Ditech Control Card Manual
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DI-800UN Flammable Gas Card

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1. GENERAL

1.1 INTRODUCTION

The DI-800UN card is a “universal” replacement for the DI-800 flammable gas card, the DI-861 and DI-862 4-20 mA input cards, and the DI-860 hydrogen sulphide Sulphistor input card. It comprises a main board and a plug-in “front-end module”. The front-end module contains the circuitry to interface to a specific type of gas sensor, while the main board provides regulated power supplies, alarm and fault detection and indication, relay and logic outputs and control input circuitry.

The DI-800UN system incorporates a CALIBRATE facility to permit on-line sensor calibration without tripping alarms, and an automatic self-test capability. Two alarm levels are provided, the first (lower) adjustable over the range 5 to 99% of full-scale while the second may be adjusted from the first alarm level setting to 99%. The lower alarm logic may be inverted to operate on a falling level, for low oxygen detection for example.

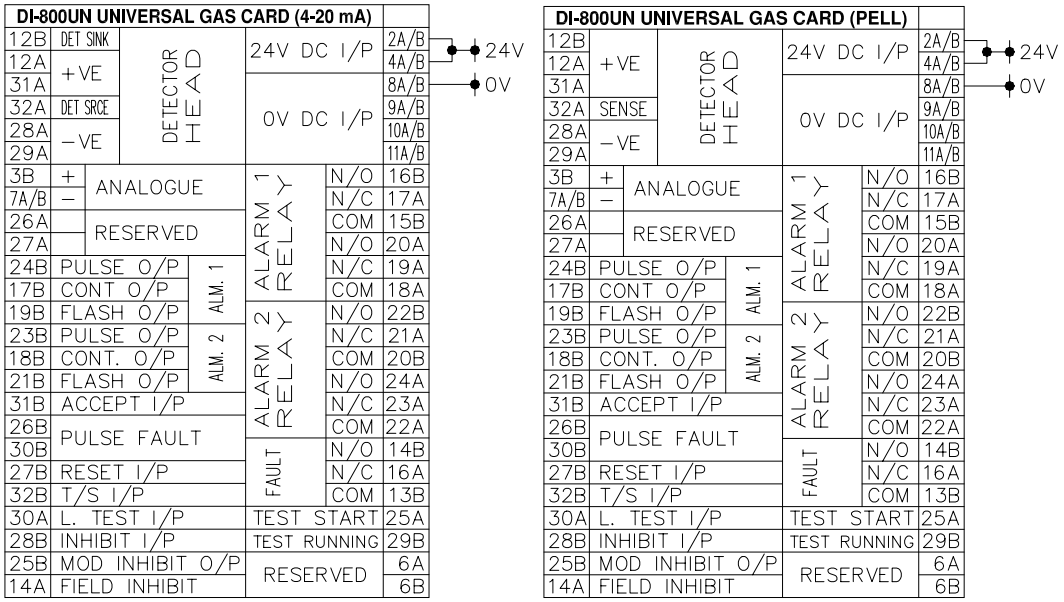
1.2 LOWER EXPLOSIVE LIMIT EXPLANATION (FLAMMABLE GASES ONLY)

Explosions occur when a flammable gas or the vapour from a flammable liquid, comes into contact with a source of ignition such as a spark or hot surface. The power of the explosion depends on the fuel and its concentration in the atmosphere. Not all concentrations of flammable gas or vapour in air will burn or explode. The *lower explosive limit*, or LEL, is the lowest concentration of fuel in air that will burn. For most flammable gases and vapours this is less than 5% by volume. This means that there can be a large risk of explosion even when relatively small amounts of gas or vapour escape into the atmosphere.

The DI-800UN will be calibrated for the most likely gas hazard to be present. Obviously this depends wholly on the application and environment being monitored. The card will measure gas or vapour concentration in % LEL up to 99%, thus giving early warning of an impending flammable hazard. 100% LEL means that a potentially explosive concentration of the target gases has been reached.

2. INPUTS AND OUTPUTS

2.1 EDGE-CONNECTOR PIN-OUTS (4-20 mA AND PELLISTOR)



2.2 POWER SUPPLY

The unit is powered from a nominal 24 V dc supply, negative ground (permitted range 18 to 35 volts). Two inputs are provided, permitting the use of independent power supplies. Each input has its own isolation diode and fuse. The inputs are protected against reverse voltage and over voltage situations, the latter causing a fuse to blow should either supply become greater than 35 V dc.

NOTE: That if only one power supply is used, all four edge-connector power input pins must be strapped together to prevent a PF (power fail) indication.

The power supply current depends on the sensor type and alarm status etc. For system planning purposes, a pellistor system with 300 mA pellistors in a 30 V cable loop will require 230 mA at 24 V dc in normal operation, rising to 450 mA with both alarms on, fault relay energised, and LAMP TEST button pressed.

2.3 SENSOR INPUTS

2.3.1 Pellistor module (Flammable gases only)

The Pellistor sensor requires a three-wire connection, for positive, negative and signal. The module supplies a regulated "constant current" bridge supply, adjustable over the range 40 to 300 mA (nominal), so that the Pellistor voltage is independent of cable resistance, up to the maximum permitted loop voltage drop of 15 volts (including the pellistor). This corresponds to a cable total loop resistance of 32.5 Ω at 400 mA, 39.4 Ω at 330 mA, or 43.3 Ω at 300 mA.

NOTE: When the card has no load on it then the detector output will rise to the maximum output of the device, approximately one volt below the supply rail.

