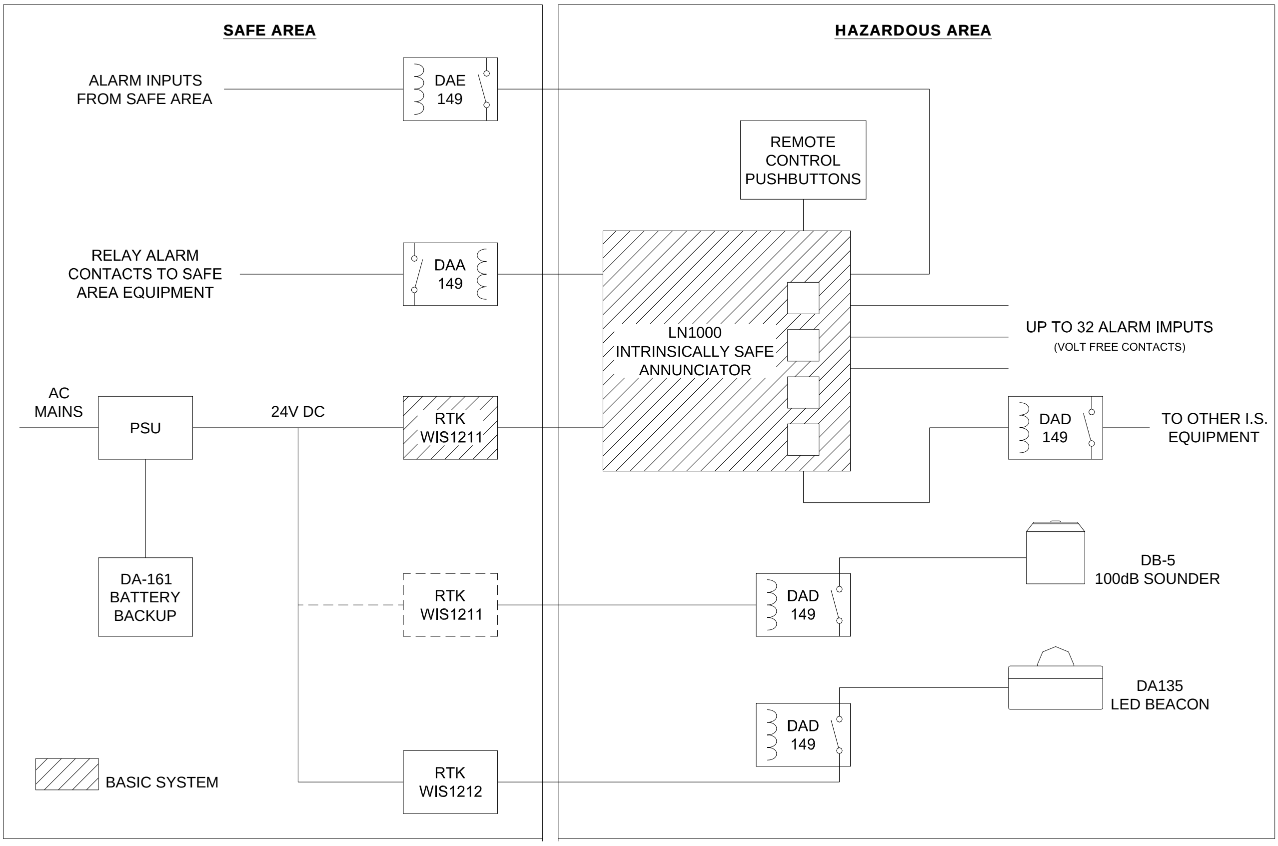
These outputs are programmable to operate in many different ways.

Inputs

The alarm inputs are normally situated in the hazardous area but can also be connected to the LN1000 from the safe area if connected via IS Relays (Type DA-149).

The other inputs such as "alarm inhibit" and pushbuttons should all be local to the LN1000.

Terminals are available as standard to fit external pushbuttons if required and the integral pushbuttons on the fascia can be disabled.



Standard system configuration showing ancillary components (Figure 2.1)

SECTION 3 INPUTS & OUTPUTS

Terminations and interconnections

All connections to the LN1000 Annunciator are via rear mounted screw terminals. These terminals are suitable for cables up to 2.5mm².

In the wall mounted versions the input and output terminals are wired to a row of 2.5mm²terminals on the backplane.

The Sequence Card and the Alarm Cards are all interconnected by a common backplane. This backplane is used to supply power to the Alarm Cards, synchronise the flashing of the LED's, ascertain the first-up alarm in any sequence, connect the pushbutton controls and provide a drive signal to the local horn, the external sounder outputs and all group outputs.

LN1000-AC Alarm Card

The Alarm Card monitors two alarm channels and each channel has the following inputs and outputs:

ALARM INPUT:	CONNECTED TO THE VOLT-FREE ALARM CONTACTS
INHIBIT INPUTS:	Connected To Volt-Free Contacts To Inhibit That Alarm Channel
GROUP A OUTPUT:	Configurable To Follow The Alarm Logic Or The Field Contact
GROUP B OUTPUT:	Configurable To Follow The Alarm Logic Or The Audible

LN1000-SC Sequence Card

Each system will have a Sequence Card which monitors and controls the common functions as follows:-

PUSHBUTTON INPUTS:	FOR TEST, ACKNOWLEDGE, RESET AND SILENCE PUSHBUTTONS
HORN OUTPUT:	Not Used
EXT SOUND:	This Output Is Used To Drive An Is Relay, Which In Turn Will Switch External Higher Level Audible Devices.
B1 OUTPUT:	Configurable To Follow The Alarm Logic Or Field Contacts
B2 OUTPUT:	Reflash Output Gives A One Second Pulse On New Alarms

SECTION 4 TECHNICAL SPECIFICATION

General

Location	Zone 0, IIB or IIC T4 Hazardous Area
Power Requirements	
Supply voltage	20-35VDC into the IS interface
Supply current	110mA max into IS interface
Terminals	Rising clamp type terminals. Maximum cable size 2.5mm²
Emc Compliance	
RF Immunity	To IEC 801-3 level 3. 10V/m 26-1000MHz
Fast Transient Burst	To IEC 801-4 level 3
Surge withstand transient	To IEC 801-5. 1.2/50ms Common mode: 2kV; Series mode: 4kV
Emissions	To EN50081-1 : 1992
Environment	
Operating temperature	-20 to +60°C
Storage temperature	-20 to +80°C
Humidity	0-95% RH, non-condensing
Environmental Protection	
Door to case	IP65 } to BS EN 60529 : 1992
Case to panel	IP65
Rear of enclosure	IP20
Construction	
Case	Stainless Steel
Front fascia	High impact resistant polyurethane
Membrane	Polyester
Panel Cut Out	
LN1000-12 (8 or 12Way)	121 x 270mm ±0.5mm (H x W)
LN1000-32 (32Way)	249 x 335mm ±0.5mm (H x W)
LN1000	Corner Radii R3 max.
Weight	
LN1000-12-P	3.8kg plus 120g per Alarm Card
LN1000-32-P	8.0kg plus 120g per Alarm Card
LN1000-12-W	20.0kg plus 120g per Alarm Card
LN1000-32-W	44.0kg plus 120g per Alarm Card

LN1000-AC Alarm Card

Each alarm card has two independent alarm channels

Alarm Inputs

Alarm contacts	Isolated volt free contacts, may be normally open or normally closed, selectable by DIL switch
Normally closed contacts	Field contact wired between H (+ve) and FC
Normally open contacts	Field contact wired between +5V and FC linked to H
Applied voltage (open contact)	5VDC typical
Current (closed contact)	250 micro amps typical

Inhibit Inputs

Inhibit contacts	Isolated, volt free contacts, closed to inhibit
Applied voltage (open contact)	5VDC typical

Alarm Outputs

Group Trip A Output (GTA)	Configurable: (a) Follows alarm logic (b) Follows field contact
Group Trip B Output (GTB)	Configurable: (a) Follows alarm logic (b) Follows audible
Group Trip Outputs (A and B)	The above two outputs are configurable as energised or de-energised on alarm. (a) Low for normal (b) Low for alarm Option (a) or (b) must be the same for both GTA and GTB outputs of each channel
Group Output voltage	Both outputs are current sinking through a 10k resistor and a series diode for switching DAA149, DAB149 and DAD149 relays.

WARNING
The maximum number of DA-149 is relays driven from one system should not exceed 35 and the maximum number of relays driven from a single output should not exceed 2.

Programmable Features

First up grouping	Each channel may be internally set by DIL switches into 1 of 7 first-up groups or no group at all
Alarm sequence selection	ISA sequences A, M, R, F1A, F2M and F3A set by DIL switches
Field contact configuration	Selectable N/O or N/C operation per channel by DIL switches
Input delay	To avoid false alarms due to momentary abnormal field contacts, such as with surging liquids in tanks, a delay can be activated using DIL switches. The delay time can be set by potentiometer between four and 30 seconds. When enabled, the annunciator will display an alarm if the field contacts remain abnormal for greater than the delay time.

LN1000-SC Sequence Card

Input

Power	Supplied from IS isolator sited in the safe area

Outputs

Ext. Sound	Low level DC signal follows audible on ISA sequence. May be used for switching DAA149 or DAD149 IS relays
B1	This output is configurable for both polarity and function. The function can be of two types either following the alarm logic or the alarm contacts.
Low level DC output	Configurable: (a) Active low (b) Active high and configurable: (a) Active whilst any channel is in alarm state (b) Active whilst any field contact in the "Field Contact Group" is abnormal. Channels are selected to be in the "Field Contact Group" by DIL switches on the Alarm Card
B2	1 sec low pulse on new alarm Used as a reflash signal to indicate to external equipment that another alarm has occurred.

Push Buttons

SILENCE [S]	Operates on the external sounder output. The visual display is not affected.
ACKNOWLEDGE [A]	Will stop the LED/LCD’s flashing and silence the audible. If a new alarm occurs on an already acknowledged system the audible will sound and the new alarm will flash. For full details refer to the sequence table relating to the alarm sequence selected.
RESET [R]	Will only operate after the alarm has been acknowledged and the plant condition has returned to normal. For full details refer to the sequence table relating to the alarm sequence selected.
TEST [T]	Illuminates all LED’s and all segments of LCD's on every alarm channel irrespective of alarm status. Will also drive the local horn and the external sounder. This function operates as long as the pushbutton is pressed. This function will not change the alarm state.
SYSTEM TEST [S & T]	Pressing and holding Silence and Test buttons for 4 seconds will cause the LN1000 to enter a test routine. Each channel is put into the highest state of alarm and latched in, it is then necessary to operate the Acknowledge and Reset pushbuttons to clear the alarms. This test will also operate both the local and external sounders and the two common outputs B1 and B2

Other Features

INTERNAL	Internal push-buttons can be disabled by a jumper link
EXTERNAL	Terminals provided for optional external normally open pushbuttons
OPTIONS	Horn re-sound delay after silence. Adjustable on Sequence Card between 0.5 to 15 minutes or infinite silence

SECTION 5 MECHANICAL DETAILS

Alarm Chassis

The annunciator consists of a stainless steel case with integral card rails.

The LN1000-12 is a single level unit, fitted with a LN1000-SC Sequence Card and up to six LN1000-AC Alarm Cards.

The LN1000-32 is a double level unit, fitted with up to eight LN1000-AC Alarm Cards on the upper level, with an additional eight LN1000-AC Alarm Cards and a LN1000-SC Sequence Card on the lower level.

The cards slide into the card rails and push into the connector mounted on the backplane. Each card is polarised to prevent incorrect assembly and are simple to remove and replace without the aid of specialised tools.

Fascia Panel

The fascia panel is high impact resistant polyurethane, with a printed polyester membrane including transparent windows to view the legends and displays. The internal pushbuttons are attached to the rear of the fascia connected by a ribbon cable to the Sequence Card.

The fascia is removed by unfastening the retained screws, and lifting the front panel down until it is held on the retaining straps

Alarm Cards

Each two-channel alarm card is fitted with an LED and a Liquid Crystal Display (LCD) for each channel.

The LED follows the normal alarm sequence and the LCD indicates the sequence, field contact status, first-up and inhibit state of the alarm channel.

To identify each alarm way when the system is in use traffolyte legends are used, these are located in the front panel above the upper channel and below the lower channel.

Sequence Card

The Sequence Card assembly contains the pushbuttons for controlling the stages in the alarm sequence and system outputs to control external audible alarms and other related control equipment.

Panel Mounting

The standard annunciator enclosure is designed for panel mounting. The fascia and the case to panel seal are protected to IP65.

The unit is supplied with a rear cable housing to aid installation. This is removable to facilitate drilling and for mounting the enclosure.

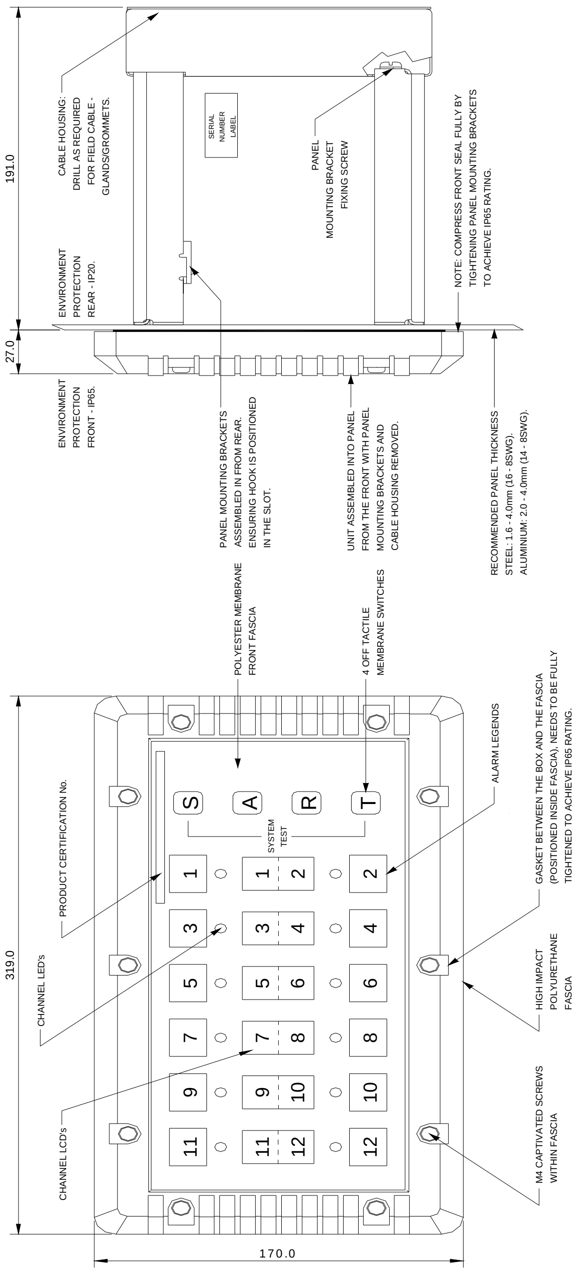
It is recommended that annunciators are installed in dry locations protected from corrosive atmospheres or direct sunlight

