Contents

Rev 6

1. Introduction

The System 9000 Alarm Annunciator system is a remote logic 19" rack based industrial alarm system. Combined with a range of flexible and cost effective displays it can be used to provide visual and audible warning of an alarm condition, or equipment status, where a high degree of reliability and flexibility is required.

The remote logic rack is mounted in a standard 19" subrack and is connected to the display unit and alarm contacts by front mounting screw terminal plugs and sockets. The display type used can be anything from standard lamp arrays to a full mosaic mimic system.

The system is programmable on site for all the commonly used functions and features. This is available via the Setup Card supplied with each system. All the commonly used annunciator sequences are available as listed in the publication "Annunciator
Sequences and Specifications S18.1 1979".
As the system is fully field-programmable, the operating specification, of both alarm sequence and function, can be changed during commissioning, or at a later date after the equipment is installed. All Active Input Cards are exactly the same so stocking requirements may be minimised. As the system is totally modular it may be expanded, reduced or rearranged at a later date with minimal effort and cost.

Reliability of operation is increased over conventional annunciators by the use of unique Application Specific Integrated Circuits (ASIC's) and microcontrollers. Each eight way alarm board is fitted with an ASIC, which is capable of complete system control. When the annunciator is initially switched on, control is arbitrarily allocated to any one of the ASIC's on any of the alarm boards, hence the annunciator requires no control or master module, failure of which could jeopardise the whole system. If the alarm board is removed or an ASIC goes faulty then control is randomly allocated to another ASIC on another alarm board, hence the worst fault that could normally occur is the loss of eight alarm ways. The use of ASIC's also results in a very low component count, again improving system reliability.
A separate buffer integrated circuit is used to drive the higher power lamps, relays and horn drive outputs.

Annunciator system reliability is further increased over conventional systems by the addition of separate dc/dc converters on each board so the whole annunciator is not reliant on a single regulator card, and a unique circuit which detects if a lamp has become short circuit, or both lamps have become open circuit. Indication and relay output is provided for faulty or missing cards or loss of power.

2. System Description and Features

General
Each annunciator is manufactured to meet individual customer's requirements. Systems can be manufactured in almost any size and format for both the remote logic and the display.
Two basic remote logic racks can be provided, the standard 19" full rack or the half rack for smaller systems. Systems up to 1600 alarm points are simply constructed by interconnecting standard racks together. The half rack will contain the Setup Card and up to 5 eight channel Active Input Cards giving a maximum of 40 alarm and control inputs. The full rack will again contain the Setup Card and up to 14 eight channel alarm cards giving a maximum of 112 alarm and control inputs.
The rack can be mounted in a conventional 19" racking system or, alternatively, rear mounted to the backplane of a control panel. The rear of the unit contains the motherboard which provides all the boards' interconnections. All the user connections are on the front of the unit via plug-in screw terminal blocks.

Active Input Card
Each Active Input Card controls eight alarm points. Each card has an Application Specific Integrated Circuit (ASIC) which controls the eight alarm ways on that board. System control is arbitrarily allocated to one of the ASIC's on any one of the alarm boards, obviating the need for a master control module. Each alarm board has a microcontroller with inbuilt EEPROM, all configurations and setup details for that card being contained in this memory. No battery backup is required to maintain this memory and system configuration can be changed tens of thousands of times without degradation. Each individual alarm way is programmable for different functions and sequences.

Reliable Annunciation
The fact that all the Input Cards are identical means that in the RTK System 9000 Alarm Annunciator there is no master or controlling module, failure of which could jeopardise the whole system. System control is arbitrarily allocated to any one of the Active Input Cards. Should this module be removed, damaged or fail for any reason, a watchdog relay, fitted in the Setup Card, will trip and another module will take over system control. This method of operation results in a system with no single source of failure and multiple redundancy giving the most reliable form of annunciation possible.

No master Philosophy
Not only is the basic function of the annunciator based on the "no master" principle but this also extends to the power supply and the communications.
Hence, each Active Input Board has its own DC/DC converter and its own communications facility. This dramatically improves the system reliability and MTBF.

Audible and Pushbutton connection
Each system is supplied with a Setup Card, which provides a horn relay to connect to external audible devices.
Any input on an Active Input Card can be configured as a pushbutton input rather than as an alarm input. As standard, the system will be configured with the last three inputs on the last card configured as Reset, Acknowledge and Lamp Test respectively.

Setup Card
Each system will be supplied complete with a Setup Card fitted in the left hand slot of the first rack. This card allows configuration of all the Active Input Cards in the system, filters the incoming supply, connects the power to the rear motherboard and provides three relay outputs for Horn, Group and Watchdog. The 3 digit red LED display is used to indicate position of card faults and general setup information. The two rows of eight LED's marked **ST** and **CH** are used to indicate input contact state and setup information for each Active Input Card in turn.

Lamp Protection
Occasionally, lamp filaments fail in a short circuit mode causing excessive current to flow in the lamp driving circuit. The System 9000 Annunciator has a circuit which senses whether a lamp has turned on. If a lamp fails to turn on when it should do so, the lamp driving circuit protects itself by turning off and trying again later.
The lamp fault condition can be configured to trip a group relay on the Group Relay Card to indicate this situation. This indication is given if either lamp should become short circuit or both lamps should become open circuit.

First-up Alarms
When a group of alarms is initiated, it is often important to know which of them was the first to occur. Four different first-up sequences are available in the System 9000 Annunciator as standard. The first-up facility can be disabled if required by using the Setup Card (see Operating Instructions section).

Status LED
Each Active Input Card has a green status LED on the front panel. This is used to indicate setup and fault information. The normal situation for the green LED is on steady. If this LED is flashing or off in normal running mode, then there is a fault or a setup problem.

System expansion
Additional plug-in cards can easily be added to existing systems to expand the number of alarm ways . Racks are supplied complete with all guides and pre-tested backplanes to allow simple future expansion. An additional rack can even be added if the system size needs to be extended above the capacity of one rack.

Serviceability
All cards are simply plugged into the guides in the 19" rack and connected via the rear motherboard. If a board needs to be replaced, it is a simple matter to unplug the system wiring from the front connector, withdraw and replace the card and replace the screw terminal plug. No special tools are required.

Repeat Relay Options
All standard systems have three relays for Horn, Group and Watchdog, if more relays are needed then two further cards are available. The Repeat Relay Card P925R will give an individual repeat relay for all alarm ways which is linked to the 8 channel Active Input Card.
The second option is the Group Relay Card which will give a further 8 common relays which can be configured as group relays, horn relays or warning relays for bulb fault, line fault or communications fault.

Communications Options
To gain access to the powerful onboard communications facilities the Interface Card P925X will be required. This card will allow the System 9000 to be linked to computers, DCS, SCADA or PLC systems. The annunciator can be configured to acknowledge alarm inputs via the serial communication port or transmit alarm information to remote equipment.
To simplify connection to the System 9000 the industry standard MODUS ASCII protocol is used.

Line Fault Monitoring Option
Where it is necessary to ensure the plant wiring is still operational the System 9000 can be supplied with a line fault monitoring option. This option will continuously monitor the field wiring for both open and short circuits.

Windows Setup Utility Software
To simplify the setup and storage of complex alarm schemes all the system features can be programmed from a Windows based personal computer. You will require the P925W software together with a P925L connection link cable to connect the annunciator to a standard computer serial port.

3. Inputs and Outputs

Terminations and Interconnections

All connections to each of the cards are via a front mounted plug-in screw terminal block. This is suitable for cables up to 2.5mm^2. Having all the user connections at the front avoids the necessity to supply complex swinging frame enclosures to gain access to rear mounted terminals.

Alarm inputs

The input circuitry for the alarm inputs is fully opto-isolated so operation in electrically noisy environments will not present a problem.
The standard System 9000 Annunciator operates from normally open or normally closed volt-free contacts. (Selection is made using the Setup Card, see Operating Instruction section.)
Field contacts are often great distances from the annunciator so it is advisable to run the contact cables separately from circuits carrying heavy currents and/or high voltages so as to minimise the effects of induced voltages from these cables. A transient filter is built into the input circuitry so that low voltage interference will be ignored. Contacts may be continuous or fleeting and provided the fleeting alarm exceeds 40 milliseconds duration, the annunciator may be made to latch-on.
Voltage inputs can be used if the 0V from each system is commoned together.

Pushbutton inputs

Standard normally open pushbuttons can be used to provide control inputs. These can be allocated to any of the active inputs.

Common relay outputs

As standard, each system is supplied with 3 relays in the Setup Card. These are the watchdog relay, horn relay and group relay. Their operation is as follows:-
Watchdog Relay:- This relay is normally energised and will de-energise on loss of power and if any of the Active Input Cards either loses power or has a fault. The relay will automatically reset when the fault condition has been removed.
Horn relay:- This relay is used to drive the external horn or siren. It will normally energise on a fault condition and de-energise on ACKNOWLEDGE or MUTE.
Group relay:- Similar to the horn relay in that it will energise when any alarm occurs but will not de-energise until all alarm ways have returned to normal and the system reset.
It is possible to configure the Group Relay as a second horn relay. (See the section on DIL switch settings)

Individual repeat relay outputs

Each alarm way can be supplied with individual repeat relay outputs which may be used to modify plant operation, provide output signals or operate protection devices etc. Relays may be either normally energised or normally de-energised. This option is selected using the Setup Card (see Operating Instructions, page 30).
The standard mode of operation for repeat relays is to latch in when an alarm condition occurs and only return to normal when the plant fault has returned to normal and the unit reset. Other relay operating modes are also available, such as relays following the input.

4. Technical Specification

INPUTS

Alarm contacts

All inputs are opto-isolated (isolation voltage 500VDC). By using different wiring configurations, the same system can be used for both:-

a) Volt-free contacts which can have the operating mode configured, using the Setup Card, to operate to alarm for contact open or to alarm for contact close.

b) Voltage input from 19VDC minimum to 36VDC maximum for the 24VDC system and 38 to 58VDC for the 48VDC system. The OV for the annunciator and voltage input reference should be connected together.

Alarm contact and cable resistance

N/C contact - Series resistance of contact cables 20kohm maximum.
N/O contact - Parallel resistance of contact cables 200kohm minimum.

Field contact voltage and current

The voltage for volt-free alarm contacts is fed from the unit at 24V DC at approximately 2mA. Systems with higher currents and voltage levels can be supplied by specifying the optional Input Resistor Board P925IR.
To maintain complete isolation it is possible to use a separate PSU to feed all the alarm contacts.

Input transient filter

Signals narrower than approximately 40ms at 30V will not trigger the annunciator.
Tolerable transient at higher voltages

100V for 2ms 200V for 1ms 1kV for 200µs

First-up discrimination

Typical 10ms

Resolution

1 millisecond between events

Control inputs

Any input can be configured to one of the following control inputs:

a) Lamp test b) Acknowledge c) Reset d) Mute
e) System Test f) First-up Reset g) "Sleep" mode h) Horn Mask

OUTPUTS

Lamp Drive

Each output can drive up to 160mA at both 24 and 48V DC, making it suitable for multi bulb displays or multiple repeat displays.

Standard Relays

Standard relays fitted on the Setup card: Horn, Group and Watchdog.
Contact rating 3A at 24VDC resistive or 2A at 240VAC resistive.
Selection of N/O or N/C contact by jumper link.

Repeat and Group Relays
The group relay card and individual repeat relays for each alarm way.
Contact rating 3A at 24V DC resistive or 2A at 240V AC resistive.
Relay outputs may be normally energised or normally de-energised and contacts can be N/O or N/C.

GENERAL

Supply Voltage
24V DC nominal (19 - 36VDC) *Standard*
48V DC nominal (38 - 58VDC)
A range of power supplies is available to convert from other AC or DC voltages.

Supply current	***24VDC System***	***48VDC System***
Quiescent for Setup Card	120mA	60mA
Quiescent for Active Input Card	40mA	30mA
Relay current	22mA per relay	10mA per relay

Add the current for the lamp drive to the totals of the above cards.

EMC Compliance
Immunity to EN50082-2:1995
Emissions to EN50081-2:1994

Environment
Operating temperature	0°C to 60°C
Storage temperature	-20°C to 80°C
Humidity	0-95% RH, non-condensing

MECHANICAL DETAILS

19" Rack
Standard 3U by 19" Eurorack to IEC297-3 (DIN1494 Pt.5) for up to 109 alarm inputs and 3 control inputs.
Standard 3U By 10 1/2" Eurorack to IEC297-3(DIN1494 Pt.5) for up to 37 alarm inputs and 3 control inputs.

Larger systems can be provided using multiple racks and interconnect cards.

Mounting
Either rear mounting direct to a backplate or front mounting in a standard 19" racking system.

Assembly
All cards plug in to a standard pre-tested motherboard using DIN41612 connectors. This allows simple expansion of system size at a later date.

Terminals
Plug and socket terminals of the rising clamp type, maximum cable size 2.5mm^2

5. Alarm Sequences

SUMMARY

From the sequence tables shown on Page 14 to 17, it will be evident that an alarm occurring causes a flashing visual indication in conjunction with an audible alarm and optional relay outputs.
LAMP TEST may be operated at any time and normally operates only on the visual indication, turning all lamps on for as long as the pushbutton is pressed.
It is possible to program the system so the lamp test facility can simultaneously operate the audible.
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 terminated only when the reset operates.
MUTE 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 having the first-up alarm flashing in a different manner compared to the subsequent alarms. Four different first-up sequences are available F0, 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 and non-latch sequence as momentary alarms can cause ambiguity. Ringback are readily used with a first-up sequence.

F0 The standard mode adopted by RTK Instruments, which indicates the first-up alarm by flashing at twice the rate of subsequent alarms.

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 so a separate first-up reset pushbutton is required. This pushbutton will reset the first-up whether the process condition has returned to normal or not.

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.

Non-latch sequence (No lock-in)
Alarms will reset immediately when the contacts clear (i.e. the alarm is not latched), although whilst alarmed the Acknowledge and Mute pushbuttons operate normally.

Reflash sequence
In the standard mode, when an alarm has occurred and has been acknowledged, any further changes of state of the alarm contact will not affect the alarm window display. With the reflash sequence, whenever the alarm re-occurs on an acknowledged alarm way, the alarm is re-initialised, the window will flash and the horn will sound just as a new alarm.

