Dräger

QuadGard

INSTALLATION AND OPERATING MANUAL

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CONTENTS

0.   ABOUT THIS MANUAL

0.1   Scope of this manual

This manual describes how to install, configure and use the QuadGard one to four channel gas detection control system.

0.2   Changes in issue 5

This issue of the manual contains
- Updated diagram showing deeper IP65 QuadGard cabinet.

1. INTRODUCTION TO QuadGard

1.1 Intended use

QuadGard (Gas Control System - Four channel) is designed to be used for the continuous monitoring of flammable, toxic and/or other gases and the control of alarms, indicators or other equipment via alarm relays.

QUADGARD is not designed or certified for use in areas where combustible or explosive gas mixtures are likely to occur.

1.2 Description

QUADGARD consists of a wall-mounted cabinet containing a power supply board and a control & display board; additionally one to four input channel boards can be fitted. The power supply board provides a mains power supply for the system, and master relays. The control & display board provides a character display and alarm status LEDs. Each input channel board provides power to, and measures the signal from, one gas measuring head.

A 4–20mA input channel board is used with two- or three-wire 4–20mA heads and can supply up to 250mA at 24Vdc to the head. A SE Ex input channel board is used with three-wire pellistor heads and can supply up to 400mA at up to 9V.

The power supply board has connections for mains supply, four master relays, subsidiary 24Vdc and remote Reset. The master relays are normally configured as three common gas alarms and a common fault alarm.

The control & display board mounted on the front panel has a two line by twenty character display which shows the concentration of gas at each measuring head, and status LEDs for each alarm. Push buttons on the front panel allow alarms to be acknowledged and Reset, and allow gas name, measurement units and measurement range to be displayed.
Full configuration, calibration and testing is carried out using the ⇧, ⇩, ⇦, ⇨ and Reset push buttons on the front panel.

Each input channel board has connections for a measuring head, three channel alarm relays and analogue output. The alarm relays are normally configured as two gas alarms and a fault alarm. The analogue output gives a 4–20mA or 0–20mA signal proportional to the displayed gas concentration.

There are no potentiometers for calibration, although head current adjustment on SE Ex channels is by potentiometer. As well as zero, span and alarm set point adjustments, the following operations can also be carried out:

- configure channel alarm relays to be latching or non-latching, manual reset or auto reset, normally energized or energized on alarm, rising or falling;
- configure system relays to be latching or non-latching, manual reset or auto reset, normally energized or energized on alarm, common or voting;
- set under-range and over-range fault levels;
- test channel and common relays and analogue output;
- set gas name, range and measurement unit for each channel.

2. FACILITIES AND CONFIGURATION

2.1 Display

The front panel has a two line by twenty character display which can be configured to display the gas measurements of all channels simultaneously, or one channel at a time. The display is backlit allowing full visibility in all ambient light conditions.

The normal display shows all channels simultaneously. The top line displays the channel number; the bottom line shows the gas measurement:

```
CH1   CH2   CH3   CH4
 27    0 20.9   -3
```

Alternatively, the top line can be configured to display each channel with its gas name:

```
CH4   CO    O2   Cl2
 27    0 20.9   -3
```

A third alternative shows just one channel at a time, changing to the next channel every two seconds. The top line shows the channel number, gas measurement, gas units and name; the bottom line shows the channel status:

```
CH1:  27%LEL CH4
TRIPPED: A1
```

or:

```
CH4:  -3.0PPM Cl2
FAULT INHIBIT
```

Use system command 60–1 to configure the display.

2.1.1 Display during power-up

When power is applied to the system, the configuration of each channel is checked against what channels are actually fitted; during this time a configuration check display occurs:

```
CONFIGURATION CHECK:
 OK   OK  NONE WAIT
```

The display shows "WAIT" for channels which have not been checked.
The display shows "OK" for a channel if the configuration of 4–20mA or SE Ex matches the input channel board which is fitted.
The display shows "mA" if the fitted input channel board is a 4–20mA type, but the setup is for a SE Ex channel.
The display shows "Ex" if the fitted input channel board is a SE Ex type, but the setup is for a 4–20mA channel.
The display shows "NONE" for a channel where there is no input channel board fitted.

Warning: **If any setup does not match the fitted input channel board, a system fault will occur (see Appendix** 1)**; use system command 52–0 to correctly configure the channels.**

2.2 Indicators and controls

LED	Indicates	
Channel A2 Channel A1	Flashing: Steady:	alarm tripped alarm acknowledged but still tripped
Channel Fault	Flashing: Steady:	fault alarm tripped fault alarm acknowledged but still tripped
M3 M2 M1	Flashing: Steady:	master alarm tripped master alarm acknowledged but still tripped
MF	Flashing: Steady:	master fault alarm tripped master fault alarm acknowledged but still tripped
Power	Steady: Flashing:	system operational system fault; see Appendix 1
Inhibit	Steady:	alarm relays inhibited

Push button	Function	
R	Acknowledge alarm Reset relay Enter command mode	
⇧	Display gas names	Press both buttons together to display
⇩	Display units	measurement ranges
⇦	Display alarm 1 trip levels in multi-channel display mode	
⇨	Display alarm 2 trip levels in multi-channel display mode	
⇦	Previous channel in single-channel display mode	Press both buttons together to hold the current channel and to release channel hold
⇨	Next channel in single-channel display mode	

Channel Alarm LEDs A2 and A1

These LEDs indicate that a gas alarm has been tripped. There are separate LEDs for each channel. When an alarm is tripped, the corresponding LED will flash. When the alarm is acknowledged the LED will stop flashing and remain steadily lit. When the alarm is reset the LED will go out.

A flashing alarm LED indicates that an alarm has been tripped but not acknowledged. A steadily lit LED indicates that the alarm has been acknowledged; the state of the alarm relay depends on whether that alarm has been configured to be acknowledgeable or not.

Channel Fault LED

The Fault LED indicates that a loop fault has occurred. There are separate LEDs for each channel. The LED will flash when a fault alarm is tripped. Pressing Reset will cause the LED to remain steady if the fault is still present, or go out if the fault has cleared.

When the LED is flashing, the fault relay will be in its alarm state. If the LED is steadily lit, the fault alarm has been acknowledged; the state of the fault relay then depends on whether that alarm is acknowledgeable.

Master Alarm LEDs M3 M2 and M1

These LEDs indicate that a master alarm has been tripped. When a master alarm is tripped, the corresponding LED will flash. When the master alarm is acknowledged the LED will stop flashing and remain steadily lit. When the master alarm is reset the LED will go out.

Master Fault LED MF

The Master Fault LED indicates that a loop fault has occurred on one or more channels. When the master fault alarm is tripped, the master fault LED will flash. When the master fault alarm is acknowledged the LED will stop flashing and remain steadily lit. When the master fault alarm is reset the LED will go out.

Power LED

The Power LED remains steadily lit when the system is operating normally.

If the Power LED flashes, a system fault has occurred (See Appendix 1.)

Inhibit LED

The Inhibit LED lights to indicate that some or all alarm relays are inhibited. All channel and alarm relays are inhibited when the card is put into command mode. The appropriate channel relays are inhibited when a loop fault occurs on a channel.

The Inhibit LED blinks to indicate that one or more alarm relays have been disabled. See section 2.3.7.

R (Reset)

The Reset button has three functions:

- To acknowledge a channel or master alarm
- To reset a channel or master alarm relay
- To enter command mode

Holding the Reset button down for five seconds puts the card into command mode, giving access to the configuration commands and inhibiting all channel and master alarm relays.

⇧ and ⇩

When the card is in normal operation (i.e. not in command mode) and is configured to display all channel measurements simultaneously:

Press ⇧ to display the name of the gases being measured
Press ⇩ to display the units of measurement
Press ⇧ and ⇩ together to display the measurement ranges.

⇦ and ⇨

When the card is in normal operation (i.e. not in command mode) and is configured to display all channel measurements simultaneously:

Press ⇦ to display the alarm 1 trip levels
Press ⇨ to display the alarm 2 trip levels.

⇧ and ⇩

When the card is in normal operation (i.e. not in command mode) and is configured to display one channel at a time:

Press ⇧ to display the alarm 1 trip levels
Press ⇩ to display the alarm 2 trip levels.

⇦ and ⇨

When the card is in normal operation (i.e. not in command mode) and is configured to display one channel at a time:

Press ⇦ to display the previous channel
Press ⇨ to display the next channel
Press ⇦ and ⇨ together to hold the current channel, or to release hold.

2.3 Alarm outputs

Each input channel board has three single-pole changeover volt-free alarm relays, rated 250Vac/30Vdc 5A.
Channel relays 1 and 2 are tripped by gas alarms A1 and A2. The third channel relay is normally the fault alarm relay but can be used as a second gas alarm A1 or A2 relay or as a combined A1&A2 relay; see section 2.3.4.

There are also four single-pole changeover volt-free master alarm relays, rated 250Vac/30Vdc 5A.
Master relays 1, 2 and 3 can be configured to provide common or voting alarms based on the status of the channel alarms. The fourth master relay is always a common fault alarm relay.

Each relay can be individually configured to be normally energized (fail-safe) or energized on alarm. Each relay can also be configured to be
• latching and non-acknowledgeable,
• latching and acknowledgeable,
• non-latching and non-acknowledgeable,
• non-latching and acknowledgeable, or
• delay-latching and non-acknowledgeable,

where:

Latching	means	Relay must be manually reset
Non-latching	means	Relay will automatically reset
Acknowledgeable	means	Relay can be reset when the gas measurement is still above[1] the alarm level
Non-acknowledgeable	means	Gas measurement must fall below[1] the alarm level before the relay can be reset
Delay-latching	means	Relay must be manually reset but will clear automatically after gas measurement falls below alarm level if the alarm has been acknowledged.

See Appendix 3 for further clarification.

Use channel commands 04–4, 04–5 and 04–6 to configure whether the A1, A2 and third channel relay is normally energised or energised on alarm. Use channel commands 11–7, 11–8 and 11–9 to configure the A1, A2 and third channel relay latch mode.

Use master commands 04–4, 04–5, 04–6 and 04–7 to configure whether the M1, M2, M3 and master fault relay is normally energised or energised on alarm. Use master commands 11–7, 11–8, 11–9 and 12–0 to configure the M1, M2, M3 and master fault relay latch mode.

2.3.1 Alarm inhibit on power-up

When power is applied to the system a 30 second inhibit period is started, during which time all channel and master alarm relays are held in their non-alarm state.

2.3.2 Alarm levels

An alarm level cannot be set lower than 5% of full scale (or the nearest display step), to prevent false alarms. For example, on a 0–25 scale, the lowest alarm level is 1.3 (5% of 25 = 1.25; nearest step is 1.3).

Use channel commands 11–1 and 11–2 to set the A1 and A2 trip level.

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[1] Refers to a rising alarm. The same logic applies to falling alarms.

2.3.3 Rising/falling alarms

Alarms A1and A2 can each be set as a rising or falling alarm[2].

Use channel commands 11–4 and 11–5 to configure A1 and A2.

2.3.4 Third alarm relay

The third channel alarm relay is normally configured to a fault alarm. It can be re-configured to 'repeat' alarm A1 or A2 (providing the equivalent of a double-pole changeover relay), or can be configured to provide a 'combination' A1&A2 alarm.

Use channel command 11–6 to configure the third alarm relay.

2.3.5 Master alarms

There are three master alarms which can be configured to provide common A1 or A2 alarms, common A1 and A2 combination alarm, or voting A1 or A2 alarms.
A fourth master alarm always provides a common fault alarm.

A common master alarm will trip when any appropriate channel alarm trips. The master alarm will 're-trip' if another channel alarm trips.
A voting master alarm will trip if a set number of appropriate channel alarms are tripped together.

Use master commands 11–4, 11–5 and 11–6 to configure M1, M2 and M3.

2.3.6 Manually testing alarm relays

Each alarm relay can be directly controlled in command mode to allow testing of the alarm relays.

Use channel commands 14–4, 14–5 and 14–6 to test the A1, A2 and third channel relay.

Use master commands 14–4, 14–5, 14–6 and 14–7 to test the M1, M2, M3 and master fault relay.

2.3.7 Disabling alarm relays

Each alarm relay can be disabled to prevent it changing state when an alarm occurs. Disabling one relay will not affect any other relay. The Inhibit LED will blink once a second to indicate that one or more alarm relays have been disabled.

Use channel commands 60–4, 60–5 and 60–6 to disable the A1, A2 and third channel relay.

Use master commands 60–4, 60–5, 60–6 and 60–7 to disable the M1, M2, M3 and master fault relay.