Wall Mounting

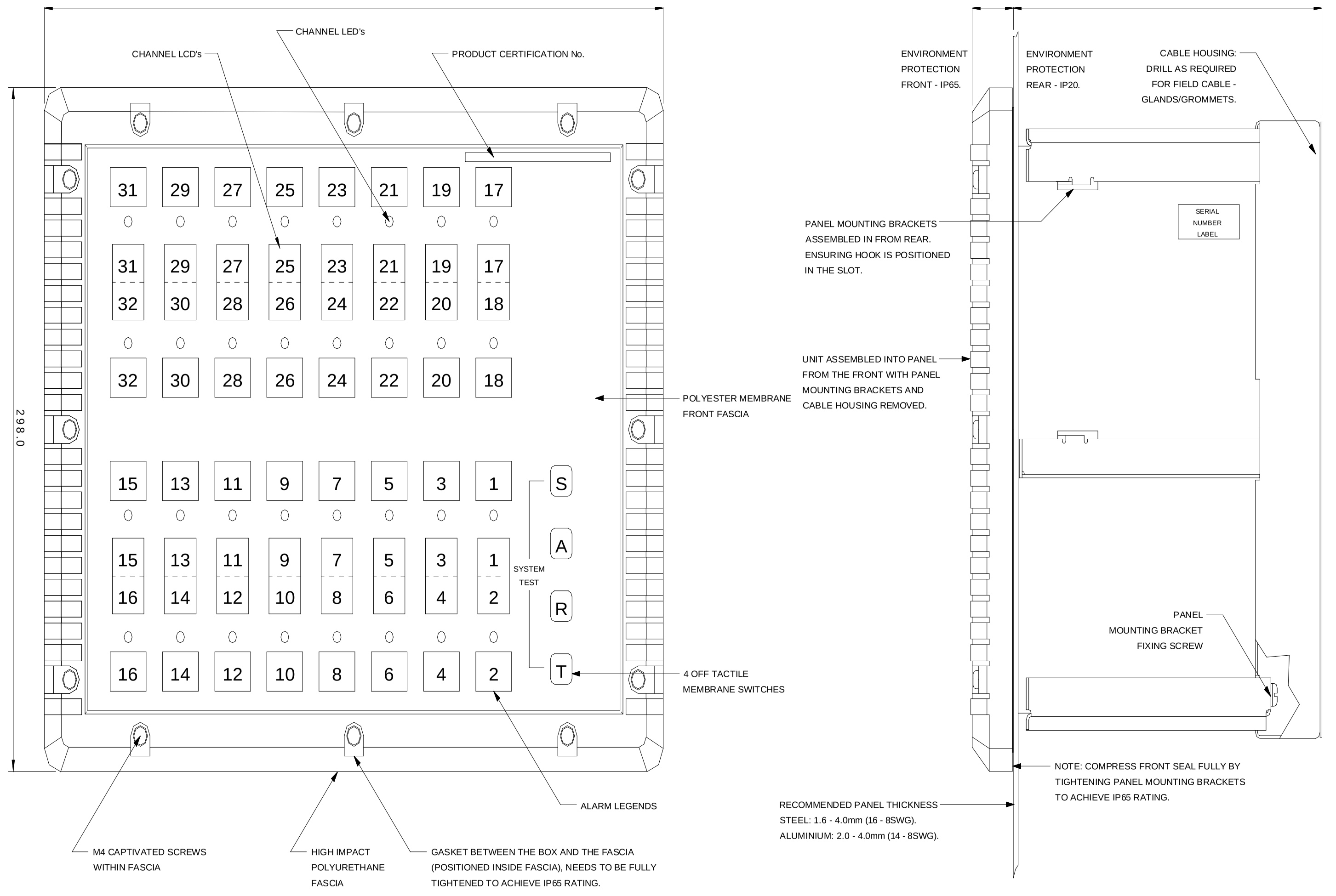
If the requirement is for a stand-alone wall mounting alarm system this can be supplied with the wall mounted variant. In this version the IS Annunciator is mounted in a stainless steel enclosure with the terminals wired and loomed around the hinge to a row of 2.5mm^2 terminals ready for external connection via the bottom gland plate.

Channel numbering

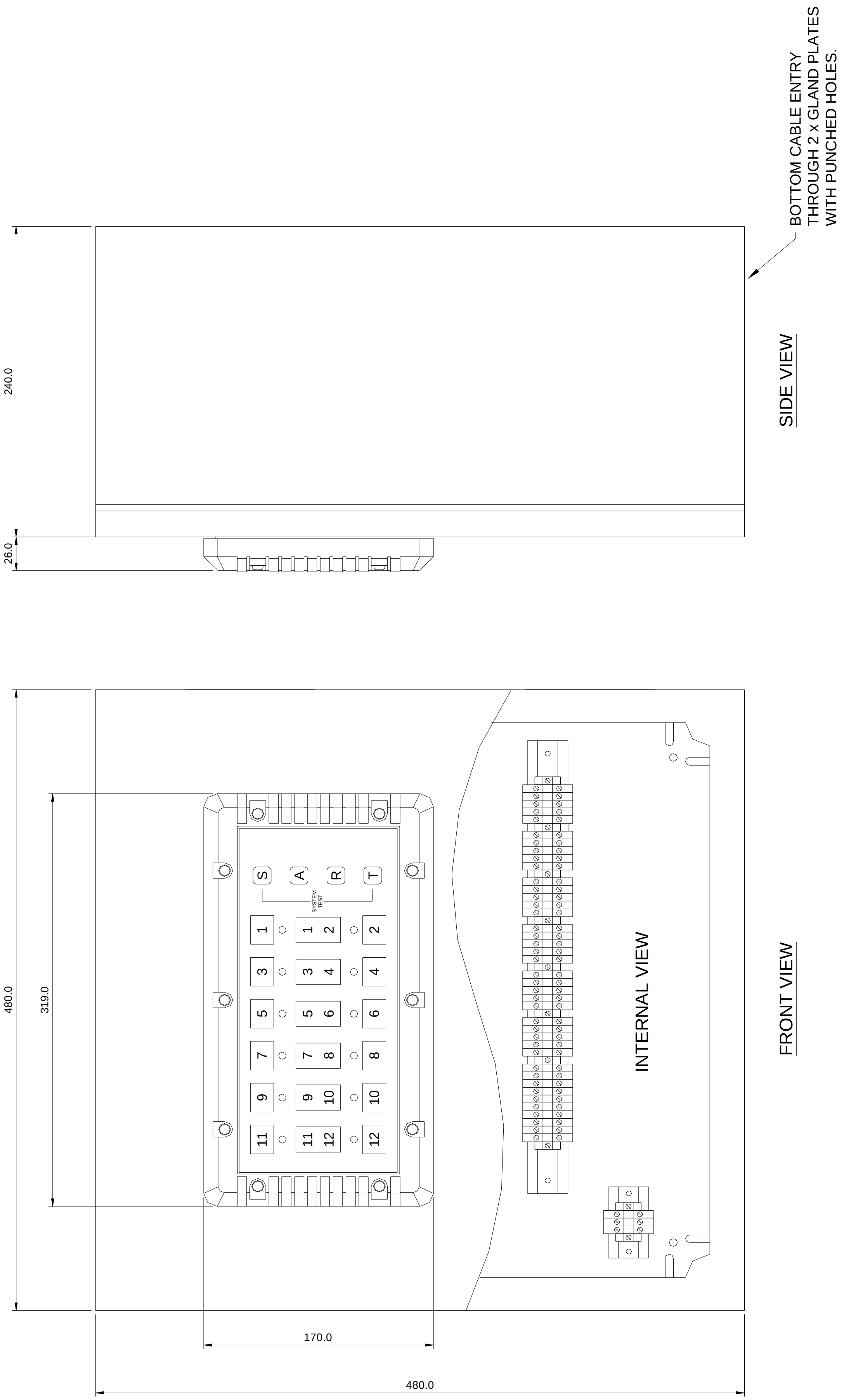
The channels are numbered starting from the Sequence Card towards the left. With two alarm channels on each card the lowest channel number is always the upper channel.



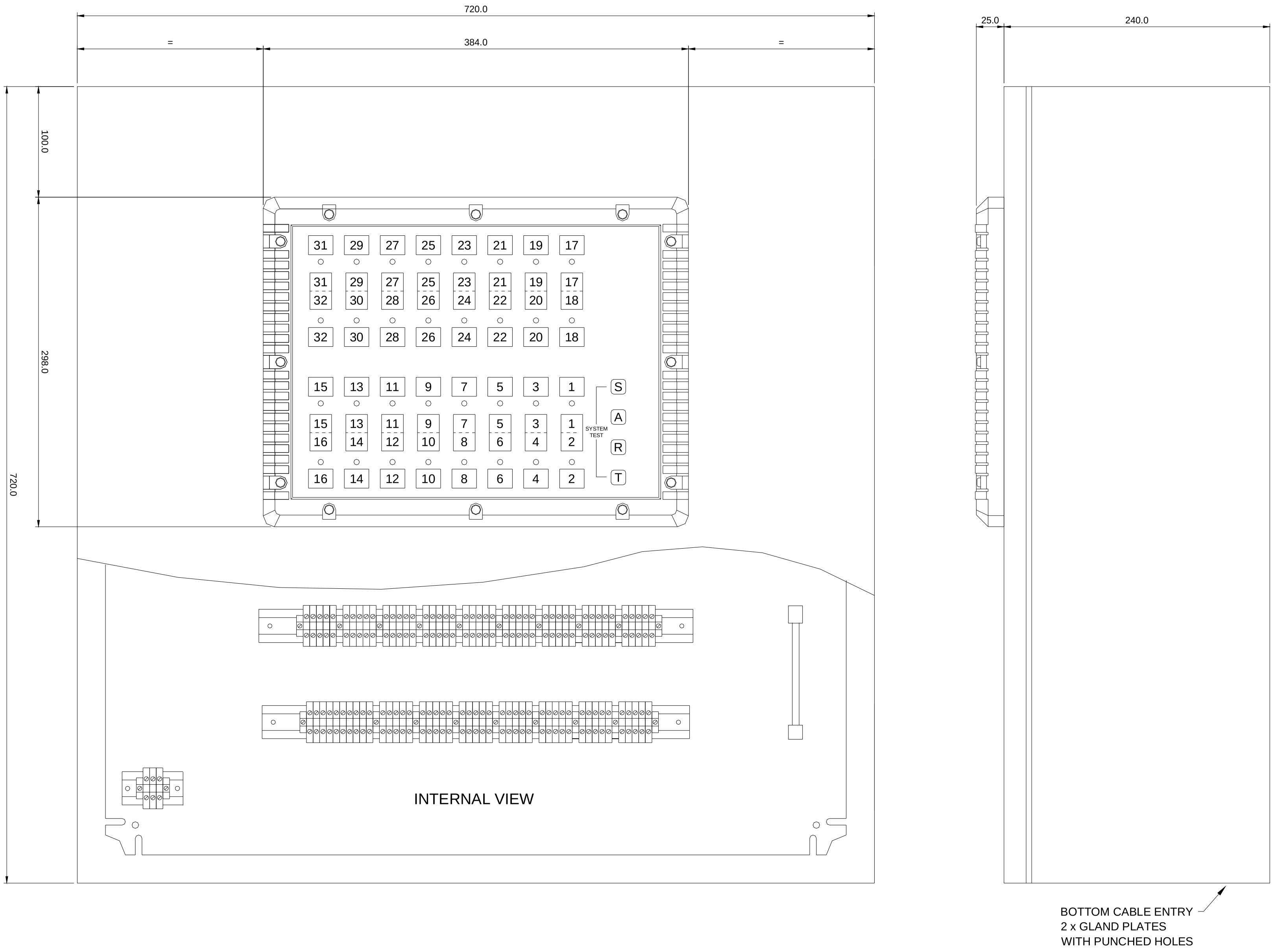
12 Way panel mounting Annunciator overall layout and dimensions (Figure 6.1)



32 Way panel mounting Annunciator overall layout and dimensions (Figure 6.2)



12 Way wall mounting Annunciator overall layout and dimensions (Figure 6.3)



32 Way wall mounting Annunciator overall layout and dimensions (Figure 6.4)

SECTION 6 ALARM SEQUENCES

Summary

From the sequence tables shown in the following pages, it will be evident that an alarm occurring causes a flashing visual indication with audible and optional relay drive.

The following pushbutton inputs summarise the user controls

TEST may be operated at any time and operates on the visual indication and the audible output, turning on all LED’s, LCD’s and the audible.
These will remain on for as long as the button is pressed.

ACKNOWLEDGE stops the flashing and audible. If a new alarm occurs on an already acknowledged system, the horn will sound and the new alarm will flash.

RESET operates only if the visual is steady and plant conditions have returned to normal. The relay drive is normally only terminated when the reset operates.

SILENCE is used only to silence the audible.

First-up sequence

When a group of alarms is initiated, it is often important to know which of them was the first to occur. This is achieved by both flashing the first-up alarm in a different manner compared to the subsequent alarms and also showing the 'F' in the LCD display.

Three different first-up sequences are available F1, F2 and F3 as detailed below and in the following sequence tables.

First-up operation should be used with care with the auto-reset sequence as momentary alarms can cause ambiguity.

F1 In this mode subsequent alarms appear in the acknowledged state, hence they do not flash. The audible device does not operate when subsequent alarms occur, unless still operating from the first alarm. The acknowledge pushbutton will reset the first-up indication.

F2 In this mode all subsequent alarms do not flash, they will however operate the audible device. The acknowledge pushbutton will reset the first-up indication.

F3 Additional types of flashing are added so that the first-up alarm can still be identified when the annunciator has been acknowledged. The acknowledge pushbutton does not reset the first-up indication this is cleared using the reset pushbutton.

Auto reset sequence

In this mode, the contacts returning to normal on an acknowledged alarm causes that alarm to reset.

If the alarm contact returns to normal prior to being acknowledged, the alarm will reset immediately on Acknowledge.

Ringback sequence

This mode is used to indicate to operators that the alarm contact has returned back to its normal state hence avoiding having to continually press the reset pushbutton, to see if the plant contacts have returned to their non alarm state.

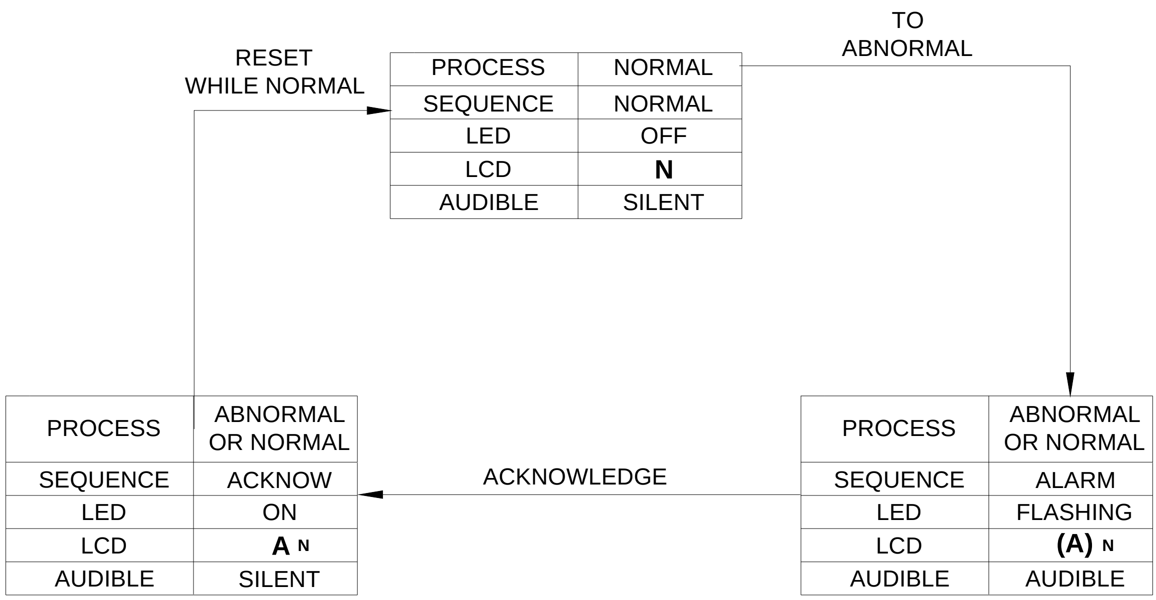
TO CHANGE FROM ONE SEQUENCE TO ANOTHER SEE THE DIL SWITCH SETTINGS DETAILS IN THE SECTION 14: SYSTEM CONFIGURATION AND PROGRAMMING

SECTION 7 SEQUENCE TABLES

Example Sequence Tables

Each alarm channel can be configured to suit the operating sequence required, as listed in the ISA publication "Annunciator sequences and specifications" S18.1 1979. Systems can be configured with different features on different alarm ways.
Remember after changing a DIL switch setting it is essential that the power is turned off and on again to register the new settings.
The following tables show the most commonly used examples.