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.
Once an alarm has been acknowledged the display will be steady illuminated. After this stage, the contacts returning to normal will cause the display to re-flash. The flash rate is very slow to distinguish it from a normal alarm and the audible device is pulsed at the same rate.
After a ringback the display can be reset immediately without a further acknowledge.
Ringback operation may be used with all but non-latched and auto reset sequences.

Two button sequence
In certain circumstances using remote pushbuttons, it may be desirable to use only two pushbuttons: Reset and Lamp Test. The Reset pushbutton is used to Acknowledge an alarm if the contacts are in the alarm condition and to Reset it if the contacts are clear.

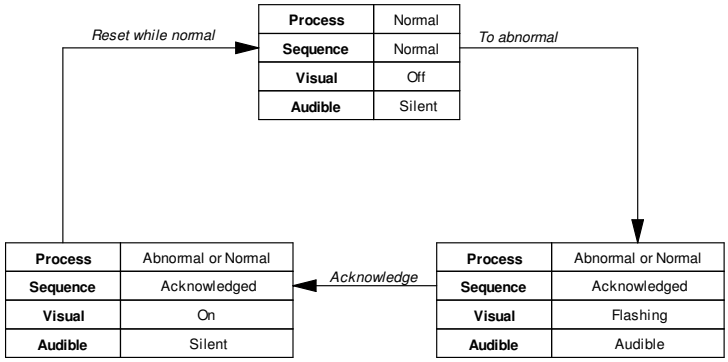
To change from one sequence to another see the Operating Instructions Page 30.

6. Sequence Tables

Example Sequence Tables

Each eight way alarm board 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 and operating modes on different alarm ways.
32 different operating modes can be selected using the Setup Card. The following tables show the most commonly used examples.

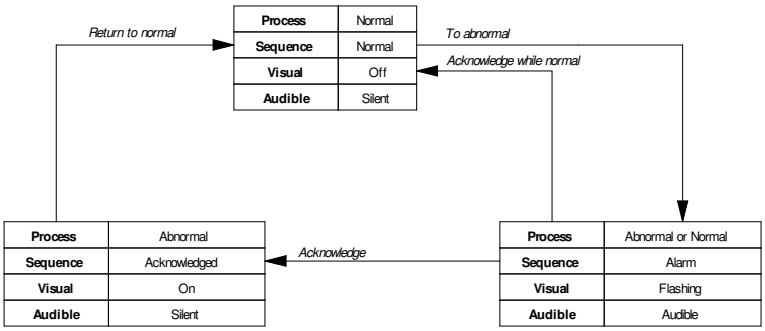
Manual Reset (Sequence M)



Sequence features

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

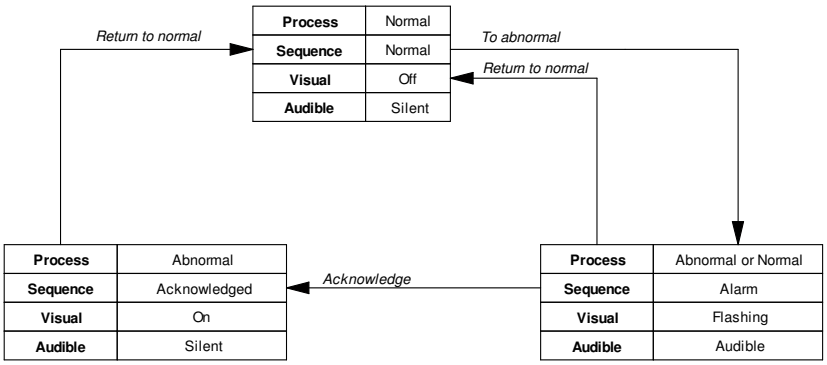
Auto Reset (Sequence A)



Sequence features

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

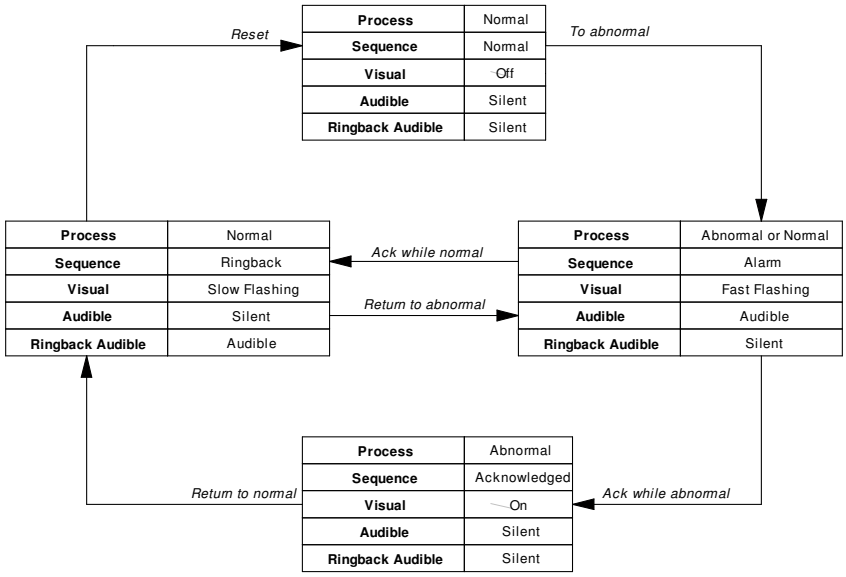
No Lock-in



Sequence features

1 Acknowledge and lamp test pushbuttons required
2 Alarm audible device
3 No lock-in of momentary alarms
4 The audible device is silenced and flashing stops when acknowledged
5 All alarms, acknowledged or not, return to normal when process conditions return to normal

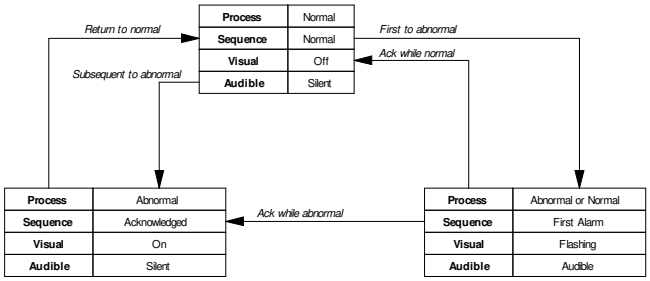
Ringback (Sequence R)
Only available in first-up modes F1, F2 and F3



Sequence features

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

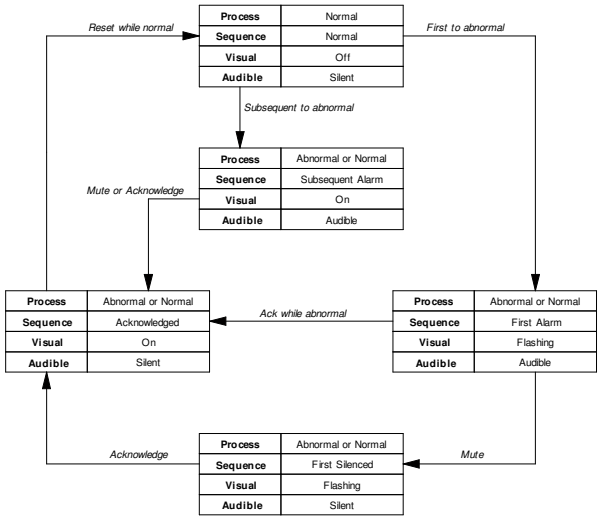
Automatic Reset First-up (Sequence F1A) with no subsequent alarm state



Sequence features

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

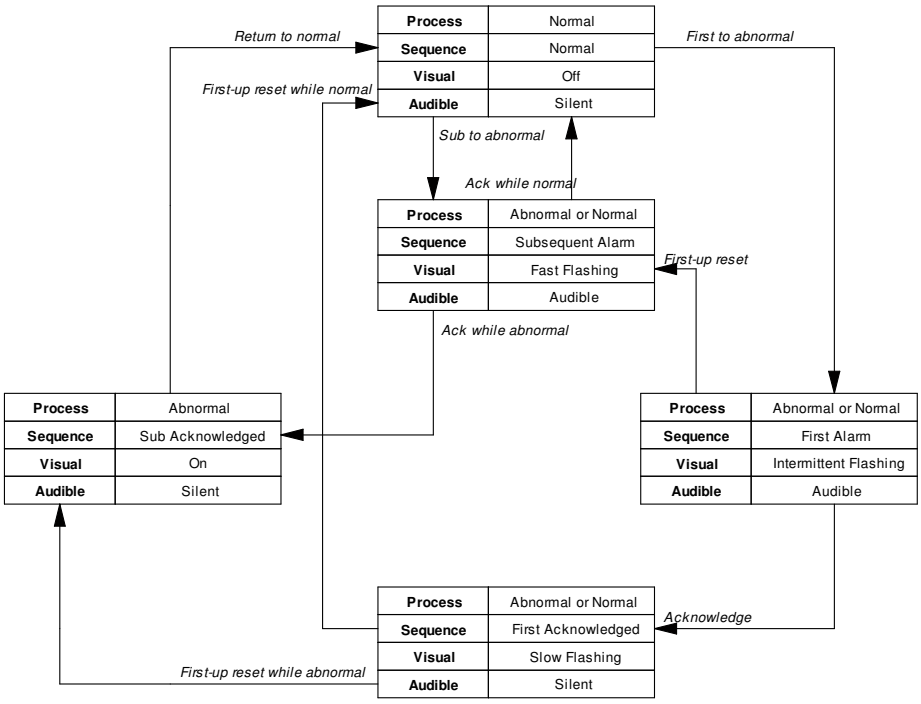
Manual Reset First-up (Sequence F2M-1) with no subsequent alarm flashing and silence pushbutton



Sequence features

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

Automatic Reset First-up (Sequence F3A) with first-up flashing and "first-up reset" pushbutton



Sequence features

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

7. Mechanical Details

Logic Rack

The System 9000 Annunciator is mounted in standard 19" subracks manufactured to IEC297-3 (DIN1494 Pt5). Two basic rack types are available as illustrated on the opposite page. The full 19" rack which is suitable for up to 112 alarm and control inputs. The half rack is useful for smaller systems and has a maximum capacity of 40 alarm and control inputs. On systems of greater than 112 alarm and control inputs multiple racks can be interconnected using the RTK Interconnect Card and cable P925I.

As standard, the rack is supplied with the mounting angles fitted at the rear to allow direct connection to the backplane of a control panel. If the logic rack is to be mounted in a conventional 19" racking system then the two rear mounted brackets should be exchanged with the front mounted closing angle (the small angle section used to fill the gaps to the right and left of the plug-in cards). The closing angles can then be discarded.

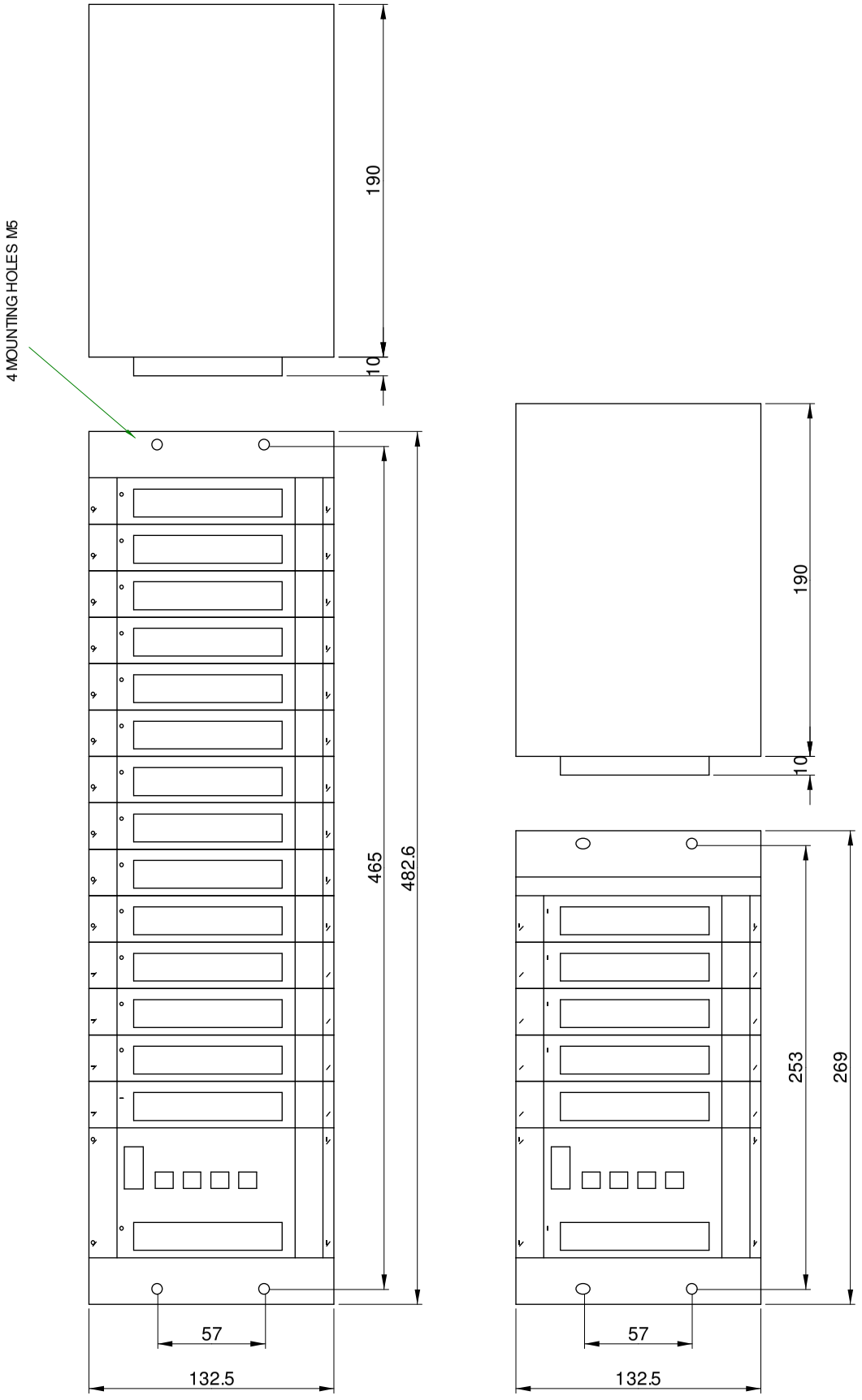
When mounting the subrack care must be taken to ensure sufficient room is allowed to withdraw all cards from the front for maintenance, configuration or repair purposes.