2.3.8 Alarm hysteresis

Alarm hysteresis[3] can be set between 0 and 5% in 0.5% steps and is pre-set to 2% of full scale. For example, on a 0 – 500 scale, a rising alarm set at 100 will reset at 2% of 500 below 100, i.e. at 90.

Use channel command 11–0 to set the alarm hysteresis.

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[2] A rising alarm is one that trips as the gas level increases. A falling alarm is one that trips as the gas level decreases.

[3] Hysteresis is the gap between an alarm trip level and alarm reset level. It is also sometimes called "dead-band".

2.4 Under-range, over-range and loop fault alarms

Under-range and over-range alarms can be set on each channel to trip the fault alarm if the signal from the head goes below zero or above full scale by a pre-set amount. The amount by which the signal must go below zero or above full scale is set independently for the under-range and over-range alarms. Both alarms can be enabled at the same time.

If an over-range alarm is set the rate of rise of the signal from the head is monitored. If the signal goes above full scale more quickly than would be expected from a measuring head, the over-range alarm will trip without tripping a gas alarm. Similarly, if an under-range alarm is set, a sudden decrease in signal will trip the under-range alarm, without tripping a falling gas alarm.

On SE Ex channels the supply voltage to the head is also monitored. Normally, this voltage should not change by more than a few hundred millivolts from its value when the head is zeroed. A wiring fault or a blown pellistor bead will cause this voltage to change by a volt or more.
Most pellistor heads have about 2 to 2.5V across them; if the head is short-circuited the supply voltage at the card will drop by this amount. Setting an alarm at 1.5V will detect a short circuit at the head, or at any point along the cable to the head. Similarly, an open circuit across the head will cause the supply voltage to the head to rise, and this rise will be detected.
If a head supply fault alarm is not set, a short circuit of all three cores together may not cause an alarm or a significant change in gas measurement.

2.4.1 Under-range alarm

On 4–20mA channels the under-range alarm can be set between 0.5mA and 3.5mA, or can be disabled.

On SE Ex channels the under-range alarm can be set between –5% and –15% of full scale, or can be disabled.

Use channel command 10–7 to set the under-range alarm.

2.4.2 Over-range alarm

On 4–20 channels the over-range alarm can be set between 20.5mA and 23.5mA, or can be disabled.

On SE Ex channels the over-range alarm can be set between 105% and 115% of full scale, or can be disabled.

If there is a possibility that a pellistor head might be exposed to a sudden high concentration of gas (much greater than FSD) such that the output of the head would rise very rapidly from zero to above full scale, an over-range alarm should not be set. The rapid rise in signal could trip the over-range alarm without tripping a gas alarm.

Use channel command 10–8 to set the over-range alarm.

2.4.3 Loop faults (SE Ex channels only)

Loop faults are detected by monitoring the head supply. The head supply fault alarm can be set to detect a change in head supply voltage of between 0.5V and 2.0V. The 'baseline' against which the change is detected is the head supply voltage when the head was zeroed. "HFLT" is displayed instead of the gas concentration when a loop fault is detected.

Use channel command 10–9 to set the SE Ex head supply fault alarm.
Use channel command 10–0 to zero the head and set the head supply voltage 'baseline'.

Warning: **If the head voltage at the card is close to the 9V limit, an open circuit loop may not be detected.**

2.5 Internal Sounder

An internal sounder gives an audible warning when any channel or master alarm trips. When an alarm is tripped and the corresponding LED flashes, the sounder will 'beep' at the same rate as the LED flashes. When the alarm is acknowledged the sounder will go silent. The internal sounder can be disabled so that it is always silent.

The internal sounder is also 'beeped' when any push button is pressed, to confirm that the button is registered.

Use system command 14–2 to test the internal sounder.
Use system command 60–2 to disable the internal sounder.
Use system command 60–3 to disable the 'beep' when a push button is pressed.

2.6 Analogue output

The analogue output of each channel can be configured to output 4mA or 0mA for a gas measurement of zero; in either case the output is 20mA for a full-scale gas measurement. The analogue output can drive a maximum load of 500Ω. The analogue output return is tied to 0V.

Use channel command 04–9 to configure the analogue output.

2.6.1 Trimming analogue output

The analogue output can be trimmed using the front panel controls to be exactly 4mA ($\pm$0.08mA) when the gas measurement reads zero. This allows any offset error in the analogue output to be corrected.

Use channel command 10–3 to trim the analogue output.

2.6.2 Manually controlling analogue output

The signal generated by the analogue output can be controlled manually in command mode. The output can be varied between 0 and 20mA in 1mA steps, or between zero and full scale in steps equivalent to the gas measurement resolution.

Use channel command 14–2 to vary the analogue output between zero and full-scale.
Use channel command 14–3 to vary the analogue output between 0mA and 20mA.

2.7 Gas names

The following pre-defined gas names can be selected:

CH_4, Ex, H_2S, CO, O_2, Cl_2, SO_2, NO, NO_2, NH_3, O_3, CO_2, ClO_2, HCN, HCl, HBr, HF, H_2, Br_2, H_2O_2, EO, AsH_3, PH_3, B_2H_6, SiH_4.

An additional user-defined gas name can also be entered.

Use channel command 04–0 to configure the gas name.
Use channel command 52–0 to configure the user-defined gas name.

2.8 Measurement units

The following pre-defined measurement units can be selected:

%LEL, %UEG, %LIE, %vol, %v/v, ppm, ppb, °C, %RH

An additional user-defined measurement unit can also be entered.

Use channel command 04–1 to configure the gas measurement units.
Use channel command 52–0 to configure the user-defined gas name.

2.9 Measurement ranges

The following measurement ranges can be selected:

0–1, 0–2, 0–3, 0–4, 0–5, 0–10, 0–20, 0–25, 0–30, 0–50, 0–100, 0–200, 0–250, 0–300, 0–500, 0–1000, 0–3000, 0–9999

The resolution of the display varies according to the range; see Appendix 2.

Use channel command 04–2 to configure the gas measurement range.

Other ranges can be programmed by Draeger if required.

2.10 User defined gas name and measurement units

Each channel has a USER text entry which allows entry of a gas name or measurement unit other than those given above. The text entered becomes available to both the GAS and UNIT commands.

Use channel command 52–0 to configure the USER text.

2.11 Zero and span adjustment

2.11.1 4–20 channels

4–20mA channels are designed to display zero for an input signal of 4mA and full-scale at 20mA. To compensate for small errors in the measuring head output, the current at which zero is displayed can be adjusted by ±1mA from 4mA and the full-scale current by ±1mA from 20mA.

Use channel command 10–0 to adjust the ZERO point.
Use channel command 10–1 to adjust the full-scale SPAN point.

2.11.2 SE Ex channels

SE Ex channels measure the pellistor head using an electronic detector 'bridge'; they are designed to display zero when the bridge output is zero (i.e. balanced) and full-scale at an adjustable bridge output between 50 and 350mV.
For most pellistor heads, the bridge can be balanced with up to ±100mV zero error.

Use channel command 10–0 to automatically balance the bridge to give ZERO.
Use channel command 10–1 to adjust the bridge output corresponding to full-scale.

2.12 Zero drift band

A band can be set around zero so that head drift is not displayed: the display will continue to read zero until the measuring head output exceeds the limit of the band. This is useful where a head exhibits large amounts of drift around zero but a steady display is required. The zero drift band can be set between 0 and 5% of full scale in 0.5% steps.

Use channel command 10–2 to set the zero drift band.

The analogue output is not affected by the setting of the zero drift band.

2.13 Over-range latching

The over-range latching feature can be useful when a pellistor head is being used in an environment where the gas concentration can exceed the LEL; this can cause the head output to fall.
Over-range latching prevents the gas measurement display falling when this occurs, instead holding the display and alarms as if the head was still at full-scale. Pressing Reset will release the display.

Use channel command 04–3 to turn over-range latching on/off.

The analogue output will also remain at 20mA when over-range latching occurs.

2.14 Remote Reset

The system has a remote Reset input that allows all channel and master alarms to be acknowledged or reset by momentarily shorting the terminals.

Use system command 14–1 to test the remote Reset input.

2.15 Turning off the display

The normal display of gas concentration can be turned off. The display will show "----"instead of the gas measurement when the card is in normal operation.
Each channel can be individually controlled.

Use channel command 60–1 to turn the gas concentration display on/off.

2.16 Polytron heads calibration signal

4–20mA channels will recognize the 1Hz calibration signal from Dräger Polytron heads. When the calibration signal is detected all alarms are inhibited and "HCAL" is displayed instead of the gas concentration.

3. INSTALLATION

3.1 Power supplies

3.1.1 Mains supply

The system requires a mains supply rated 240Vac or 120Vac; in either case a variation of ±10% is acceptable. The mains supply is connected at the bottom left of the power supply board inside the cabinet.

ENSURE THAT THE MAINS SUPPLY SWITCH ON THE POWER SUPPLY BOARD IS CORRECTLY POSITIONED, AND THAT THE CORRECT MAINS FUSE IS FITTED.

Operating the system at 240Vac with the switch set to 120Vac will **destroy** the system. Operating the system at 120Vac with the switch set to 240Vac will result in erratic operation.

At the bottom right of the power supply board is a link which connects the system 0V to mains Earth (safety Earth). This may have to be removed; see Section 3.3.3.

The internal power supply is rated 24Vdc at 2A; up to 1A is used to power the system, allowing 1A to power sensor heads.
The typical requirement of sensor heads ensures that a fully populated system normally has at least 0.5A 'spare'; subsidiary 24Vdc terminals at the top right of the power supply board allow connection of low-current rated 24V devices such as external sounders with a rating of no more than 0.5A in total.

3.1.2 DC supply

The system can be powered from an external 24Vdc supply instead of a mains supply. In this event the mains connections are left open, and the external supply is connected via the subsidiary 24Vdc terminals at the top right of the power supply board.
The subsidiary 24Vdc fuse, F2, must be replaced with a 2A anti-surge type.

The system requires a maximum of 1A, with up to 0.5A additional for the sensor heads.

Reverse connection of an external dc supply will blow fuse F2.

3.1.3 Fuses

The system has three fuses on the power supply board and one on each 4–20mA input channel board.

A 1A anti-surge fuse, MF1, protects the mains supply. For operation at 120V ac, a 2A anti-surge fuse must be fitted.
A 2A quick blow fuse, F1, protects the system.
A 0.5A quick blow fuse, F2, protects the subsidiary 24Vdc supply.
When operating the system from an external dc supply a 2A quick blow fuse must be fitted in the F2 position to protect the system; fuse F1 is redundant.

A 250mA quick blow fuse on each 4–20mA input channel board protects the sensor head and loop.
No fuse is required on SE Ex input channel boards since the sensor head supply is constant current.

3.2 Standby batteries

When the mains supply is used, the subsidiary 24Vdc terminals can be used to connect a standby battery or standby dc input.

The terminals do not have blocking diodes to prevent current flow from the internal dc supply into a battery or external dc supply. The emergency supply should have suitable protection against reverse current flow if necessary. For further information on emergency supplies, refer to the Dräger Application Guideline *Emergency Supply Operation*.
If a standby battery is to be charged by the internal dc supply, ensure that the 0.5A rating will not be exceeded when charging a fully discharged battery.

3.3 Connecting measuring heads

Connection diagrams for measuring heads are given in Appendix 6.

3.3.1 Cable types

Use screened cable to all measuring heads; connect the screen to earth at the control system end only.
Screened cable (braided screen) gives maximum protection against radio frequency interference (RFI). Shielded cable (foil shield), although cheaper, gives less protection against RFI and should only be used where the risk from RFI is low.

PVC/SWA/PVC cable without a screen or shield does not give adequate immunity against RFI. It should not be used to connect to measuring heads unless the possibility of RFI is known to be unlikely for the lifetime of the installation or where the routeing of the cables gives adequate protection against RFI.

3.3.2 Loop resistance and maximum cable length

The maximum loop resistance that a SE Ex channel can drive is 20Ω (10Ω per core) for the Draeger SE Ex pellistor head at 280mA. The maximum cable lengths for 1.5mm^2 and 2.5mm^2 cable are:

Cable	Maximum length
1.5mm^2	450m
2.5mm^2	750m

The maximum loop resistance for a 4–20mA channel depends on the minimum voltage the head will operate at and the maximum drive capability of the head. Cable lengths up to 1000m are unlikely to cause problems.

3.3.3 Zener barriers and earthing

Observe local practice on earthing when connecting measuring heads through zener barriers. In the UK, it is usual to connect 0V on the control system at the zener barrier earth only. The diagram in Appendix A6-8 shows the 0Vdc terminal of the channel connected to the zener barrier earth busbar; alternatively, the 0Vdc terminal of the 24Vdc subsidiary supply can be connected, effectively earthing all the channel cards in the system.