Throughout the life of a particular detector the head voltage should not have to be adjusted. If, however, either the detector or the card is replaced then the card will have to be set up again to match the connected detector.

The sensor connections are monitored for open and short circuit faults, and also (optionally, by link selection) for a current imbalance between the positive (go) and negative (return) head currents. A difference of more than 20 mA in the go and return currents results in a *fault* indication.

A gas reading over 99% LEL results in an *overrange* condition and the pellistor power being shut down.

2.3.2 4 to 20 mA module (Flammable and Toxic gases)

This module may be configured (on the back plane, using board edge-connector pin-outs) for:

- a two-wire current-sinking sensor, sensor +ve connected to +24 V
- a two-wire current-sinking sensor, sensor -ve to 0 V
- a three-wire current-sourcing sensor
- a three-wire current-sinking sensor

In the 3-wire configurations, the unit will supply a nominal 23 V dc (i.e. 1 V less than DI-800UN supply voltage) via a supply-side 250 mA fuse and a 1 Ω current-sensing resistor. Maximum permitted load current is 200 mA.

The maximum permitted cable loop resistances are 80 Ω for 2 wire detectors and 31 Ω on power and ground wires for a 3-wire detector, assuming 18 V dc for the DI-800UN supply, a 200 mA load and a detector which can run from a minimum of 10 V.

The module incorporates SPAN and ZERO adjustments.

An inhibit indication is given if the loop current is between 1.5 and 2.5 mA (see section 2.8).

A *fault* indication occurs if the loop current falls outside the range <0.9 mA or >28 mA nominal, or (optionally) if the go and return loop currents differ by more than approximately 2 mA for a 2-wire sensor, or approximately 20 mA for a 3-wire sensor.

NOTE: When the card has no load on it then the detector output will rise to the maximum output of the device, approximately one volt below the supply rail.

2.3.3 Sulphistor module (Hydrogen sulphide 'DI-8' only)

The Sulphistor sensor requires a three-wire connection, for positive (red), negative (black) and signal (yellow). The module supplies a regulated "constant voltage" bridge supply, adjustable over the range 5 to 14 V. The maximum permitted loop voltage drop is 15 V (including the Sulphistor) corresponding to a total cable loop resistance of 21 Ω - this assumes 6.5 V on the Sulphistor at 400 mA, and an 18 V power supply.

NOTE: When the card has no load on it then the detector output will rise to the maximum output of approximately 16 V.

The Sulphistor sensor has a logarithmic response to hydrogen sulphide, with a nominal output of approximately 60-100 millivolts per decade. This signal is expanded by an anti-log circuit to a linear 0-100% output over a two decade range of gas.

A *fault* indication is given if the positive Sulphistor terminal is outside the range 5.9 V to 15.5 V or (optionally) if the positive and negative terminal currents differ by more than approximately 20 mA.

2.4 CONTROL INPUTS

These are associated with internal system logic functions. They are not normally directly accessible externally from the control rack. All inputs are active low (i.e. zero volts) and will rise to 12 V when inactive, via an internal 10 kΩ pull-up resistor. These inputs are transient and ESD protected.

- External reset (pin 27B) — 0.5 second pulse or wired to ground
- Accept alarm (pin 31B) — 0.5 second pulse
- T/S (flash clock) input (pin 32B) — 1Hz, 12V square-wave
- External inhibit (pin 28B)
- External lamp test (pin 30A)
- Test start (pin 31A)

External Reset

This input is used to reset the control card following an alarm, fault or overrange. If a gas level exceeds either alarm level, it will not be possible to reset that alarm. In a similar way, a fault condition may only be reset once the fault has been cleared.

NOTE: The external RESET input may be permanently wired to ground. In which case the alarms will automatically reset when the signal level drops below the alarm threshold. The ACCEPT ALARM input (see below) has no effect in this mode.

Accept Alarm
This input accepts a momentary 0 V signal as an acknowledgement that an *alarm* condition is present. In the event of an alarm condition, the red alarm LED(s) on the DI-800UN front panel will flash and the FLASHING ALARM output associated with the particular alarm level will pulse in synchronism with the clock pulse signal. This will continue until the ACCEPT ALARM input signal is received, then the red alarm LED(s) will remain steady and the appropriate FLASHING ALARM output will be constantly active. This condition will remain until a RESET is received.

Clock Pulse
The clock pulse expects a nominal 1 Hz oscillating signal (toggled continually between 0 V and 12 V dc) which is usually generated by the DI-952 Audio card. It is used to synchronise all flashing alarms on the control cards within a control system to let the operators visually differentiate between alarms which have been acknowledged (accepted) and those that have not.

External Inhibit
When low, this input forces the DI-800UN into the *inhibit* state. In this state, the unit operates normally to indicate gas level and detect alarm and fault conditions, and all front-panel indications and external fault outputs work as normal. However, all or some external alarm indications may be inhibited selectively as required by link options (see section 3.1). If an alarm occurs during *inhibit*, it will result in the normal alarm indications when the *inhibit* condition is removed, unless reset first.

During inhibit, the MODULE INHIBITED output is pulled low.

External Lamp Test
When this input goes low, all LEDs and numerical display segments on the front panel relating to the zone illuminate, so verifying their operation. The same operation can be performed locally with the RESET/LAMP TEST button on the front panel.

Test Start
A low on this input initiates the automatic test sequence (see section 2.7).

2.5 PRIMARY OUTPUTS

These outputs are of two types, i.e. volt-free changeover relay contacts and ‘active low’ current sinking transistor outputs. The relays are rated at 2 A at 30 V dc.