Plug-in Cards

All systems are supplied with an integral Setup Card, which is 14E wide. The Active Input Card, Interconnect Card and Relay Card are all 5E wide. All cards are connected to the motherboard by DIN41612 connectors to allow interconnection between cards for all the control functions.
On the front of each of these plug-in cards is a 16 way screw terminal connector. This connector is a plug-in type to allow the speedy exchange of cards. Cable up to 2.5mm^2 can be connected to these screw terminals.

Displays

The System 9000 Annunciator is suitable to drive a vast range of display types and styles. For detailed information on any display supplied with the system, please refer to the separate display instruction leaflet.



Rack Dimensions (Figure 1)

8. Installation

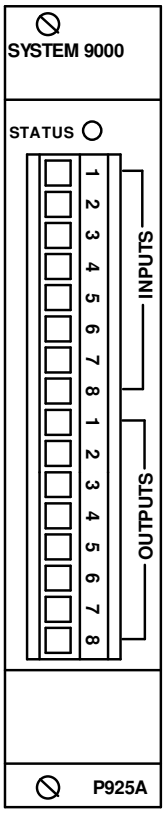
GENERAL

Mounting
Mount the subrack in a location free from excessive moisture, vibration, heat and dust.
Allow sufficient clearance at the front of the unit to withdraw all cards without obstruction.
All spare positions in a rack are fitted with blanking plates, which can be removed if the system is expanded at a later date.

Earthing
In order to comply to the EMC requirements for Electrostatic Discharge IEC801-2 it is essential that each 19" subrack is earthed. A specific earthing point is supplied on the right sideplate of each rack.

STANDARD SYSTEMS
All systems will have, as a minimum, a Setup Card and a number of Active Input Cards. Connections to these systems are described below. The additional optional cards and configurations are described individually below.

Input and outputs
Each Active Input Card has eight inputs and eight outputs. Each input is directly related to its corresponding output on that card. Inputs and outputs on each card are numbered 1 to 8.



Active Input Card P925A (Figure 2)

Connections - Standard Systems

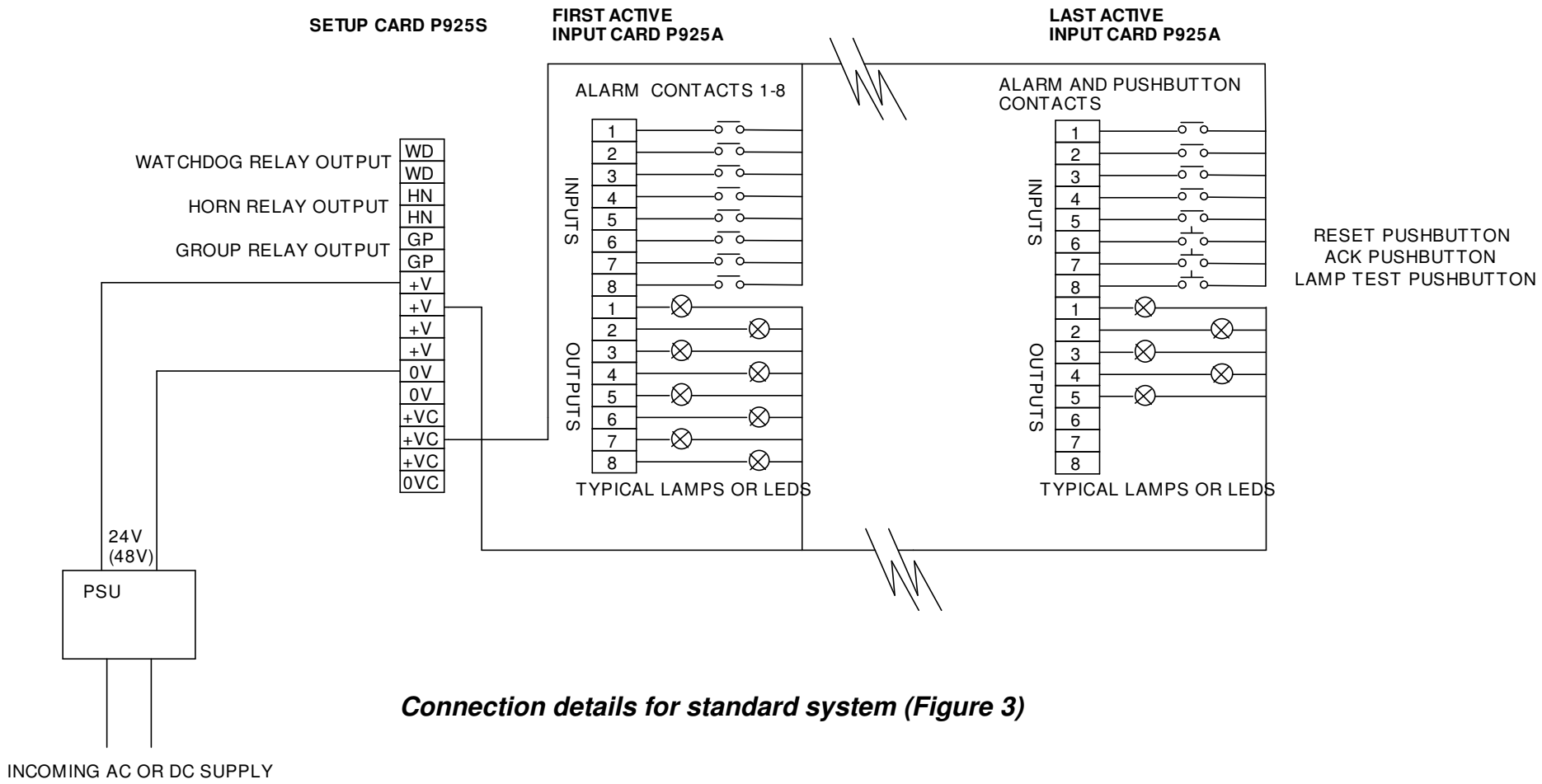
Both alarm and control inputs and lamp/LED outputs are connected using a common 24VDC or 48V DC. An external Power Supply Unit is used to convert the incoming supply voltage into this standard 24 or 48VDC supply for the annunciator system. The system supply voltage (either 24VDC or 48VDC) is connected to the terminals marked +V and 0V. The terminals marked +VC are used as a common for alarm contacts and control inputs. In a standard system, these two voltage outputs are commoned together internally in the Setup Card.
Systems should be wired as illustrated on Page 22.

Connections - Isolated Wetting Voltage

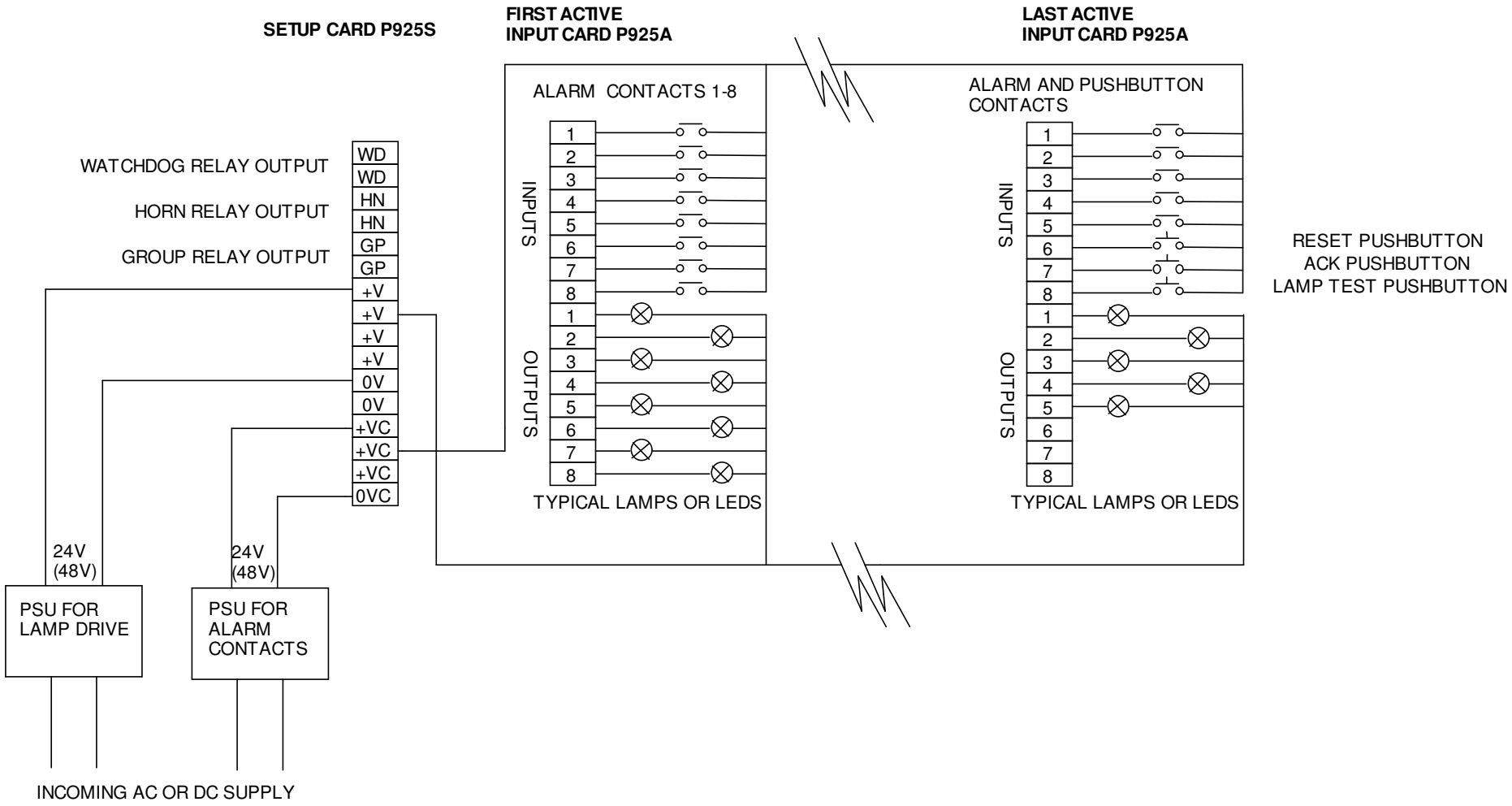
In situations of extreme electrical noise, it may be necessary to supply the alarm and control inputs with a separate isolated power supply. This will significantly reduce any disturbance due to large current flowing in the common lines. Systems using this isolated supply should be wired as illustrated on Page 23. It will also be necessary to snip two links in the Setup Card that connect the two supply lines together (see the section on DIL Switch and Link settings).

Pushbutton Inputs

As standard, the last three inputs of the last Active Input Card are configured for control inputs, starting at the last input with Lamp Test and then Acknowledge and Reset as shown on Pages 22 and 23. The outputs relating to these inputs cannot be used to drive alarm ways. They will simply follow the pushbutton input so when the input is activated, the related output will come on.



Connection details for standard system (Figure 3)



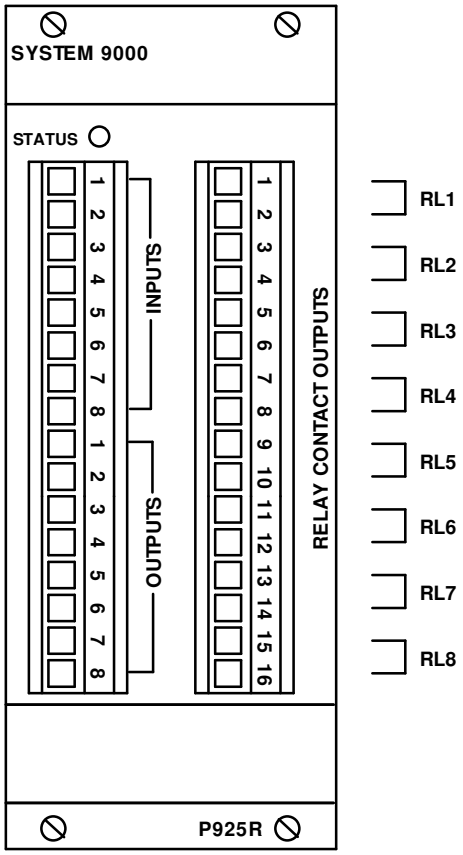
Connection details for system with isolated wetting voltage (Figure 4)

SYSTEMS WITH INDIVIDUAL REPEAT RELAYS

Connection details

When repeat relays on each individual alarm way are required then the P925R combined Active Input and Repeat Relay Card is supplied. This card has the standard eight inputs and eight outputs for the alarm ways but it also has an additional board which contains the 8 relay outputs corresponding to the 8 alarm channels.

All the connections to the alarm inputs and outputs are as previously described and as shown on pages 22 and 23. The additional relay connections are as shown below.
Each relay output has two terminals, the output on these terminals can be configured as normally open or normally closed by changing jumper links (see the section on DIL Switch and Link Settings).



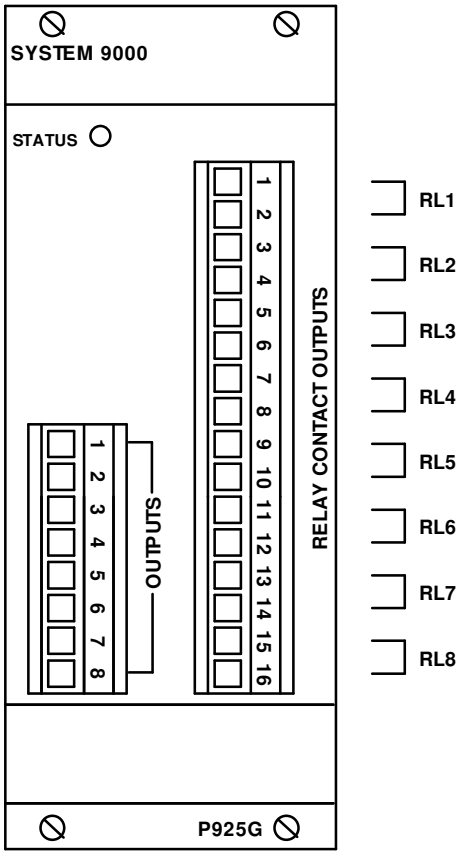
Repeat Relay Card P925R (Figure 5)

SYSTEMS WITH GROUP RELAY OUTPUTS

Connection details

When the three relays provided in the Setup Card are insufficient to meet the application, the Group Relay Card may be needed. This card provides a further 8 relays. These relays can be configured in any combination of Group Relays, Audible Relays and Special Function Relays up to a maximum of 8 Group Relays, 4 Audible Relays and 4 Special Function Relays.
Group Relay 1 and Audible Relay 1 are mounted in the Setup Card and will still operate in the normal way. Three of the relays can be configured as special function relays to indicate Line Fault (if the Line Fault Monitoring is fitted), Bulb Fault or as a Ringback Audible, if the ringback function is selected.