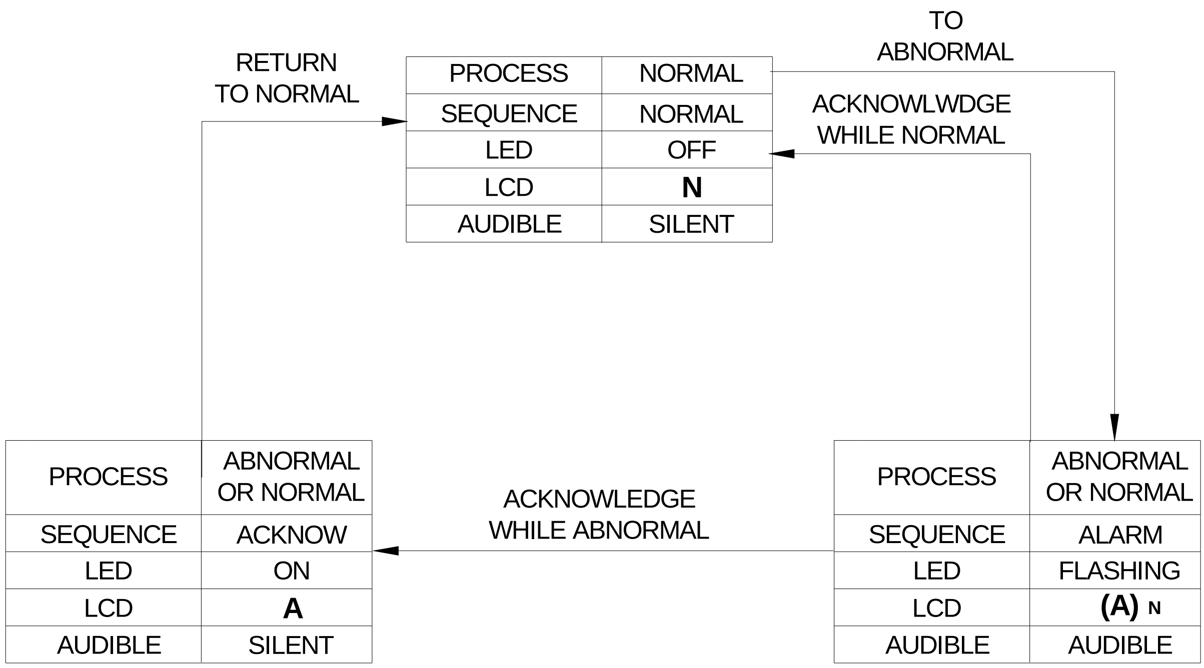
ISA – M Manual Reset



Sequence features

- Acknowledge, reset and lamp test pushbuttons required
- Alarm audible device
- Lock-in of momentary alarms until acknowledged
- The audible device is silenced and flashing stops when acknowledged
- Manual reset of acknowledged alarms only after process conditions return to normal

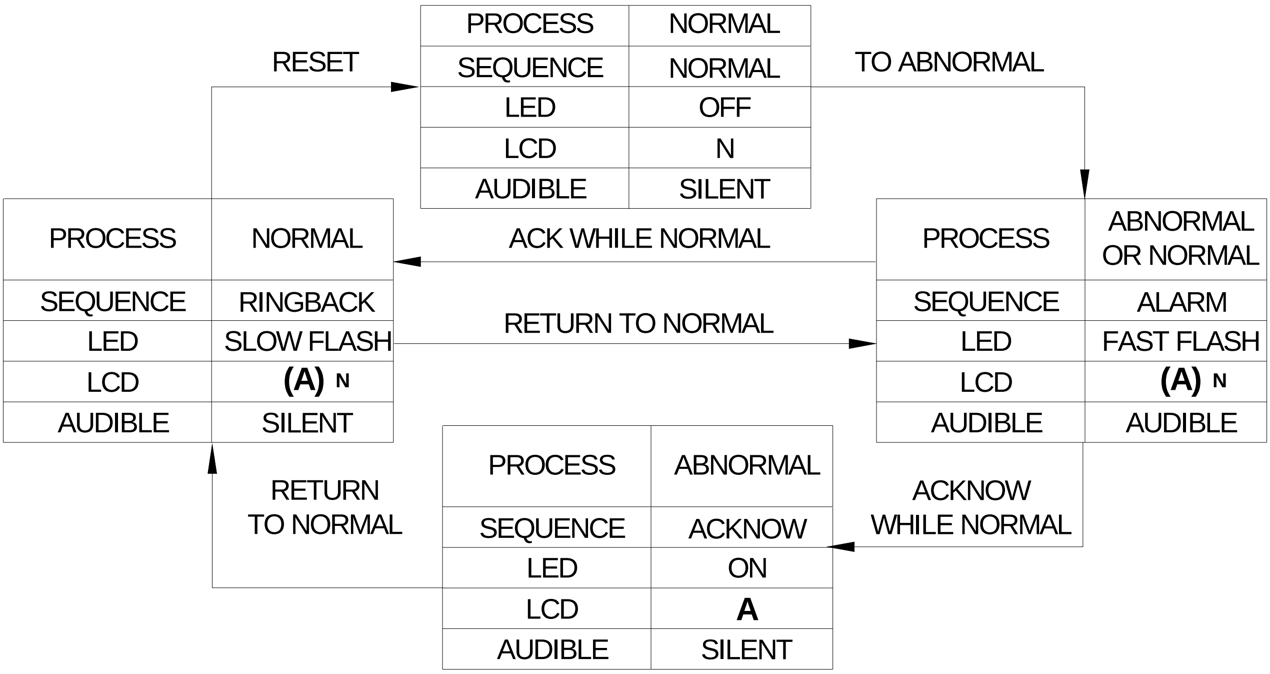
ISA – A Auto Reset



Sequence features

- Acknowledge and lamp test pushbuttons required
- Alarm audible device
- Lock-in of momentary alarms until acknowledged
- The audible device is silenced and flashing stops when acknowledged
- Automatic reset of acknowledged alarms when process conditions return to normal

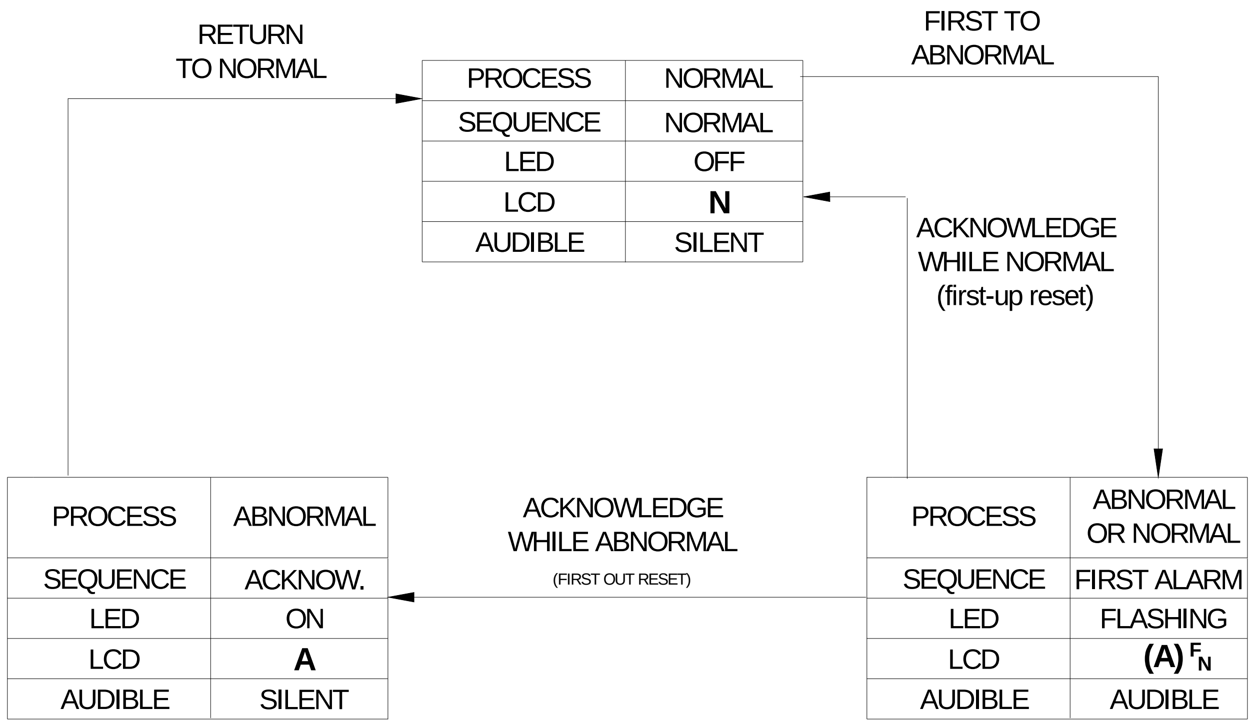
ISA – R Ringback



Sequence features

- Acknowledge, reset and lamp test pushbuttons required
- Audible device, used for alarm and ringback
- Lock-in of momentary first alarm until acknowledged
- Ringback visual and audible indicates when process conditions return to normal
- Manual reset of ringback indications

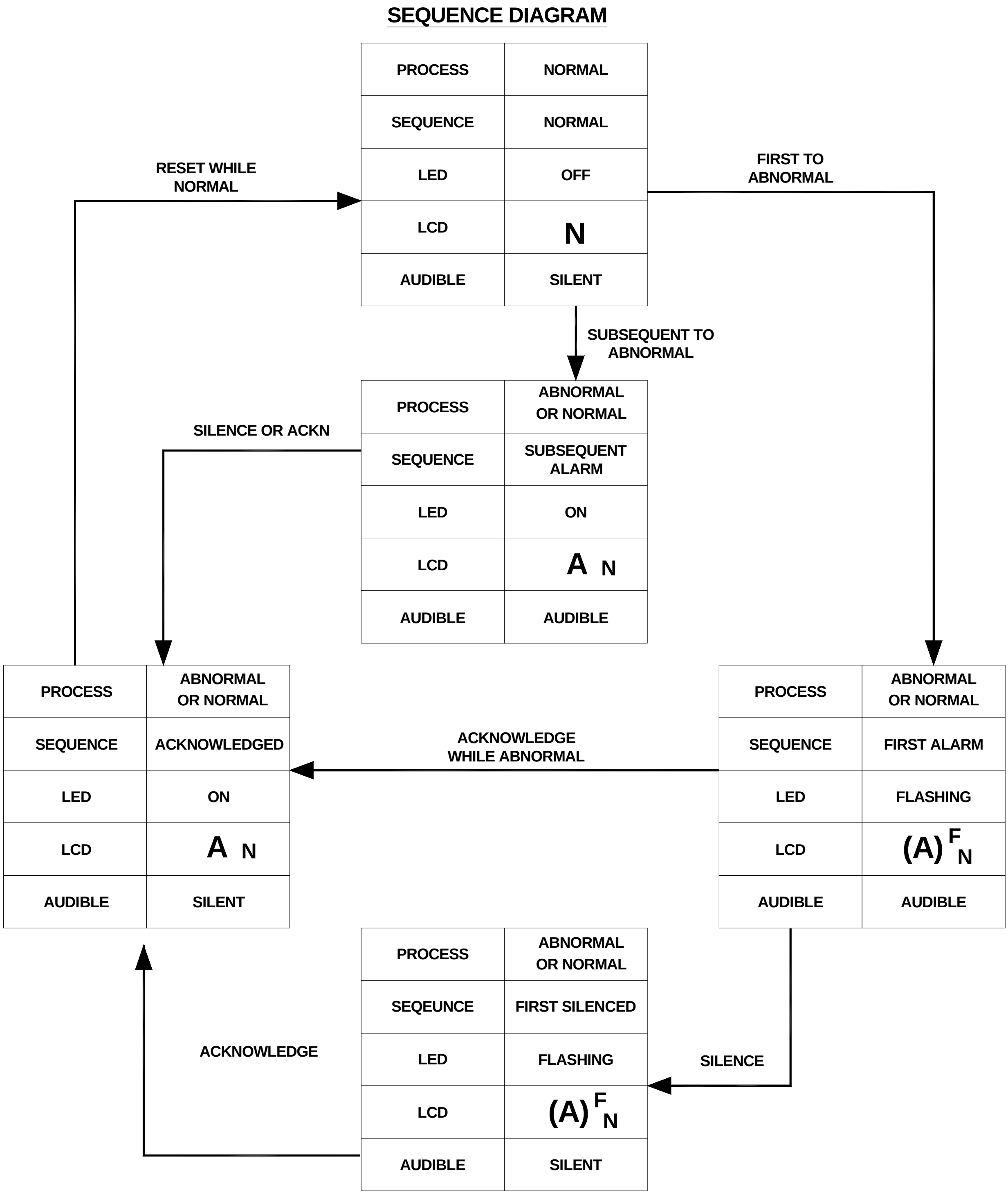
ISA – F1A First-up Automatic Reset
with no subsequent alarm state



Sequence features

- Acknowledge and lamp test pushbuttons required
- Alarm audible device
- Lock-in of momentary first alarm until acknowledged. No lock-in of momentary subsequent alarms
- Flashing and audible indications for first alarm only. New subsequent alarms go to the acknowledged state
- First-up indication is reset and the audible devices silenced when acknowledged
- Automatic reset of acknowledged alarms when process conditions return to normal

ISA – F2M-1 First-up with Manual Reset
with no subsequent alarm flashing and silence pushbutton



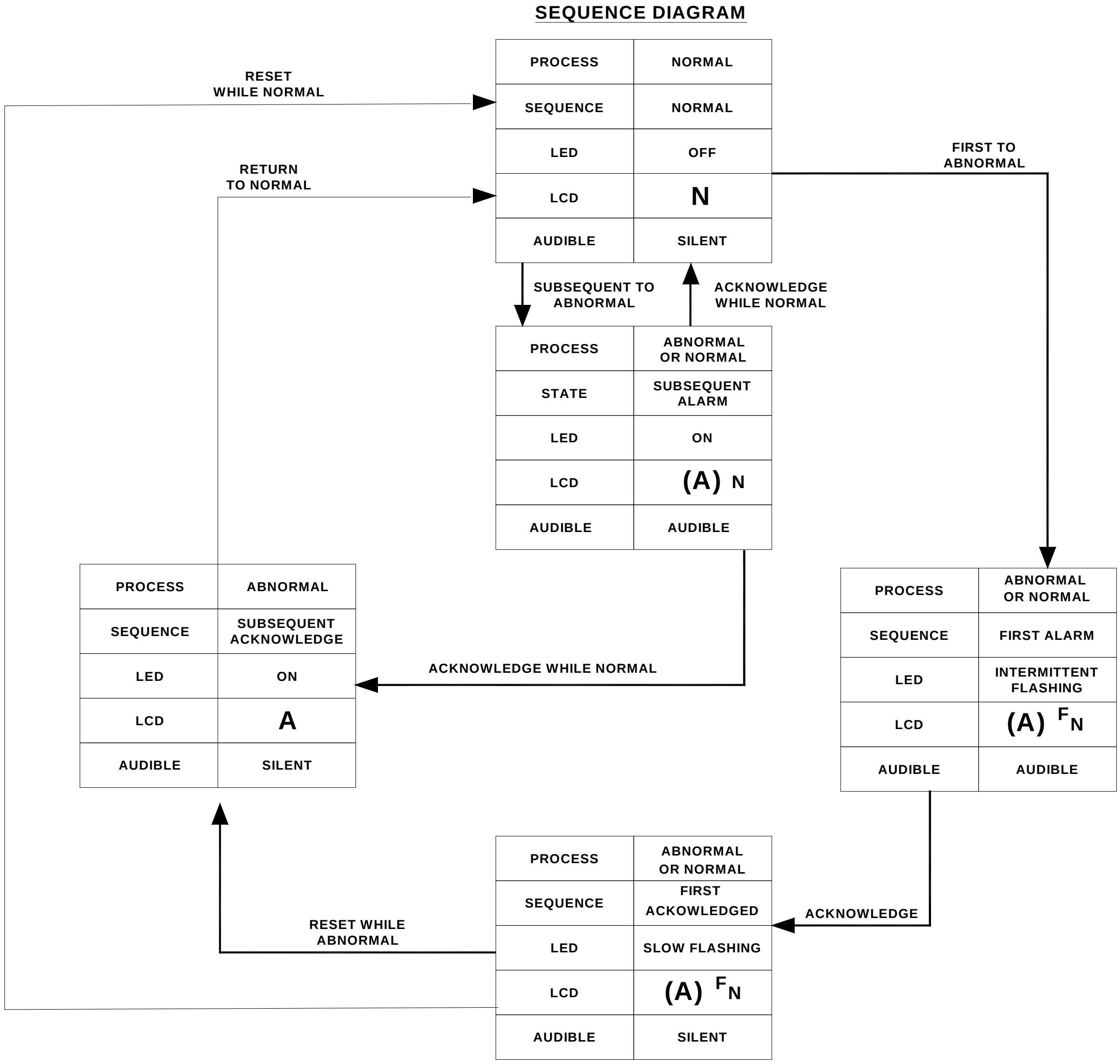
SEQUENCE ISA F2M-1

(MANUAL RESET FIRST OUT WITH NO SUBSEQUENT ALARM FLASHING & SILENCED PUSHBUTTON)