The transistor outputs can each sink up to 500 mA, but the load should not exceed 100 mA per output if several are loaded continuously.

NOTE: The externally applied voltage must remain within the range 0 to +30 V dc.

Alarm 1 Relay
This output is a double pole changeover type which operates when the concentration displayed on the control card is greater than the set value for the first level of alarm (lower than the alarm threshold if Alarm 1 is set to alarm on a falling level – see section 2.1). This output will latch until

the measured concentration has dropped below (or risen above) the alarm set point and the card reset.

(The relay may be set by a programming link to be normally energised or normally de-energised see section 3.1)

Alarm 1 Continuous Output
This output goes low when Alarm 1 is tripped. The output will latch until the measured concentration has returned to the normal range and the card reset.

Alarm 1 Flashing Output
This output will pulse on and off in synchrony with the *clock pulse* input when Alarm 1 is tripped. Once the card has received an accept pulse then the output will remain on and function in the same way as the *Continuous Alarm* 1 output.

Alarm 2 Relay
As for the Alarm 1 relay output, except that it responds to the Alarm 2 threshold, and operates only on a rising gas level.

Alarm 2 Continuous Output
This is an active low output which operates in the same way as the continuous alarm 1 output, but it reacts to the second level of alarm rather than the first.

Alarm 2 Flashing Output
This output pulses on and off in time with the clock pulse input when the second level of alarm is exceeded. As with the alarm 1 flashing output, it will go steady when the alarm has been accepted.

2.6 SECONDARY OUTPUTS

Fault Relay Output
This relay output consists of a single set of isolated changeover contacts, rated at 2 A at 30 V dc. Under normal, healthy conditions the relay is energised. If a fault or a power failure should occur, the relay de-energises and these contacts change state. Once the fault condition has been cleared, the contacts will revert to the normal state on resetting the card.

Pulse Fault
This output pulses active low once only for approximately 1 second when the *fault* condition occurs. It is usually combined with other control card outputs, and used to notify the DI-952 Audio card that a fault has just occurred.

Pulse Alarm 1 and 2
These outputs pulse low once only when an *alarm* condition is detected. When the first level of alarm is recorded then the PULSE ALARM 1 output operates and if the second level of alarm is exceeded then the PULSE ALARM 2 operates. The pulse duration is approximately 1 second and is normally combined with other control card outputs into a common alarm bus that notifies the DI-952 audio card that an alarm has just occurred.

Module Inhibited
This output goes low whenever the DI-800UN is in the *inhibit* state or the *field inhibit* condition.

Test Running
This output goes low for a few seconds while the DI-800UN automatic self-test is running. The MODULE INHIBITED output also goes low during self-test (see section 2.7 below).

2.7 SELF-TEST FACILITIES

The DI-800UN incorporates comprehensive self-test facilities that check for correct functioning of the sensor input circuitry, the ALARM 1, ALARM 2 and OVERRANGE thresholds, and logic.

The test sequence is started on application of a momentary low to the TEST START input, provided that the DI-800UN is not already in an *inhibit*, *alarm* or *fault* state. While the sequence is running, the TEST RUNNING and MODULE INHIBITED output pins are pulled low and the front panel INHIBIT led lights.

NOTE: The selective INHIBIT options function as described in section 2.4, except that the flashing alarm outputs are always inhibited in the *self-test* mode. This means that the CONTINUOUS ALARM, PULSED ALARM and ALARM RELAY outputs will operate during a self-test, unless LINKS 9, 10 and 11 respectively are fitted.

The test sequence first resets all latches, then applies a negative-going ramp which is summed with the sensor signal. The ramp will trip the alarm 1 circuitry if this is set to “falling”, and is terminated when the 7-segment display reaches -5%. A positive-going ramp is then generated, which trips the alarm 1 circuitry if this is set to “rising”, then alarm 2. The positive ramp is terminated when the overrange condition is reached (at 100% on the display).

Provided the alarms, -5% and overrange thresholds have been tripped in the correct sequence, the test will terminate, resetting all latches and removing the INHIBIT and the TEST RUNNING low outputs.

The entire test sequence will take from about 6 seconds up to about 15, depending on sensor SPAN setting and on any test failures.

If any of the conditions described above are not met, a TEST FAIL latch will be set but all other latches will be cleared, the TEST RUNNING output will remain low and the 7-segment display will show segment test (for test fail). The *fault* state, as described in section 2.6, will be set.

The TEST FAIL state can be cleared by pressing the RESET/LAMP TEST push button, or by an external or power-on RESET.

In addition to the “test-on-demand” facilities described above, the status of the two incoming 24 V dc supplies and supply fuses (F1 and F2) is continuously monitored. If either supply is below 18 volts or either fuse is open circuit, this will result in a segment test (power fail) indication on the 7-segment display, which will continue until the fault is corrected. All alarm facilities continue to operate normally in this state, and holding down the READ push button may be used to monitor the gas level.

2.8 ANALOGUE OUTPUT

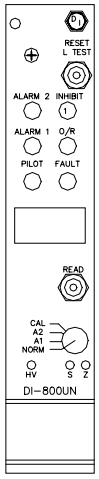
The analogue output is basically a current-sourcing circuit, which may be configured by a link option to a range of either 4-20 mA (LINK 4 fitted) or 0-20 mA (LINK 4 removed), corresponding to zero to 100% of full-scale.

A further optional programming link (LINK 3) converts the output to 1-5 V or 0-5 V.

During *fault* conditions the analogue output is clamped to 0 mA or 0 V. In the *overrange* condition the analogue output is forced to approximately 22 mA or 5.5 V.