The connections are essentially the same as the Relay Card P925R, with the exception that the card has no alarm input terminals. The output terminals can be used to drive lamps to indicate that the Group Relay has been operated. These terminals are wired as shown previously on Page 22 and 23.



Group Relay Card P925G (Figure 6)

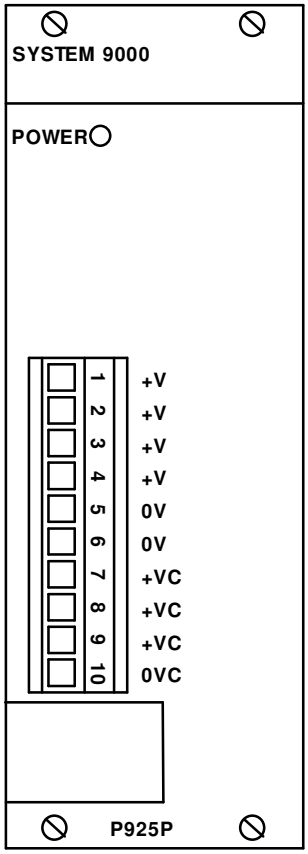
MULTIPLE RACKS SYSTEMS

Connection Details

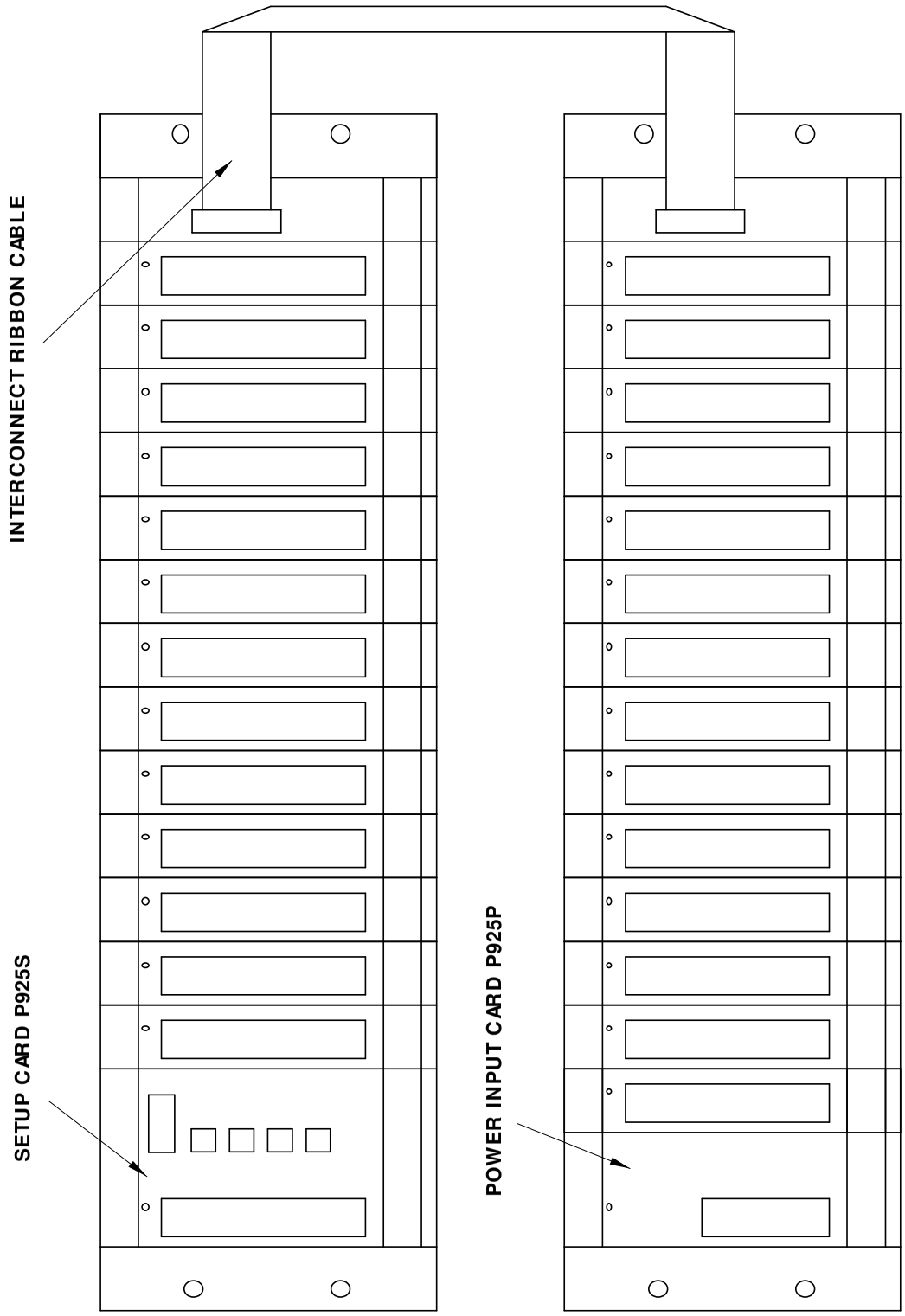
Alarm systems greater than 112 ways will need to be fitted into multiple racks. These systems still only require a single Setup Card to configure all Active Input Cards. All the common signals are fully buffered and connected between racks by using the Interconnect Card P925I. This card comes complete with a plug-in ribbon cable to connect each rack together. As all the signals are fully buffered on each rack there is no limit to the number of racks that can be interconnected in this way.
As each rack will normally take a load of 10A at 24VDC, with all the lamps on, it is recommended that each rack is powered from a separate power supply. The power for the first rack is connected via the Setup Card but all subsequent racks will need a Power Input Card, P925P. This card will simply filter the incoming supply and connect it to the rear motherboard.

In standard systems the supply voltage (+V) and the contact voltage (+VC) are commoned together internally as in the Setup Card. If an isolated wetting voltage is required as shown on Page 23 then two separate power supplies will be required and the internal links will need to be removed. See section on DIL Switch and Link Settings.

All the connections to the individual cards will remain as previously described.
The Power Input connections are shown below and the multiple rack example is shown on the opposite page.



Power Input Card P925P (Figure 7)



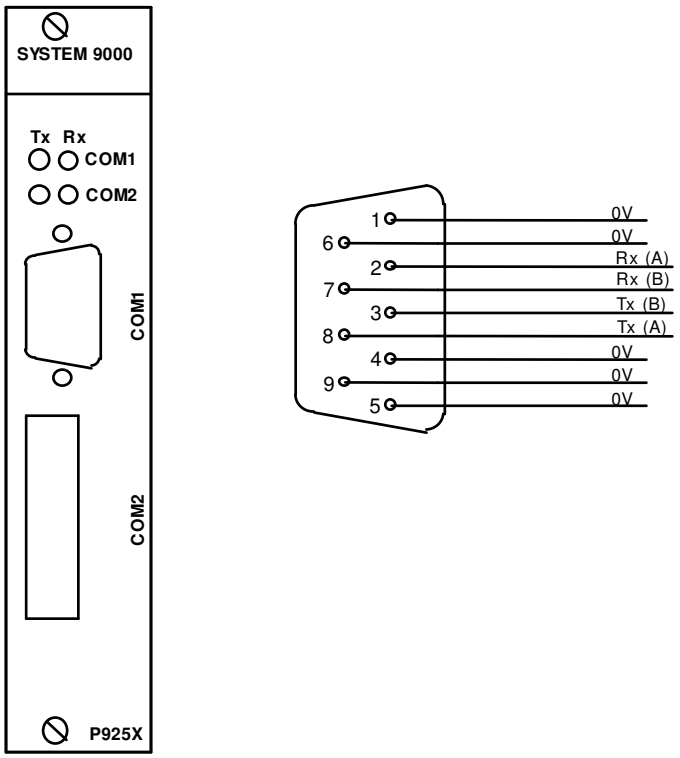
Example of multiple rack system (Figure 8)

SYSTEMS WITH COMMUNICATIONS FACILITY

Connection Details

Each Active Input Card can have full communications capability to link to external computers, PLC's, SCADA or DCS systems. This powerful communications facility can only be accessed using the Interface Card type P925X. This card will provide the link or interface to the "no-master" communications facility on each Active Input Card.

The Interface Card is always situated in the far right position on the first rack. The card has two connectors, a 9-way D for the external communications and a standard ribbon connector, which is used to interconnect additional racks, if required. If multiple racks are needed the ribbon cable to connect these will be supplied so the only user connection is the 9-way D. The connection details are shown below.



Interface Card P925X (Figure 9)

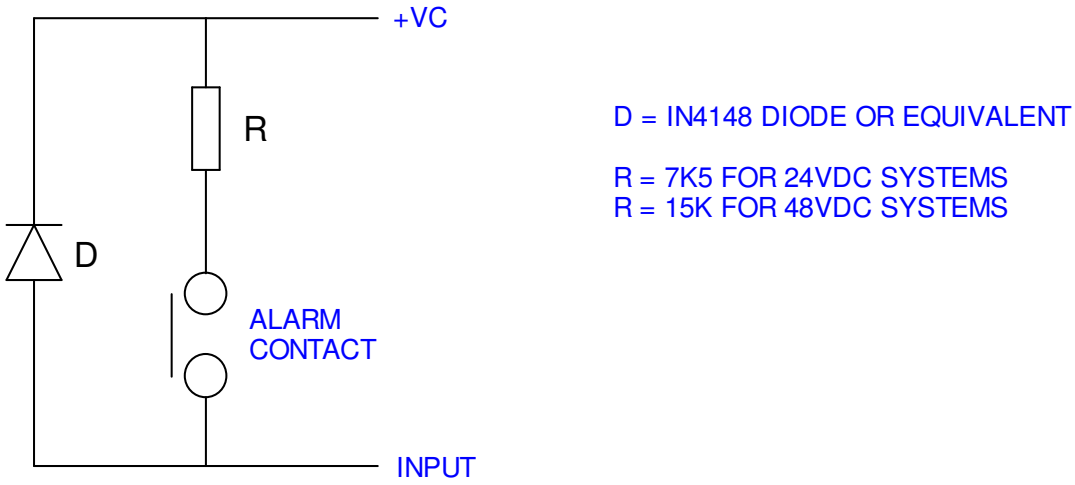
It is recommended that the RS485 communications output is wired in twin twisted pair cable which has both a screen over each twisted pair and an overall screen. The internal screen should be connected to the communications OV line. The overall screen should be taken to earth, at one point only.
It is also recommended to run this cable in separate trunking from cable carrying high current or high voltages.
The above precaution will ensure the most trouble free communications will be obtained.
Note:- The Receive (Rx) lines and the Transmit lines (Tx) refer to the System 9000 unit, i.e. Rx means data in to the annunciator, TX means data out from the annunciator

SYSTEMS WITH LINE FAULT MONITORING

Connection Details

The Line Fault monitoring option will continuously monitor the alarm contact wiring for both open and short circuit faults. The Line Fault Monitoring board is a piggy back board that fits to the standard Active Input Board so the connections are exactly the same as for a standard system.

The only difference regarding installation is the addition of a resistor and diode in series and parallel to the alarm contact.
The exact configuration is shown below, these components should be fitted as close as possible to the original initiating alarm contact within the site wiring.



Additional components required for Line Fault Monitoring (Figure 10)

9. Operating Instructions

Pre-checks

After connection has been completed as described in the last section, complete the following checks before applying power. The system is supplied fully tested and configured to suit your application (if requested), so detailed on site re-testing should not be necessary.

- Ensure the equipment is earthed using the specific earth stud on the right-hand side of the rack.
- Check that the Power Supply is the correct type for the proposed supply voltage and the output voltage matches the annunciator system voltage. The System 9000 Annunciator will be either a 24VDC or a 48VDC system.
- Check that all cards are fully plugged in and the retaining screws are fitted and tight.
- Check all alarm contacts are volt-free and correctly wired using the common voltage +VC.
- Care should be taken with the output wiring to the display to ensure no shorts occur. This will not damage the equipment but will give extremely misleading results.

Power ON

After completing the above pre-checks, power can be supplied to the unit.
The system will take approximately 6 seconds to complete an initial self-test and will complete a search for all Active Input Cards up to card 199. During this search the display will show Fnd which indicates that the Setup Card is finding the Input Cards. After it has successfully completed this check the 3 digit display should read run and all the green Status LED's on the Active Input Cards should be on and not flashing. If you do not have this situation then refer to the Fault Finding section on Page 61.

Status LED

Each Active Input Card has a status LED which is used for fault and setup indication as follows:-

ON	Normal operation
OFF	Card is faulty or has not been recognised by the Setup Card
INTERMITTENT FLASHING	The card has been selected for configuration using the Setup Card
SLOW FLASH	Bulb fault
FAST FLASH	Line fault in alarm wiring *(if option fitted)*

Operating Modes

The system can be set into two distinct operating modes. CAL mode for system calibration and commissioning and RUN mode for normal operation after the system has been tested and been put into service. Although the annunciator will operate in CAL mode this should not be used when the equipment is finally put into service as the speed of response due to the additional calibration routines is not adequate on large systems.
To change from one mode to another, simply press the CARD and the CH pushbuttons on the Setup Card simultaneously and hold for approximately 4 seconds. Repeating this operation will again toggle to the other mode.

CAL mode

This mode is used when the system is being calibrated and commissioned. The system will function in the normal way with a slight reduction in response time. The display will normally show a function number between F0 and F99 when in this mode.

RUN mode

In run mode the 3 digit display will simply display run and all other LED's on the Setup Card are disabled.

Setup Card

All Active Input Cards can be setup using the Setup Card (as shown on Page 32). When a configuration is changed the result is stored in EEPROM in the microcontroller on the actual Active Input Card. As this memory is non volatile, no battery backup is required.
The Setup card has 4 pushbuttons as described below:-

CARD: This is used in conjunction with the UP and DOWN pushbuttons to select an Active Input Card for configuration. When a card is selected the Status LED on that card will flash fast intermittent.