At the bottom right of the power supply board is a link which connects the system 0V to mains Earth (safety Earth). This link must be removed so that 0V is earthed at the zener barrier earth only.

3.4 Relays, remote Reset and analogue output connections

The terminals for the relays, remote Reset input and analogue output are shown in Appendix A6-2 and A6-3.

4. SYSTEM SET-UP AND CALIBRATION

4.1 Preparation

Ensure that the correct number and type of input channel boards is fitted.

Warning!   **Do not connect a pellistor head to a 4-20mA channel: the current on the head supply terminals is not limited and will permanently damage the pellistors.**

Apply power to the system; watch the display during the configuration check:

```
CONFIGURATION CHECK:
 OK   OK  NONE WAIT
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Verify that all the fitted channels display "OK" and that any spare channel positions display "NONE". If this is not the case, use system command 52–0 to correctly setup the channels.

Check that the head current of any SE Ex channels is correct to within a few mA. If the current is too low, the head will not reach its correct operating temperature; if it is too high the pellistors may be damaged.

Allow the measuring heads to settle for 24 hours before calibration. Some measuring heads may need more than 24 hours to settle fully.

Put the system into command mode, using the configuration mode password. It is advisable to lock the system using system command 60–0 to prevent automatic return to normal mode during the set-up procedures.
See section 5 for details of using command mode.

For guidance on calibration methods, refer to the Dräger Application Guideline *Calibration*.

The following sections describe a basic set-up and calibration routine, which should be carried out for each channel in the system.

4.2 Set head current

Applicable only to SE Ex channels.

The head current will change slightly as the system reaches normal operating temperature[4]. A multi-turn potentiometer at the top right of the SE Ex input channel board can be adjusted to set the head current. Test terminals at the top left of the SE Ex input channel board allow measurement of the head current. See Appendix A6-3.

A 0–1V DVM connected across the test terminals of the SE Ex input channel board is used to set/check the head current; measurement is across a 1Ω resistor (i.e. 280mA reads as 0.28V).

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[4] Once at operating temperature, changes in ambient temperature within the specified operating limits will not cause a significant change in head current.

4.3 Set range, gas name and measurement units

Set the name of the gas being measured using channel command 04–0. For SE Ex channels it is recommended that the gas name be set to "Ex".

Set the measurement unit using channel command 04–1.

Set the measurement range using channel command 04–2.

The range of each card must be the same as the measuring head to which it is connected, otherwise the reading displayed by the card will not correspond to the gas concentration being measured by the head.

4.4 Set alarm trip points

Always set the alarm trip points **after** setting the measurement range, because changing the range resets the alarm trip points to 20% and 40% of full-scale.

Set the A1 alarm level using channel command 11–1.

Set the A2 alarm level using channel command 11–2.

Set rising or falling alarms using channel commands 11–4 and 11–5.

4.5 Set zero

4.5.1 Set zero for 4–20mA channels

Zero can be adjusted by ±1mA from 4mA.

1. Select channel command 10–0.

2. While there is no gas at the measuring head, use ⇧ and ⇩ to set the display to zero.

    If the display is still above zero and pressing ⇩ displays "MINIMUM", this indicates that the signal from the measuring head is too high to set zero; if the display is negative and pressing ⇧ displays "MAXIMUM", this means that the signal from the head is too low. Check the measuring head and re-calibrate it if necessary.

3. When the display reads zero, press Reset.

4.5.2 Set zero for SE Ex channels

Zero is set by automatic adjustment (balancing) of the electronic 'bridge', compensating for an imbalance of up to 100mV.

1. Select channel command 10–0. The display will show "DO NOTHING".

2. While there is no flammable gas at the measuring head, use ⇧ or ⇩ to change the display to "BALANCE Ex HEAD" and press Reset.

3. Wait for the bridge balance point to be found, after which the display will show "BALANCE OK".

    A display of "TOO LOW" or "TOO HIGH" indicates that the heads zero error is too great. Check the head and/or the connections.

    A display of "BALANCE FAILED" indicates that the signal from the head has changed during the zero routine. Allow the head to settle before trying to zero again.

4.6 Set span

4.6.1 Set span for 4–20mA channels

Span can be adjusted by ±1mA from 20mA.

1. Select channel command 10–1.

2. If the measuring head has a "calibrate" switch, make sure it is in the OFF position.

3. Apply a known concentration of gas to the measuring head and allow the gas measurement display to stabilize.

4. Use ⇑ and ⇓ to adjust the reading on the display until it is the same as the concentration of the calibration gas.

   If you cannot set the display to read the same as the calibration gas concentration ("MINIMUM" or "MAXIMUM" is displayed), the measuring head may be giving an incorrect output. The measuring head should be checked and, if necessary, re-calibrated.

5. When the display reading is correct, press Reset.

4.6.2 Set span for SE Ex channels

Span can be adjusted for a full-scale change in pellistor head output of between 50mV and 350mV.

1. Select channel command 10–1.

2. Apply a known concentration of gas to the measuring head and allow the gas measurement display to stabilize.

3. Use ⇑ and ⇓ to adjust the reading on the display until it is the same as the concentration of the calibration gas. The display may occasionally show "ADJUSTING GAIN" while the gain of the SE Ex input channel board is altered to maintain optimum resolution.

   If the display shows "MINIMUM" or "MAXIMUM" this indicates that maximum or minimum gain has been reached: the output of the head is either too low or too high.

4. When the display reading is correct, press Reset.

   The display will show the calculated full scale output of the head in volts. You can use this figure to monitor the change in sensitivity of the head each time it is calibrated.

4.7 Save settings

The procedures outlined in sections 4.1 through 4.7 should be carried out for all channels. If required, other configuration settings can be changed, including configuration of the master relays.

When configuration is complete, the settings should be saved; once this has been done, turning off the power to the system will not lose the settings.

1. Select system command 00–2. The display will show "CONFIRM:NO".

2. Use ⇧ or ⇩ to change the display to "CONFIRM:YES" and press Reset.

3. All system, channel and master configurations will be saved permanently. The display will show "PLEASE WAIT"; when the process is complete the display will show "SUCCESSFUL".

4. Use system command 00–0 to quit command mode, so that normal monitoring of gas levels occurs.

5. COMMAND MODE

5.1 Introduction

Command mode allows full configuration of the system. The commands available are divided into three groups:
- **System** settings, such as disabling the internal sounder
- **Channel** settings, such as measurement range, zero, span and alarm levels
- **Master** relay settings, such as common or voting alarms.

Access to the commands is password restricted. There are three levels of access:
- **Read**, in which configuration settings can be read but not altered, and basic testing done
- **Maintenance**, which allows access to commands used during calibration & maintenance
- **Configuration**, which allows access to all commands used to set up the system.

The table in Appendix 7 shows which commands are available in each group and which can be accessed at each level.

The default maintenance level password is MMMM; the default configuration password is CCCC.

5.2 Using command mode

To enter command mode press and hold the Reset button for five seconds: the Inhibit LED will light and the display will show the software version number until the Reset button is released. Initially system command 00–0 is selected:

```
00-0:QUIT COMMANDs
```

The top line of the display always shows the command number followed by a command description. During selection of the command, the bottom line of the display is blank.

Press ⇧ to change the display to "00–1:ENTER PASSWORD", press Reset and enter the maintenance or configuration password to select the required level of access.
Press ⇧ three times to change the display to "00–4:CONFIGURE MODE", press Reset and select which command group is required.

All commands are accessed in the same way: use ⇧ and ⇩ to select the number of the command you want then press Reset to select the command. The bottom line of the display now shows the current setting:

```
04-0:SELECT GAS NAME
CH1 :O2
```

The bottom left of the display shows which command group is selected; it is blank for system commands and shows "MSTR" for master commands. For channel commands "CHx" is shown, indicating which channel the setting applies to.

When a command is selected, most commands use ⇧ and ⇩ to change the setting. The setting is "fixed" by pressing Reset again, which also de-selects the command.
When channel commands are selected, use ⇦ and ⇨ to select the channel to which the command applies. Some system and master commands also use ⇦ and ⇨ to select channels.

To exit command mode, select system command 00–0:

```
00-0:QUIT COMMANDs
     :CONFIRM:NO
```

Use ⇧ or ⇩ to change the display to "CONFIRM:YES" and press Reset. The Inhibit LED will go out (unless any channel is in fault) and the normal display and monitoring of gas measurements will begin.

5.2.1 Example

1. Press the Reset button for five seconds. The display changes to show the software version, then shows "00–0:QUIT COMMANDs" when the Reset button is released
2. Press ⇧; the display changes to "00–1:ENTER PASSWORD"
3. Press Reset; the display shows "????"
4. Press ⇧ three times to change the first letter to C
5. Press Reset four times to enter the other three letters of the password; the display briefly shows "CONFIGURATION"
6. Press ⇧ until the display shows "00–4:CONFIGURE MODE"
7. Press Reset; the display shows "SYSTEM COMMANDS"
8. Press ⇧; the display changes to "CHANNEL ALARMS"
9. Press Reset
10. Press ⇧ until the display changes to "04–0:SELECT GAS NAME"
11. Press Reset; the display shows the current gas name for the first channel
12. Press ⇧; the display changes to the next gas name
13. Press Reset
14. Press ⇩ until the display shows "00–4:CONFIGURE MODE"; press Reset
15. Press ⇩; the display changes to "SYSTEM COMMANDS"; press Reset
16. Press ⇩ until the display shows "00–2:SAVE CHANGES"
17. Press Reset; the display shows "CONFIRM:NO"
18. Press ⇧; the display changes to "CONFIRM:YES"
19. Press Reset; the display shows "PLEASE WAIT" then "SUCCESSFUL"
20. Press ⇩ until the display shows "00–0:QUIT COMMANDs"
21. Press Reset; the display shows "CONFIRM:NO"
22. Press ⇧; the display changes to "CONFIRM:YES"
23. Press Reset; the display returns to showing gas measurements.

5.3 Alarm inhibit in command mode

When command mode is selected all alarms are inhibited: the relays will remain in their current state and will not change state unless changed manually. Any relay already in its alarm state when command mode is entered will remain in that state. The Inhibit LED lights to indicate that alarms are inhibited.

You can manually change the state of the alarm relays while in command mode using channel commands 14–4, 14–5 and 14–6, and master commands 14–4, 14–5, 14–6 and 14–7.

5.4 Locking the system in command mode

Normally the system will automatically exit command mode if no buttons are pressed for 10 minutes. The system can be locked in command mode indefinitely using system command 60–0.
Note that this command is not available in read mode.

5.5 Saving configuration settings

Use system command 00–2 to save changes to the configuration settings before you exit command mode. If you decide that you do not want to keep the changes you have made, exit command mode using system command 00–0 without first using system command 00–2.

Saved configuration settings are not lost when power is removed. When the system is next powered up, the configuration settings last saved will be used.

6. COMMANDS REFERENCE

A summary of all commands available in each group, and the modes in which each command is available, is given in the tables in Appendix 7.

6.1 System Commands

00–0 Quit command mode

Exits command mode without saving configuration settings.

1. Select system command "00–0:QUIT COMMANDs" and press Reset
2. The display will show "CONFIRM:NO" if no configuration settings have been changed, or "ABANDON:NO" if changed (un-saved) configuration settings will be lost
3. Press ⇧ or ⇩ to display "YES" then press Reset.

00–1 Enter password

Allows entry of the password appropriate to configuration or maintenance level, so that configuration settings can be altered.

1. Select system command "00–1:ENTER PASSWORD" and press Reset
2. The display will show "????"; the first "?" will be flashing
3. Press ⇧ or ⇩ to select the first letter of the password
4. Press Reset to enter the first letter; the second letter will then flash
5. Use ⇧ and ⇩ to select the second letter and press Reset again
6. Enter the third and fourth letters in the same way
7. When the Reset button is pressed after the fourth letter has been set, the display will show "MAINTENANCE" if the maintenance password was entered, "CONFIGURATION" if the configuration password was entered, or "INVALID" if an incorrect password was entered.

If you entered a correct password, you can now use ⇧ and ⇩ to select other commands.

00–2 Save configuration settings

Saves **ALL** new configuration settings (for channels and master relays).

1. Select command "00–2:SAVE CHANGES" and press Reset
2. The display will show "CONFIRM:NO" if configuration settings have been changed
3. Press ⇧ or ⇩ to display "YES" then press Reset
4. The display will show "PLEASE WAIT" while the configuration settings are being saved, then "SUCCESSFUL".

   If no configuration settings have been changed, the display will show "NOTHING TO SAVE" at step 2; press Reset.

00–3 Change password

Allows the password for the current access level to be changed.

1. Select command "00–3:CHANGE PASSWORD" and press Reset
2. The display will show "????"; if you press Reset now the password will remain unchanged
3. Use ⇧, ⇩ and Reset to enter a new password in the same way as system command 00–1.

The new password becomes effective immediately but only becomes permanent if you use the system command 00–2 to save the configuration settings.

14–0 Test LEDs and display

Allows all front panel LEDs and the display to be tested.

1. Select system command "14–0:TEST LEDs" and press Reset
2. All channel and master alarm LEDs and the Power and Inhibit LEDs will flash; the display will alternate between blank and fully dark
3. Press Reset to stop the test.

14–1 Test remote Reset input

Allows the remote Reset input to be tested.

1. Select system command "14–1:TEST REMOTE" and press Reset
2. The display will show "ACTIVE (CLOSED)" when the remote Reset terminals are shorted and "INACTIVE (OPEN)" when they are open circuit
    If the remote Reset terminals are held shorted for more than 10 seconds the display will show "FAULTY (SHORT)"
3. Press Reset to stop the test.

14–2 Test Internal Sounder

Allows the internal sounder to be tested.

1. Select system command "14–2:TEST SOUNDER" and press Reset
2. The display will show "OFF"
3. Press ⇧ or ⇩ to toggle between "OFF" and "ON"; when "ON" is displayed the sounder will operate
4. Press Reset to stop the test; the sounder will be silenced.

14–3 Test what Channels are fitted

Allows confirmation of the correct function of the 4–20mA and SE Ex channels in the system.

1. Select system command "14–3:TEST CHANNELS" and press Reset
2. The display will show "CONFIGURATION CHECK"; all four channel positions will be tested, displaying "NONE" if no channel is present, "mA" if a 4–20mA channel is pressed or "Ex" if a SE Ex channel is present
3. Press Reset once all four channel positions have been tested.

This test is similar to that carried out automatically when the system is first powered up.

52–0 Setup what Channels are fitted

Configures the presence and type of fitted input channel boards. The system automatically recognises what channels are fitted; however it controls the channels according to this setup.

1. Select system command "52–0:SETUP CHANNELS" and press Reset
2. The display will show "CH1:" followed by the current setup of channel 1, which can be "mA", "Ex" or "NONE"
3. Press ⇧ or ⇩ to change the setup for the channel; select "mA" if a 4–20mA input channel board is fitted or "Ex" if a SE Ex input channel board is fitted; if no input channel board is fitted, select "NONE"
    If the setup differs from that tested by the system the 'correct' setup will be shown in brackets
4. Press ⇦ or ⇨ to select different channels
5. Press Reset; if the channel setup has been altered, the display will show "NEW SETUP" and all configuration settings for that channel will be reset to factory defaults.

60–0 Lock system in command mode

Locking the system in command mode prevents it automatically returning to normal mode if no buttons are pressed for ten minutes. Only system command 00–0 will exit command mode.

1. Select system command "60–0:LOCK COMMANDs" and press Reset
2. The display will show "NO"
3. Press ⇧ or ⇩ to change the display to "YES:NO TIMEOUT"
4. Press Reset.

60–1 Configure display of gas measurements

The display of gas measurements in normal mode can be set up to display all channels simultaneously with a heading of channel numbers or of gas name, or be set up to display one channel at a time.

1. Select system command "60–1:DISPLAY HEADING" and press Reset
2. The display will show the current configuration, which can be "CHANNEL NUMBERS", "GAS NAMES" or "ONE AT A TIME"
3. Press ⇧ or ⇩ to change the configuration; "CHANNEL NUMBERS" displays all gas measurements together headed by the channel numbers, "GAS NAMES" displays all gas measurements together headed by the appropriate gas names, and "ONE AT A TIME" displays the gas measurement of one channel at a time
4. Press Reset.

60–2 Disable Internal Sounder

Forces the internal sounder to remain silent at all times. Note that the 'beep' when a push button is pressed is not affected by this setting; see system command 60–3.

1. Select system command "60–2:DISABLE BEEPER" and press Reset
2. The display will show "NO" if the sounder is enabled or "YES:SILENT" if it is disabled
3. Press ⇧ or ⇩ to change the setting
4. Press Reset.

The Inhibit LED does **not** blink when the internal sounder is disabled.

60–3 Disable Sounder when push button pressed

Stops the 'beep' when a push button is pressed.

1. Select system command "60–3:DISABLE KEYBEEP" and press Reset
2. The display will show "NO" if 'beeps' are enabled or "YES:SILENT" if 'beeps' will not occur when push buttons are pressed
3. Press ⇧ or ⇩ to change the setting
4. Press Reset.

99–9 Configure language in which messages are displayed

Selects the language in which all messages are displayed.
