

***Ditech Control Card Manual***

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***DI-947 Fire Suppression Card***

*File reference: DI-947*

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## 1. GENERAL

The DI-947 extinguishant release control card is used as the electrical control centre for fire suppression sub-systems. It has the ability to integrate automatic and manual requests for release of up to two 100% capacity banks of suppression agent, one being used as a 100% backup of the other. The release would be performed by release solenoids that are fully monitored for field and operational faults. An input for a release manifold pressure switch provides positive feedback to confirm that the release has started. The control card provides independent timing facilities for each of its two solenoid drive channels so that flexibility can be ensured for almost all applications. These facilities, together with detailed front panel displays giving the user a snapshot overview of the current state of the release system, allow for a fully customisable initiation system for fire suppression agents. Naturally, this card integrates seamlessly with the other control cards within the Ditech range allowing for a completely integrated systems solution package to be designed.

Pre-discharge alarms will warn of imminent release of extinguishant although the control card is also compatible with suitable safety interlocks, such as door switches, which will inhibit the release of the agent until such time as the system deems it to be safe to do so.

Logic input signals to the card are of the active low type and inputs must be pulled down to 0 V to signal a true condition. Outputs are also active low capable of sinking up to 500 mA.

## 2. CARD INPUTS AND OUTPUTS

| DI-947 EXTINGUISHANT RELEASE CARD |                   |                |                        |    |        |
|-----------------------------------|-------------------|----------------|------------------------|----|--------|
| 2B                                | LAMP TEST         |                |                        |    |        |
| 8B                                | 1                 | INHIBIT        | SOLENOID<br>DRIVE      | A  | 3B/4A  |
| 9B                                |                   | SIGNAL         |                        |    | 5A/6A  |
| 5B                                | 2                 | INHIBIT        |                        | B  | 1A/B   |
| 10B                               |                   | SIGNAL         |                        |    | 2/3A   |
| 6B                                | INHIBITED         |                | TIMER COMPLETE O/P     |    | 14B    |
| 25A/B                             | I/P               | MANUAL RELEASE | DOOR SW. I/P           | 1  | 7B     |
| 27B                               | O/P               |                | 2                      | 4B |        |
| 29B                               | MAN. PRE. SW. O/P |                | RELEASE INSTRUCTED O/P |    | 13B    |
| 32B                               | CONFIRMED PULSE   |                | RELEASE CONFIRMED I/P  |    | 22B    |
| 21B                               | I/P               | C/O SIGNAL     | PNEUMATIC P.S. I/P     |    | 23B    |
| 30B                               | O/P               |                | RELEASE CONFIRMED O/P  |    | 31B    |
| 26B                               | COM               | FAULT          | 24V DC I/P             |    | 20A/B  |
| 28B                               | N/C               |                | OV I/P                 |    | 24A/B  |
|                                   |                   |                |                        |    | 31/32A |

The sections below list out the primary and secondary inputs and outputs to this card. Some of them are affected by the link settings on the card. Refer to the section on link settings for details on how the functions listed below may be affected.

### 2.1 PRIMARY INPUTS

The primary inputs to the control card are those which are directly associated with the control of the solenoid outputs attached to the banks of extinguishant.

#### **Auto Signal 1 and 2**

When this logic signal is activated then the release sequence will start, assuming no overrides or inhibits are in place (see later). The release instructed output will become active giving a logic signal appropriate to trigger a pre-release sounder and/or warning beacon and the *Auto Signal* LED will illuminate on the front panel. After the preset time delay has expired then the selected solenoid drive will energise. This will be determined by the state of the change over input.

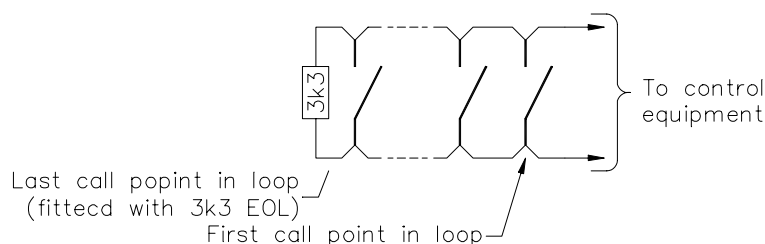
Auto signal 2 performs exactly the same functions only that it is used as a backup circuit and does not illuminate the LED on the front panel.