CH: This is used in conjunction with the UP and DOWN pushbuttons to select a particular channel on a particular card. Configuration can be made down to each individual alarm or control input. The channel(s) selected is indicated by the red LED's marked CH, these are numbered 1-8 to match the input channels. This selection will cycle round and will include a selection of all channels simultaneously, so a complete card can be configured together.

By pressing the above two pushbuttons together in conjunction with the UP and DOWN pushbutton, the FUNCTION can be selected (see later).

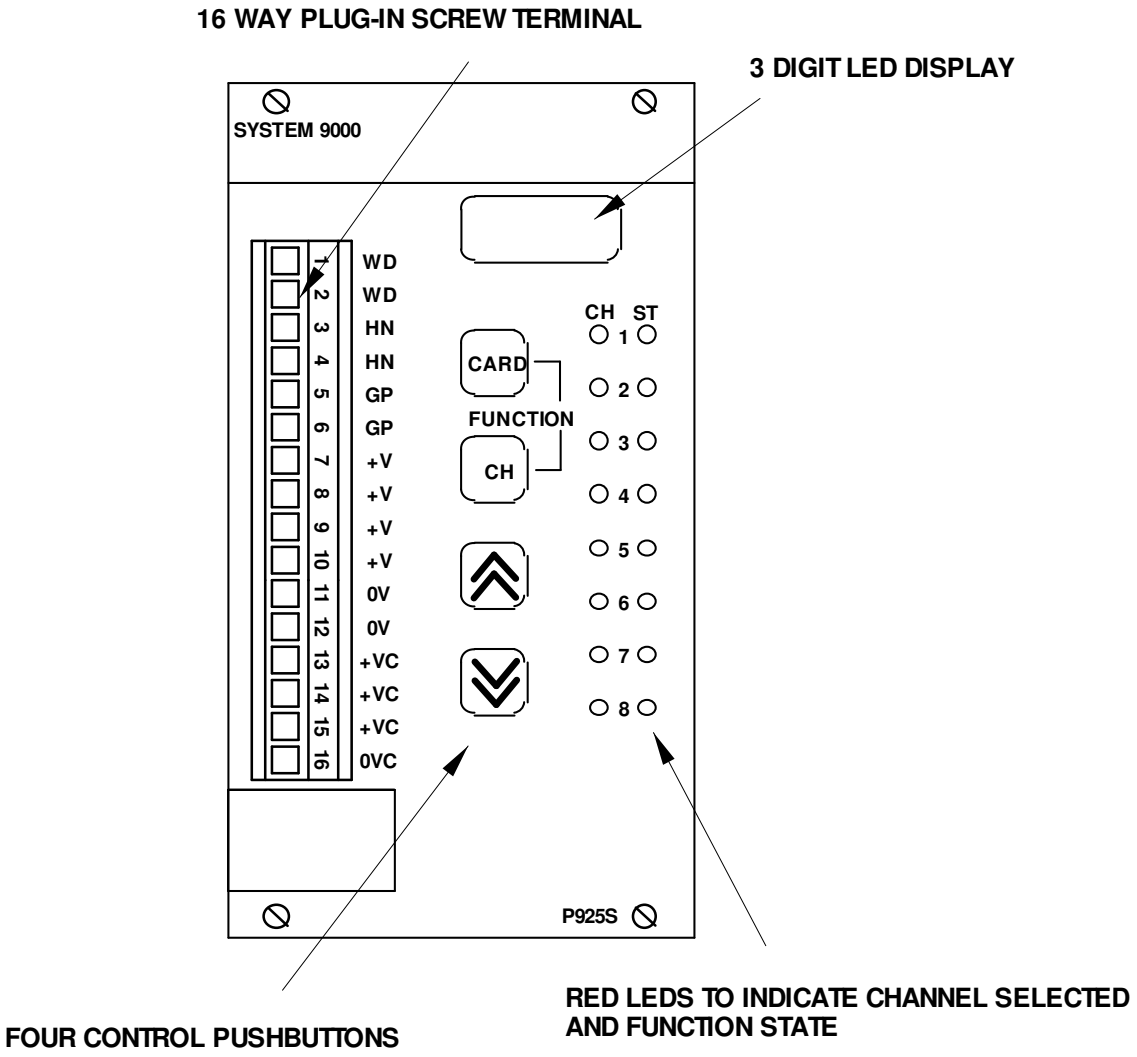
By pressing the above two pushbuttons simultaneously and holding on for 4 seconds, the system will toggle between CAL and RUN modes.

UP: Used to move up during card, channel and function selection. Once a selection is made it is used to turn a function on for a particular channel or card.

DOWN: Used to move down during card, channel and function selection. Once a selection is made it is used to turn a function off for a particular channel or card.

By pressing the UP and DOWN pushbuttons together the FIND routine is started . This is used if the number of cards has changed. The Setup card will search for all Active Input Card up to card 199. Using this function the Setup Card can store the system setup and trip the watchdog relay if any card fails or is removed.

The Setup Card also has two rows of eight red LED's. Both rows are numbered 1-8 to relate to the eight channels on the Active Input Card. The row marked CH show which channel(s) has been selected during calibration. The row marked ST show the status (either ON or OFF) of the setting for that channel for the displayed function number.



Setup Card front panel controls (Figure 11)

Functions

To enable the System 9000 Annunciator to be configured for a range of different sequences, operating modes and options, up to 99 separate functions are available for configuration on each of the alarm and control inputs. This list of functions and their function number is described on the following pages. Each function relates to a particular method of operation and can be turned on or off for each alarm input in turn.
A particular function can be configured for all inputs or just one depending on the system requirements.

Unless otherwise specified all systems are shipped with the default functions set. These default conditions are marked with a * on the following list of function numbers. These will suit a large proportion of basic alarm annunciator requirements.

To check a channel configuration

If in RUN mode switch the unit to CAL mode as previously described. The display will now be display the function number F0. Select the required card using the CARD pushbutton combined with the UP and DOWN pushbuttons. The status LED on the selected card will flash fast intermittent.
The Setup Card status LED's will display the state of all the eight channels for the selected card for the function number displayed. If that function has been selected for any ways on the selected card then the status LED will be on for the appropriate channel(s). If the settings for another function number are required then simply press the CARD and CH pushbuttons together in conjunction with the UP and DOWN pushbutton to change to a different function number.

To change a channel configuration

Select the required combination of card, function and channel as described above. When the correct channel(s) has been selected then the function can be turned on or off using the UP or the DOWN pushbuttons. UP turns that function on and DOWN turns the function off. As the functions are turned on or off in this way the appropriate status LED on the Setup Card will change state, i.e. if the LED is on the function is selected.
The new setup information is stored only when the function or card is changed or the system is switched back into RUN mode.

For example:- If it was necessary to make channel 1 on card 5 have the auto reset facility then follow the simple steps below.

-Ensure the system is in CAL mode
-Select card 5
-Select channel 1
-Select Function 3 (For auto reset from list on Page 35)
-Turn channel 1 on with the UP pushbutton
-To store this information then change the card selected or the function number selected.
-Return to the correct channel to ensure it has been programmed correctly.

Functions with Multiple Options

Most of the programmable options are simply selected as ON or OFF as described above but other more advanced functions will need to be selected from a list of options.
These are programmed in essentially the same way, except that when the actual function is turned on using the UP pushbutton the display will start to scroll between the function number and 1. If the UP is pressed again this analogue value will increase. This allows different options to be programmed for one function. When the required option number is reached for the particular function being set then this is stored by changing the CARD or FUNCTION. This will store the setting to the EEPROM on the Active Input Card. These options are of course mutually exclusive as it will be impossible to select two different option numbers for one function.
If it is necessary to turn off a previously selected function then the card and channel is selected as normal and the option number reduced using the DOWN pushbutton. When the option number reaches 0 then the function is turned off, the STATUS LED is also turned off to indicate that the function is no longer selected.

Functions with Analogue Values

Functions such as time delays will need to set an analogue value. The method to do this is exactly the same as setting option numbers described above. The time delays can be switched off in the same way by pressing the DOWN pushbutton until the display counts to 0. As the display changes to 0 the function will automatically switch off, showing the time delay function is no longer selected.

Return to run mode

If no pushbuttons have been pressed for 10 minutes with the Setup Card in the calibration mode then it will automatically return to the run mode.

10. Function Numbers

F0 Contact state
F1 Normally open or Normally closed alarm contact (N/C LED on)
F2* Output relay energised or de-energised (Energised LED on)
F3 Auto reset
F4 No lock-in operation
F5 Inhibit Input
F6 Ringback
F7 2 button operation
F8 Reflash Single Input
F9 Silence Interlock (ISA Option 2)
F10 Select drive suitable for LED's
F11
F12 First-up Reset Interlock (ISA Option 3)
F13 Communications input
F14 Communications output
F15 Enable line fault monitoring *(If option supplied)*
F16 Selection of standard Group Relays *(Group Relay Card only)*
F17 Selection of Group Relays with reflash *(Group Relay Card only)*
F18 Selection of Audible Relays *(Group Relay Card only)*
F19 Selection of Special Function Relays *(Group Relay Card only)*
F20* First-up Sequence F0
F21 First-up Sequence F1
F22 First-up Sequence F2
F23 First-up Sequence F3
F24 Circuit Breaker Indication Sequence *(only fitted as an option when required)*
F25 Change of State Sequence
F26
F27
F28
F29
F30* First-up group A
F31 First-up group B
F32 First-up group C
F33 First-up group D
F34 Relay follow alarm logic
F35 Relay follow input
F36 Disable relay operation on system test
F37
F38
F39
F40* Group Relay 1 enable
F41 Group Relay 2 enable
F42 Group Relay 3 enable
F43 Group Relay 4 enable
F44 Group Relay 5 enable
F45 Group Relay 6 enable
F46 Group Relay 7 enable
F47 Group Relay 8 enable
F48 Inhibit Group 1
F49 Inhibit Group 2
F50 Inhibit Group 3
F51 Inhibit Group 4
F52 Inhibit Group 5
F53 Inhibit Group 6
F54 Inhibit Group 7
F55 Inhibit Group 8
F56* Audible group 1
F57 Audible group 2

F58 Audible group 3
F59 Audible group 4
F60 Delay before alarm 1-199 seconds
F61 Delay before alarm 1-199 minutes
F62 Delay before reset 1-199 seconds
F63 Delay before reset 1-199 minutes
F64 Output Relay Delay 1-199 seconds
F65 Output Relay Delay 1-199 minutes
F66 Discrepancy Window Delay 0.1 - 19.9 seconds
F67
F68
F69
F70 AND Group A
F71 AND Group B
F72 AND Group C
F73 AND Group D
F74 OR Group A
F75 OR Group B
F76 OR Group C
F77 OR Group D
F78 Discrepancy Group A
F79 Discrepancy Group B
F80 Discrepancy Group C
F81 Discrepancy Group D
F82 Multiple Input Reflash A
F83 Multiple Input Reflash B
F84 Multiple Input Reflash C
F85 Multiple Input Reflash D
F86
F87
F88
F89
F90
F91 Group Inhibit Selector
F92 Horn Mask input
F93 "Sleep" selector
F94 First-up Reset/Acknowledge pushbutton
F95 System Test pushbutton
F96 Mute pushbutton
F97* Reset pushbutton
F98* Acknowledge pushbutton
F99* Lamp Test pushbutton

11. Function Descriptions

F0- Contact information
During commissioning it is often useful to have a visual indication of the state of alarm contacts, as these could be situated over a very wide area. The Setup Card status LED's will indicate contact state for the channels on the selected card. If the light is on the contact is closed, if the light is off the contact is open. Note:- This is not related to the alarm state, it is simply an indication of contact state only.

F1- Normally open or normally closed alarm contact
Each alarm input can be configured for N/O or N/C operation. If the alarm input is normally closed and opens to alarm the Setup Card status LED will be on for that channel. If the contact closes for alarm the LED will be off.

F2- Output relay energised or de-energised
This is only relevant if individual repeat relays are fitted to the system. If this function is selected then the relays will be energised as standard and will de-energise on alarm condition (fail-safe).

F3- Auto reset
If it is required to automatically reset all acknowledged alarms as soon as the alarm condition returns to normal then this function should be selected. The Reset pushbutton will not be required when using this function.

F4- No lock-in operation
Alarms will sound and relays will trip only while the alarm contacts are in fault condition. As soon as the fault clears the alarm will reset.

F5- Inhibit Input
It is often necessary to disable an alarm channel, for instance when equipment is shut down for maintenance. Function F5 will completely inhibit any particular alarm channel. This means all functions are disabled, the alarms will not be latched in, the lamps will not be driven, all relay and horn outputs will be disabled and any communications from this channel will cease.

F6- Ringback
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.
Once an alarm has been acknowledged the display will be steady illuminated. After this stage, the contacts returning to normal will cause the display to re-flash. The flash rate is very slow to distinguish from a normal alarm.
After a ringback the display can be reset immediately without a further acknowledge.
Ringback operation may be used with all but non-latched and auto reset sequences. A ringback audible relay is also available to drive a different audible from the alarm audible to inform operators of a fault condition clearing. This is available in the Group Relay Card.

F7- Two Button Operation
With this function selected the reset pushbutton will operate both the acknowledge and the reset functions.

F8- Reflash Single Input

In a standard application an acknowledged alarm will remain steady illuminated until the system is reset. This will remain steady independent of any change in the alarm contact. When the "reflash single input" function is set the particular alarm way will be activated as a new alarm when the alarm contact goes into the alarm state again. For example, a fleeting input will activate an alarm which can then be acknowledged - if the fleeting alarm occurs again before the system is reset then the alarm way will "reflash" as a new alarm.

F9- Silence Interlock

This is a standard option as listed in the ISA publication "Annunciator Sequences and Specifications S18.1 1979". After an alarm has occurred, the horn sounds in the normal way, but it is not possible to acknowledge the alarm until the Silence pushbutton has been pressed. This option can be used with any of the alarm sequences.

F10- Select Drive suitable for LED's

The System 9000 will normally detect for faulty bulbs and flash the status LED on the Active Input Card. If LED's are used instead of incandescent lamps then this fault sensing is not necessary and in these circumstances, this option should be selected to disable the detection circuit.

F12- First-up Reset Interlock.