Sequence features

- Mute, acknowledge reset and lamp test pushbuttons required
- Alarm audible device
- Lock-in of momentary first alarm until acknowledged.
- Silence pushbutton to silence the audible device while retaining first-up flashing indication
- Flashing indication for first alarm only. New subsequent alarms have the same visual as acknowledged alarms
- First-up indication is reset and the audible devices silenced when acknowledged
- Manual reset of acknowledged alarms after process conditions return to normal

ISA – F3A First-up with Automatic Reset
with first-up flashing and "first-up reset" pushbutton



SEQUENCE ISA F3A
(AUTOMATIC RESET FIRST OUT WITHOUT FLASHING & RESET PUSHBUTTON)

Sequence features

- Acknowledge, first-up reset and lamp test pushbuttons required
- Alarm audible device
- Lock-in of momentary first alarm until acknowledged.
- First-up flashing different from subsequent flashing.
- First-up reset pushbutton to change the first-up visual indication to be the same as subsequent visual indication.
- Automatic reset of acknowledged alarms when process conditions return to normal

SECTION 8 MOUNTING

Panel mounting version

Refer to Figures 6.1 and 6.2 for panel cut-out dimensions and for details covered by the mounting procedure which follows:

1 Prepare the panel cut out to the dimensions shown in Figure 6.1 or 6.2 for the appropriate unit size

2 Remove rear cover, cable housing and all panel mounting clamps from the box

3 Slide the unit backwards through the cut out in the panel from the front until the front flange gasket butts up to the panel

4 Attach all panel mounting brackets ensuring hooks are positioned into the slots provided in the box

5 Tighten panel mounting bracket screws evenly unit the box fascia flange is tight up against the front of the panel

6 Drill the cable housing to suit glands/grommets to be used and re-fit onto box

7 Wire as required

8 Re-fit the rear cover

Removal / fitting of Fascia Panel

Antistatic precautions should be taken when the fascia is removed and when handling Sequence/Alarm Cards (see Appendix B for details)

Removal

1 Use the special socket provided for fastening/unfastening the fascia screws

2 Loosen fascia screws evenly until they are free. Note the screws are retained within the fascia moulding itself

3 Holding either side of the fascia moulding, slide forwards off the alignment dowels positioned either side on the top of the box

4 Lower the top of the fascia towards you (down), positioning the bottom of the fascia under the bottom flange on the box to act as a hinge until the two retaining straps hold the fascia in an open position

5 DO NOT LEAN OR REST HEAVY LOADS on the inside of the fascia

6 Full access to PCB's/alarm legends is now available

Re-fitting

1 Refitting is the reverse of the above section on the removal process. Ensure fascia straps and Pushbutton Board ribbon cable do not trap between fascia and box seal

2 Hold fascia in position while partly tightening fascia screws

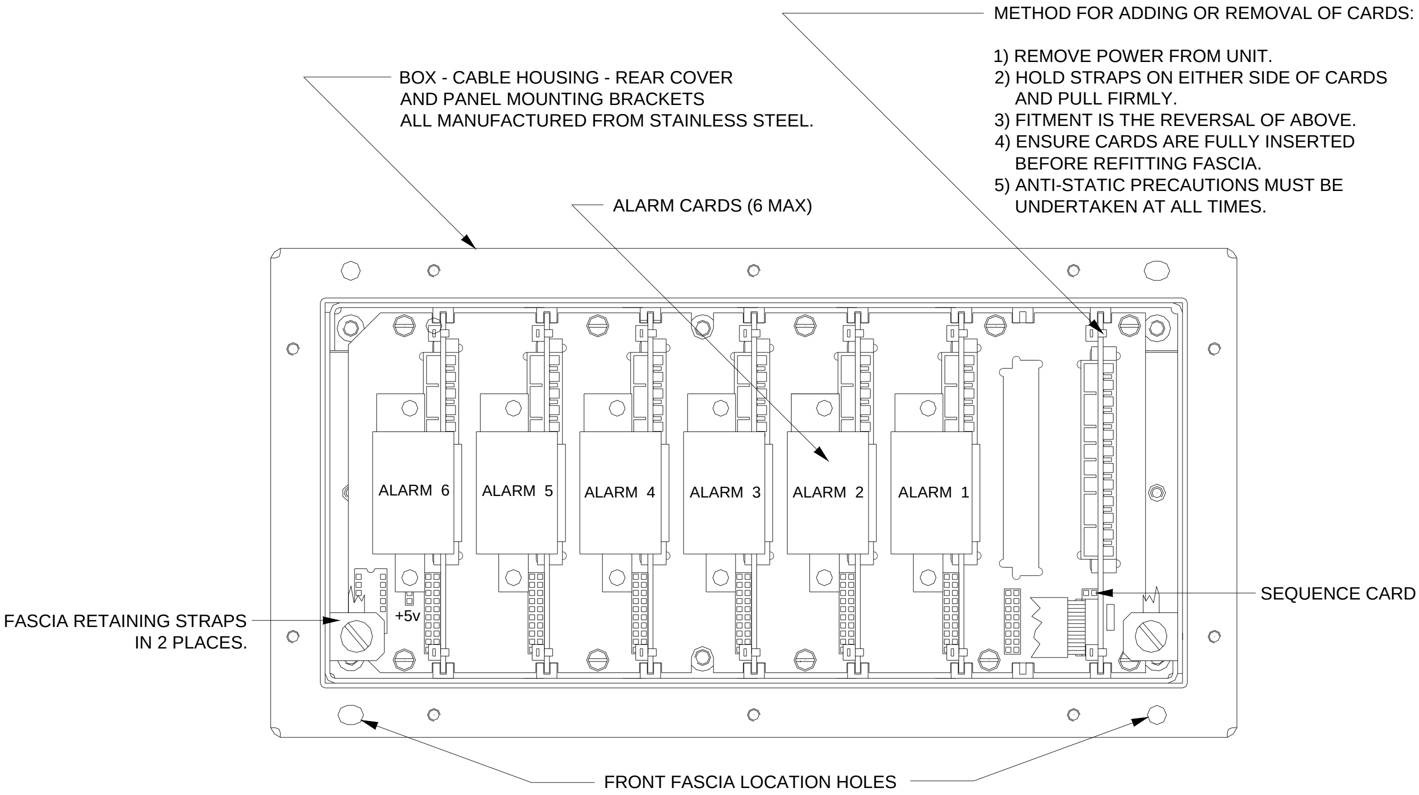
3 Tighten fascia screws evenly to seal to the enclosure, some resistance will be felt due to the compression of the seal gasket, do not over tighten.

Removal / Replacement of Sequence and Alarm Cards

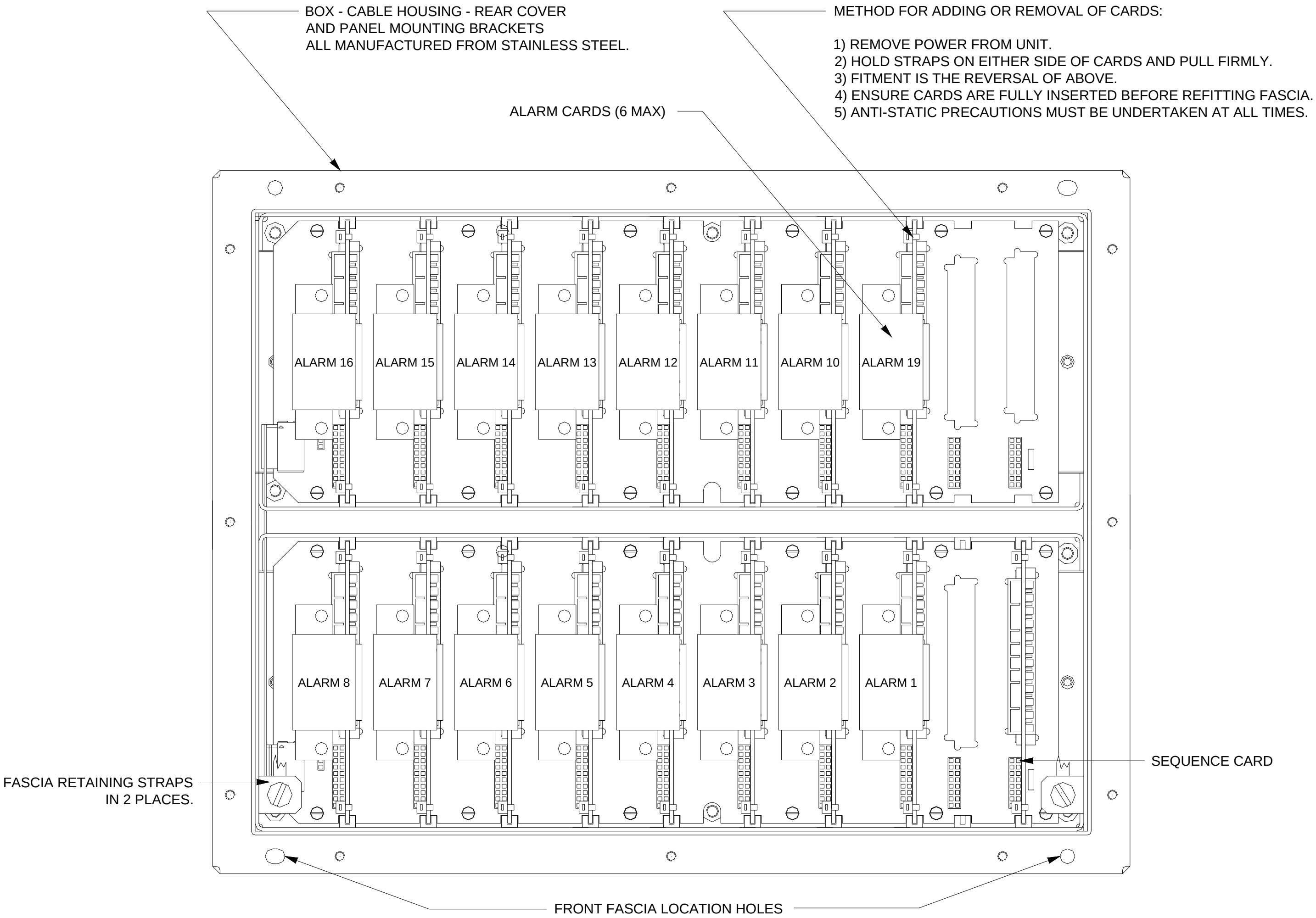
Antistatic precautions should be taken when the front fascia is removed and when handling Sequence/Alarm Cards (see Appendix B for details)

Grip the card at the edge above and below the LCD/LED bracket, evenly pull the card so that it slides along the guide rails to remove it from the case.

To replace a card slide it along the guide rails until it is firmly located in the two connectors mounted on the backplane.



12 Way Annunciator with the fascia removed (Figure 8.1)



32 Way Annunciator with the fascia removed (Figure 8.2)

Identification Legends

Annunciators are supplied with engraved legends when specified by the user.

These are used to easily identify the alarm channel and by using different material colours can also differentiate between different types of alarms.

The legends can easily be changed by the user. Refer to the actions below and Figure 8.3

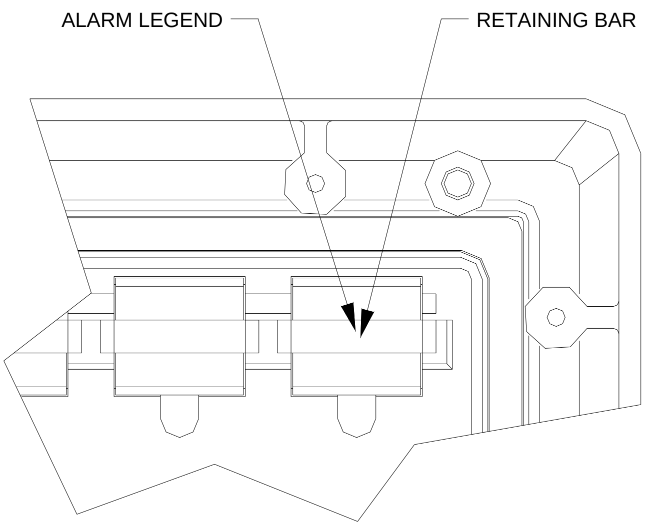
1 Remove fascia from the unit (see section Removal/fitting of Fascia panel)

2 Remove the Legend Retaining bar from behind the legend to be removed

3 Remove the Legend

4 Place the replacement legend into the fascia with machined edges top and bottom

5 Slide the legend retaining bar into the slots positioned either side of the legend to secure



Part view of inside of fascia showing method of retaining legends (Figure 8.3)

SECTION 9 FIELD WIRING

Certification

The LN1000 IS Annunciator system must be installed and wired in accordance with the requirements of the IS System certificate and IS codes of practice. This document should be read along with the associated equipment certificates and drawings before proceeding further. Copies of these drawings and certificates are available on request from RTK Instruments Ltd

General

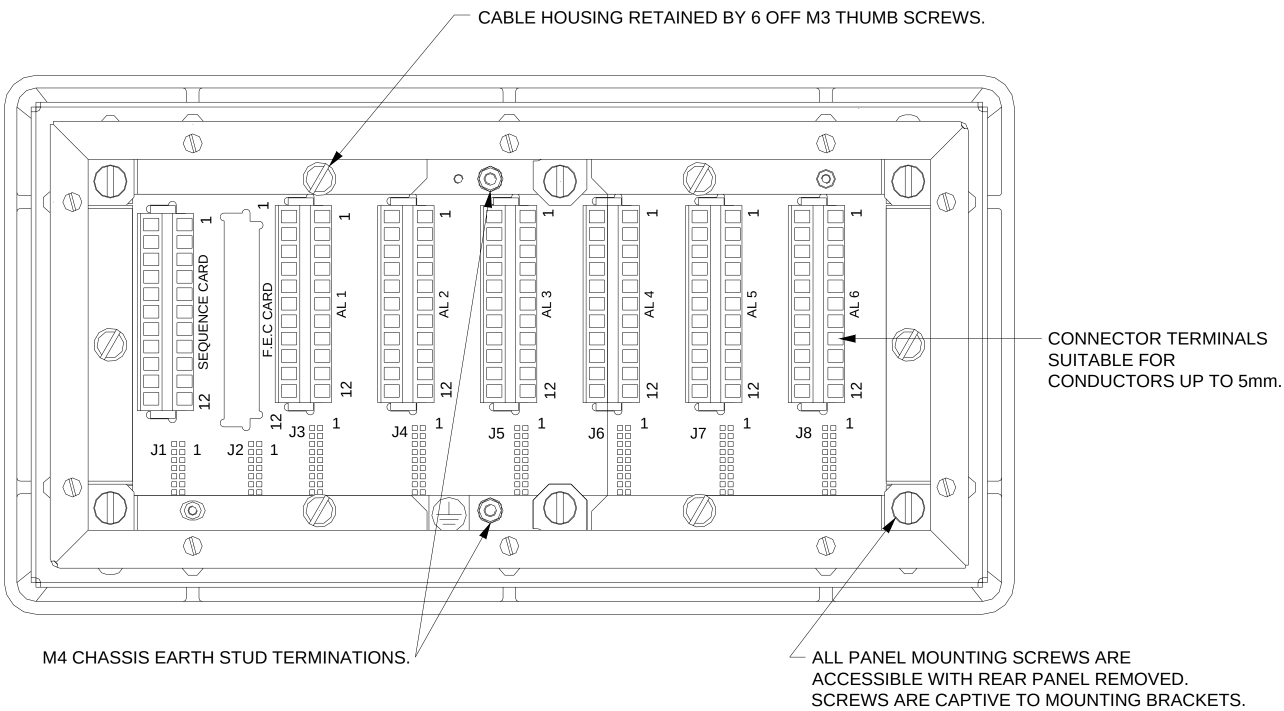
All field wiring to the annunciator should use screened cable. The screening must be securely terminated using ring terminals on the studs provided. The removable cable housing should be drilled for user supplied gland fittings.