### **Auto Inhibit 1 and 2**

An active logic level on this input will disable all timing and subsequent functions of the associated *Auto Signal* inputs. Where appropriate the *Auto Signal* LED will still illuminate on the front panel to show that the input is active but there will be a yellow inhibit LED below it to show that the functions have been masked.

### **Manual Release Input**

This is a monitored input that can be connected directly to an item of field equipment. The last field unit must be fitted with a 3.3 k $\Omega$  end of line resistor in order to allow the open circuit fault monitoring to operate correctly, and must be connected up in the following way:

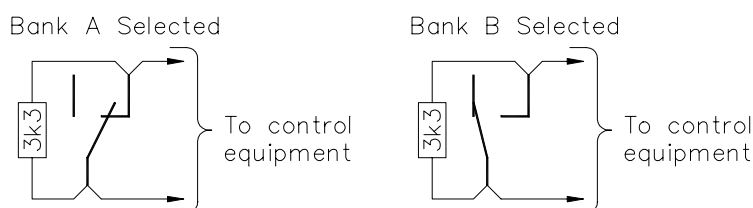


Optionally the manual release input may be delayed in the same way that the automatic release is, but typically link 19 (solenoid 1) and link 20 (solenoid 2) would be fitted allowing the timer to be bypassed and an immediate release to be effected.

By default the manual release input will operate the solenoid for the secondary bank of fire suppression agent, based upon which ever bank, A or B, is currently being used as the primary as defined by the state of the change over input.

### **Change Over Signal**

When the control card is being used on a dual redundant configuration with two banks of fire suppression agent there is a choice which needs to be made as to which would be the default bank to be released. The change over input is a monitored input which connects to a change over switch which may be mounted in the field but, more typically, is located on the control panel. The connection is as follows:



The principal of operation is that when the main bank of fire suppression agent is spent (assuming that the second bank was not required) then the change over switch can be operated so that the next time that automatic release is required then the reserve bank can be used.

**NOTE:** In dual redundant systems it is imperative that a used bank of fire suppression agent is recharged as soon as is practical. The change over switch should only be used to increase system reliability in the time that only one bank of fire suppression agent is available or for system maintenance.

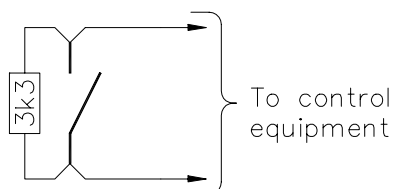
The solenoid output currently selected as the primary, A or B, is reflected in the state of the green LED indicator on the front of the control card.

### **Door Switch Input 1 and 2**

These two separate inputs are used for connection to exit doors on the room being protected by the fire suppression system, if appropriate. They are non-monitored normally closed inputs such that if the input is left open circuit then the appropriate release input, 1 or 2, will be inhibited.

### **Release Confirmed Input**

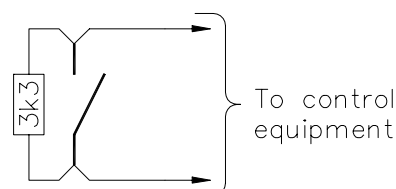
This is a monitored input connected to the pressure switch usually located within the common manifold of the distribution pipe work for the fire suppression agent. The connections details are as shown:



When the control card receives the signal from the field then the *Release Confirmed* LED is illuminated in the front of the control card and the release confirmed output is activated. This may be used as a feedback signal to the rest of the control system to initiate shutdown outputs when it has not actually been the control system which initiated the release.

### **Pneumatic Pressure Switch Input**

There are a number of ways by which the fire suppression system may be initiated. One of these is via a pneumatic line running around the area to be detected. This line will be set up such that a change in pressure, either caused by fire heating the air within the tube or melting it, will cause a pressure switch to operate. Whereas this input will not cause the fire suppression system to activate, there will be a corresponding LED illuminated on the front of the control card and the subsequent output may be used to feed back into the card if a release signal is required. The field input signal should be connected to the card in the following way:



## **2.2 SECONDARY INPUTS**

### **External Lamp Test**

When this input is pulled low (0 V) it forces all front panel indicators on, thus allowing the condition of the LEDs to be confirmed.

## **2.3 PRIMARY OUTPUTS**

### **Solenoid Drive A and B**

These are line monitored 24 V dc outputs suitable for direct connection to solenoid drives. The solenoids may have a resistance anywhere between 40 Ω and 140 Ω, corresponding to a range between 4 Watts and 14.4 Watts at 24 V dc. Open or short circuit field cable fault conditions are reflected by a yellow fault under the corresponding green A or B LED on the front panel of the control card.