This is an alternative interlock to that defined in Function F9. This Function is also a standard Option as defined by the ISA standards. This interlock will only allow operation of the First-up Reset Pushbutton after the Acknowledge has been pressed. This function is used to prevent operators inadvertently acknowledging alarms without first noting which was the first-up alarm.
The normal operation of the Acknowledge pushbutton is changed so that all alarms are acknowledged in the conventional way, apart from the first-up alarm, which remains unchanged. The horn is silenced on Acknowledge as normal. After acknowledging, the first-up alarm will still be flashing in the normal way - this can then be Acknowledged by pressing the First-up Reset Pushbutton.
With this function selected the operation of the First-up Reset pushbutton is changed to a First-up Acknowledge. The first-up alarm is not simply changed to a subsequent but also simultaneously acknowledged.
This option can be selected with any sequence.

F13- Input from Serial Communications Port

Alarms can be activated from either volt-free contacts, voltage inputs or from the serial communications port. The standard is from volt-free contacts or voltage input but by selecting this function the Active Input Card will monitor the communications port for alarm state information. This alarm information will need to be transmitted serially using the MODBUS ASCII protocol. See Serial Communications section for further details.

F14- Output to Serial Communications Port

In the same way as the Active Input Card can take information from the communications port, it can also give out alarm information. This is useful if alarm contact or alarm state information is required remotely on a DCS, SCADA or PLC system.
This function has multiple options as listed below, the appropriate option is selected as described on Page 34.

0 The communications output is switched off.

1 The communications will transmit the state of the alarm contact, either 1 (closed) or 0 (open).

2 The communications will transmit the basic alarm state, in exactly the same way the repeat relay would. This method is related to the alarm state of the annunciator not the state of the alarm contact, as the annunciator could have inversions, logical functions, time delays etc then the two will not correspond.

3 The communications will transmit the state of the alarm logic and give further detailed information. As option 2 this is related to the alarm state not the state of the alarm contact. The unit will transmit 4 different alarm states:-
OFF, FIRST-UP ALARM, SUBSEQUENT ALARM, ACKNOWLEDGED ALARM.

F15- Enable line fault monitoring

The System 9000 can be supplied with comprehensive line fault monitoring as an option. Using this function it is possible to enable or disable this feature. Obviously this function is not relevant if the line fault monitoring has not been supplied.

F16 to F19- Group Relay Card Settings

See section on the Group Relay Card configuration on Page 50.

F20- First-up Sequence F0

This is the standard form of first-up indication where the first alarm that occurs will flash at twice the speed of subsequent alarms. The acknowledge pushbutton will reset the first-up alarm when this sequence is selected.

F21- First-up Sequence F1

In this sequence first-up alarms will flash and sound the audible; subsequent alarms will appear in the acknowledged state, hence do not flash and do not sound the audible. The acknowledge pushbutton will also reset the first-up alarm when this sequence is selected.

F22- First-up Sequence F2

This first-up sequence is similar to sequence F1 except that the subsequent alarms do not appear in the acknowledged state. The first-up alarm flashes and sounds the audible as standard, the subsequent alarms will sound the audible but will not flash. The acknowledge pushbutton will also reset the first-up alarm when this sequence is selected.

F23- First-up sequence F3

F3 is a widely used sequence as it is the only sequence where the first-up information is still available after the alarms have been acknowledged. A first-up alarm will flash intermittently and subsequent alarms will be fast flashing. The Acknowledge pushbutton will silence the horn and change all subsequent alarms to steady illumination in the normal way, but the
first-up alarm will change to slow flashing and will not clear. In this way the first-up alarm is still clearly visible as it will be the only alarm way flashing. To clear this first-up alarm it is necessary to press the First-up Reset pushbutton, this pushbutton will simply change the
first-up alarm to a subsequent, whether the process condition has returned to normal or not.

NOTES ON SELECTING SEQUENCES:-
ALL SEQUENCES ARE MUTUALLY EXCLUSIVE, WHEN A SEQUENCE TYPE IS SELECTED IT WILL AUTOMATICALLY CANCEL ANY OTHER SEQUENCES ALREADY SELECTED FOR THAT ALARM CHANNEL.
IF ALL SEQUENCES ARE DE-SELECTED THEN THE ALARM WAY WILL OPERATE AS A STATUS-ONLY DISPLAY, SIMPLY FOLLOWING THE STATE OF THE ALARM CONTACT.
REFER TO THE SECTION "ALARM SEQUENCES" ON PAGE 12 FOR FURTHER INFORMATION

F24- Circuit Breaker Indication sequence
(Only fitted as on option when requested)

This sequence is used to indicate both the state of a circuit breaker and when it changes state. It will also indicate circuit breaker fault conditions. The channels to be selected for this function are always selected in pairs. These pairs are 1&2, 3&4, 5&6 and 7&8. The Setup Card will only allow selection of these pairs when function 24 is selected.
Under normal circumstances, two contacts are taken from the circuit breaker (one normally open and one normally closed) into the two alarm inputs. The visual output will indicate whether the circuit breaker is open or closed.
The diagram below shows the circuit breaker being open. If the circuit breaker then closes, the contacts will change-over (the open will close and the closed will open). When this happens the horn will sound, the "closed" lamp will flash and the "open" lamp will remain steady. This indicates that the circuit breaker is changing to the closed state. When this alarm is acknowledged, the horn will be silenced, the steady lamp will go off and the flashing lamp will go steady. The system now indicates that the circuit breaker is in the "closed" position. There is an inbuilt delay in this sequence of 500ms to allow the circuit breaker to change over from one state to another.

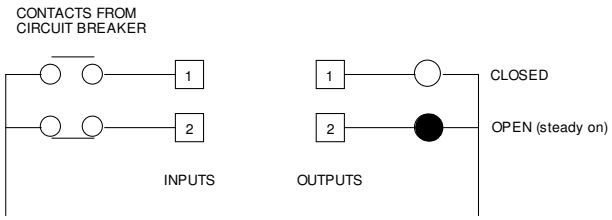


Figure 12

If it is necessary for the inputs to operate in the inverted state, then simply select normally closed inputs rather than normally open using the Function F1. Using this feature it is possible to programme the inputs in any combination.
In fault situations where both inputs are normally open or both inputs normally closed, both lamps will flash and the horn will sound. When acknowledged the two lamps will indicate the true state of the input contacts - both on if the contacts are closed and both off if the contacts are open. This indication will ignore any inversion setup on the inputs using the Function F1.
The reset pushbutton is not used in this sequence.

F25- Change of State Sequence

Where it is necessary to indicate an alarm every time an alarm contact changes state, this function should be turned on. As soon as the alarm contact changes state, the alarm way will flash and the horn sound. On acknowledge, the horn will silence and the visual indication will indicate the state of the contact - on if the contact is closed and off if the contact is open.
If it is required to indicate the inverted state, that is, the light is on if the contact is open and off if the contact is closed, then simply select normally closed inputs instead of normally open using the Function F1.
The reset pushbutton is not used with this function.

F30 to F33- First-up Groups A to D

All alarm ways configured in this group will operate as a single first-up group. Any one alarm occurring in the group will become the first-up and lock out any other first-up alarms. It is possible to be in some, all or none of the First-up Groups A-D.

F34- Relay Follow Alarm Logic

This function is only applicable if the System 9000 is fitted with individual repeat relays on all alarm ways.
With this function selected, the repeat relay will trigger when the alarm is activated and will remain on until the alarm has been acknowledged and reset.
This function is mutually exclusive with Function F35.
The relay operation can be changed from energise to de-energise by using Function F2.

F35- Relay Follow Input

This function is only applicable if the System 9000 is fitted with individual repeat relays on all alarm ways.
With this function selected the repeat relay will simply follow the alarm contacts and be independent of the visual display.
This function is mutually exclusive with Function F34.
The relay operation can be changed from energise to de-energise by using Function F2.

F36- Disable Relay Operation on System Test

The System Test pushbutton, when pressed, will simulate an alarm input on all active ways. This will cause all repeat relays to trip into the alarm state. If it is required to operate a System Test without triggering these repeat relays then this function should be selected.
The three standard relays in the Setup Card will all operate as normal.

F40- Group Relay 1 Enable

The group 1 output relay is the group relay in the Setup Card. All systems without the Group Relay Card will have just this single group relay output. The default settings for a standard system will set all alarm ways to trip this relay. If certain alarm ways do not need to trip this relay then this function should be turned off for those alarm inputs.

F41 to F47- Group Relay 2 to 8 Enable

The additional 7 group relays are only available if the Group Relay Card, P925G, has been supplied. Each alarm way can be configured into any combination of these 8 groups (including Group 1 in the Setup Card). This covers all combinations from, an alarm way triggering no group relays to triggering all group relays. The first alarm in the group will trip the appropriate group relay - this relay will not clear until all alarms in that group have been acknowledged and reset.

F48 to F55- Group Inhibit 1 to 8

When a number of alarm ways need to be inhibited simultaneously the group inhibit facility can be used. This allows up a 8 separate groups to be defined which can be disabled from 8 separate group inhibit inputs.

Any alarm way can be configured into any combination of the 8 Inhibit Groups. All alarms configured into a particular Inhibit Group will be totally inhibited when the corresponding Group Inhibit input is turned on, see Function F91. When inhibited, all functions are disabled, the alarms will not be latched in, the lamps will not be driven, all relay and horn outputs will be disabled and any communications from these channels will cease.

If a group containing some active alarms is inhibited before these alarms are acknowledged and reset then these will remain active until the inhibit is removed. All the pushbutton functions are also inhibited, so no further acknowledgement or resetting is possible.

The 8 Inhibit Groups are totally independent to the configuration of the 8 Group Relays.

F56- Audible Group 1

The audible group A output relay is the horn relay in the Setup Card. The default settings for a standard system will set all alarm ways to trip this horn relay. If certain alarm ways do not need to trip this relay then this function should be turned off for those alarm inputs. (See also F57- Audible Group B).

F57- Audible Group 2

It is often necessary to have two separate horn outputs for critical and non-critical alarms. This function will be used to drive a separate horn relay for the second audible group. On systems with only the Setup Card the standard Group Relay can be configured as a second Horn Relay by simply changing a DIL switch on the Setup Card (See DIL Switch setting Page 58). Audible Groups 1and 2 are not mutually exclusive so it is possible to select any alarm way to be in one, both or neither audible group.

F58 to F59 - Audible Groups 3 and 4

If more than two audible groups are required then the Group Relay Card will be needed. With the Group Relay Card a maximum of 4 audible relays are available. These additional audible groups are programmed in exactly the same way as described above. For details on assigning the audible relays see the section on the Group Relay Card on Page 50

F60- Delay before alarm 1-199 seconds

Each alarm way can have a time delay programmed into the Active Input Card. This function is used to select the time delay between an alarm contact changing state and the alarm logic recognising this as an alarm. This means an alarm contact must be in the alarm state for a certain time before it is registered as an alarm. The delay is adjustable between 1 and 199 seconds in 1 second steps.
To program this feature select the function, card and channel in the normal way and turn on the delay using the UP pushbutton. This will then cause the display to start counting from 1 up to 199 and back round to 1 again. When the required time delay is reached, simply change the function or card to store the data to the EEPROM. To turn a delay off, simply adjust the time delay to 0, this will automatically cancel this function and turn off the status LED to show that it is not selected. If longer delays are required use Function F61, giving 1-199 minutes. These two functions are mutually exclusive, when one is selected the other will be cancelled automatically.

F61- Delay before alarm 1-199 minutes

Where the 1-199 second time delay above is not long enough, this function can be selected. The selection and adjustment is exactly as described above. This delay is mutually exclusive to the 1-199 second delay Function F60.

F62- Delay before reset 1-199 seconds

This is a further programmable time delay that is configured as described in Function F60. This delay is the time between an alarm contact returning to normal and the system being able to be reset, either manually or automatically. This delay is mutually exclusive to the longer delay in Function F63

F63- Delay before reset 1-199 minutes

Where the 1-199 second time delay in Function F62 is not long enough, this function can be selected. The selection and adjustment is exactly as described above. This delay is mutually exclusive to the 1-199 second delay Function F62.

F64- Output Relay Delay 1-199 seconds

This function is only applicable if the System 9000 is fitted with individual repeat relays on all alarm ways.
This is a further programmable time delay that is configured as described in Function F60. This delay is the time between an alarm being triggered and its corresponding repeat relay tripping. This delay is mutually exclusive to the longer delay in Function F65.

F65- Output Relay Delay 1-199 minutes

Where the 1-199 second time delay in Function F64 is not long enough, this function can be selected. The selection and adjustment is exactly as described above. This delay is mutually exclusive to the 1-199 second delay Function F64.

F66- Discrepancy Window Timer 0.1 to 19.9 seconds

When using the discrepancy function as described in Function F78 to F81 it will be necessary to configure a window timer. This delay is the time allowed for the contacts to be in a discrepancy state before an alarm is triggered. The delay is configured as described in Function F60 except that the display changing from 1 to 199 corresponds to a delay of 0.1 to 19.9 seconds.

F70 to F73- Logical AND Function

These functions allow alarm ways to be linked by the logical AND operation, so all inputs linked together will need to be activated before the alarm is triggered. Each Active Input Card can have up to 8 inputs linked and up to four 2-input AND gates per card. Four separate AND groups are available per card labelled A,B,C and D. All inputs that need to be linked are programmed into the same group. For example, if a 4 input AND and two further 2 input ANDs are required then programme alarm ways 1 to 4 into AND group A, alarm ways 5 & 6 into AND Group B and Alarm ways 7 & 8 into AND Group C. Each group will only drive the lowest corresponding output configured in that group. For the above example, group A will drive Output 1, Group B will drive Output 5 and Group C will drive Output 7.

F74 to F77- Logical OR Function

These functions work in exactly the same way as the AND functions described above, except that the inputs are combined with the OR function, so any of the inputs activated within a group will trigger the corresponding alarm way.

F78 to F81- Discrepancy Function

The discrepancy function is programmed in the same way as the above logical functions. The discrepancy function will trigger an alarm when any one input in the group is different to the others. As above, each group will only drive the lowest corresponding output configured in that group.
There is also a programmable window timer associated with this discrepancy function. This window timer is necessary because the discrepancy function is looking for a difference in any of the alarm inputs. If these all change state there will be a point when there is a discrepancy, as the contacts will not changeover in exactly the same time. The Timer F66 allows a window for the contacts to change state. This is described in Function F66.