Note that the command is easily accessible by pressing ⇩ to move back one command from system command 00–0, when command mode is first selected. The required language can then be selected even before any password is entered.

1. Select system command "99–9:SELECT LANGUAGE" and press Reset
2. The display will show "ENGLISH" as the currently selected language
3. Press ⇧ or ⇩ to select a different language
4. Press Reset.

6.2 Channel Commands

04–0 Set gas name

Configures the gas name used to identify the gas being monitored (can be displayed in normal mode).

1. Select channel command "04–0:SELECT GAS NAME" and press Reset
2. The display will show the current gas name for the selected channel
3. Press ⇧ or ⇩ to select a new gas name
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

04–1 Set measurement units

Configured the gas units in which the gas is being monitored (can be displayed in normal mode).

1. Select channel command "04–1:SELECT UNITS" and press Reset
2. The display will show the current measurement units for the selected channel
3. Press ⇧ or ⇩ to select a new measurement units
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

04–2 Set measurement range

Configures the full-scale range of the gas being monitored; must match the range of the sensor head being used.

1. Select channel command "04–2:SELECT RANGE" and press Reset
2. The display will show the current measurement range for the selected channel
3. Press ⇧ or ⇩ to select a new measurement range
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset; the display will show "ALARMS RESET" if the measurement range is changed.

Note: Changing the range resets the A1 and A2 alarm trip points to 20% and 40% of full-scale, rising.

04–3 Enable or disable over-range latching

A gas concentration which exceeds the full-scale range of the sensor head can be latched, preventing erroneous lower gas concentration displays if the sensor head output subsequently falls.

1. Select channel command "04–3:OVERRANGE LOCK" and press Reset
2. The display will show "YES:FSD LOCKED" if over-range latching is enabled, or "NO" if it is disabled
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

Note: If over-range latching is enabled, the alarms will also latch even if they are not configured to be latching using channel commands 11–7, 11–8 and 11–9.

04–4 Set channel alarm 1 relay normally energised or energised on alarm

Channel alarm 1 relay can be configured to normally energised ('failsafe') or not; a 'failsafe' relay will always be in alarm state if the power fails.

1. Select channel command "04–4:A1 RLY ENERGISE" and press Reset
2. The display will show "... ON ALARM" if the channel alarm 1 relay is energized on alarm or "... NORMALLY" if it is normally energized
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

04–5 Set channel alarm 2 relay normally energised or energised on alarm

Channel alarm 2 relay can be configured to normally energised ('failsafe') or not; a 'failsafe' relay will always be in alarm state if the power fails.

1. Select channel command "04–5:A2 RLY ENERGISE" and press Reset
2. The display will show "... ON ALARM" or "... NORMALLY", for the selected channel alarm 2 relay
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

04–6 Set channel relay 3 normally energised or energised on alarm

Channel relay 3 can be configured to normally energised ('failsafe') or not; a 'failsafe' relay will always be in alarm state if the power fails.

1. Select channel command "04–6:R3 RLY ENERGISE" and press Reset
2. The display will show "... ON ALARM" or "... NORMALLY", for the selected channel relay 3
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

04–9 Set analogue output range

The analogue output can give 4mA or 0mA for zero gas concentration; full-scale gas concentration always gives 20mA.

1. Select channel command "04–9:ANALOGUE O/P" and press Reset
2. The display will show "4mA TO 20mA" or "0mA TO 20mA"
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

10–0 Set zero for 4–20 channels

Calibrates the system to the zero gas concentration signal from the sensor head.

1. Select channel command "10–0:SET ZERO" and press Reset
2. The display will show the current gas measurement for the selected channel
3. Press ⇦ or ⇨ to select the required channel
4. Press ⇧ or ⇩ until the display shows a gas measurement of zero (assuming that no gas is present)
5. Press Reset.

Note: The zero point can only be adjusted by ±1mA. If you are unable to zero the display the measuring head may need re-calibrating.

10–0 Set zero for SE Ex channels (balance)

Calibrates the system to the zero gas concentration signal from the sensor head.

1. Select channel command "10–0:SET ZERO"and press Reset
2. The display will show "DO NOTHING"
3. Press ⇦ or ⇨ to select the required channel
4. Press ⇧ or ⇩ to display "BALANCE Ex HEAD" then press Reset
5. The display will show "BALANCE TEST" briefly; then the display will count up to the balance point
6. The display will show "BALANCE OK" briefly.
   The head supply voltage at this time is recorded for use when detecting loop supply voltage faults; see channel command 10–9.

   If the heads zero error is too great to allow the detector bridge to be balanced the display will show "TOO LOW" or "TOO HIGH". Press Reset to cancel the command. Check the head and wiring.

   If the display shows "BALANCE FAILED" the signal from the head has changed during the zero routine. Press Reset to cancel the command and allow the head to settle fully then repeat the procedure.

10–1 Set span for 4–20 channels

Calibrates the system to the full-scale gas concentration signal from the sensor head.

1. Select channel command "10–1:SET SPAN" and press Reset
2. The display will show the current gas measurement for the selected channel
3. Press ⇦ or ⇨ to select the required channel
4. Press ⇧ or ⇩ until the display shows the correct gas measurement corresponding to the concentration of the calibration gas
5. Press Reset.

Note: The span point can only be adjusted by ±1mA. If you cannot set the display to the correct gas measurement the measuring head may need re-calibrating.

10–1 Set span for SE Ex channels

Calibrates the system to the full-scale gas concentration signal from the sensor head.

1. Select channel command "10–1:SET SPAN" and press Reset
2. The display will show the current gas measurement for the selected channel
3. Press ⇦ or ⇨ to select the required channel
4. Press ⇧ or ⇩ until the display shows the correct gas measurement corresponding to the concentration of the calibration gas
5. Press Reset.

   The display may occasionally show "ADJUSTING GAIN" while the circuit gain of the SE Ex input channel board is adjusted to maintain optimum resolution. Wait for the display to return to the gas measurement before pressing ⇧ or ⇩ again.

   If the display shows "MAXIMUM" when you press ⇧ the output of the head is too low for correct calibration. If the display shows "MINIMUM" when you press ⇩ the output of the head is outside the maximum range of the system.

10–2 Set zero drift band

Any gas measurement within this band around zero is displayed as zero. The drift band can be set between 0.0% and 5.0% inclusive in 0.5% steps.

1. Select channel command "10–2:ZERO DRIFT BAND" and press Reset
2. The display will show the current drift band setting for the selected channel
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

10–3 Trim analogue output

Trims the analogue output signal to compensate for component tolerances.

1. Connect a 0–20mA DVM to the analogue output of the required channel
2. Select channel command "10–3:TRIM 4mA O/P" and press Reset
3. The display will show "+/- ADJUSTS 4mA"; the analogue output of the selected channel will change to 4mA
4. Press ⇦ or ⇨ to select the required channel
5. Press ⇧ or ⇩ to set the output to 4.0mA; each press of ⇧ or ⇩ increases or decreases the output by 0.08mA; the maximum adjustment is approximately ±1mA
6. Press Reset.

The signal is still trimmed at 4mA if the analogue output is configured to "0mA TO 20mA"; see channel command 04–9.

10–7 Set under-range fault level for 4–20mA channels

The under-range fault level is adjustable between 0.5mA and 3.5mA in 0.1mA steps, or can be disabled.

1. Select channel command "10–7:U/RANGE FAULT" and press Reset
2. The display will show the current under-range fault setting for the selected channel
3. Press ⇧ or ⇩ to change the setting; selecting "OFF" disables under-range faults
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

10–7 Set under-range fault level for SE Ex channels

The under-range fault level is adjustable between -15% and -5% of full-scale in 1% steps, or can be disabled.

1. Select channel command "10–7:U/RANGE FAULT" and press Reset
2. The display will show the current under-range fault setting for the selected channel
3. Press ⇧ or ⇩ to change the setting; selecting "OFF" disables under-range faults
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

10–8 Set over-range fault level for 4–20mA channels

The over-range fault level is adjustable between 20.5mA and 23.5mA in 0.1mA steps, or can be disabled.

1. Select channel command "10–8:O/RANGE FAULT" and press Reset
2. The display will show the current over-range fault setting for the selected channel
3. Press ⇧ or ⇩ to change the setting; selecting "OFF" disables over-range faults
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

10–8 Set over-range fault level for SE Ex channels

The over-range fault level is adjustable between 105% and 115% of full-scale in 1% steps, or can be disabled.

1. Select channel command "10–8:O/RANGE FAULT" and press Reset
2. The display will show the current over-range fault setting for the selected channel
3. Press ⇧ or ⇩ to change the setting; selecting "OFF" disables over-range faults
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

10–9 Set loop supply fault trip voltage for SE Ex channels