Access to the annunciator terminals is achieved by removal of the rear cover on the cable housing. The terminal blocks form part of the edge connector for each card.

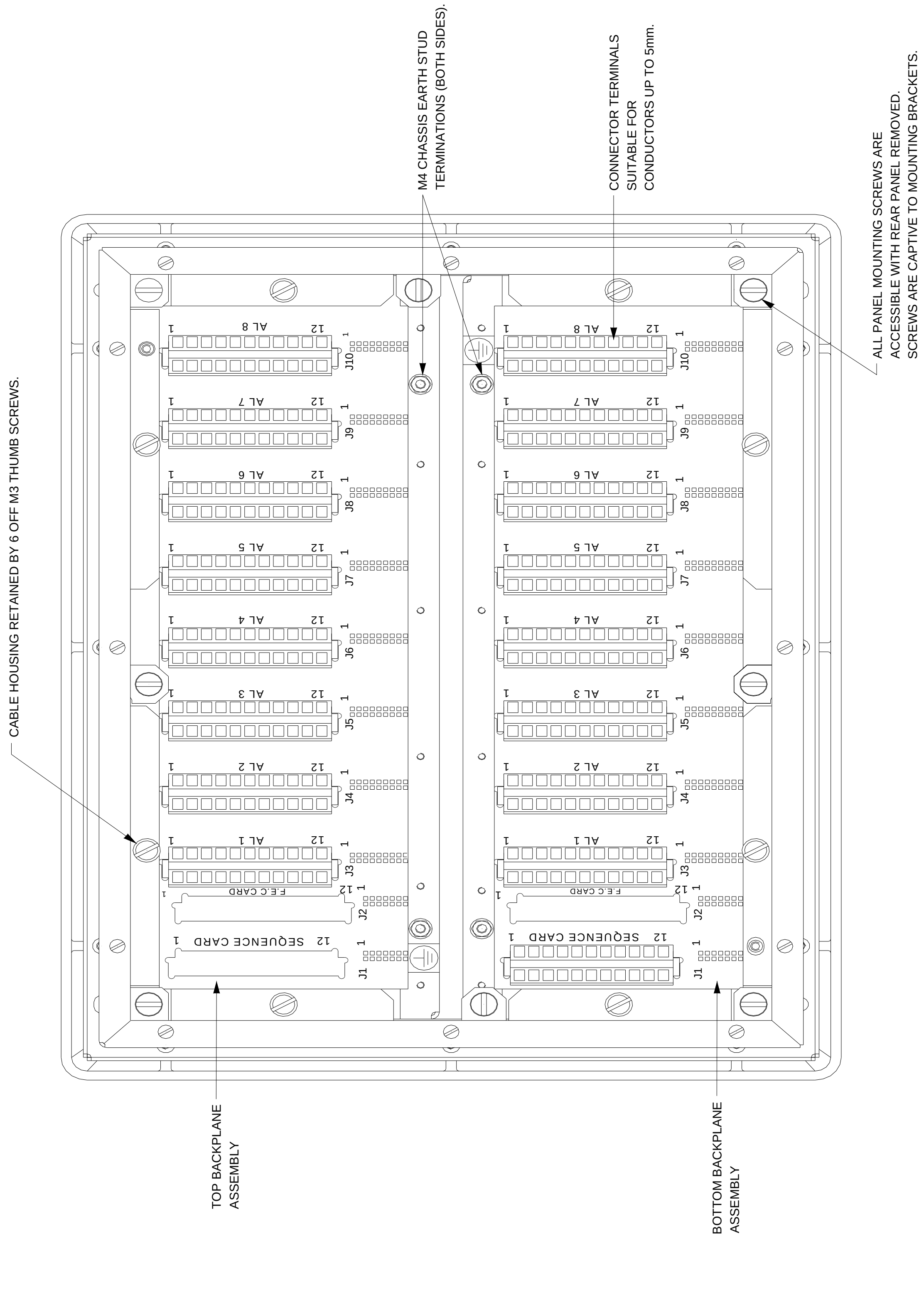
All wiring must meet the Cable Parameter requirements detailed in Appendix A.

The terminals are clearly marked on the backplane as to their function i.e. AL1, AL2 etc for the Alarm Cards and Sequence Card are marked as such. The individual terminals for each block are numbered 1 to 12.

The terminal connectors are clipped into the backplane. **These should not be removed from the backplane during wiring.** Check the connectors are still correctly clipped into the backplane on completion of wiring.



Rear view of the 12 way annunciator showing the terminals (Figure 9.1)



Rear view of 32 way annunciator showing the terminals (Figure 9.2)

SECTION 10 TERMINAL NUMBERS

Sequence Card Terminal Numbering:

TERMINAL NO:	DESCRIPTION
1	Supply +VE from IS Isolator
2	Supply 0V from IS Isolator
3	Not used
4	Not used
5	Silence (external pushbutton)
6	Acknowledge (external pushbutton)
7	Reset (external pushbutton)
8	Test (external pushbutton)
9	B1 output
10	B2 output
11	Ext. sound (To drive external sounder via DA-149 Relays)
12	5V

Alarm Card Terminal Numbering:

TERMINAL NO:	DESCRIPTION
1	5V
2	0V
3	Channel 1 H output
4	Channel 1 Field contact input (FC1)
5	Channel 1 Group Trip A output
6	Channel 1 Group Trip B output
7	Channel 1 Inhibit
8	Channel 2 Inhibit
9	Channel 2 H output
10	Channel 2 Field contact input (FC2)
11	Channel 2 Group Trip A output
12	Channel 2 Group Trip B output

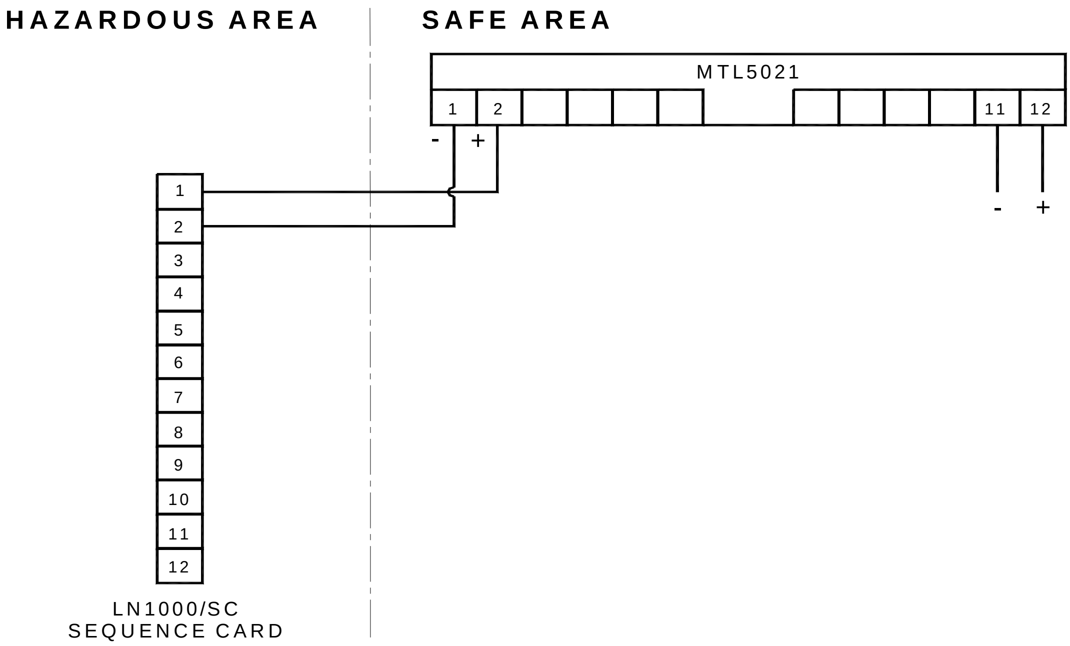
SECTION 11 SYSTEM SUPPLY CONNECTIONS

Power Supply

The power supply is connected to the Sequence Card from a certified IS Isolator mounted in the safe area, the recommended isolator is the MTL5021.

This Isolator can supply up to 32 alarm channels and the necessary IS relays to switch on external Sounders and Beacons.

Connection is as shown in Figure 11.1 below



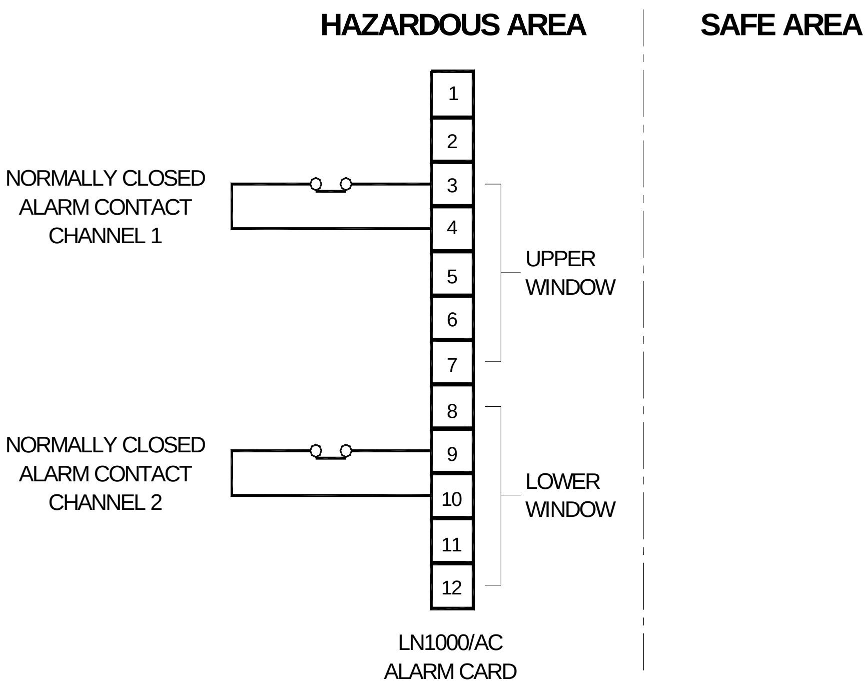
WARNING
Never connect the LN1000 directly to a 24VDC supply, this will result in damage to the sequence card. Always use a suitable is isolator as shown in figure 11.1

SECTION 12 SYSTEM INPUT CONNECTIONS

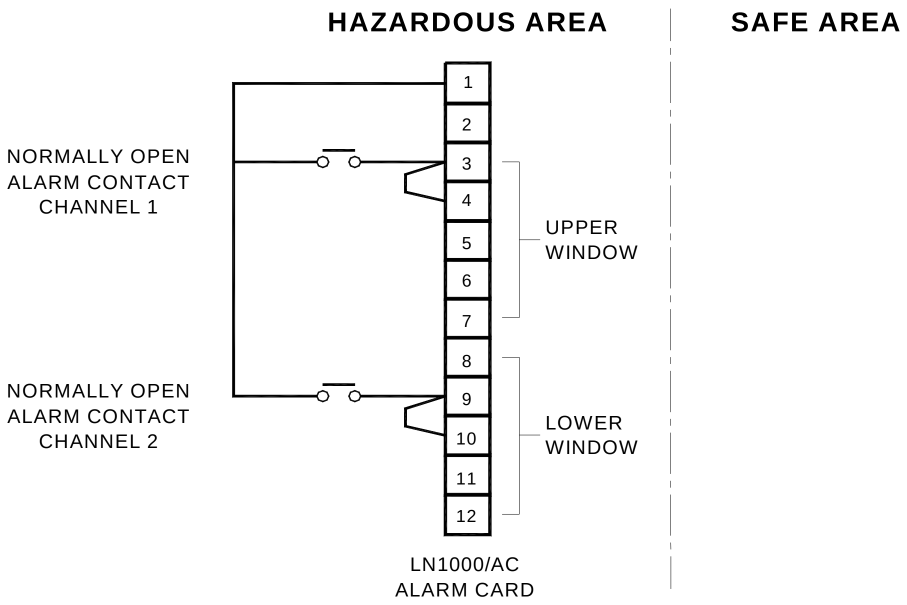
Alarm inputs - Hazardous areas

The alarm contacts to be connected to the annunciator may be located in any hazardous area but must meet the requirements defined for simple apparatus in Clause 5.4 of BS EN50020:1995. Because these alarm contacts are switching such low currents and voltages they should be of a suitably high quality with a specification suitable for switching signals of 5VDC and 250uA. Each contact should be wired as a conductor pair using either two core or suitable multi-pair screened cable. Cable parameters are listed in Appendix A.

Usually, normally closed (open to alarm) contacts are used and these are wired as shown in Figure 12.1. If normally open (close to alarm) contacts are used the terminal connections are as shown in Figure 12.2



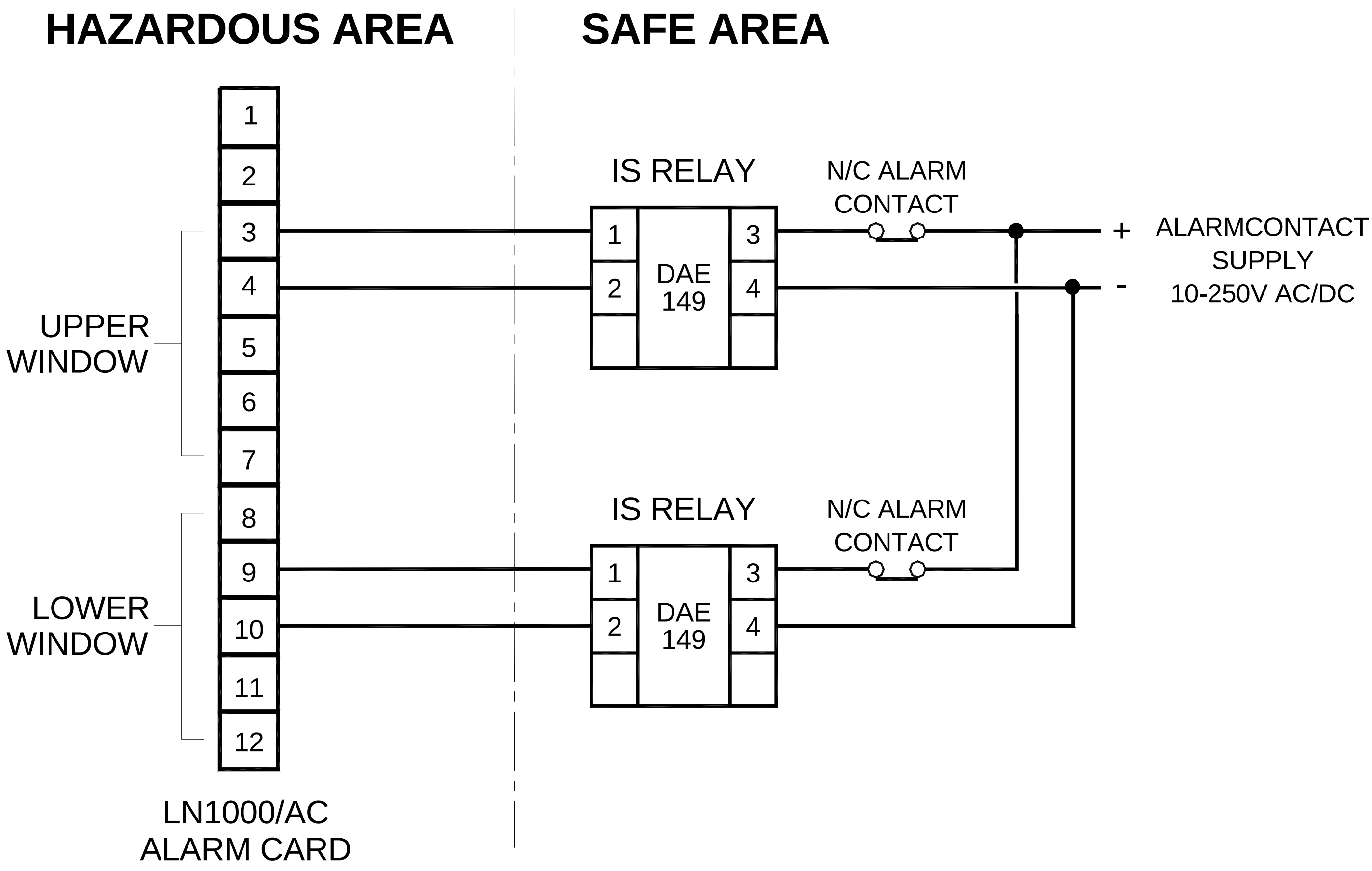
Alarm ways wired with normally closed contacts (Figure 12.1)