The analogue negative output may be isolated from the local 0 V rail (for remote grounding) by removal of LINK 5.

2.9 FRONT PANEL INDICATORS AND CONTROLS



Alarm 1 LED
The ALARM 1 LED will flash (in synchrony with the CLOCK PULSE input) as soon as the measured gas level rises above or falls below the limit set for the alarm 1 set point, as determined by the setting of LINK 2 (see section 3.1). Once an ACCEPT signal has been received by the DI-800UN, the LED will turn on continuously. It can only be extinguished once the measured concentration of gas is below (or above) the alarm 1 set point and the card has been reset.

Alarm 2 LED
When the gas level exceeds the alarm 2 set point, the ALARM 2 LED will flash. Once an ACCEPT signal has been received by the card, the LED will change from flashing to steady. The alarm 2 LED may be reset only when the gas level has dropped below the Alarm 2 set point.

Overrange LED
Should the gas concentration measured by the card continue to rise beyond 99% FSD but no *fault* condition has been detected, then the card will go into an *overrange* condition.

Clearly, in *overrange*, the ALARM 2 threshold will have been exceeded, and also ALARM 1 unless this is set to a falling condition (e.g. for oxygen detection). The alarms which existed before the *overrange* occurred will continue to give all the normal indications and outputs.

The *overrange* state inhibits any subsequent fault from setting the fault latch, illuminates the *overrange* LED, blanks the 7-segment display, and removes power from certain sensors (e.g. pellistor devices). The analogue output will indicate approximately 22 mA or 5.5 V regardless of the actual overload level.

If the overrange condition should develop into a *fault* level (i.e. >200%), an attempt to reset will clear the overrange indication and set the normal fault state.

The overrange state may be reset, after the overrange condition has been cleared, by an external RESET (low) pulse or by pressing the RESET/LAMP TEST front panel push button. This will also start the normal power-on delay to inhibit spurious alarm indications during the sensor warm-up period. If a RESET is attempted while the overrange condition persists, the *overrange* LED and 7-segment display will flash alternately, and the unit will remain inhibited.

NOTE: Under circumstances of unusually high sensitivity settings on the span adjustment (see later) the card may go into the overrange condition. This is most likely to happen when setting the card up for the first time. The reset will have to be applied to the card continuously whilst the span adjustment is reduced. For further details see the section on trouble shooting.

Pilot LED

The green PILOT LED will normally be illuminated and is extinguished only if the DI-800UN is in a *fault* state, or in the event of a complete power failure. Pressing the reset/lamp test button, as with all the LEDs, will prove the operation of this LED.

NOTE: This button will also attempt to reset the card. Should the pilot have been extinguished as a result of a resettable fault, this action will clear it.

Fault LED

The yellow FAULT LED will illuminate whenever the DI-800UN is in a *fault* condition. A fault condition may be caused by an open circuit or short circuit fault on the sensor line or by an input below -25% or above +200% of full-scale (Refer to the trouble shooting in section 3.5).

Inhibit/Beam Block LED

The yellow INHIBIT LED will illuminate whenever the DI-800UN is in an *inhibit* condition. This occurs for a few seconds on initial power-up, whenever the front-panel MODE switch is set to the A1, A2 or CAL positions, or if an external inhibit input is applied. The power-up delay is also restarted whenever the mode switch is moved back to the NORMAL position.

Four option links are provided to permit the alarm relays (LINK 11), the pulsed alarm outputs (LINK 10), the continuous alarm outputs (LINK 9) and the flashing alarm outputs (LINK 8) to be selectively inhibited from going into the alarm condition while inhibit is in effect. Operation is inhibited with the associated link fitted (See section 3.1).

NOTE: In the inhibit condition, the two-digit display operates in the normal manner, and the front-panel ALARM LEDs continue to indicate any alarm states. If an alarm occurs during inhibit, it will result in the normal alarm indications when the inhibit condition is removed, unless cleared and reset first.

In *inhibit*, the PILOT and FAULT LEDs and all fault facilities continue to operate normally. The analogue output is forced to 2.0 mA/0.5 V (or 0 mA/0 V in the non offset-zero mode with LINK 4 removed see section 3.1).

The *inhibit* LED is also used to indicate the *beam block* condition that may be signalled by some 4-20 mA sensors (e.g. Nimbus), by sending a 2 mA current. When 2 mA is detected by a 4-20 mA front-end module, the DI-800UN is set into the *inhibit* state. All of the indications and outputs are as above, except that the front-panel INHIBIT LED flashes instead of lighting continuously, and the *field inhibit* output is pulled low.

Two Digit Display

This display shows that the measured concentration of gas as detected by the remote-sensing element. Below a pre-set threshold (nominally ±5% of full-scale) the display is turned off to conserve power. Once the concentration has exceeded this limit the display will turn on. However, as the display rises beyond 99% full-scale the overrange state will be triggered and the display blanked again.

NOTE: Readings below –5% are indicated by the display flashing. Negative readings will not trip alarms.

The display may be set to read any value from 25 to 99 at full-scale input by means of the DVM pre-set, VR4 on the DI-800UN Main Board. An optional decimal point may be set between the two digits by fitting LINK 1.

In the event of one of the two power supply inputs or fuses failing, the display will read segment. Obviously, failure of both supplies or fuses will result in a non-operative card, with no indications.

Following an automatic test sequence (section 2.7), the display will read segment test (test fail) in the event of a failure.

Read Button
This button forces the two-digit display to read the gas value whenever it is blanked or indicating a test-fail or power-fail condition.