Upon initiation of a release sequence a timer is started. Once the timer has completed then the selected solenoid drive output will be activated for approximately 1-2 seconds. The timer will reset and start timing again, operating the solenoids for a further 1-2 seconds after it times out again. This repeats until the release sequence is stopped, either by removing the initiation signals or by

inhibiting them. When the inhibit is removed, or the release signals re-established, the timing sequence is reset and starts again.

The change over switch has a direct effect on which solenoid drive becomes active. If bank A is selected then solenoid A will be energised by the automatic signal and solenoid B will be energised by the manual signal. Conversely, if bank B is selected then the automatic signal will trigger bank B and the manual signal will trigger bank A.

#### ***Release Instructed***

When the *Auto Signal* input is activated then the *Release Instructed* output is activated immediately. This may be used as a logic signal to initiate pre-discharge sounders and/or beacons.

#### ***Release Confirmed***

Upon confirmation being received of a release of the fire suppression agent then this output goes active. It may be used as a logic signal to start shutdown sequences in the event that the release has been initiated manually in the field directly at the fire suppression cylinders, and hence the control system would be otherwise unaware of the release.

## **2.4 SECONDARY OUTPUTS**

#### ***Auto Inhibited***

When either of the automatic initiation inputs are being inhibited then there is an inhibit LED which illuminates. In addition to this there is an output which activates for as long as the inhibit input is active.

#### ***Manual Release Output***

When an electronic manual release signal is being received by the card this manual release output is also active.

#### ***Pneumatic Pressure Switch***

As described earlier, this output is active only when the pneumatic pressure switch input is active and is not in fault.

#### ***Confirmed Pulse***

Upon confirmation of a fire suppression agent release the *Release Confirmed* output is activated and also the *Confirmed Pulse* output. This signal is used internally to the Ditech control system to initiate the panel alarm.

#### ***Change Over Signal***

This output reflects the current status of the primary or secondary release bank selection. If bank A has been selected then this output is active. If bank B has been selected then this output is inactive. It may be used as a control signal when dealing with change over requests when there are two change over switches rather than just one.

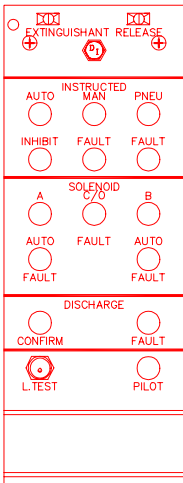
#### ***Fault Relay***

The fault relay is normally energised and will de-energise on failure of card power input, onboard regulator or if any of the monitored inputs or outputs detect a fault. The fault output is most commonly used in conjunction with the system fault loop which gives a common indication of the operational state of the complete system.

#### ***Timer Complete***

During the automatic release from input 1 and, depending on certain link settings, manual release requests timer 1 is started. When timer finishes counting then this logic signal goes active for 1-2 seconds and the timer restarts. The sequence repeats until the initiation signals are removed or inhibited.

## 2.5 FRONT PANEL INDICATORS



There are 14 indicators on the front panel. The large green pilot LED indicates that the card power is within tolerance, that the power regulation components are functioning correctly and that there are no faults detected by the card. The large yellow LEDs will illuminate whenever either faults or inhibits are active.

The red *Auto* LED will illuminate when an automatic release of fire suppression agent has been requested. Its corresponding yellow *Inhibit* LED below it will illuminate when an inhibit signal is in effect.

The red *Manual* Led will illuminate when a manual release signal is received and the yellow fault LED will illuminate if a fault is detected on that line. The pneumatic input is essentially the same.

The two green LEDs, *A* and *B* indicate which bank of fire suppression agent has been selected as being the primary. Below each of them is a yellow LED which will illuminate when a fault is detected on the corresponding field cables. The change over switch also has a fault indicator associated with it and this will illuminate when a fault is detected.

The red discharge confirmed LED will illuminate when the pressure switch input is active and the yellow fault LED next to it will illuminate if a fault is detected on that line.

## 2.6 FRONT PANEL CONTROLS

The only front panel control is the lamp test button which illuminates the front panel LEDs to confirm their operation when depressed.

### 3. OPERATION

The operation of the card is generated almost entirely by combination logic. Summarised, this distils down starting a timer when either a manual or an automatic initiation request has been received, and the automatic initiation has not been inhibited. Upon completion of the timer the appropriate solenoid output will energise.