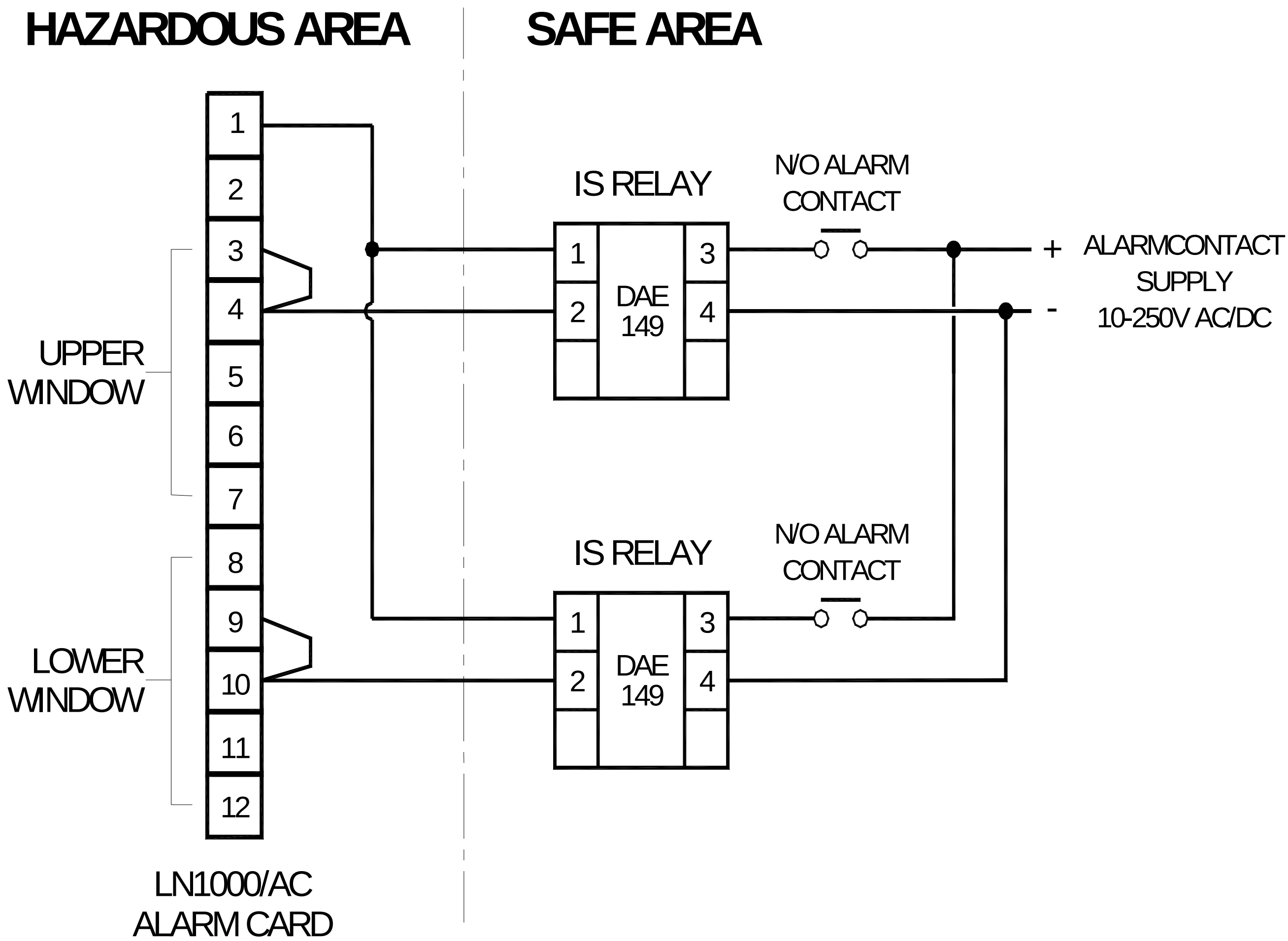
Alarm ways wired with normally open contacts (Figure 12.2)

Alarm Inputs - Safe areas

Inputs from sources which cannot meet the segregation requirements e.g. inputs from relays in safe area equipment, or inputs that do not meet the simple apparatus requirements must be isolated using an appropriate IS interface. The approved device for this purpose is the DAE149 or DAD149 Intrinsically Safe Relay. Typical connections for normally closed alarm contacts are shown in Figure 12.3 and for normally open alarm contacts in Figure 12.4 below



Alarm ways with normally closed contacts mounted in the safe area (Figure 12.3)



Alarm ways with normally open contacts mounted in the safe area (Figure 12.4)

WARNING
When using the DA-149 is relays, ensure the polarity is correct for both the coil and contact connections.

Inhibit Inputs

Terminals are provided for connecting links to inhibit the alarm function for plant start up or commissioning. Each alarm card should have these links wired separately.
The length of each connection should not exceed 100mm.

Inhibit channel 1: Connect terminal 1 to terminal 7

Inhibit channel 2: Connect terminal 1 to terminal 8

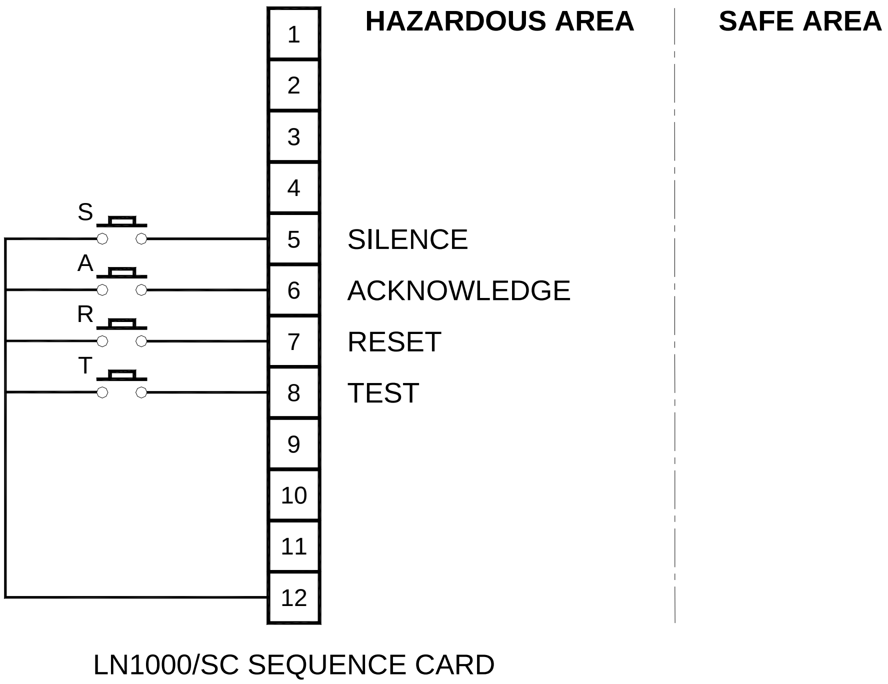
External pushbutton inputs

A set of membrane pushbuttons is provided as standard on the annunciator fascia panel. These can be disabled by jumper links. Where required, an additional or replacement set of pushbuttons may be connected to the Sequence Card terminals for remote use.

Good quality pushbuttons should be used with contacts suitable for 5VDC with a low current capability of 0.1mA. They must meet the requirements defined for simple apparatus in Clause 5.4 of BS EN50020. They should be separated from other electrical equipment and isolated from earth. If these requirements cannot be met the signals must be isolated by the use of the appropriate IS relay, i.e. DAD149 for IS signals or DAE149 for non IS signals.

Remote pushbuttons should be connected using the normally open contacts.

Terminal connections are shown in Figure 12.5 below



Remote pushbutton connections (Figure 12.5)

SECTION 13 SYSTEM OUTPUT CONNECTIONS

General

In addition to the audible output signals there are various additional outputs available from the annunciator.

These can be used to trigger control action from the safe area or activate further alarms.

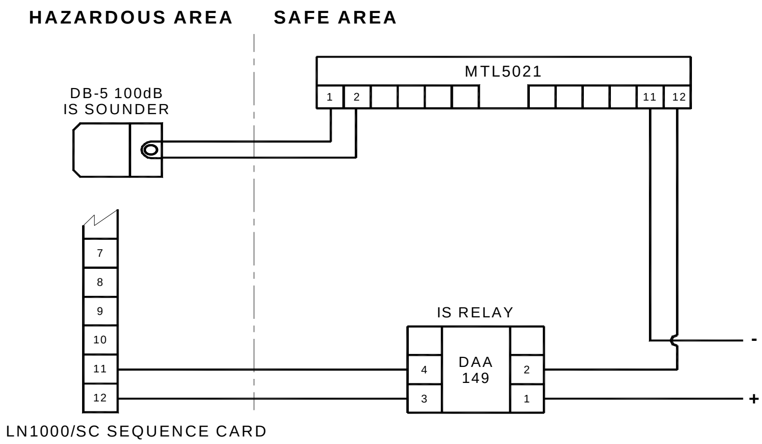
These outputs can be common to the system or individual to each channel.

Audible outputs

Two audible outputs are available from the Sequence Card. These are designated "Horn" and "Ext.Sound". (The "Horn" output is not used)If a higher level of sound is required the "Ext.Sound" output is used to drive an external IS relay which is used to switch power to a high output sounder e.g. Type DB5 or DB7.

These examples are shown in Figures 13.1 and 13.2

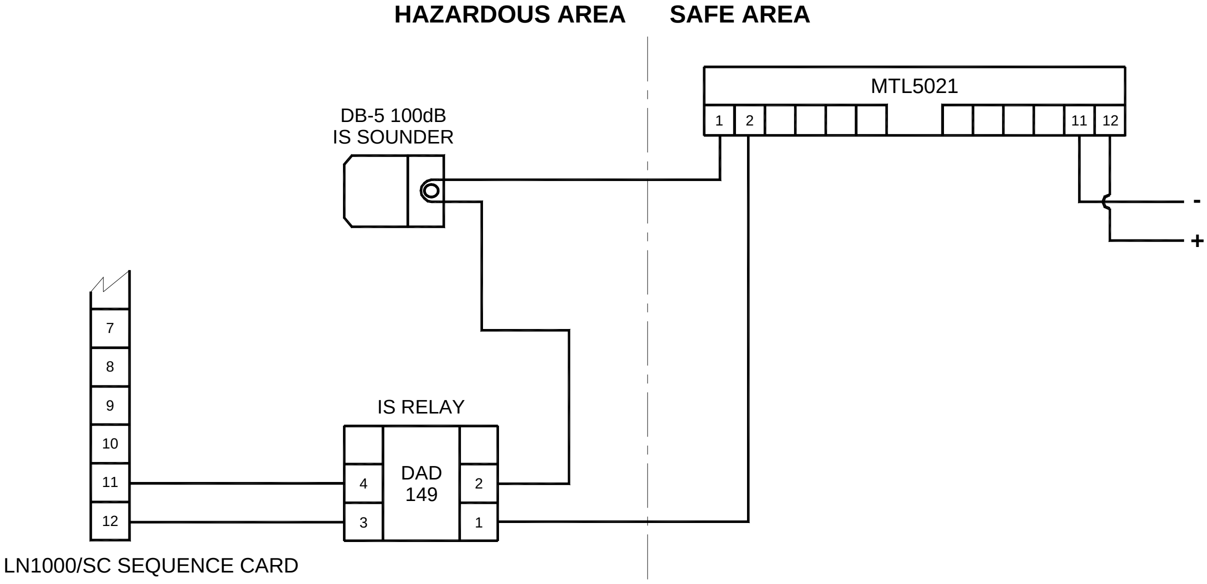
This output follows the alarm sequence as defined in section 6 on Alarm Sequences. When the Test pushbutton is pressed both Audible outputs are activated.



Connections to sounder using safe area mounted IS relay (Figure 13.1)

To reduce the amount of wiring between safe and hazardous areas it is possible to use an alternative hazardous area mounting IS Relay (DAD149).

This configuration is shown in Figure 13.3



Connections to sounder using hazardous area mounted IS relay (Figure 13.2)

WARNING
When using the DA-149 is relays, ensure the polarity is correct for both the coil and contact connections.

Common outputs

Two additional outputs are available from the Sequence Card designated B1 and B2. Both these outputs can be connected to the safe area using IS Relays as shown in Figure 13.4

B1 output

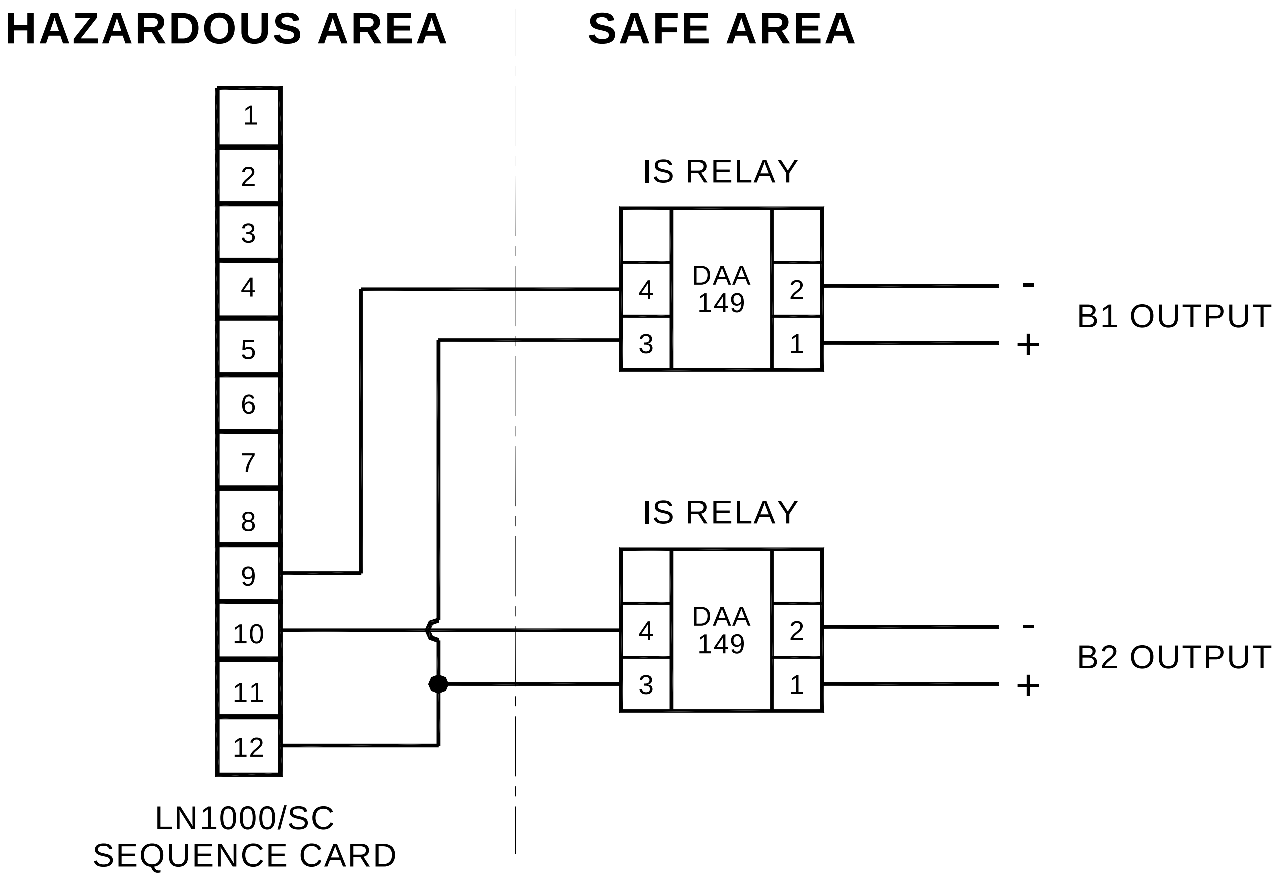
The B1 output is either active if any channel is in alarm or alternatively active if any field contact in Field Contact Group is abnormal.