Reset/Lamp Test Button
This button will illuminate all the LEDs on the card (including the display) and also attempt to reset the card. The card will only reset if the measured concentration has dropped below the thresholds (alarm 1, alarm 2 or overrange) or in the case of a fault indication, the fault has been cleared.

Rotary Mode Switch
This is a four position rotary switch. Its positions are labelled NORM for *normal*, A1 for *alarm 1*, A2 for *alarm 2,* and CAL for *calibrate*.

NORM	Display shows measured gas concentration. All alarms outputs will operate as described above
A1	Display shows the alarm 1 set point. Unit is inhibited
A2	Display shows the alarm 2 set point. Unit is inhibited
CAL	Display shows measured gas level No blanking between ±5% LEL The unit is inhibited (some external alarm outputs will not operate)

Span Potentiometer – VR1
The span potentiometer, labelled “S”, is used to adjust the DI-800UN to read the concentration of a test gas correctly during the calibration procedure (described in full later in section 3).

Zero Potentiometer - VR2
The zero potentiometer, labelled “Z”, is used to adjust the display to read 00 when the sensor is in clean air.

NOTE: a qualified person must only carry out Adjustments to the Span and Zero potentiometers. Incorrect calibration will affect the way the card responds to genuine gas alerts, and could put lives at risk.

Head Voltage/Current Potentiometer - VR3 (Pellistor and Sulphistor modules only)
This potentiometer is used to set the sensor supply voltage or current. This must only be adjusted when the card is powered and the sensor voltage is being monitored in the field, and only by qualified personnel (see section 3).

NOTE: Clockwise turns will increase the head volt output. Anti-clockwise turns will decrease the head volt output.

3. OPERATION

3.1 LINK SETTINGS

The DI-800UN Main Board has eleven option programming links with functions as follows:

Link	Function	Fitted	Not Fitted
1	Display decimal point	On	Off
2	ALARM 1 sense - alarm on	Rising	Falling
3	Analogue output	Voltage	Current
4	Analogue output zero	4 mA/1 V	0 mA/0 V
5	Analogue ground	To card 0 V	Floating
8	Inhibit FLASHING alarm	Inhibit	Enable
9	Inhibit CONTINUOUS alarm	Inhibit	Enable
10	Inhibit PULSED alarm	Inhibit	Enable
11	Inhibit alarm RELAYS	Inhibit	Enable

Link	Function	Position 1	Position 2
6	ALARM 1 relay	Energise on alarm	De-energise on alarm
7	ALARM 2 relay	Energise on alarm	De-energise on alarm

3.2 PRE-SET POTENTIOMETER ADJUSTMENTS

The following pre-set potentiometers are located on the DI-800UN Main Board.

Pot No.	Function	Description
VR4	DVM range	Sets reading of 2-digit display to 25-99 at full-scale input
VR5	ALARM 1 level	Sets first alarm threshold within range 5-99%
VR6	ALARM 2 level	Sets second alarm threshold from Alarm 1 level to 99%

3.3 SETTING UP THE CARD

Before the card can be set up and the channel calibrated it is assumed that all field cabling for the channel has been completed, and the sensor installed as per the relevant manual.

To complete this procedure a 64 way uncommitted extender card (C03233) is required. This will allow adjustments to be made to the card whilst it is powered up. Initial settings are made with the DI-800UN un-powered.

Un-powered Adjustments
With the DI-800UN out of the rack or on an extender card, make the following settings to the Main Board:

1 Turn VR3 (Head Voltage/Current) on the DI-800UN front panel fully counter-clockwise.

2 Put the four position MODE switch on the front panel into the CALIBRATE position

3 Fit LINK 1 if a decimal point is required in the 2-digit display

4 Fit LINK 2 if ALARM 1 is to operate on a RISING gas level

5 Fit LINK 3 if a VOLTAGE analogue output is required

6 Fit LINK 4 if an OFFSET analogue zero (4 mA or 1 V) is required

7 Fit LINK 5 if the analogue output is not grounded at the remote end

8 Fit LINKS 6 and 7 if the ALARM 1 and 2 relays are to energise on alarm

9 Fit LINK 8 to prevent the FLASHING ALARM output from operating in INHIBIT mode

10 Fit LINK 9 to prevent the CONTINUOUS ALARM output from operating in INHIBIT mode

11 Fit LINK 10 to prevent the PULSED ALARM output from operating in INHIBIT mode

12 Fit LINK 8 to prevent the ALARM RELAYS from operating in INHIBIT mode

On the Pellistor Module:

13 Fit LINK 401 if the go-and-return current imbalance EARTH FAULT MONITORING is required.

Powered Adjustments

Before power is applied fit a 64 way uncommitted extender card in the rack. Fit the DI-800UN to the extender and ensure all the connections are firm and suitably supported.

Power may then be applied. Press the RESET button and wait for the INHIBIT LED to extinguish.

Press the RESET button to clear any fault condition and adjust the ZERO potentiometer (VR2) until the display reads 00.

Turn the four-position mode switch to the A1 position and adjust VR5 until the correct value for first alarm trip point is shown on the 2-digit display.

Turn the switch to the A2 position and adjust VR6 until the required Alarm 2 trip point value is displayed.

NOTE: The Alarm 2 setting cannot be set below the Alarm 1 level.

Finally turn the four-position switch to the CAL position. The card is now ready for calibration.

Refer to the detector documentation to confirm the required head voltage.

NOTE: The head voltage must be read at the detector junction box connections rather than at the card.