F82 to F85- Multiple Input Reflash

The multiple input reflash works in the same way as a single input reflash except that up to 8 channels can be grouped together. This function is used when multiple inputs are required to drive a single display window. The alarm inputs are grouped in exactly the same way as the AND function described above and the lowest corresponding output is driven in the same way. The first alarm to occur in a particular group will trigger the output, this can then be acknowledged in the normal way. Any further alarms that occur in the same group will re-trigger or "reflash" the alarm window as a new alarm.

F90- Lamp test with audible pushbutton

When it is necessary to simultaneously test the horn with the lamps this function is used instead of the standard Lamp Test (Function 99). This will simply operate the lamps and horn with no further testing of the circuit function.
If a more thorough test is required then the System Test (Function 95) should be used.
The output related to this input will simply follow the state of the pushbutton.

F91- Group Inhibit Selector

This function is used to enable the 8 Group Inhibit inputs. The Group inhibit function is used to disable a group of alarms by turning on one input, this is useful to disable alarms on a section of plant that is undergoing routine maintenance, such as ships engines, or turbine generators etc. This function is used to allocate a particular input to inhibit a particular group of alarms.

Each alarm way can be allocated to up to eight of these inhibit groups using Functions F48 to F55. To configure the inhibit group selector, select the function, card and channel in the normal way and turn on the group inhibit using the UP pushbutton. This will then cause the display to start counting from 1 up to 8 and back round to 1 again. This number is the Inhibit Group number the input will be set to. When the required number is reached, simply change the function or card to store the data to the EEPROM. To turn a group inhibit off simply adjust the number to 0, this will automatically cancel this function and turn off the status LED to show this is not selected.

F92- Horn Mask input

In some circumstances it is necessary to mask the horn drive during a particular time period. This function is used for this purpose and is different from simply disconnecting the horn in that the alarm ways will not actually trigger the Horn Relay at all. Any alarms that occur when this input is ON will be masked from driving the horn. All alarms will be displayed and react as normal in all other aspects, the only difference being that the Horn Relay will not be activated. Any alarm that occurs after this input has returned to normal will drive the Horn Relay in the normal way.
This function can be used with the Time Delay Function F62 so that a single pushbutton press can mask the horn on all alarms for a fixed time period.

F93- "Sleep" Input

In applications where the alarm equipment is temporarily un-manned, this function can be extremely useful. When this input is switched ON all the lamp drivers and the HORN relay are disabled, hence no alarms will be indicated. The alarms are still latched in and maintained in the normal way so when the equipment is returned to the normal mode all the alarms, complete with first-up information, will be displayed. When in "Sleep" mode all repeat relays, group relays and serial communications will operate as normal.

F94- First-up Reset/Acknowledge pushbutton

In the normal mode this pushbutton will simply change the first-up alarm to a subsequent alarm. If multiple first-up groups are being used this pushbutton will change all first-up alarms to subsequent alarms. When the First-up Reset Interlock Option is selected (F12) this pushbutton will simultaneously acknowledge and reset the first-up alarm(s). The output related to this input will simply follow the state of the pushbutton.

F95- System Test pushbutton

This pushbutton will simulate an alarm on all inputs, so all displays will flash, all relays will trip and all audibles will sound. The first-up will be randomly allocated. This test is cleared by pressing the Acknowledge and Reset pushbuttons.

F96- Silence pushbutton

This will silence the horn by switching the horn relay off - it does not effect the visual display. The output related to this input will simply follow the state of the pushbutton.

F97- Reset pushbutton

This will reset all visual indication if the alarm contact has returned to normal. The output related to this input will simply follow the state of the pushbutton.

F98- Acknowledge pushbutton

Exact operation is dependent on the sequence selected but generally this will silence the horn and change flashing display to steady. The output related to this input will simply follow the state of the pushbutton.

F99 Lamp Test pushbutton

The Lamp Test function will simply operate the lamps without any further testing of the circuit function. If a more thorough test is required then the System Test (Function F95) should be used.
The output related to this input will simply follow the state of the pushbutton.

Note:- All the functions that are used to program pushbuttons can also have time delays included. These are programmed in the normal way using Functions 60-63.

12. Common ISA Sequences

GENERAL

The standard systems are supplied with a default configuration set as a standard annunciator with a single horn relay, a single group relay, a single first-up group with the first-up indicated by a faster flashing display and three pushbuttons for Lamp Test, Accept and Reset.

Using the various programmable functions it is possible to program the system for a vast range of different alarm sequences and operations. The following are some of the more commonly used alarm sequences together with the Function numbers that need to be set.
All other functions numbers not listed should be OFF.
The following assumes that a single group relay, a single horn relay, and a single first-up group is required for all alarms in the system.

AUTO RESET

Sequence A (Auto reset, no first-up)
F3, F20, F40, F56, F98, F99

Sequence A-4 (Auto reset, no first-up, no lock-in)
F3, F4, F20, F40, F56, F98, F99

Sequence A-5 (Auto reset, no first-up, no flashing)
F3, F22, F40, F56, F98, F99

Sequence A-4-5 (Auto reset, no first-up, no lock-in, no flashing)
F3, F4, F22, F40, F56, F98, F99

Sequence A-1-2 (Auto reset, no first-up, silence pushbutton, silence interlock)
F3, F9, F20, F40, F56, F96, F98, F99

MANUAL RESET

Sequence M (Manual reset, no first-up)
F20, F40, F56, F97, F98, F99

Sequence M-1-2 (Manual reset, no first-up, silence pushbutton, silence interlock)
F9, F20, F40, F56, F96, F97, F98, F99

Sequence M (Manual reset, no first-up, no flashing)
F22, F40, F56, F97, F98, F99

RINGBACK

Sequence R (Ringback, no first-up)
F6, F20, F40, F56, F97, F98, F99
(A separate ringback audible is only available if a Group Relay Card is supplied)

Sequence R-1-2 (Ringback, no first-up, silence pushbutton, silence interlock)
F6, F9, F20, F40, F56, F96, F97, F98, F99

FIRST-UP (AUTO RESET)

Sequence F3A (First-up sequence F3, auto reset)
F3, F23, F30, F40, F56, F98, F99

Sequence F3A-3 (First-up sequence F3, auto reset, first-up reset interlock)
F3, F12, F23, F30, F40, F56, F98, F99

Sequence F3A-1-2-3 (First-up sequence F3, auto reset, silence pushbutton, silence interlock, first-up reset interlock)
F3, F9, F12, F23, F30, F40, F56, F96, F98, F99

FIRST-UP (MANUAL RESET)

Sequence F3M-3 (First-up sequence F3, manual reset, first-up reset interlock)
F12, F23, F30, F40, F56, F97, F98, F99

Sequence F3M-1-2 (First-up sequence F3, manual reset, silence pushbutton, silence interlock)
F9, F23, F30, F40, F56, F96, F97, F98, F99

Sequence F1M (First-up sequence F1, manual reset)
F21, F30, F40, F56, F97, F98, F99

Sequence F2M-1 (First-up sequence F2, manual reset, silence pushbutton)
F22, F30, F40, F56, F96, F97, F98, F99

13. Line Fault Monitoring

Description

The Line Fault Monitoring Board is a piggy back board that sits on the standard Active Input Board. This board will continuously monitor the alarm contact field wiring for both open and short circuit faults. The monitoring circuit is sufficiently sensitive to detect high resistance faults as well as complete open circuits.

When a fault is detected the status LED on the relevant Active Input Card will fast flash and the Line Fault Relay will trip (if fitted). The Line Fault Relay is a special function relay which is programmed within the Group Relay Card, see following section.

Specification

As the system's primary function is to monitor the alarm status of the plant the fault monitoring is undertaken as a secondary procedure. Because of this, in very large systems the time taken to detect a fault could be up to 16 seconds.

When a fault occurs the status LED will fast flash but there is no indication of the type of fault, short or open circuit.

The open circuit system will indicate a fault when the resistance of the contact wiring goes over 1kW and the short circuit system will detect at short circuit fault when the parallel resistance between the input and +VC drops to 200kohm.

Functions

Only one Function is required to operate the line fault monitoring option. This is Function F15 which simply enables or disables the feature.
When a fault has been detected the fast flashing LED will indicate the board with the faulty wiring it is then possible to check further for the exact channel at fault; by selecting Function F0 which monitors the status of alarm contacts (open or closed) for the faulty card the channel with the fault, being neither open or closed, will flash to indicate an indeterminate state.
From this point it will be a simple procedure to check for an open or short circuit.

14. Group Relay Card

Description

The Group Relay Card is a 10E wide module which is used to provide an additional 8 programmable relays. All systems are supplied as standard with three relays in the Setup Card for Watchdog, Horn and Group. If these are insufficient to meet the operational requirements then a Group Relay Card will be required. A maximum of two Group Relay Cards can be fitted per system.

Each of the eight relays on the Group Relay Card can be programmed for a variety of different functions to suit the applications. Each relay can be programmed to operate as a normal group relay, group relay with reflash, audible relay or special function relay.

Functions

The eight relays can all be programmed to function differently, as required, but these are limited to a maximum of 8 different group relays, 4 audible relays and 4 special function relays.
With the 3 relays in the Setup Card there is a total of 11 output relays with the addition of just one Group Relay Card.
These relays are programmed using Functions 16-19, no other Functions are valid for the Group Relay Card.
Referring to the 3 relays in the Setup Card, the watchdog relay is fixed and is not programmable, the Audible relay in the Setup Card always defaults to Audible Group 1 and the group relay in the Setup Card will either default to Group 1 or, if configured as an audible using the DIL switch, will default to Audible Group 2.

F16- Selection of standard group relays

Each of the 8 relays on this Card can be configured as one of the 8 group relays. Using exactly the same programming methods described on Pages 31-34, select the function number, the card and the channel that needs programming and then, using the UP and DOWN pushbuttons select the group number required. The display will change from 1 to 8 representing the 8 group relays. When 0 is selected the function is turned off. The number refers to the Group relay number that the relay will be assigned to. For example, if you require the 3rd relay to be Group Relay 6 select channel 3 and program as number 6.

F17- Selection of group relays with reflash

With a relay selected with this function the reflash facility is enabled. This means that the first alarm that occurs in a particular group will trigger the appropriate group relay and any subsequent alarm that occurs in the same group will cause the relay to dropout for 0.5 second. The relay reflash can be used with external monitoring equipment to show every occurrence of a new alarm in a group without the necessity of the original fault being acknowledged or reset.

F18- Selection of audible relays

These are programmed in exactly the same way as the group relays except that there is a maximum of 4 audible groups so the display will only change from 1 to 4. Again selecting 0 will turn the function off.

F19- Selection of special function relays

Four special function relays are available, ringback audible, bulb fault, line fault and communications fault. These are programmed as described above, selecting the following number for the different functions:-

1 Ringback Audible
2 Bulb Fault
3 Line Fault
4 Communications Fault

The ringback option can be selected using Function F6. This will inform the operator that an alarm way has returned to normal by flashing at a particular rate. Using the ringback audible relay this indication can be combined with an audible tone different to the standard alarm audible tone.

The bulb fault relay will trigger when any alarm way is unable to illuminate its alarm window either due to both bulbs being open-circuit or one short-circuit.

The line fault relay is only available if the line fault option has been supplied. With line fault monitoring all the cables to the alarm contacts are monitored to ensure the resistance does not go above or below specified limits. If the cable resistance goes out of spec then this line fault relay is triggered and the status LED on the Active Input Card with the line fault will be fast flashing.

The communications fault relay is used when the external communications facility is supplied. This relay will trigger when a normal communications time-out has occurred and the system has been unable to regain communications. Generally a communications fault will trip the standard Watchdog relay in the Setup Card but when this function is selected on the Group Relay Card it is automatically disabled on the Setup Card.

15. Serial Communications

Introduction
The System 9000 Alarm Annunciator can be supplied with serial communications to interface to PLC's, DCS systems, industrial computers, SCADA packages etc. The annunciator output is RS485 compatible. As standard the annunciator acts as a 'slave' device and can only respond to commands from a 'master' device.
The ASCII Modbus protocol is used for data interchange as explained in the following paragraphs. Up to 199 Active Input Cards can be connected together on a single RS485 multidrop loop and can be supplied complete with comprehensive alarm monitoring and logging software.

No Master Communications
Each Active Input Card has its own communications facility which can be accessed using the Interface Card P925X. This card has a D type connector which is used to connect to the external communications. The Interface Card will connect to the System 9000 internal bus system to gain communications from each card. Because each card has its own communications functions a card fault will only result in the loss of communications to 8 alarm ways, i.e. one card.

Configuration
The Baud rate and Parity are selected by changing DIL switch settings in the Setup Card as described on Page 59.

Address Selection
Each Active Input Card is addressed individually on the serial link so has to have an individual address. This address is preset using the 8 way DIL switch as shown on Page 58. The same address that is used for the internal communications is used by the external communications.

Character Format
7 data, 1 start, 1 stop, 1 parity

Message Format
In accordance with the standard ASCII Modbus protocol all data exchange is assumed to start with a colon and end with Longitudinal Redundancy Check (LRC), Carriage Return and Line Feed.

Fault Indication
If communications cannot be established within a specified time-out period then the watchdog relay will trip and the display will toggle at one second intervals between 'con' and 'x' where 'x' is the card that communications has failed on. This indicates there is a connection fault. Because the system continually attempts to regain communications it will self recover as soon as communications is re-established.

Modbus Communications

Full details on how to use Modbus ASCII protocol are not given within this manual as they are well covered by more specialised manuals. A brief overview of the main features are shown below.

Modbus Function Codes
The function code field tells the addressed 'slaves' what function to perform. The only relevant function codes are as follows:-

03	Read Register	This reads 16 bit data registers containing alarm information
06	Write Register	Writes data to 16 bit register. This data request can be used as an alternative alarm input source.

Error Check

The error check is an LRC (longitudinal redundancy check). This is an 8-bit binary number represented and transmitted as two ASCII hexadecimal characters. The check is produced by converting the hexadecimal to binary, adding the binary characters without wraparound carry, and two's complementing the result. At the receiving end the LRC is recalculated and compared with the sent LRC. The colon, CR, LF and any embedded non-ASCII characters are ignored in calculating the LRC.

Software

RTK Instruments can supply comprehensive monitoring software for use with the System 9000 Alarm Annunciator. This can be configured as an alarm/event management system with user generated custom displays to monitor plant wide system operation. It is also capable of monitoring analogue inputs to give an inexpensive SCADA system complete with animated colour graphic displays and real-time and historic trending.