The voltage by which the head supply must change to trip a fault alarm can be set between 0.5V and 2.0V in 0.1V steps, or can be disabled.
The head supply voltage is compared with what it was when the head was last zeroed; see channel command 10–0.

1. Select channel command "10–9:Ex SUPPLY FAULT" and press Reset
2. The display will show the current supply fault trip voltage for the selected channel
3. Press ⇧ or ⇩ to change the setting; selecting "OFF" disables loop supply faults
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

Selecting a 4–20mA channel will show "OFF", which cannot be altered.

11–0 Set alarm hysteresis

Alarm hysteresis[5] can be set between 0% and 5% of full scale in 0.5% steps.

1. Select channel command "11–0:HYSTERESIS BAND" and press Reset
2. The display will show the current hysteresis setting for the selected channel
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

11–1 Set channel alarm 1 trip level

Sets the gas concentration at which A1 will trip; cannot be below 5% or above 100% of full-scale.

1. Select channel command "11–1:A1 TRIP LEVEL" and press Reset
2. The display will show the current alarm 1 level for the selected channel
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

11–2 Set channel alarm 2 trip level

Sets the gas concentration at which A2 will trip; cannot be below 5% or above 100% of full-scale.

1. Select channel command "11–2:A2 TRIP LEVEL" and press Reset
2. The display will show the current alarm 2 level for the selected channel
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

---

[5] Hysteresis is the gap between an alarm trip level and alarm reset level. It is also sometimes called "dead-band".

11–4 Set channel alarm 1 as a rising or falling alarm

If A1 is "RISING", it will trip if the gas concentration exceeds the trip level set by channel command 11–1; if "FALLING", it will trip if the gas concentration is below the trip level (a 'deficiency' alarm).

1. Select channel command "11–4:A1 TRIP MODE" and press Reset
2. The display will show the current alarm 1 mode for the selected channel; either "RISING ALARM" or "FALLING ALARM"
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

11–5 Set channel alarm 2 as a rising or falling alarm

If A2 is "RISING", it will trip if the gas concentration exceeds the trip level set by channel command 11–2; if "FALLING", it will trip if the gas concentration is below the trip level (a 'deficiency' alarm).

1. Select channel command "11–5:A2 TRIP MODE" and press Reset
2. The display will show the current alarm 2 mode for the selected channel
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

11–6 Set channel relay 3 as a fault alarm or as a repeat gas alarm

The third relay on each channel is normally a fault alarm; it can be configured to operate as a second A1 or A2 alarm, or as a combination A1 and A2 alarm.

1. Select channel command "11–6:R3 TRIP MODE" and press Reset
2. The display will show the current third relay mode for the selected channel; "FAULT ALARM", "REPEAT A1", "REPEAT A2" or "REPEAT A1 & A2"
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

Selecting "REPEAT A1" or "REPEAT A2" will cause the third relay to trip at the same time as the 'normal' A1 or A2 relay; however it need not follow the normal relay, since the latching mode can be different. This allows a configuration where, for example, one alarm relay can be acknowledged (driving a sounder) and the other will not cancel until the alarm has cleared (driving a lamp). See channel commands 11–7, 11–8 and 11–9.
If the third relay is configured identically to the normal relay, the two relays function as a double-pole changeover volt-free alarm relay.

Selecting "REPEAT A1 & A2" will cause the third relay to trip when A1 and/or A2 trip; this is most useful when the relay can be acknowledged; it will trip when A1 trips, then after being acknowledged will trip again when A2 trips.

11–7 Set channel alarm 1 latch mode

Sets A1 to be latching, non-latching or delay-latching, acknowledgeable or non-acknowledgeable.

1. Select channel command "11–7:A1 LATCH MODE" and press Reset
2. The display will show the current alarm 1 latch mode setting for the selected channel; either "DELAYED NON-ACK", "LATCHED NON-ACK", "NON-ACK", "LATCHED ACK" or "ACKNOWLEDGEABLE"
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

See appendix 3 for clarification of the different latch modes.

11–8 Set channel alarm 2 latch mode

Sets A2 to be latching, non-latching or delay-latching, acknowledgeable or non-acknowledgeable.

1. Select channel command "11–8:A2 LATCH MODE" and press Reset
2. The display will show the current alarm 2 latch mode setting for the selected channel
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

11–9 Set channel relay 3 latch mode

Sets the third relay to be latching, non-latching or delay-latching, acknowledgeable or non-acknowledgeable.

1. Select channel command "11–9:R3 LATCH MODE" and press Reset
2. The display will show the current third relay latch mode setting for the selected channel
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

14–2 Test analogue output

Allows the output signal to be manually controlled in steps equivalent to the display resolution.

1. Select channel command "14–2:TEST O/P UNITS" and press Reset
2. The display will show the current gas measurement for the selected channel
3. Press ⇧ and ⇩ to increase or decrease the gas measurement; the output signal changes appropriately
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset to stop the test.

14–3 Test analogue output

Allows the output signal to be manually controlled in 1mA steps between 0mA and 20mA.

1. Select channel command "14–3:TEST O/P mA"and press Reset
2. The display will show the current output signal in mA for the selected channel (the signal is rounded to the nearest mA from what it was before the command was selected)
3. Press ⇧ or ⇩ to increase or decrease the output signal
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset to stop the test.

14–4 Test channel alarm 1 relay

Allows manual control of A1 relay for testing or to over-ride a latching/non-acknowledgeable alarm.

1. Select channel command "14–4:TEST A1 RLY" and press Reset
2. The display will show "ON" if the A1 relay of the selected channel is energized or "OFF" if it is de-energized
3. Press ⇧ or ⇩ to toggle the relay
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset; the relay will remain in the last state shown.

When the relay is "ON", contacts "NO" and "COM" are connected; when the relay is "OFF", contacts "NC" and "COM" are connected.

14–5 Test channel alarm 2 relay

Allows manual control of A2 relay for testing or to over-ride a latching/non-acknowledgeable alarm.

1. Select channel command "14–5:TEST A2 RLY" and press Reset
2. The display will show "ON" or "OFF"
3. Press ⇧ or ⇩ to toggle the relay
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset; the relay will remain in the last state shown.

14–6 Test channel relay 3

Allows manual control of the third relay for testing or to over-ride a latching/non-acknowledgeable alarm.

1. Select channel command "14–6:TEST R3 RLY" and press Reset
2. The display will show "ON" or "OFF"
3. Press ⇧ or ⇩ to toggle the relay
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset; the relay will remain in the last state shown.

52–0 Set user text

This text is used when the USER setting is selected for the gas name or measurement unit.

1. Select channel command "52–0:USER TEXT" and press Reset
2. The display will show the current user text for the selected channel; if it has not been set before, "????" will be shown
3. Press ⇦ or ⇨ to select the required channel
4. Press Reset now if you do not want to change the text; otherwise, press ⇧ or ⇩ to change the first character
5. Press Reset to "fix" the first character
6. Set the second, third and fourth characters in the same way
7. When you press Reset to fix the fourth character, the display will show "CHANGED" as a confirmation.

60–1 Gas measurement Display on/off

Allows normal display of gas measurement to be turned on or off. If turned off, the display will not show the gas measurement during normal operation.

1. Select channel command "60–1:DISPLAY" and press Reset
2. The display will show the current setting for the selected channel; either "YES" or "NO:GAS DISP OFF"
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

Any channel set to "NO" will show "----" (or "NON-DISPLAY") instead of the gas measurement.

60–4 Disable channel alarm 1 relay

Forces A1 relay to remain in its non-alarm state when a gas alarm is tripped.

Warning!   **A disabled relay will not respond to a gas alarm.**

1. Select channel command "60–4:DISABLE A1 RLY" and press Reset
2. The display will show "NO" if the A1 relay for the selected channel is enabled or "YES:NO ALARMS" if it is disabled
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

Channel commands 04–4, 11–1, 11–4 and 11–7 display "OFF" when the A1 relay is disabled, and do not allow the alarm 1 configuration to be altered.

The Inhibit LED will blink once a second to indicate that an alarm relay is disabled.

60–5 Disable channel alarm 2 relay

Forces A2 relay to remain in its non-alarm state when a gas alarm is tripped.

1. Select channel command "60–5:DISABLE A2 RLY" and press Reset
2. The display will show "NO" or "YES:NO ALARMS"
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

Channel commands 04–5, 11–2, 11–5 and 11–8 display "OFF" when the A2 relay is disabled, and do not allow the alarm 2 configuration to be altered.

60–6 Disable channel relay 3

Forces third relay to remain in its non-alarm state when a gas alarm is tripped.

1. Select channel command "60–6:DISABLE R3 RLY" and press Reset
2. The display will show "NO" or "YES:NO ALARMS"
3. Press ⇧ or ⇩ to change the setting