To set the head voltage on flammable detectors, proceed as follows:

In the field, open the Crowcon Junction box using a 4 mm Allen key. Care must be taken when opening the cover to avoid letting water and dirt into the junction box enclosure.

The gas detector has three coloured wires: one red, one green and one black.

Using a suitably certified voltmeter measure the head volts between the red and black wires on the gas detector.

At the panel adjust the HEAD VOLTAGE/CURRENT potentiometer (VR3, on the front panel of the control card) clockwise until the voltage between the red and black wires on the gas detector is at the correct voltage.

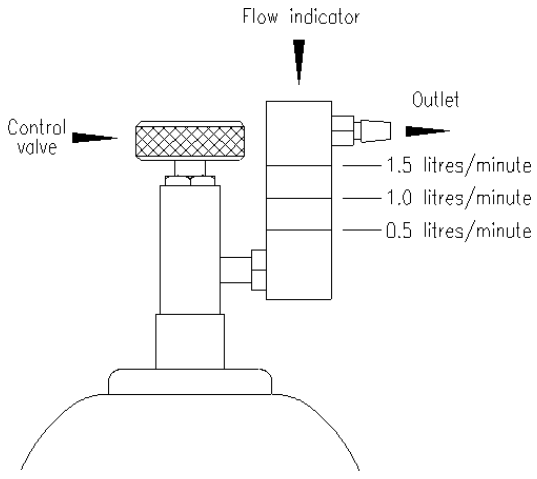
NOTE: The head voltages are associated with a particular pellistor type. Check the details printed on the detector.

3.4 CARD CALIBRATION

New gas detectors require a period of powered operation to settle before being calibrated. Subsequently, they will need to be re-calibrated from time to time to ensure reliable and accurate operation. The frequency of these calibrations is very much dependent on the sensor type and on particular site conditions. If, for example, the sensors are in a dirty environment then they may need more attention. The recommended interval for calibrations is every six months minimum. Consideration must also be taken of the conditions during the calibration and the condition of the calibration gas itself. The engineer performing the calibration must ask themselves the following questions before performing any calibration work on a gas detection system:

- Do I have the correct calibration gas?
- Has the gas “use by” date passed?
- Have I the correct permits?
- Is the gas I am using hazardous to health?
- Is it safe to proceed?
- Do others know where I am?
- Do I know what I am doing?

The Crowcon calibration gas comes in 20 litre, 57 litre and 103 litre cans. Each of these variations needs an integrated valve and flow indicator, which is available as a separate product. This should be fitted as before any calibration work can take place. The flow indicator, as shown, has graduations engraved on it. There is a small ball bearing that floats in the stream of gas, when the valve is turned on, and this should be lined up with the appropriate engraved line for the correct flow rate. It is important that the gas cylinder is kept upright at all times during the calibration so that the flow indicator can operate correctly. A keen eye should be kept on the state of the ball, as it will drop quickly when the gas cylinder is almost empty.



NOTE: All new gas detectors need a period of time to settle down when first powered up. A minimum of 24 hours should be allowed with the system powered before the initial commissioning calibration is performed. During this time the DI-800UN four position Mode switch should be left in the CAL position to inhibit the system and prevent nuisance alarms.

The Flamgard-EXE, Flamgard-D and Flamgard-4/20 flammable gas detectors are based on a pellistor type of sensing element, which runs warm under normal operation. The following procedure assumes that the detectors are being calibrated to methane by using test gas of 50% LEL (2.5% v/v) methane in air, and that the head voltage has been correctly set.

1. Identify the control module associated with the gas detector to be calibrated and put it into its CAL mode to inhibit the alarm outputs.

2. Ensure that the area in the immediate vicinity of the gas detector is free from any flammable gases.

3. At the control panel adjust the ZERO potentiometer on the control card front panel until the display reads 00.

4. Apply the test gas to the gas detector at the rate of between 0.5 litre/minute and 1 litre/minute.

5. Allow the reading on the control module to stabilise. This may take up to two minutes.

6. Adjust the SPAN potentiometer on the control card front panel so that the display reads between 80 and 99.

7. If the display cannot get above 80% LEL when using 50% LEL test gas the sensor has come to the end of its life and must be replaced.

8. Confirm that all alarm LEDs are on. If a reading over 99 can be achieved, confirm that the overrange LED comes on and the 2-digit display blanks when the reading exceeds 99.

9. Hold the card reset button and wind the SPAN potentiometer back to read 50 on the display.

10. Turn off the test gas and remove the calibration adapter from the detector.

11. Confirm that the display on the control card drops to 00.

12. Place the control card back into the NORMAL operation mode.

13. Move on to the next detector and return to step 1.

Should it have been discovered that the sensor has lost its response to gas then it must be replaced. **Hot work permits may be required for this procedure.** This procedure assumes that the control card is still in INHIBIT mode and that the gas has been turned off:

1. In the field open the Crowcon Junction box using a 4 mm Allen key. Care must be taken when opening the cover to avoid letting water and dirt into the junction box enclosure.

2. The gas detector has three coloured wires: one red, one green and one black.

3. Using a suitably certified voltmeter measure the head volts between the red and black wires on the gas detector.

4. At the panel adjust the HEAD VOLTAGE/CURRENT potentiometer (VR3, on the front panel of the control card) fully counter-clockwise until the voltage across the red and black wires on the gas detector is at a minimum.

5. Make a note of which terminal in the junction box each wire is connected to and disconnect the wires from their terminals.

6. Unscrew the gas detector from the junction box.

7. Remove the new gas detector from its protective packaging and put the faulty one in its place.

8. Poke the wires of the new gas detector into the junction box through the M20 mounting hole.

9. Gently screw the new gas detector into the junction box. Take care not to twist the wires or cross-thread the detector.