This sequence is broadly controlled and tuned by a number of link settings, the majority of which relate to the timing functions on the card. A list of all the link options for the card are shown below:

#### **Links 11-18: Auto 1 Timing Functions**

Fit the link corresponding to the time delay required for the main automatic delay.

| Link No | Time Delay |
|---------|------------|
| 17      | 3 seconds  |
| 15      | 6 seconds  |
| 11      | 9 seconds  |
| 12      | 12 seconds |
| 18      | 15 seconds |
| 14      | 18 seconds |
| 13      | 21 seconds |
| 10      | 24 seconds |
| 16      | 27 seconds |

#### **Links 1-9: Auto 2 Timing Functions**

Fit the link corresponding to the time delay required for the secondary automatic delay.

| Link No | Time Delay |
|---------|------------|
| 8       | 3 seconds  |
| 6       | 6 seconds  |
| 2       | 9 seconds  |
| 3       | 12 seconds |
| 9       | 15 seconds |
| 5       | 18 seconds |
| 4       | 21 seconds |
| 1       | 24 seconds |
| 7       | 27 seconds |

#### **Link 19 and 20**

Link 20 should be fitted if the manual release should bypass the main timer. Link 19 should be fitted if the manual release should bypass the secondary timer.

#### **Links 21, 22 and 23**

These links enable the backup facilities inherent on the card. If link 21 is fitted then door switch inhibit is backed up, if link 22 is fitted then the automatic release inhibit function is backed up, and if link 23 is fitted then the automatic release functions themselves are backed up. This allows parallel operation of the timers and solenoid drive circuits on the card. The change over function will still work in the same way but if a timer fails then the other one will be there to initiate the discharge.

**NOTE: When using the dual-redundant backup facility available on this card all link settings for time delays, etc. must be set the same for each timer.**



### 3.1 FAULT FINDING

There may be times that the card appears not to behave as expected. The most typical characteristic is that a fault LED will not go out:

1. Remove the card from the rack and locate the appropriate terminals in the cabinet by using the rack and cabinet wiring diagrams.
2. Use a meter to measure the resistance of the two field cables that are in fault. If the contacts are open circuit then investigate the fault in the field cables.
3. If the resistance is in the order of  $3.3\text{ k}\Omega$  then swap the card for one configured in the same way. If the problem goes away then the card is faulty.
4. If the problem remains then there is a rack or cabinet wiring problem.

Another common fault is that the card is permanently in inhibit.

1. Remove the card from the rack and install an uncommitted 64 way extender card (Part no. C03233). Reconnect the card to the extender and check that a voltage greater than 11.5 V dc is present on pin 8B (and 5B if the second timer is being used or if link 22 is fitted on the card).
2. If the voltage is nearer to 0 V then use the control rack wiring diagrams to trace through the inhibit line to its source and rectify the problem there.
3. Check that on pins 7B (and 4B if the second timer is being used or if link 21 is fitted on the card) and confirm that a voltage of approximately 0 V is recorded.
4. If the voltage at 7B (and 4B) is approximately 12 V dc then locate the field wires connected to these terminals using the rack and cabinet wiring diagrams as a guide. Check the voltage at that point and, if a similar voltage is recorded, disconnect the card measure the resistance of the field cables. If they are open circuit then investigate where the break in the circuit is and rectify there.
5. If the resistance is in the region of a short circuit then swap the card for one configured in the same way. If the problem goes away then the card is faulty.
6. If the problem remains then there is a rack or cabinet wiring problem.

## 4. SPECIFICATION

### *Mechanical*

|        |                 |
|--------|-----------------|
| Width  | 50.8 mm (10 HP) |
| Height | 128 mm          |
| Depth  | 247 mm          |

### *Connections*

DIN41612 64 way A/B male connector

### *Electrical*

|                      |                                                                                                                          |
|----------------------|--------------------------------------------------------------------------------------------------------------------------|
| Logic outputs        | 500 mA sink to 0 V when active<br>12 V dc when inactive                                                                  |
| Logic inputs         | 0 V to activate<br>12 V when inactive                                                                                    |
| Solenoid drive       | 40 $\Omega$ to 140 $\Omega$ (Power rating of 4 W to 14.4 W at 24 V dc)                                                   |
| Fault Relay          | Single pole normally open (closed under healthy conditions)<br>Normally energised, de-energising on fault, non-inductive |
| Power<br>(Estimated) | 18-35 V dc<br>180 mA maximum operation<br>281 mA during lamp test<br>150 mA minimum                                      |