The operational mode is user selectable by DIL switch.

The output is active low or active high, again selectable by DIL switch.

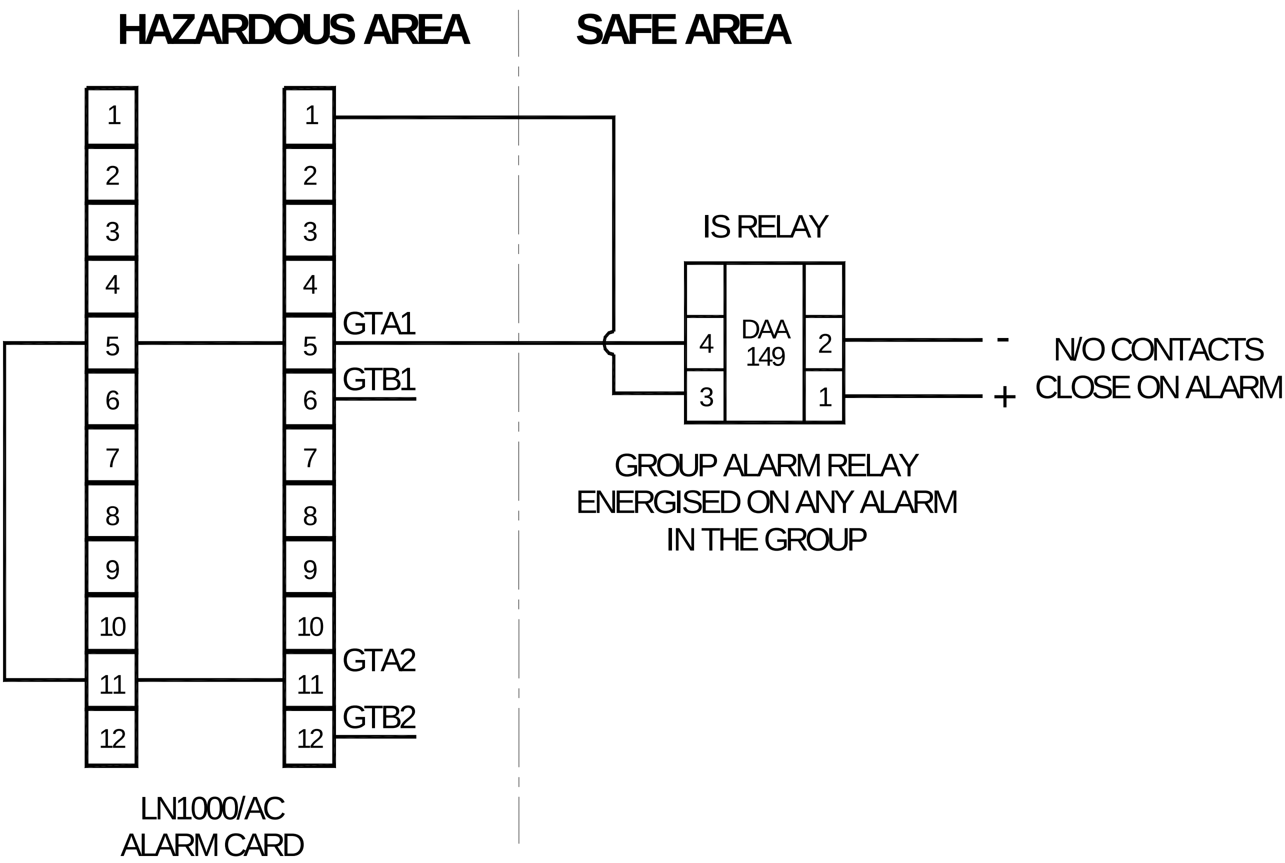
B2 output

The B2 output pulses for 1 second with each new alarm.



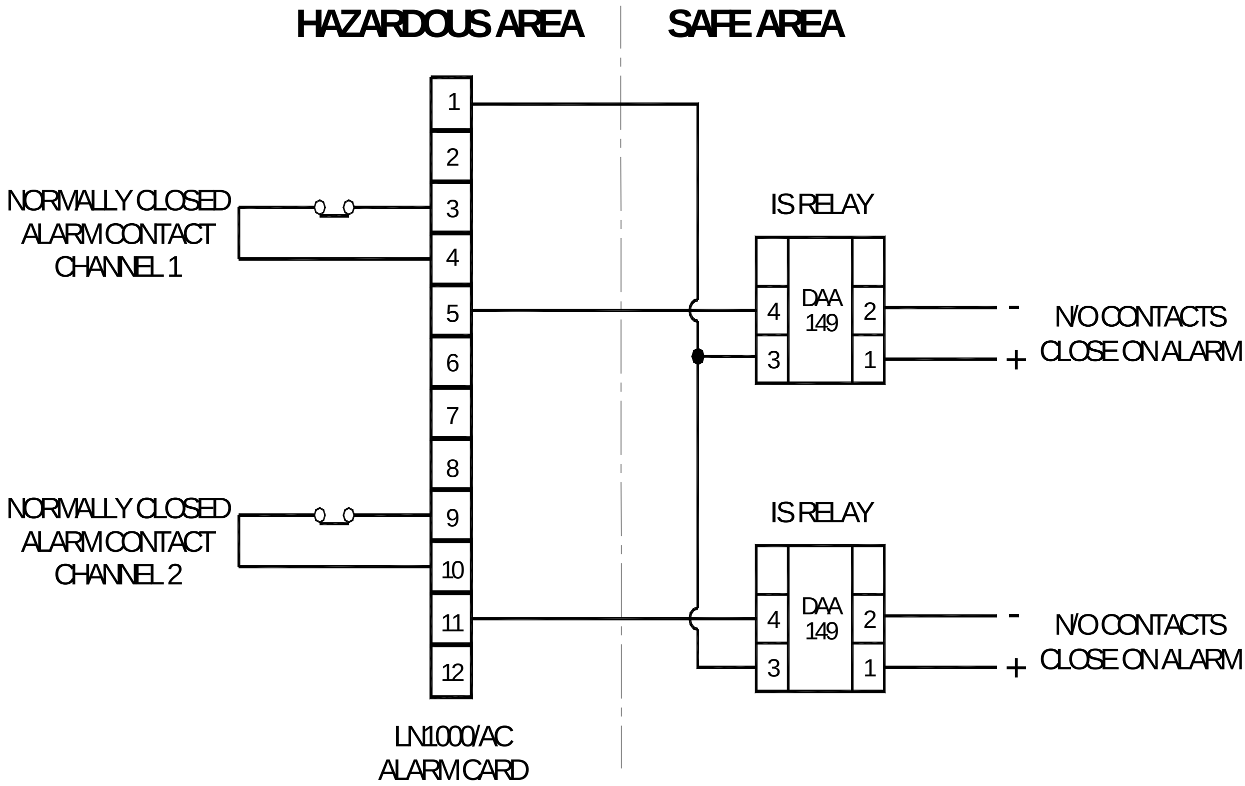
Alarm Outputs

Each alarm channel has two outputs; Group Trip A (GTA) and Group Trip B (GTB). Each gives an open collector type output and may be configured for polarity and function as listed in the Technical Specification. They may be used individually or grouped together to take alarm signals to other equipment or initiate control action. The example below shows four alarm channels from two cards connected together to a single group alarm relay situated in the safe area. The second Group (GTB) may be used individually or grouped in the same way as group A



Alarm contact repeat outputs

If it is required that the alarm contacts are repeated into the safe area, this must be done by isolating the signals via a DAA149 IS relay. The repeat relays are driven by the RTA output which is set to repeat the alarm contact information. See Section 14 on System Configuration



Repeat alarm contacts to the safe area (Figure 13.5)

SECTION 14 SYSTEM CONFIGURATION & PROGRAMMING

General

To configure the system for your particular requirements DIL switches are set on the Sequence Card (LN1000-SC) for system configuration and on each Alarm Card (LN1000-AC) for individually configuring each alarm channel.

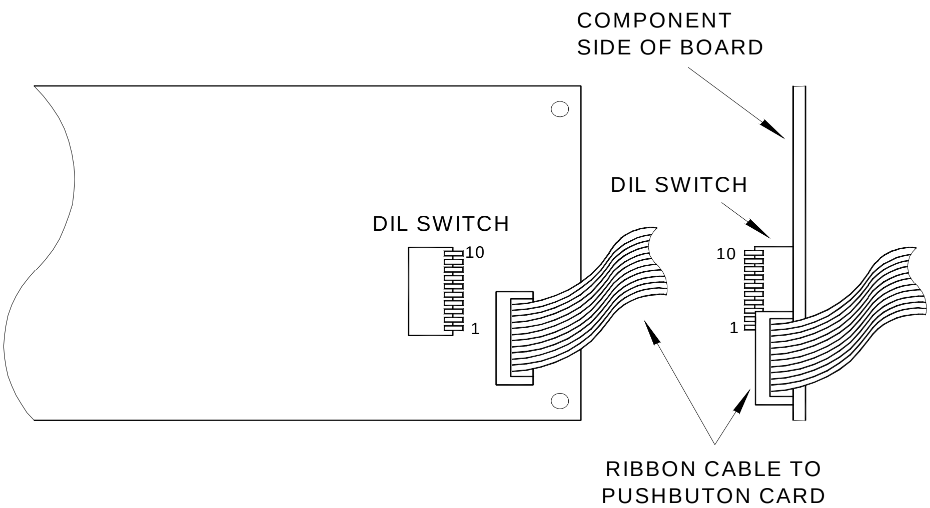
Unless otherwise specified all switches will be configured in the default position which is UP

To gain access to the DIL switches firstly remove the fascia. The settings can be made with cards mounted in the case or alternatively the cards can be removed to set up DIL switches and potentiometers. Refer to Section 8 for fascia and card removal and re-fitting

WARNING
The DIL switch settings are only read on power up so the equipment must be switched off and back on again before any configuration changes are registered.

Commons Card DIL Switch Settings

The location of the DIL switches are shown in the diagram below.



The DIL switch details are given below:

SW	*FUNCTION*	*UP*	*DOWN*
1	B1 Output mode	Alarm sequence	Field contacts
2	Audible re-sound time bit 2	Min	Max
3	Audible re-sound time bit 1	Min	Max
4	Audible re-sound time bit 0	Min	Max
5	B1 Output polarity	Low	High
6-10	Unused		

B1 Output

The B1 output can be configured to operate in a number of different ways.

Firstly this output can be configured using DIL Switch 1 to follow the alarm sequence or the field contacts. When set to follows the alarm sequence this output is active when any channel is in the alarm state. The output only goes off when all alarm contacts have returned to the normal state and the annunciator reset.

The second mode available is where the B1 output is active whenever one of the field contacts in the "Field Contact Group" is in the abnormal condition. Channels are selected to be in the "Field Contact Group" by DIL switches on the Alarm Card. (See next section)

Audible Re-sound

In critical alarm situations it is often important to continue to remind an operator that the situation has not yet been dealt with. In normal situations the audible is silenced permanently by pressing the SILENCE pushbuttons and the audible does not re-sound.

On the LN1000 it is possible to program this audible to re-sound until the alarm channel has returned to normal.

The delay between each time the audible re-sounds is selectable, as shown in the table below.

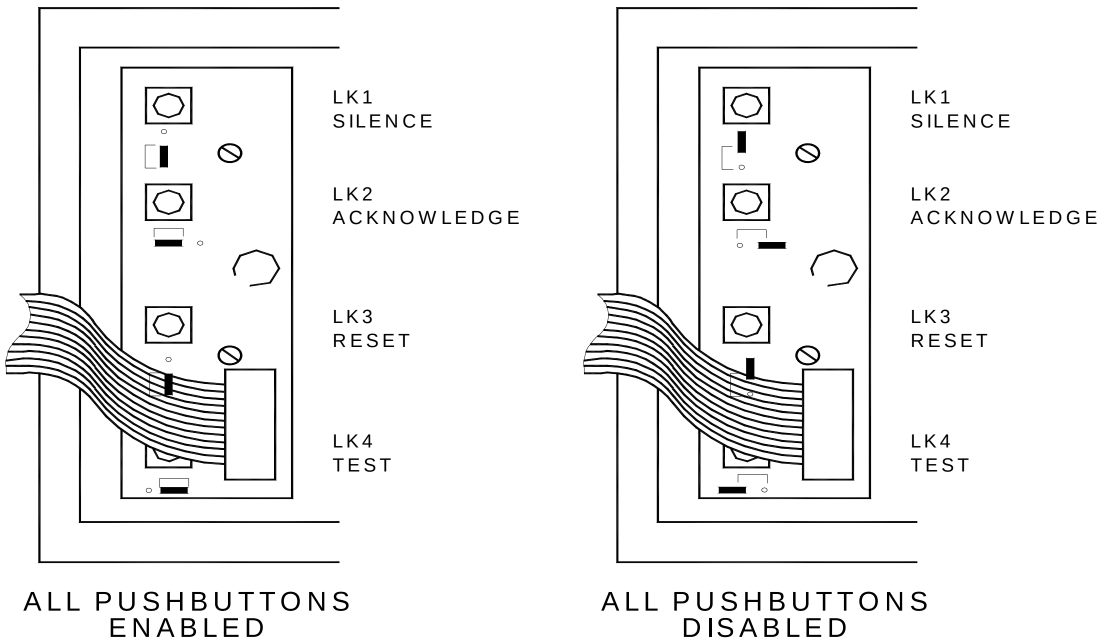
Audible re-sound table

SWITCH			**TIME IN MINUTES**
2	***3***	***4***	
UP	UP	UP	INFINITE
UP	UP	DOWN	0.25
UP	DOWN	UP	0.5
UP	DOWN	DOWN	1
DOWN	UP	UP	2
DOWN	UP	DOWN	4
DOWN	DOWN	UP	8
DOWN	DOWN	DOWN	15

Integral Pushbutton Links

The Pushbutton Card is attached to the rear of the fascia, on the rear of this card are jumper links used to enable/disable the internal pushbuttons. See Figure 14.2

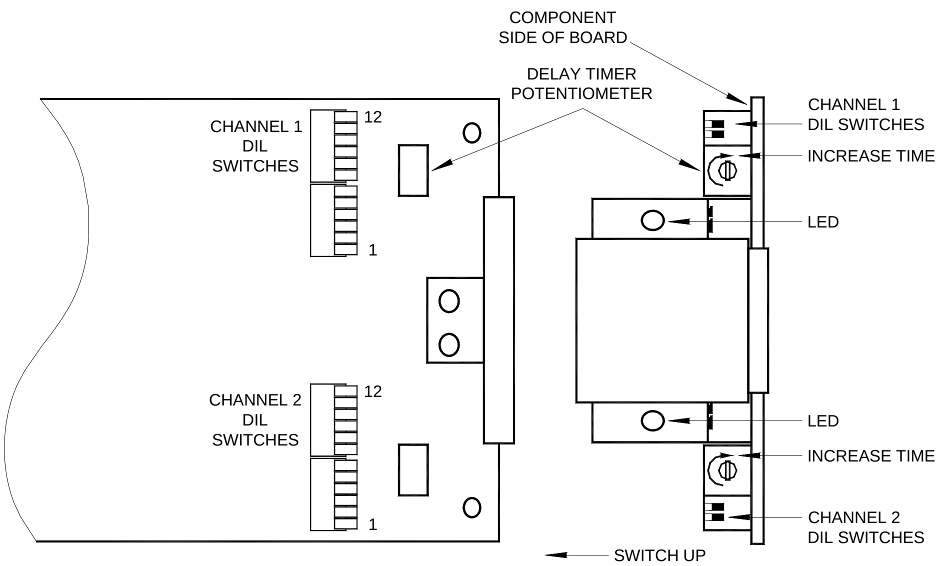
LK1	INTERNAL SILENCE PUSH-BUTTON	ENABLED	DISABLED
LK2	INTERNAL ACKNOWLEDGE PUSHBUTTON	ENABLED	DISABLED
LK3	INTERNAL RESET PUSHBUTTON	ENABLED	DISABLED
LK4	INTERNAL TEST PUSHBUTTON	ENABLED	DISABLED



Jumper links on Pushbutton Card (Figure 14.2)

Alarm Card DIL Switch Settings

Each alarm channel can be configured individually using the 12 DIL switches. The switch position and details are as follows:-



Alarm Card DIL switch and potentiometer location (Figure 14.3)

SW	FUNCTION	UP	DOWN
1	GTA Output mode	Alarm sequence	Field contact
2	GTB Output mode	Alarm sequence	Channel audible
3	GT Output Polarity	Low	High
4	B1 Field Contact Group	Yes	No
5	Field contact input delay	No	Yes
6	Field contact mode	Normally closed	Normally open
7	First-up group number bit 2	see first up group table	
8	First-up group number bit 1	see first up group table	
9	First-up group number bit 0	see first up group table	
10	Alarm sequence number bit 2	see alarm sequence table	
11	Alarm sequence number bit 1	see alarm sequence table	
12	Alarm sequence number bit 0	see alarm sequence table	

Group Trip Outputs

Each alarm channel has a two Group Trip Outputs (GTA and GTB).