10. With the detector hand tight in the junction box an adjustable spanner may be required to screw the detector fully home. The washer around the neck if the detector must make a good seal with the junction box. Do not over tighten.

11. Refer to the notes made earlier and reconnect the red, green and black wires on the new detector.

12. Measure the head volts again between the red and black wires on the detector (red is positive, black is negative).

13. At the panel, slowly adjust the HEAD VOLTAGE/CURRENT potentiometer, VR3, until the voltmeter reads correct for the particular sensor between the red and black wires.

14. Check the head volts at the detector again and confirm that it is still reading correctly between the red and black wires.

15. Close up the junction box. Care must be taken to avoid over tightening the junction box cover.

16. Allow the gas detector to settle with power applied for a minimum of 24 hours before attempting to calibrate it. Leave the control card in the CALIBRATE position for this period of time to avoid nuisance alarms.

The life expectancy of a 96HD/FL gas detector is approximately 2 years under normal operation in a clean atmosphere. If it is found that sensors last little more than 6 months then it is likely that the detectors are becoming *poisoned* by an airborne contaminant. Such contaminants are contained in silicone-based products and leaded petroleum fuel. Refer to Crowcon for queries regarding poisoning of detectors and measures that can be taken to avoid or reduce it.

Sulphistor Module:

13. Fit LINK 301 if the go-and-return current imbalance earth fault monitoring is required.

Powered Adjustments

Before power is applied fit a 64 way uncommitted extender card in the rack. Fit the DI-800UN to the extender and ensure all the connections are firm and suitably supported.

Power may then be applied. Press the RESET button and wait for the INHIBIT LED to extinguish.

Press the RESET button to clear any fault condition and adjust the ZERO potentiometer (VR2) until the display reads 00.

Turn the four-position switch to the A1 position and adjust VR5 until the correct value for first alarm trip point is shown on the 2-digit display.

Turn the switch to the A2 position and adjust VR6 until the desired Alarm 2 threshold is displayed. Note that the Alarm 2 setting cannot be set below the Alarm 1 level.

Finally turn the four-position switch to the CAL position. The card is now ready for calibration.

Refer to the detector documentation to confirm the required head voltage (normally 6.5 V for the Sulphistor).

NOTE: The head voltage must be read at the detector junction box connections rather than at the card.

To set the head voltage, proceed as follows:

1. In the field open the Crowcon Junction box using a 4 mm Allen key. Care must be taken when opening the cover to avoid letting water and dirt into the junction box enclosure.

2. The gas detector has three coloured wires: one red, one yellow and one black.

3. Using a suitably certified voltmeter measure the head volts between the red and black wires on the gas detector.

4. At the panel adjust the HEAD VOLTAGE/CURRENT potentiometer (VR3, on the front panel of the control card) clockwise until the voltage across the red and black wires on the gas detector is at 6.5 $\pm$ 0.2 V.

The following procedure assumes that the detectors are being calibrated to hydrogen sulphide by using test gas of 20 ppm hydrogen sulphide in air.

5. Identify the control module associated with the gas detector to be calibrated and put it into its CALIBRATE mode to inhibit the alarm outputs.

6. Ensure that the area in the immediate vicinity of the gas detector is free from any flammable gases.

7. At the control panel adjust the ZERO potentiometer on the control card front panel until the display reads 01, just on the verge of changing to 00.

8. Apply the test gas to the gas detector at the rate of between 0.5 litre/minute and 1 litre/minute.

9. Allow the reading on the control module to stabilise. This may take up to two minutes.

10. Adjust the SPAN potentiometer on the control card front panel so that the display reads 20 (or the appropriate value if the test gas concentration is different from 20 ppm).

11. Turn off the test gas and remove the calibration adapter from the detector.

12. Confirm that the display on the control card drops to 01. This may take some time.

13. Place the control card back into the NORMAL operation mode.

14. Move on to the next detector and return to step 1.

Should it have been discovered that the sensor has lost its response to gas then it must be replaced. **Hot work permits may be required for this procedure.** This procedure assumes that the control card is still in INHIBIT mode and that the gas has been turned off:

1. In the field open the Crowcon Junction box using a 4 mm Allen key. Care must be taken when opening the cover to avoid letting water and dirt into the junction box enclosure.

2. The gas detector has three coloured wires: one red, one yellow and one black.

3. Using a suitably certified voltmeter measure the head volts between the red and black wires on the gas detector.

4. At the panel adjust the HEAD VOLTAGE/CURRENT potentiometer (VR3, on the front panel of the control card) fully counter-clockwise until the voltage across the red and black wires on the gas detector is at a minimum.

5. Make a note of which terminal in the junction box each wire is connected to and disconnect the wires from their terminals.

6. Unscrew the gas detector from the junction box.

7. Remove the new gas detector from its protective packaging and put the faulty one in its place.

8. Poke the wires of the new gas detector into the junction box through the M20 mounting hole.

9. Gently screw the new gas detector into the junction box. Take care not to twist the wires or cross-thread the detector.

10. With the detector hand tight in the junction box an adjustable spanner may be required to screw the detector fully home. The washer around the neck if the detector must make a good seal with the junction box. Do not over tighten.

11. Refer to the notes made earlier and reconnect the red, yellow and black wires on the new detector.

12. Measure the head volts again between the red and black wires on the detector (red is positive, black is negative).

13. At the panel, slowly adjust the HEAD VOLTAGE/CURRENT potentiometer, VR3, until the voltmeter reads 6.5 $\pm$ 0.2 V dc between the red and black wires.