OUTPUT TO SERIAL COMMUNICATIONS PORT

Read Request

The following table shows the standard message format for a read request where the master device is interrogating the System 9000 for its alarm status information. Each Input Board is addressed individually so the Modbus address is the same as the board address which is set on DIL Switches on the Active Input Board (See Page 58)
Please note:- On the following examples the X refers to 4 bits of data

	ADDRESS	FUNCTION	REGISTER START	NUMBER OF REGISTERS			
COLON	XX	03	0000	0001	LRC	CR	LF

Read Response

The System 9000 will respond by transmitting the following message format.

	ADDRESS	FUNCTION	NUMBER OF REGISTERS	DATA			
COLON	XX	03	01	XXXX	LRC	CR	LF

The DATA field will give the information on alarm status for each of the eight alarm ways on the addressed board. The following table indicates which bits relates to which alarm way. The two bits, shown below as the low and high bit, are used to give different information on each alarm way as explained below.

low bit	high bit	
0	8	allocated to channel 1
1	9	allocated to channel 2
2	10	allocated to channel 3
3	11	allocated to channel 4
4	12	allocated to channel 5
5	13	allocated to channel 6
6	14	allocated to channel 7
7	15	allocated to channel 8

The DATA information transmitted will depend on how the System 9000 is configured. Refer to the section on Function Numbers for full details on programming the different functions. Function F14 refers to the serial communications outputs and has four different options as listed below. The function numbers can be programmed on a per channel basis including the different modes for each function.

F14 set to 0

In this mode the communication is switched off an invalid response will be transmitted.

F14 set to 1

This is the most basic setting where the System 9000 transmits the state of the alarm contact only. This information is transmitted using the high bit, the low bit is not used.
This bit will be 1 when the alarm contact is closed and 0 when it is open.

F14 set to 2

This is transmitted using the same high bit as above but it will refer to the alarm state of the annunciator. This will be a 1 when the annunciator is in alarm and changed to 0 only when the alarm way is cleared and reset.

F14 set to 3

In this mode both the low and the high bit are used to transmit additional information relating to the alarm way. The following table shows the data transmitted and the bits used. As can be seen the data now includes information on first-up alarms and whether they are acknowledged or not.

	High bit	**Low bit**
Alarm off	0	0
Subsequent alarm on	1	0
Alarm acknowledged	0	1
First up alarm on	1	1

INPUT FROM SERIAL COMMUNICATIONS

Write Request

As well as transmitting alarm information from the System 9000 Annunciator it is also possible to receive information into the annunciator to trigger inputs or to operate control functions remotely from the DCS or PLC system. The message content is slightly different but the message format is exactly the same as the read request format as detailed on the table below.

	ADDRESS	FUNCTION	REGISTER ADDRESS	DATA			
COLON	XX	06	0000	XXXX	LRC	CR	LF

The DATA transmitted to the System 9000 will be the actual state required for the different channels on the addressed alarm card. The data information should be 16 bits with only the bottom 8 bits used, as shown below

Bit	
0	Allocated to channel 1
1	Allocated to channel 2
2	Allocated to channel 3
3	Allocated to channel 4
4	Allocated to channel 5
5	Allocated to channel 6
6	Allocated to channel 7
7	Allocated to channel 8

In the same way as the serial communications output is enabled using the Function numbers the input will also need to be enabled. As standard, the annunciator inputs are activated from volt-free contacts or voltage inputs, if the input information needs to be received from the serial communications port then Function F13 should be turned on. As with all function numbers these can be programmed on a per channel basis.

After a write request is received from the DCS or PLC system the System 9000 will make the required changes to the specified inputs and return a write response message which will be in the same format as the write request.

16. Multiplexed Systems

Introduction

Using the MODBUS communications it is possible to configure the standard System 9000 Annunciator as a multiplexer so a remote unit can take in the alarm contacts, this alarm information is then transmitted via the RS485 communications to a local unit that will then display the alarm information on a standard display fascia.
The two systems can communicate in both directions so alarm contact information can be received at the local annunciator and transmitted to the remote unit.

Setting up

In order to operate in this mode both System 9000 racks must be configured with the same addresses for all their cards and the baud rate set at 9600. Each card in the remote system will only communicate to the corresponding card in the local system and vice versa. The only difference between the two racks will be, on the remote annunciator that gathers the alarm information, DIL switch SW2-4 is switched ON. This simple change enables the two systems to operate as "remote" and "local" systems. (See the section DIL Switch and Link setting)

When the DIL switches are set it is then necessary to configure all the channels to receive or transmit on the serial communications. For full details see information on Functions F13 and F14

Fault indication

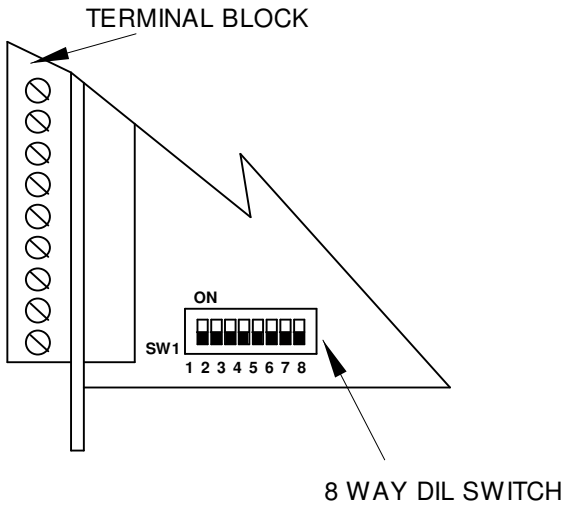
If a communications fault occurs when two systems are configured in this mode then the displays in both units will toggle at one second intervals between "con" and "x" where "x" is the card number that communications has failed on. The watchdog relay in both systems will also trip.
Because the system continually attempts to regain communications it will self-recover as soon as communications is re-established.
If a card goes faulty then the system with the faulty card will display "flt" and "x" where "x" is the card number. The corresponding unit will display the standard communications fault "con" as it will be unable to communicate with its corresponding card.

17. DIL Switch and Link Settings

ACTIVE INPUT CARD (P925A)

Address setting

On the Active Input Card there is only one 8 way DIL switch as shown below.
This switch is used to select the card address. Systems will be supplied pre-configured with the card address preset. The numbering will start on Card 1 at the left hand position of the first rack and going up to a maximum of card 199. The required card number will need to be converted to a binary number to give the DIL switch settings. For example, if the card needs to be set to card 38. The binary number for 38 is 100110 so the DIL switch should be set to match this number with the least significant digit on S1 and the most significant digit on S8. Switch ON for 1 and OFF for 0.



DIL Switch on the Active Input Card (Figure 13)

SETUP CARD (P925S)

Operator Lockout

To prevent unauthorised alteration of the system setup, a DIL switch is used to disable all control functions on the Setup card. If configuration changes need to be made then simply withdraw the Setup Card and switch S1 on the DIL switch marked SW1 to the ON position. This position is marked SET (See diagram opposite).

Second Audible relay

On systems without a Group Relay Card that require two horn relays it is possible to re-configure the Group Relay in the Setup Card as a second Horn Relay. This is done by changing switch S2 on the DIL switch SW1 to the ON position. This position is marked HN2 (See diagram opposite).

Parity for serial communications

SW2 is used to configure certain aspects of the serial communications.
To select odd parity switch S3 on DIL switch SW2 to the ON position. If this switch is set to the OFF position the parity will be EVEN.

Baud Rate

This again relates to the external serial communications, refer to the following table to select the required Baud rate using S1 and S2 on DIL switch SW2.

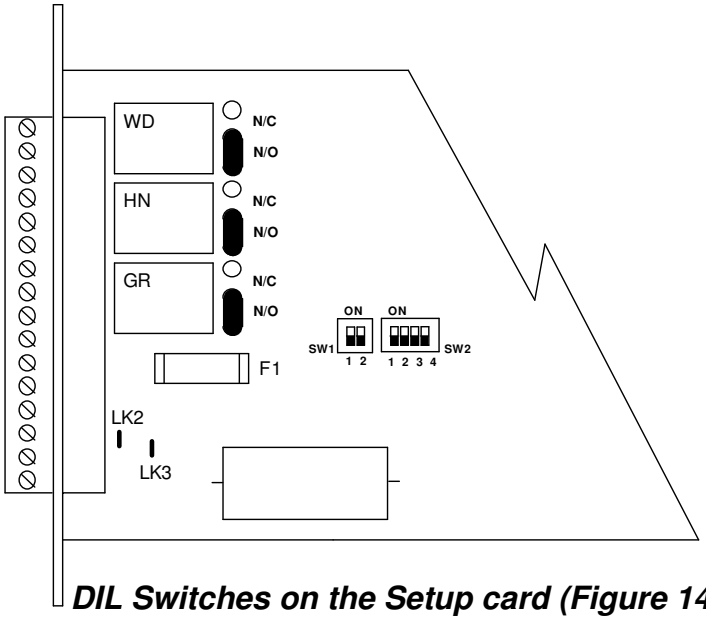
S1	S2	Baud Rate
OFF	OFF	9600
ON	OFF	4800
OFF	ON	2400
ON	ON	1200

Multiplexed Systems

Where two systems are configured to operate as a multiplexed pair as described in the previous section the switch SW2-4 on the remote system should be switched ON.

Isolated wetting voltage

Where it is necessary to power the lamps and control circuitry from a different supply to the alarm contacts then the system should be wired as described previously and as shown on Page 23. As standard, all systems are supplied with the two supplies +V and +VC connected together internally so it will be necessary to snip two wire links LK2 and LK3. These are shown on the diagram below.



DIL Switches on the Setup card (Figure 14)

Relay state

The three relays in the Setup Card are supplied with the Normally Open contact connected to the terminals. This can easily be changed by moving the links LK4-LK6 from the N/O position to the N/C position. This will then select a Normally Closed contact. (See diagram above)

POWER INPUT CARD (P925P)

Isolated wetting voltage

On multiple rack systems the Power Input Card will be required to connect and filter the power supply to the rear motherboard.

Where it is necessary to power the lamps and control circuitry from a different supply to the alarm contacts then the system should be wired as described previously and as shown on Page 23. As standard, all systems are supplied with the two supplies +V and +VC connected together internally so it will be necessary to snip two wire links LK2 and LK3. These are exactly the same as the two links in the Setup Card illustrated in the figure above.

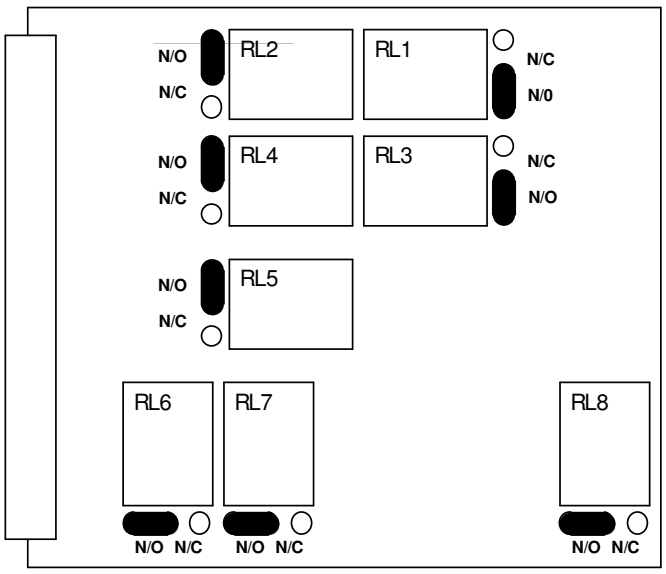
REPEAT RELAY AND GROUP CARD (P925R)

Change from normally open to normally closed contacts

Each relay output on the repeat relay card have two terminals associated with it. The relay itself has a changeover contact available, so by simply moving a jumper link it is possible to change the output from normally open to normally closed.
The relay positions are as shown below, these are also shown on the PCB legend. Each relay has an adjacent link which is marked N/O and N/C. Simply move the link to the required position.

NOTE:- THE N/O AND N/C REFERS TO THE RELAY CONTACTS IN THE DE-ENERGISED STATE, THE DE-ENERGISED STATE IS NOT NECESSARILY THE NON-ALARM STATE.

As standard the System 9000 Annunciator will be supplied in the fail-safe mode. This is where the relay will be normally energised and will de-energise on fault. The contacts are in the normally open position, so because the relay is energised these contacts will be closed and will open on fault.



Jumper links on the Relay Card (Figure 15)

18. Fault Finding

Find Function

The "find" function is operated by pressing the UP and the DOWN pushbuttons on the Setup Card simultaneously. This will search the complete annunciator system for all alarm cards from address 0 to address 199. This is useful if cards have been removed or changed or the display is showing a fault indication. During the find routine, which will take up to 6 seconds, the display will show "fnd"

Fault display

If a card is removed, fails or loses its power then the 3 digit display on the Setup Card will flash a message to indicate this problem. The message will alternate between "flt" and the card number that is faulty. The watchdog relay will also trip and remain tripped until the fault is rectified.

Faulty Card

If the Setup Card is showing a faulty card as described above then ensure the following checks are made:-

- Check all cards have the correct address set using the 8 way DIL switch as described on Page 58
- Check also that all cards have different addresses and that they are all within the range 0 to 199
- Repeat the "find" routine - if this still does not clear the error message then return the suspect board to RTK Instruments Service Dept for repair or replacement.

Status LED is flashing

The status LED on each Active Input Card should normally be steady on when the system is in run mode. If this LED is flashing slow then there is a bulb fault related to this card - check all bulbs or LED's. If the status LED is flashing fast intermittent then the system is still in CAL mode, return to RUN mode as described on Page 30-31. If the LED is fast flashing then there is a fault in the external alarm contact wiring, this is only relevant if the Line Fault Monitoring option has been supplied.

Communications Fault

If communications cannot be established within a specified time-out period then the watchdog relay will trip and the display will toggle at one second intervals between 'con' and 'x' where 'x' is the card that communications has failed on. This indicates there is a connection fault. Because the system continually attempts to regain communications it will self recover as soon as communications is re-established.

Group Relay Fault

If it appears that a group relay is not operating correctly first check that all inputs that are assigned to that group are not in the alarm state and all these alarms are acknowledged and reset. Ensure that all unused channels are also checked, care must be taken with unused channels as there will be no display to check if they are in the alarm state or not.

19. Other RTK Products

RTK Instruments Ltd is fully ISO9001:2000 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