These are solid state open collector outputs that can be used to trip or control further parts of the plant either in the safe or hazardous area. There are a number of user selectable features on both these outputs as shown below:-
The outputs can be configured to be active high or active low by using DIL switch 3. This DIL switch will change the operation of both outputs (GTA and GTB) on that alarm channel.

Group Trip A

There are two choices for this output, to follow the alarm sequence or the field contact.

When configured to follow the field contact the output will trigger when the channel is in the alarm state, independent of whether N/O or N/C alarm contacts are being used. When configured to follow the alarm sequence the output will remain active until the alarm channel has returned to normal AND the annunciator reset.

Group Trip B

Again there are two choices for the second output GTB, either to follow the alarm sequence or the channel audible.

The method of following the alarm sequence is exactly as described above. When set to follow the audible it is driven whenever a channel goes into alarm and goes off when the unit is silenced or acknowledged. This is useful if the operator needs to be aware of a particular alarm or group of alarms using a different audible tone.

B1 Field Contact Group

The B1 Output is a common output on the Sequence Card.

When this output is set to follow the field contacts it is possible to select each alarm channel to be in this group or not. The Group is described as the "Field Contact Group". This is useful to link a group of channels to a common output to trigger some additional action or indication.

Alarm Input Delay

Field contact input delay is active when DIL switch 5 is set Down.

The time delay can then be adjusted between 3 and 30 seconds by adjusting the channel's delay time potentiometer situated on the front of the Alarm Card. Increase the delay time by turning clockwise.

Field Contact Mode

Each alarm channel can be configured as N/C (open to alarm) or N/O (close to alarm).

To change from N/C to N/O DIL switch (SW6) is used and the wiring must be modified as shown in Section 12 on System Inputs Connections.

First-up Group

The first-up facility is often an essential feature for the alarm annunciator to inform the operator which alarm was the first to occur in a sequence of events.

If a single annunciator is monitoring different unrelated areas of the plant it is possible to have different first-up groups for these different areas.

These are programmed into the different groups as shown below.

If it is required to have some alarm channels with a first-up facility and others without then those alarms that do not have the first-up facility should be programmed with a suitable sequence and also set in the group for non first-up sequences.

First up group table

SWITCH			FIRST UP GROUP
7	***8***	***9***	
UP	UP	UP	Non First-Up sequences
UP	UP	DOWN	Group 1
UP	DOWN	UP	Group 2
UP	DOWN	DOWN	Group 3
DOWN	UP	UP	Group 4
DOWN	UP	DOWN	Group 5
DOWN	DOWN	UP	Group 6
DOWN	DOWN	DOWN	Group 7

Alarm Sequence

Each alarm way can be individually setup to indicate alarm conditions using a particular ISA alarm sequence. There are six possible selections, three standard and three with the first-up facility. These selections will cover most commonly used alarm sequences. For full details on the alarm sequences please refer to Section 6 and the standard ISA reference document "Annunciator Sequences and Specifications S18.1-1979.

Alarm sequence table

SWITCH			***ISA ALARM SEQUENCE***
10	***11***	***12***	
UP	UP	UP	A
UP	UP	DOWN	M
UP	DOWN	UP	R
DOWN	UP	UP	F1A
DOWN	UP	DOWN	F2M
DOWN	DOWN	UP	F3A

SECTION 15 COMMISSIONING

Commissioning and servicing operations must be carried out by a qualified technician properly trained and authorised to work on intrinsically safe electronic equipment in hazardous environments.

Tools required

Tools required are:

Small straight blade screwdriver for terminals

Medium straight blade screwdriver for terminal cover and panel mounting brackets

RTK supplied Double Hex 8mm socket for removal of front fascia

IS approved Multimeter (at least 20kohm/V)

Commissioning

1 Check all alarm contacts, external devices and remote pushbuttons for earth faults.

2 Check that all cables installed in the hazardous area are installed in accordance with proper IS practice.

3 Check that all cables installed in the hazardous areas comply with the cable parameters specified in Appendix A and in the certification documents.

4 Check that all wires are correctly terminated.

5 Power up and check the supply voltage between Terminal 1 & 2 on the Sequence Card this should be between 7.5V and 8.5VDC.

6 Press the Test button and check all LED's, all segments of LCD's and any audibles connected to the system operate correctly.

7 With all field contacts normal initiate the System Test sequence by pressing and holding for 3 seconds the Silence and Test pushbuttons together. The test simulated an alarm condition on all channels. All audible outputs are driven but not the group outputs.
The Acknowledge and Reset pushbuttons are pressed to clear the alarms.

8 Set an alarm contact to abnormal and check the LED, LCD, audible and other outputs follow the ISA sequences specified. Complete the process by pressing Silence, Acknowledge, returning the field contact to normal and pressing the Reset buttons.

9 Set several alarm contacts to abnormal and repeat the test detailed in part (8) above. This time also check that the first-up and only the first-up alarm is showing the "F" correctly

10 Systematically check every alarm channel as part (8) above.

SECTION 16 TROUBLE SHOOTING

For these checks the annunciator fascia and terminal cover can be removed whilst the unit is powered.

There is no displays visible on either LCD or LED - Check

1. The power to the IS Isolator is switched on
2. The output from the IS Isolator is correct
3. The unit has not been connected directly to 24VDC
4. Inspect the Sequence Card for signs of burnt components

Displays do not operate when Test pushbutton pressed - Check

1. Voltage between Commons Card terminal 1 & 2
2. IS Isolator fuse not blown?
3. Power supply correctly wired
4. Sequence Card correctly installed
5. No earth fault on remote pushbutton controls (when fitted)
6. Field wiring is correct

All alarm channels function incorrectly - Check

1. Sequence Card correctly installed
2. Field contact wiring is correct
3. Alarm sequence is set correctly on Alarm Card DIL switches 10, 11 and 12
4. No earth fault on remote pushbutton controls (when fitted)
5. Check functioning of Sequence Card by replacement

One channel functions incorrectly - Check

1. Alarm Card correctly installed
2. Alarm sequence is set correctly on Alarm Card DIL switches 10, 11 & 12
3. No earth fault on field contact and wiring
4. Connection is neither open nor short circuited
5. Wiring is terminated correctly
6. Check functioning of Alarm Card by replacement

The DIL Switch programming does not function - Check

1. The DIL switches have been set correctly
2. The unit has been powered down to read the new DIL switch settings
3. Is the fault related to all cards or just one
4. If just one card, check fault by card replacement

The audible is not working correctly - Check

1. If a horn is being used is it connected to the Horn connections on the Sequence Card (Terminals 3 and 4)
2. If an external sounder is used (e.g. DB-5) is this driven via a DA-149 Relay from the EXT SOUND Output on the Sequence Card (Terminals 11 and 12)

The IS Relays are not switching correctly - Check

1. Has the correct type of relay been specified?
2. Has the relay polarity been connected correctly for both the coil and the contact connections?
3. Check the annunciator card by replacement

Routine maintenance

1 Keep the system free from dust and clean the front fascia and any plastic labels using a dry cloth to lightly wipe the surface. For ingrained dirt we suggest a water dampened cloth is used to lightly wipe the surface, however, please avoid the clear area of the window to avoid clouding.

2 At the beginning of each working shift, press the Test pushbutton and check that all LED's, LCD's displays and audibles are functioning correctly

3 At regular intervals (established by operational experience) check the correct operation of all alarm channels. These checks should be made by a qualified technician / engineer and records kept of the test schedule

4 Include the LN1000 system in the inspection schedule for IS equipment

Recommended Spares

The LN1000 system is very reliable. If the annunciator is essential to the safe operation of the plant it is recommended that a stock of the following spares is maintained:

1	LN1000-AC	Alarm Card
1	LN1000-SC	Sequence Card
1	MTL5021	IS Isolator
1	Power Supply Unit	RT Series

SECTION 17 APPENDIX A

Cable Parameters

A1: Safe Area Apparatus

The Safe Area Apparatus is a MTL5021 isolating interface The parameters of interconnecting cables must not exceed the following:

Group	Capacitance (uF)	Inductance (mH)	L/R Ratio (uH/ohm)
IIC	0.17	0.88	36
IIB	0.51	3.52	108
IIA	1.36	10.12	288

A2: Commons Card B1, B2, and Ext. Sound Outputs

The total parameters of cables connected to Sequence Card terminals #9 to #12 must not exceed the values given in the table below.

Group	Capacitance (uF)	Inductance (mH)	L/R Ratio (uH/ohm)
IIC	14.5	180	1,496
IIB	43.5	540	4,488
IIA	116	1,440	11,968

A3: Commons Card IS Horn Output

The parameters of cable interconnecting Sequence Card terminals #3 and #4 and the DA-125 IS Horn must not exceed the following:

Group	Capacitance (uF)	Inductance (mH)	L/R Ratio (uH/ohm)
IIC	14.5	1.33	136
IIB	43.5	5.13	408
IIA	116	14.63	1,088

A4: Commons Card Remote Pushbutton Station

The total combined parameters of load and cables connected to Commons Card terminals #5 to #8 and #12 must not exceed:

Group	Capacitance (uF)	Inductance (mH)	L/R Ratio (uH/ohm)
IIC	14.5	320	2,080
IIB	43.5	660	6,240
IIA	116	2,560	16,640

A5: Alarm Card Connections

On the LN1000/12 the alarm card terminals are identified by the AL1 to AL6 (AL X) markings on the backplane.

On the LN1000/32 the alarm card terminals are identified by the AL1 to AL8 (AL X) markings on the top and the bottom backplanes.

Terminals AL X #7 and #8 must only be connected to AL X #1, by separate connections with a maximum connection length of 100mm.

For each alarm card the total combined parameters of interconnecting cables and any connected load for AL X terminals #1 to #6 and #9 to #12 must not exceed:

Group	Capacitance (uF)	Inductance (mH)	L/R Ratio (uH/ohm)
IIC	14.5	32	613
IIB	43.5	96	1,839
IIA	116	256	4,904

LN1000 Anti-static Precautions

Static Electricity can cause serious, permanent damage to unprotected electronic equipment. Everyday activities such as walking across a carpet, working at a bench, or simply handling items can generate large static voltages. Clothing is a common source of static electricity, particularly garments made from man-made fibres such as nylon. Even cotton clothing can generate significant static at low humidity levels.

There are other, less familiar, causes of static electricity. Air conditioning systems, for example, can produce significant levels of ambient static charge. Unwrapping goods packaged in plastic film, bubble-wrap and expanded polystyrene can also generate high levels of static electricity.

Electrostatic Discharge (ESD) occurs when the static charge held by an item (such as a screwdriver or a finger) is transferred to another item at a different electrical potential. This common phenomenon often results in a noticeable "crack" or "zap" at the point of discharge. Note, however, that serious damage can occur at relatively low static potentials that do not necessarily cause a "zap" - ESD does not always advertise its presence!

The LN1000 has been designed to withstand ESD strikes to the casing and terminals. In common with most Printed Circuit Boards (PCB) the Alarm Cards and Commons Card contain sensitive components that can be damaged by voltages as low as a few tens of volts. Consequently, since activities such as walking across a sealed concrete floor, or just working at a bench, can generate static charges of several *thousand* volts, it follows that the PCB circuits can easily be damaged.

It is important to be aware of this risk when configuring the LN1000, since this involves opening the case and adjusting dip switches, links and potentiometers on the PCB's. To minimise the risk of static damage, always configure the units using ESD Protection techniques. Earthed wrist straps and anti-static overalls should also be worn to dissipate static charge which can build up on personnel. Ionizers and humidifiers can also be employed to neutralise ambient static charge. Full details on the EPA can be found in *British Standard BSEN100015-1: Protection of Electrostatic Sensitive Devices.*

The likelihood of ESD damage can be eliminated by observing the following precautions:

1. Configure the LN1000 using appropriate ESD protection techniques
2. Always use an earthed wrist strap and, if possible, wear anti-static overalls
3. Minimise touching sensitive points on the PCB such as the link pins, and do not touch any other components
4. Ensure the Alarm Cards and Commons Card are only handled by personnel familiar with anti-static precautions
5. Keep all conductive material, food and drink, away from the PCB's and the open annunciator

EC DECLARATION OF CONFORMITY

This is to certify that the LN1000 Intrinsically Safe Alarm Annunciator

Manufactured by:-

RTK INSTRUMENTS LTD
ST JAMES BUSINESS PARK

KNARESBOROUGH
NORTH YORKSHIRE
HG5 8PJ

Conforms to the protection requirements of the following directives:

- Council directive 89/336/EEC (EMC Directive) to BS EN 61000-6-4 and BS EN 61000-6-2

- Council Directive 94/9/EC (ATEX Directive) to EN60079-0:2012 and EN60079-11:2012

The 12 way and 32 way versions of the product are certified to:
II 1G Ex ia IIB T4 Ga (-20oC $\leq$ Ta $\leq$ +60oC)

The 8 way version of the product is certified to:
II 1G Ex ia IIC T4 Ga (-20oC $\leq$ Ta $\leq$ +60oC)

Certificate No: Baseefa02ATEX0184

The Quality System is certified and monitored by Baseefa Ltd, notified Body no 1180, Rockhead Business Park, Staden Lane, Buxton, Derbyshire, SK17 9RZ.

....
PAUL HARTLEY - MANAGING DIRECTOR
Date: 12th November 2012

OTHER RTK PRODUCTS

RTK Instruments Ltd is fully ISO9001:2008 approved and manufactures a comprehensive range of complementary products from our factory in Knaresborough, UK for use in the Industrial Control and Instrumentation field as per the summary list provided below.

All standard products come complete with a 5 year guarantee

Sequential event recorder
Alarm management systems
Programmable remote logic alarm systems
Hazardous area alarm systems
Trip amplifiers
Trip monitoring systems
Signal isolators
Multi-output isolators
Signal converters
Frequency converters
Tachometers and inverse tachometers
Universal panel meters
Large character displays
Power supplies
Loop powered isolators and displays
Intrinsically safe alarm and status display products including:-
LED beacons
Sounders
Led clusters

Please ring the sales office on + 44 (0) 1423 580500 for latest product information or visit our web site www.rtkinstruments.com