14. Check the head volts at the detector again and confirm that it is still reading 6.5 $\pm$ 0.2 V dc between the red and black wires.

15. Close up the junction box. Care must be taken to avoid over tightening the junction box cover.

Allow the gas detector to settle with power applied for a minimum of 24 hours before attempting to calibrate it. Leave the control card in the CALIBRATE position for this period of time to avoid nuisance alarms.

The life expectancy of a Sulphistor gas detector is approximately 2 years under normal operation in a clean atmosphere. If it is found that sensors last little more than 6 months then it is likely that the detectors are becoming *poisoned* by an airborne contaminant. Refer to Crowcon for queries regarding poisoning of detectors and measures that can be taken to avoid or reduce it.

4 to 20 milliamp Module:

13. Fit LINK 201 (on the plug-in module) if the go-and-return current imbalance earth fault monitoring is required.

14. Fit LINKS 202 and 203 if a 3-wire head drawing its power from the DI-800UN is used.

The 4 – 20 mA module is designed to work with 2-wire transmitters or 3-wire units requiring an unregulated positive power supply not exceeding 200 mA (e.g. Nimbus). It may be configured to work with the following:

- Two-wire current-sinking transmitter, sensor +ve to +24 V
- Two-wire current-sinking transmitter, sensor -ve to 0 V
- Three-wire current-sourcing transmitter
- Three-wire current sinking transmitter.

See the relevant connection diagram.

The transmitter should be calibrated to give the normal 4 mA (zero) and 20 mA (full-scale) levels as instructed for the unit. If necessary, the DI-800UN front panel SPAN and ZERO preset potentiometers may subsequently be used to make small adjustments without requiring access to the transmitter – they provide approximately +/-10% trim range.

3.5 TROUBLESHOOTING

In all cases of abnormal operation, it is suggested that the DI-800UN be replaced with a known good unit before proceeding further: if the problem persists, proceed as below.

The format of this section is designed so that the user picks the description that matches the problem and then follows down the list of things to do until the problem is solved.

No LEDs are illuminated and the display is not on.

1. If the problem is isolated to one card then press the LAMP TEST/RESET button. All lamps and display segments should light. If not, check both fuses on the card. If more than one card is affected, check the 24 V power to the control rack.

2. If the card fuses are intact and the power to the rack is within tolerance, the fault will lie either with the card or with the rack wiring.

The 2-digit display is blanked

1. Press LAMP TEST/RESET and confirm that all display segments are working.

2. Press READ and confirm that the display reads close to zero.

3. If the OVERRANGE lamp is lit, see below.

The overrange LED is on and will not reset.

1. Confirm that the sensor is not subjected to a very high gas level.

2. Press RESET momentarily, and wait for the power-on inhibit to time out. If the overrange indication was due to a slow-onset fault condition, the OVERRANGE LED will reset and FAULT will light.

3. If not, hold RESET on and observe the card to oscillate in and out of the overrange condition, confirming a persistent overrange input (i.e. an input signal within the range 100 to 200% of full scale). In the field, confirm that the detector head volts are correct for the particular sensor, and adjust if necessary.

4. If the condition persists, the sensor or cabling is at fault.

The FAULT LED is lit and cannot be reset.

1. This may be due to an open-circuit sensor or cable, a short-circuit or leakage to ground within the cabling.

2. Check the voltage at the sensor, and compare with expected values for that sensor type. Abnormally high values suggest a faulty sensor, low values suggest a faulty sensor or cable short- circuit, and zero voltage suggests an open-circuit cable.

3. Substitute a known good sensor, re-check, and if necessary adjust the head voltage. If the voltages are still abnormal:

4. Disconnect the field cabling in the cabinet, and measure the voltage at the terminals – with the head open circuit, the voltage should be about 1 volt below the supply voltage, i.e. approximately 23 V dc.

5. Disconnect the cabling at the head end and check for short circuits between each cable pair.

6. Short all wires together at the head end and check for continuity between each pair at the cabinet end.

7. If the fault persists then it lies with the internal wiring of the cabinet or control rack.

The span adjustment cannot be adjusted to the required value.

1. If the test gas has been applied and the span adjustment cannot be made to reach the corresponding concentration for the display, then the detector is likely to be too insensitive and must be replaced, or the head volts are too low.

2. Check the head volts. If they are correct for the particular sensor then the detector will have to be changed.

3. Set up the new sensor as per the *Card Calibration* section.

4. SPECIFICATIONS

Mechanical

Width	25.4 mm (5 HP)
Length	128 mm
Depth	247 mm

Connections

64 way DIN41612 A/B male connector

Electrical

Alarm Settings	Alarm 1 and alarm 2 adjustable between 5% and 99% full scale
Gas Type	selection by means of plug-in module
Sensitivity	to suit sensor type
Display	Two digit, seven segment, red LED Flashing display indicates negative reading
Relay Outputs	2-pole change over 1 A, 30 V dc non-inductive Normally de-energised or energised (link selectable)
Logic Outputs	500 mA max sink when active 12 V when inactive
Logic Inputs	0 V to activate 12 V when inactive
Fault Relay	Single pole, normally open (closed under healthy conditions) Normally energised, de-energising on fault 0.5 A non-inductive
Power	18-35 V dc input, polarity and over-voltage protected

4-20 mA module	*Pellistor module*
91 mA minimum	126 mA minimum
253 mA full alarm	256 mA full alarm
273 mA maximum	455 mA maximum