4. Press ⇦ or ⇨ to select a different channel
5. Press Reset.

Channel commands 04–6, 11–6 and 11–9 display "OFF" when the third relay is disabled, and do not allow the third relay configuration to be altered.

6.3 Master Commands

04–4 Set master alarm 1 relay normally energized or energized on alarm

Master alarm 1 relay can be configured to normally energised ('failsafe') or not; a 'failsafe' relay will always be in alarm state if the power fails.

1. Select master command "04–4:M1 RLY ENERGISE" and press Reset
2. The display will show "... ON ALARM" if the M1 relay is energized on alarm or "... NORMALLY" if it is normally energized
3. Press ⇧ or ⇩ to change the setting
4. Press Reset.

04–5 Set master alarm 2 relay normally energized or energized on alarm

Master alarm 2 relay can be configured to normally energised ('failsafe') or not; a 'failsafe' relay will always be in alarm state if the power fails.

1. Select master command "04–5:M2 RLY ENERGISE" and press Reset
2. The display will show "... ON ALARM" or "... NORMALLY"
3. Press ⇧ or ⇩ to change the setting
4. Press Reset.

04–6 Set master alarm 3 relay normally energized or energized on alarm

Master alarm 3 relay can be configured to normally energised ('failsafe') or not; a 'failsafe' relay will always be in alarm state if the power fails.

1. Select master command "04–6:M3 RLY ENERGISE" and press Reset
2. The display will show "... ON ALARM" or "... NORMALLY"
3. Press ⇧ or ⇩ to change the setting
4. Press Reset.

04–7 Set master fault relay normally energized or energized on alarm

Master fault relay can be configured to normally energised ('failsafe') or not; a 'failsafe' relay will always be in alarm state if the power fails.

1. Select master command "04–7:MF RLY ENERGISE" and press Reset
2. The display will show "... ON ALARM" or "... NORMALLY"
3. Press ⇧ or ⇩ to change the setting
4. Press Reset.

11–1 Set master alarm 1 voting data

Voting data can only be configured when the master alarm 1 mode is "VOTING A1" or "VOTING A2"; see master command 11–4.
A voting alarm is configured by including one or more channel alarms in the vote, and setting how many must be tripped together before the master alarm trips.

1. Select master command "11–1:M1 VOTE DATA"and press Reset
2. The display will show "CH1 A1" (if the mode is "VOTING A1") or "CH1 A2" (if the mode is "VOTING A2") followed by "YES" if the channel 1 alarm is included in the vote, or "NO" if the channel 1 alarm does not affect the vote
3. Press ⇦ or ⇨ to select the required channel
4. Press ⇧ or ⇩ to include/exclude the selected channel in the vote
5. Repeat steps 3 and 4 so that all channels to be included in the vote display "YES", and all others display "NO"
6. Press Reset; the display will show "1 OF CH1/2/3/4"; the list of channels following "OF" is those included in the vote (those displaying "YES" in steps 3 and 4)
7. Press ⇧ or ⇩ to alter the number of channels required to cause the master alarm to trip, between 1 and the number of channels in the vote
8. Press Reset.

11–2 Set master alarm 2 voting data

Voting data can only be configured when the master alarm 2 mode is "VOTING A1" or "VOTING A2"; see master command 11–5.
A voting alarm is configured by including one or more channel alarms in the vote, and setting how many must be tripped together before the master alarm trips.

1. Select master command "11–2:M2 VOTE DATA"and press Reset
2. The display will show "CH1 A1" or "CH1 A2" followed by "YES" or "NO"
3. Press ⇦ or ⇨ to select the required channel
4. Press ⇧ or ⇩ to include/exclude the selected channel in the vote
5. Repeat steps 3 and 4 so that all channels to be included in the vote display "YES", and all others display "NO"
6. Press Reset; the display will show "1 OF CH1/2/3/4"; the list of channels following "OF" is those included in the vote
7. Press ⇧ or ⇩ to alter the number of channels required to cause the master alarm to trip, between 1 and the number of channels in the vote
8. Press Reset.

11–3 Set master alarm 3 voting data

Voting data can only be configured when the master alarm 3 mode is "VOTING A1" or "VOTING A2"; see master command 11–6.
A voting alarm is configured by including one or more channel alarms in the vote, and setting how many must be tripped together before the master alarm trips.

1. Select master command "11–3:M3 VOTE DATA"and press Reset
2. The display will show "CH1 A1" or "CH1 A2" followed by "YES" or "NO"
3. Press ⇦ or ⇨ to select the required channel
4. Press ⇧ or ⇩ to include/exclude the selected channel in the vote
5. Repeat steps 3 and 4 so that all channels to be included in the vote display "YES", and all others display "NO"
6. Press Reset; the display will show "1 OF CH1/2/3/4"; the list of channels following "OF" is those included in the vote
7. Press ⇧ or ⇩ to alter the number of channels required to cause the master alarm to trip, between 1 and the number of channels in the vote
8. Press Reset.

11–4 Set master alarm 1 mode

M1 can be a 'common' or a 'voting' alarm, monitoring the A1 and/or A2 channel alarms.

1. Select master command "11–4:M1 MODE" and press Reset
2. The display will show the current master alarm 1 mode; either "COMMON A1", "COMMON A2", "COMMON A1 & A2", "VOTING A1" or "VOTING A2"
3. Press ⇧ or ⇩ to change the setting
4. Press Reset.

"COMMON A1" will trip master alarm 1 when any channel alarm 1 trips.
"COMMON A2" will trip master alarm 1 when any channel alarm 2 trips.
"COMMON A1 & A2" will trip master alarm 1 when any channel alarm 1 or alarm 2 trips.
"VOTING A1" will trip master alarm 1 when sufficient channel alarm 1s trip of those included in the vote.
"VOTING A2" will trip master alarm 1 when sufficient channel alarm 2s trip of those included in the vote.

11–5 Set master alarm 2 mode

M2 can be a 'common' or a 'voting' alarm, monitoring the A1 and/or A2 channel alarms.

1. Select master command "11–5:M2 MODE" and press Reset
2. The display will show the current master alarm 2 mode
3. Press ⇧ or ⇩ to change the setting
4. Press Reset.

11–6 Set master alarm 3 mode

M3 can be a 'common' or a 'voting' alarm, monitoring the A1 and/or A2 channel alarms.

1. Select master command "11–6:M3 MODE" and press Reset
2. The display will show the current master alarm 3 mode
3. Press ⇧ or ⇩ to change the setting
4. Press Reset.

11–7 Set master alarm 1 latch mode

Sets M1 to be latching, non-latching or delay-latching, acknowledgeable or non-acknowledgeable.

1. Select master command "11–7:M1 LATCH MODE" and press Reset
2. The display will show the current M1 latch mode setting; either "DELAYED NON-ACK", "LATCHED NON-ACK", "NON-ACK", "LATCHED ACK" or "ACKNOWLEDGEABLE"
3. Press ⇧ or ⇩ to change the setting
4. Press Reset.

See appendix 3 for clarification of the different latch modes.

11–8 Set master alarm 2 latch mode

Sets M2 to be latching, non-latching or delay-latching, acknowledgeable or non-acknowledgeable.

1. Select master command "11–8:M2 LATCH MODE" and press Reset
2. The display will show the current M2 latch mode setting
3. Press ⇧ or ⇩ to change the setting
4. Press Reset.

11–9 Set master alarm 3 latch mode

Sets M3 to be latching, non-latching or delay-latching, acknowledgeable or non-acknowledgeable.

1. Select master command "11–9:M3 LATCH MODE" and press Reset
2. The display will show the current M3 latch mode setting
3. Press ⇧ or ⇩ to change the setting
4. Press Reset.

12–0 Set master fault relay latch mode

Sets MF to be latching, non-latching or delay-latching, acknowledgeable or non-acknowledgeable.

1. Select master command "12–0:MF LATCH MODE" and press Reset
2. The display will show the current MF latch mode setting
3. Press ⇧ or ⇩ to change the setting
4. Press Reset.

14–4 Test master alarm 1 relay

Allows manual control of M1 relay for testing or to over-ride a latching/non-acknowledgeable alarm.

1. Select master command "14–4:TEST M1 RLY" and press Reset
2. The display will show "ON" if the M1 relay is energized or "OFF" if it is de-energized
3. Press ⇧ or ⇩ to toggle the relay
4. Press Reset; the relay will remain in the last state shown.

When the relay is "ON", contacts "NO" and "COM" are connected; when the relay is "OFF", contacts "NC" and "COM" are connected.

14–5 Test master alarm 2 relay

Allows manual control of M2 relay for testing or to over-ride a latching/non-acknowledgeable alarm.

1. Select master command "14–5:TEST M2 RLY" and press Reset
2. The display will show "ON" or "OFF"
3. Press ⇧ or ⇩ to toggle the relay
4. Press Reset; the relay will remain in the last state shown.

14–6 Test master alarm 3 relay

Allows manual control of M3 relay for testing or to over-ride a latching/non-acknowledgeable alarm.

1. Select master command "14–6:TEST M3 RLY" and press Reset
2. The display will show "ON" or "OFF"
3. Press ⇧ or ⇩ to toggle the relay
4. Press Reset; the relay will remain in the last state shown.

14–7 Test master fault relay

Allows manual control of MF relay for testing or to over-ride a latching/non-acknowledgeable alarm.

1. Select master command "14–7:TEST MF RLY" and press Reset
2. The display will show "ON" or "OFF"
3. Press ⇧ or ⇩ to toggle the relay
4. Press Reset; the relay will remain in the last state shown.

60–4 Disable master alarm 1 relay

Forces M1 relay to remain in its non-alarm state when a gas alarm is tripped.

Warning!   **A disabled relay will not respond to a gas alarm.**

1.   Select master command "60–4:DISABLE M1 RLY" and press Reset
2.   The display will show "NO" if the M1 relay is enabled or "YES:NO ALARMS" if it is disabled
3.   Press ⇧ or ⇩ to change the setting
4.   Press Reset.

Master commands 04–4, 11–1, 11–4 and 11–7 display "OFF" when the M1 relay is disabled, and do not allow the master alarm 1 configuration to be altered.

The Inhibit LED will blink once a second to indicate that an alarm relay is disabled.

60–5 Disable master alarm 2 relay

Forces M2 relay to remain in its non-alarm state when a gas alarm is tripped.

1.   Select master command "60–5:DISABLE M2 RLY" and press Reset
2.   The display will show "NO" or "YES:NO ALARMS"
3.   Press ⇧ or ⇩ to change the setting
4.   Press Reset.

Master commands 04–5, 11–2, 11–5 and 11–8 display "OFF" when the M2 relay is disabled, and do not allow the master alarm 2 configuration to be altered.

60–6 Disable master alarm 3 relay

Forces M3 relay to remain in its non-alarm state when a gas alarm is tripped.

1.   Select master command "60–6:DISABLE M3 RLY" and press Reset
2.   The display will show "NO" or "YES:NO ALARMS"
3.   Press ⇧ or ⇩ to change the setting
4.   Press Reset.

Master commands 04–6, 11–3, 11–6 and 11–9 display "OFF" when the M3 relay is disabled, and do not allow the master alarm 3 configuration to be altered.

60–7 Disable master fault relay

Forces MF relay to remain in its non-alarm state when a gas alarm is tripped.

1.   Select master command "60–7:DISABLE MF RLY" and press Reset
2.   The display will show "NO" or "YES:NO ALARMS"
3.   Press ⇧ or ⇩ to change the setting
4.   Press Reset.

Master commands 04–7 and 12–0 display "OFF" when the MF relay is disabled, and do not allow the master fault alarm configuration to be altered.

(End of Commands Reference)

7. MAINTENANCE AND SPARES

7.1 Maintenance

The system does not require any maintenance but should be checked for correct operation at six month intervals.

Measuring heads should be checked and recalibrated at the intervals specified in the measuring head instructions.

7.2 Spares

Description	Part No.
4–20mA input channel board	4205805
SE Ex input channel board	4205806
Power supply board	4205804
Control & display board	4205803
Keypad membrane	4205802
Fuse, 1A HRC anti-surge 20×5mm	4205818
Fuse, 2A HRC anti-surge 20×5mm	4205819
Fuse, 0.5A fast blow 20×5mm	
Fuse, 2A fast blow 20×5mm	
Fuse, 250mA fast blow 20×5mm	

APPENDIX 1: SYSTEM FAULTS

A system fault is a detected fault in the system. Faults are classed as either **critical**, which may stop the system working, or **advisory**, when the system will continue to work safely, but its functions may be limited.

When a system fault occurs the Power LED will turn on and off once a second and the display will alternate between normal and the message "SYSTEM FAULT x", where "x" is one of the fault codes in the table below.
A critical fault will be signalled by turning the master fault relay on and off once a second. Pressing Reset will stop the relay turning on and off, unless there is more than one critical fault.

Fault code	Meaning	Remedy
B	Button fault. **Advisory.** One of the front panel buttons appears to be continuously pressed. Operations which use the front panel controls may not be possible.	Check all front panel buttons.
D	Data error. **Critical**. Configuration settings have been lost or corrupted. Default configuration settings will be used. Alarms may not operate reliably.	Use SAVE to try to save new settings. If fault does not clear, contact Draeger Service.
E	EEPROM failure. **Critical**. Configuration data has been lost. Default configuration settings will be used.	Contact Draeger Service.
I	Internal configuration settings error. **Advisory.** The internal copy of the configuration settings was temporarily corrupted. The fault has been corrected.	Press Reset to clear fault warning. If fault recurs, contact Draeger Service.
Mx	Microcontroller failure. **Critical**. System has stopped working. "M" is followed with an additional code identifying the fault.	Hold down Reset to reset system. If fault recurs, contact Draeger Service.
P	EEPOT fault. SE Ex channels only. **Advisory.** The electronic balance pot has changed position in error. The fault has been corrected.	Press Reset to clear fault warning. If fault does not clear, contact Draeger Service.
R	Remote Reset fault. **Advisory**. The remote Reset terminals appear to be continuously shorted. The remote Reset input will be ignored.	Check remote Reset control and wiring.
S	Setup failure. **Critical**. One or more configured channels does not match the input channel boards fitted.	Check fitted channels with system command 14–3; correct setup with system command 52–0.
V	Voting failure. **Advisory**. A master alarm is configured to "VOTING A1" or "VOTING A2" but the vote data is not valid.	Check vote data for all master alarms.
W	Watchdog reset. **Advisory.** An unknown error has caused system to reset. System will continue to operate normally.	Press Reset to clear fault warning. If fault recurs, contact Draeger Service.

APPENDIX 2: SPECIFICATIONS

IP54 version (white)	
Weight	10kg approx.
Dimensions	400x350x90mm
IP65 version (blue)	
Weight	12kg approx.
Dimensions	440x350x100mm

A2-1 Operating conditions

Operating ranges	
Supply voltage	240Vac $\pm$10% 50-60Hz 120Vac $\pm$10% 50-60Hz
Power consumption	50W typical 100W maximum
Temperature	-5 – 40°C
Humidity	0 – 90% RH, non-condensing
Environmental protection	to IP54 (optionally to IP65)

Analogue outputs	
Maximum load	500Ω

A2-2 Alarm relays

Contact material	Silver alloy
Nominal switching capacity	5A 250Vac; 5A 30Vdc
Max. switching power	1250VA, 150W
Max. switching voltage	250Vac, 100Vdc
Max. switching current	5A
Min. switching voltage	10V
Min. switching current	100mA

A2-3 Display resolution

The resolution of the display of gas measurement depends on the selected range. The following table gives the resolution and the number of decimal places displayed for a positive reading on each range.

Range	Resolution	Dec. places	Range	Resolution	Dec. places
0 – 1	0.01	2	0 – 50	0.1	1
0 – 2	0.01	2	0 – 100	1	0
0 – 3	0.01	2	0 – 200	1	0
0 – 4	0.01	2	0 – 250	1	0
0 – 5	0.01	2	0 – 300	1	0
0 – 10	0.1	1	0 – 500	1	0
0 – 20	0.1	1	0 – 1000	1	0
0 – 25	0.1	1	0 – 3000	10	0
0 – 30	0.1	1	0 – 9999	25	0

APPENDIX 3: RELAY LATCH MODES

Each channel and master relay in the system can be individually configured to one of the latch modes "DELAYED NON-ACK", "LATCHED NON-ACK", "NON-ACK", "LATCHED ACK" or "ACKNOWLEDGEABLE".

Provided that the channel is not inhibited and the relay is not disabled, the relay will always 'trip' (contacts change to alarm state) when the gas concentration first reaches the alarm level.

Different latch modes allow for the relay to remain tripped while the gas is present, or to 'clear' (contacts return to non-alarm state) when the alarm is 'accepted' (by pressing Reset or momentarily shorting the Remote Reset input). If the relay remains tripped while gas is present, it can clear automatically when the gas clears, or clear only when Reset is pressed.

The two tables below clarify the behaviour of an alarm relay in each latch mode; in the first table, Reset is pressed while the gas concentration is still at alarm levels (i.e. the alarm is accepted); in the second table, this does not occur.

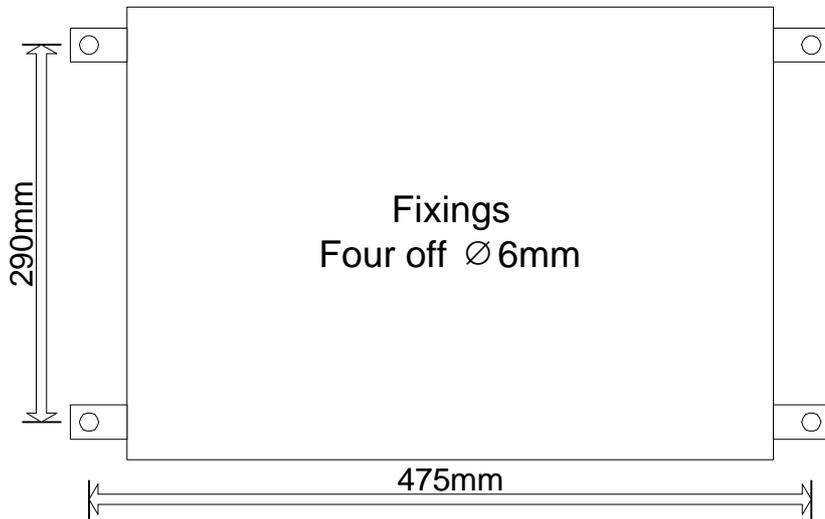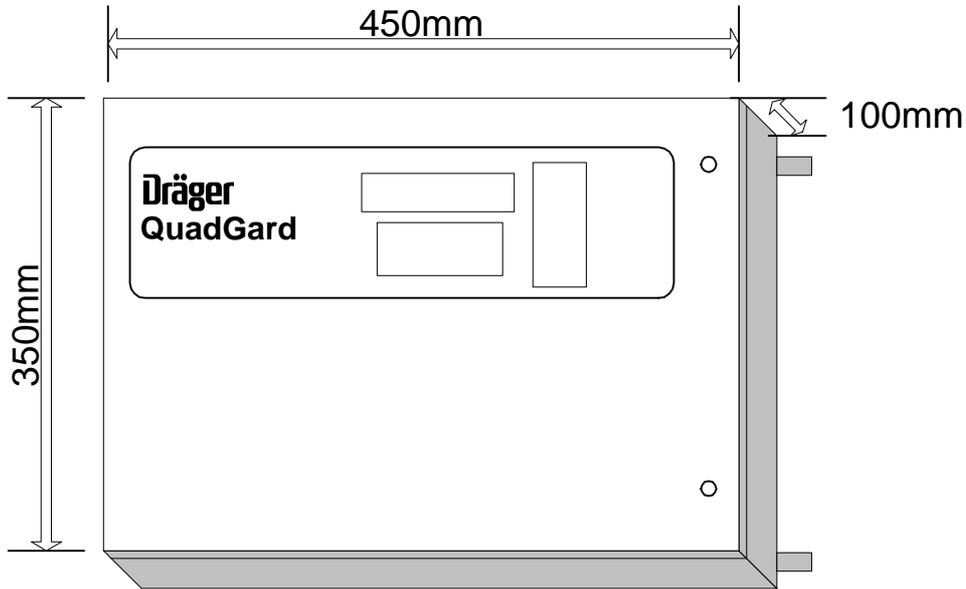|	Gas present	Reset pressed	Gas clears	Reset pressed
DELAYED NON-ACK	Relay trips	Alarm accepted; relay stays tripped	Relay clears	No effect
LATCHED NON-ACK	Relay trips	Alarm accepted; relay stays tripped	No effect	Relay clears
NON-ACK	Relay trips	Alarm accepted; relay stays tripped	Relay clears	No effect
LATCHED ACK	Relay trips	Alarm accepted; relay clears	No effect	No effect
ACKNOWLEDGEABLE	Relay trips	Alarm accepted; relay clears	No effect	No effect

	Gas present	Gas clears	Reset pressed
DELAYED NON-ACK	Relay trips	No effect	Alarm accepted; relay clears
LATCHED NON-ACK	Relay trips	No effect	Alarm accepted; relay clears
NON-ACK	Relay trips	Relay clears	Alarm accepted; relay stays cleared
LATCHED ACK	Relay trips	No effect	Alarm accepted; relay clears
ACKNOWLEDGEABLE	Relay trips	Relay clears	Alarm accepted; relay stays cleared

The latch mode "DELAYED NON-ACK" requires additional explanation. Comparing relay behaviour with that when the latch mode is "LATCHED NON-ACK" shows that "DELAYED NON-ACK" 'remembers' if Reset is pressed while gas is present, resulting in the relay clearing automatically when the gas clears. "LATCHED NON-ACK" does not do this, requiring Reset to be pressed a <u>second</u> time to clear the relay after the gas clears.

APPENDIX 4: CABINET DIMENSIONS FOR IP54 VERSION (WHITE)

400mm

90mm

350mm

Dräger
QuadGard

310mm

Fixings
Three off $\varnothing$ 6mm

360mm
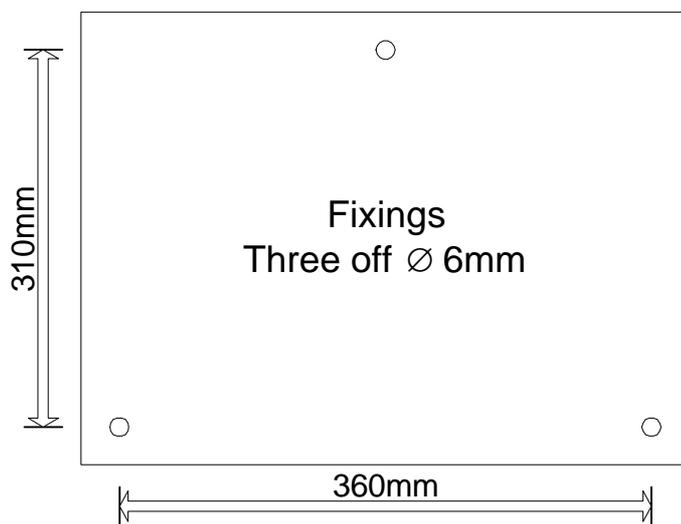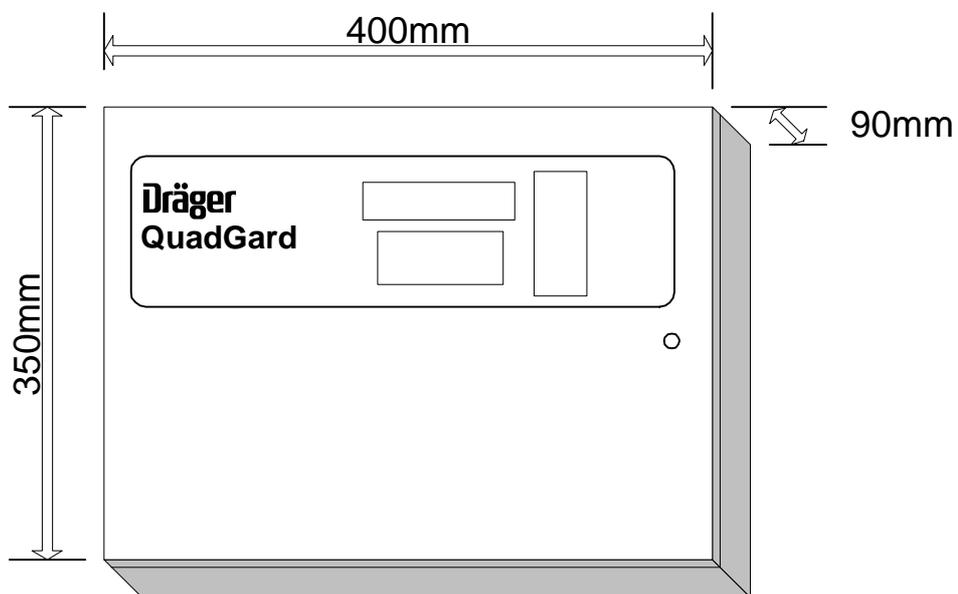
APPENDIX 5: CABINET DIMENSIONS FOR IP65 VERSION (BLUE)

450mm

100mm

350mm

Dräger
QuadGard

290mm

Fixings
Four off ∅ 6mm

475mm

APPENDIX 6: CONNECTION DIAGRAMS

A6-1   General arrangement

AUXILIARY
CONNECTIONS

MEASURING HEAD TERMINALS & 4-20mA
OUTPUTS

POWER SUPPLY BOARD

CHANNEL
1 BOARD

CHANNEL
2 BOARD

(IF FITTED)

CHANNEL
3 BOARD

(IF FITTED)

CHANNEL
4 BOARD

(IF FITTED)

MASTER RELAYS
TERMINALS

CHANNEL RELAYS TERMINALS

MAINS
INPUT

A6-2   Power Supply board

RS485   Remote   24Vdc
A B   Reset   + -

MF1

Mains Fuse

24Vdc fuse

System fuse

F1   F2

Mains Switch
Set to 240
or 120

240

E N L

Mains
Input

NO COM NC   NO COM NC   NO COM NC   NO COM NC

M1   M2   M3   MF

Relays shown de-energized

Link 0V to
Earth

MASTER RELAYS

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A6-3 Internal layout - Channel Boards

4-20 CHANNEL

SE Ex CHANNEL

Head   4-20mA
        Output

SUPPLY
SIGNAL
0V

+   -

Head   4-20mA
        Output

SUPPLY
C/T
RETURN

+   -

T+

Measure
head current

T-

Set head
current

F1   Head fuse

Operational LED
OK = lit, blinking
off every 2
seconds

NO
COM
NC

NO
COM
NC

NO
COM
NC

A1   A2   A3/F

NO
COM
NC

NO
COM
NC

NO
COM
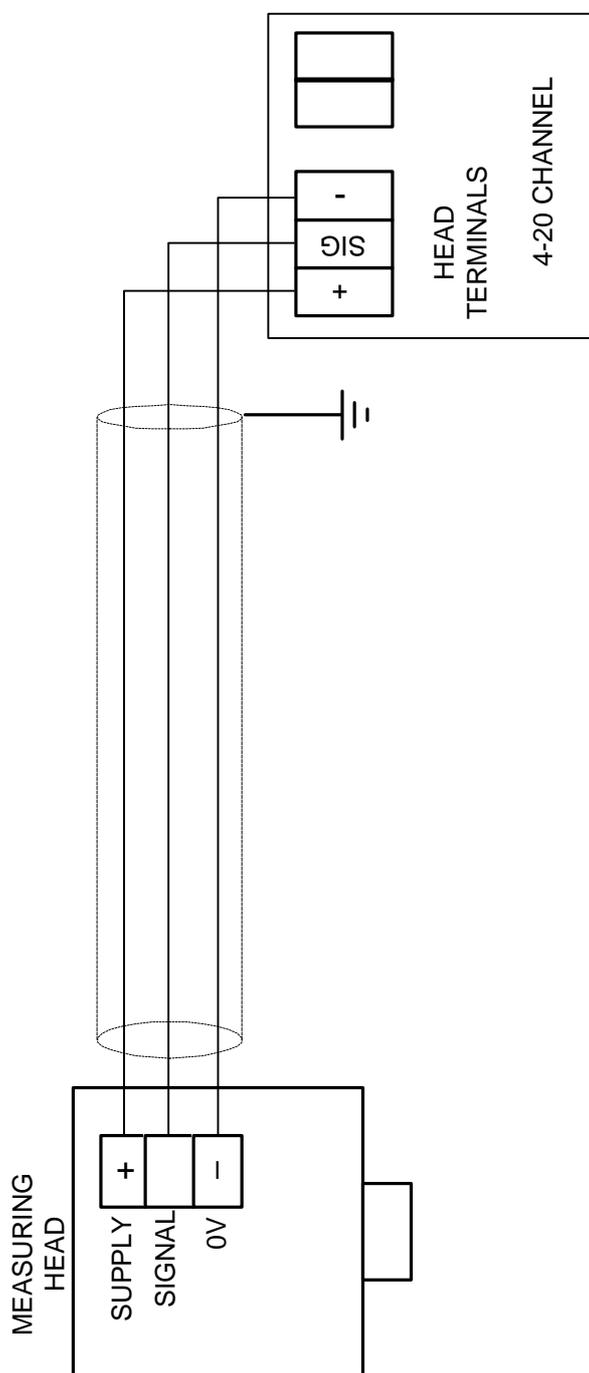NC

A1   A2   A3/F
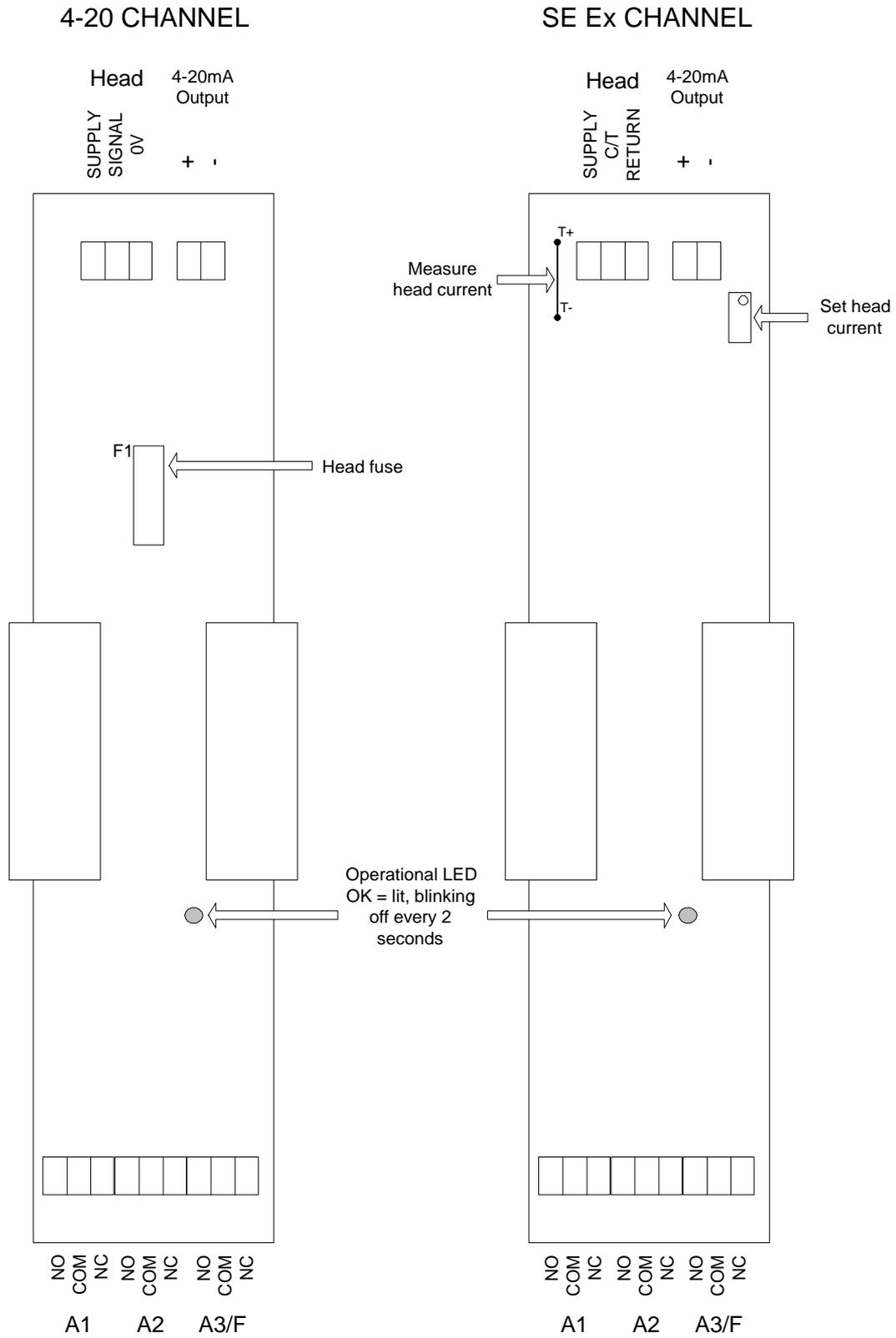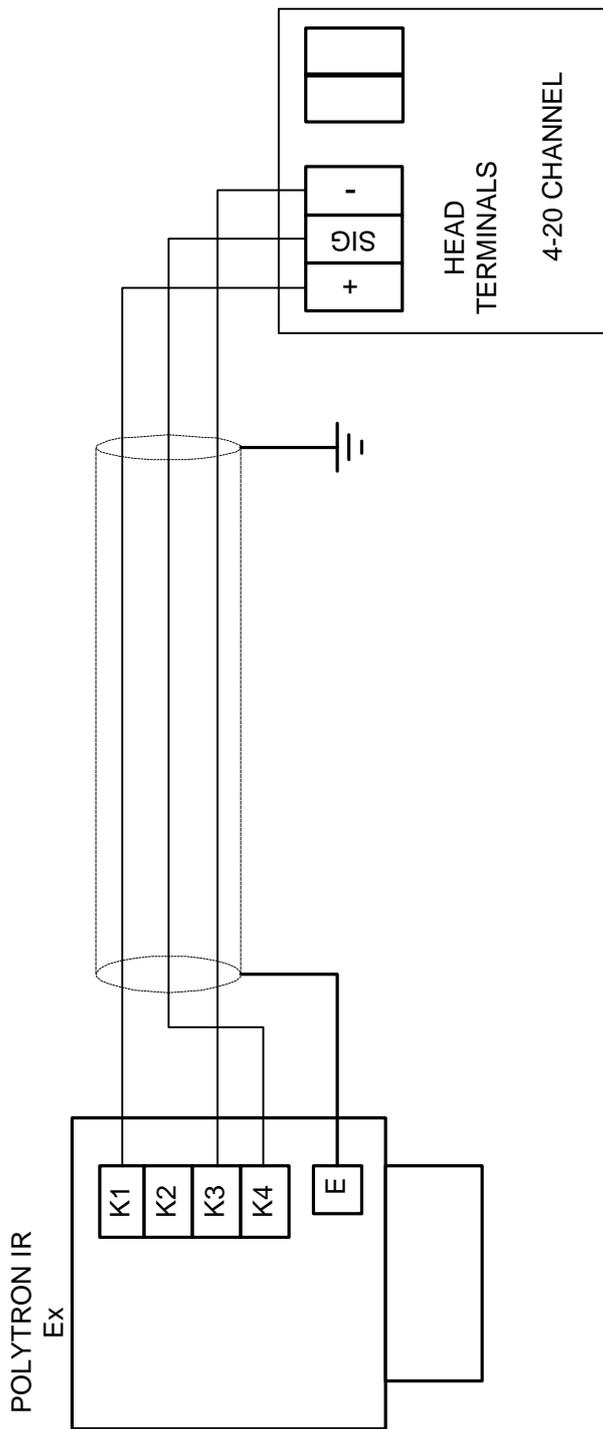
Relays shown de-energized

A6-4   Two-wire 4–20mA measuring head connections
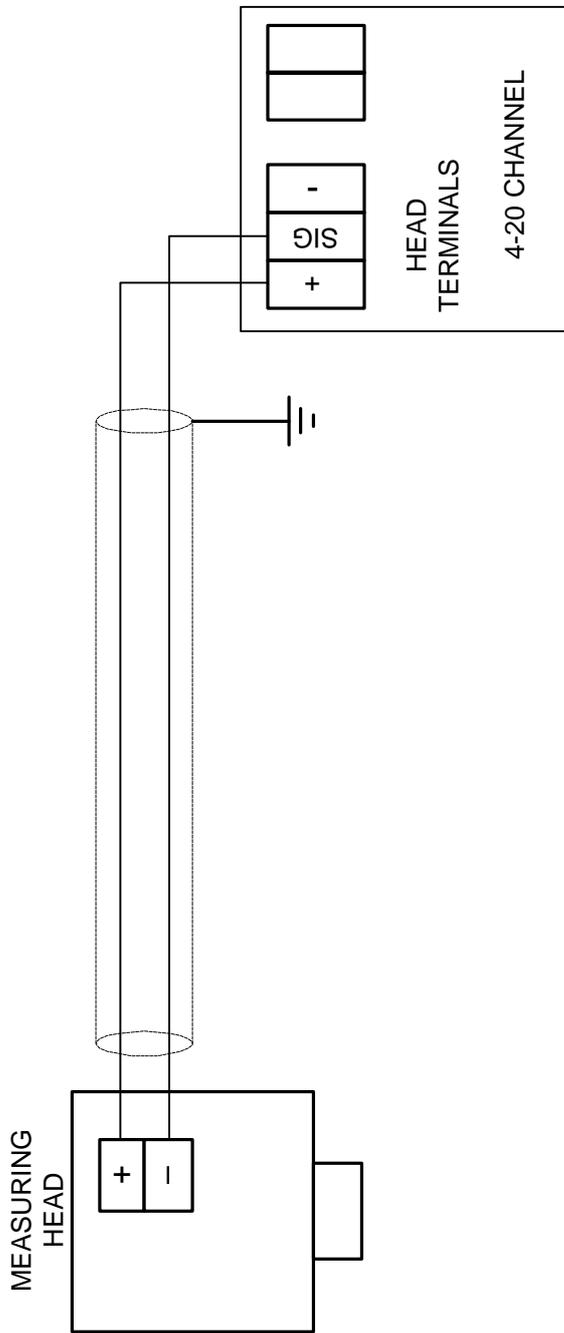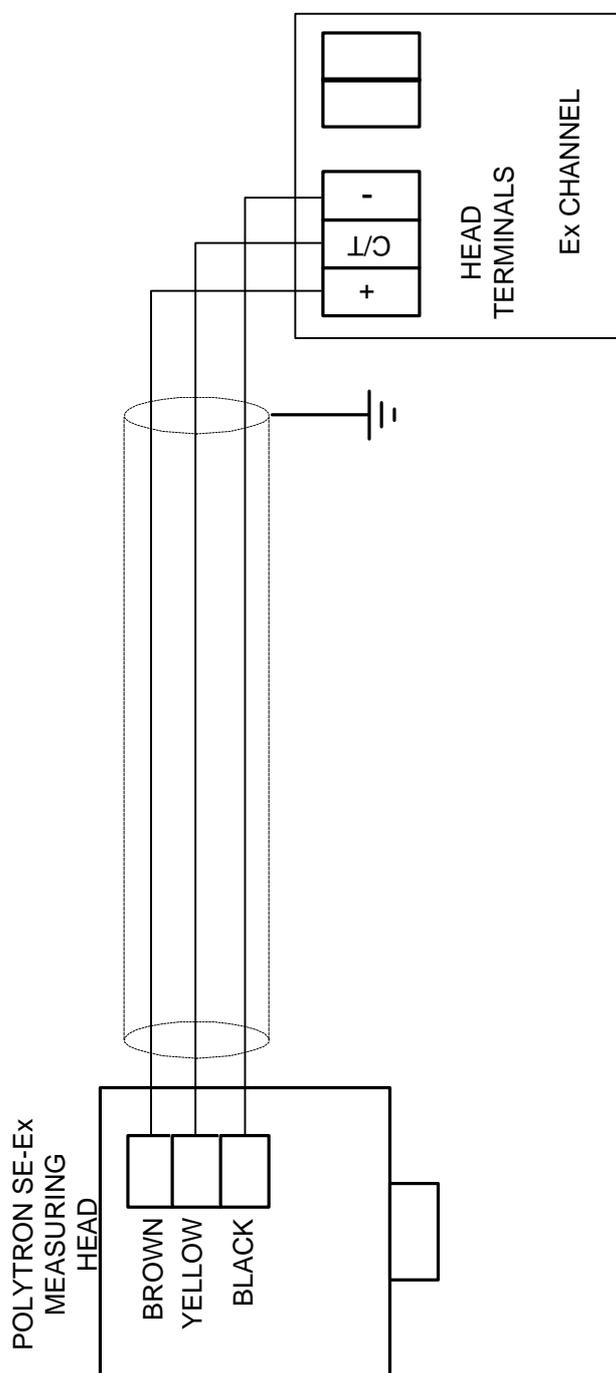
A6-5 Three-wire 4–20mA measuring head connections
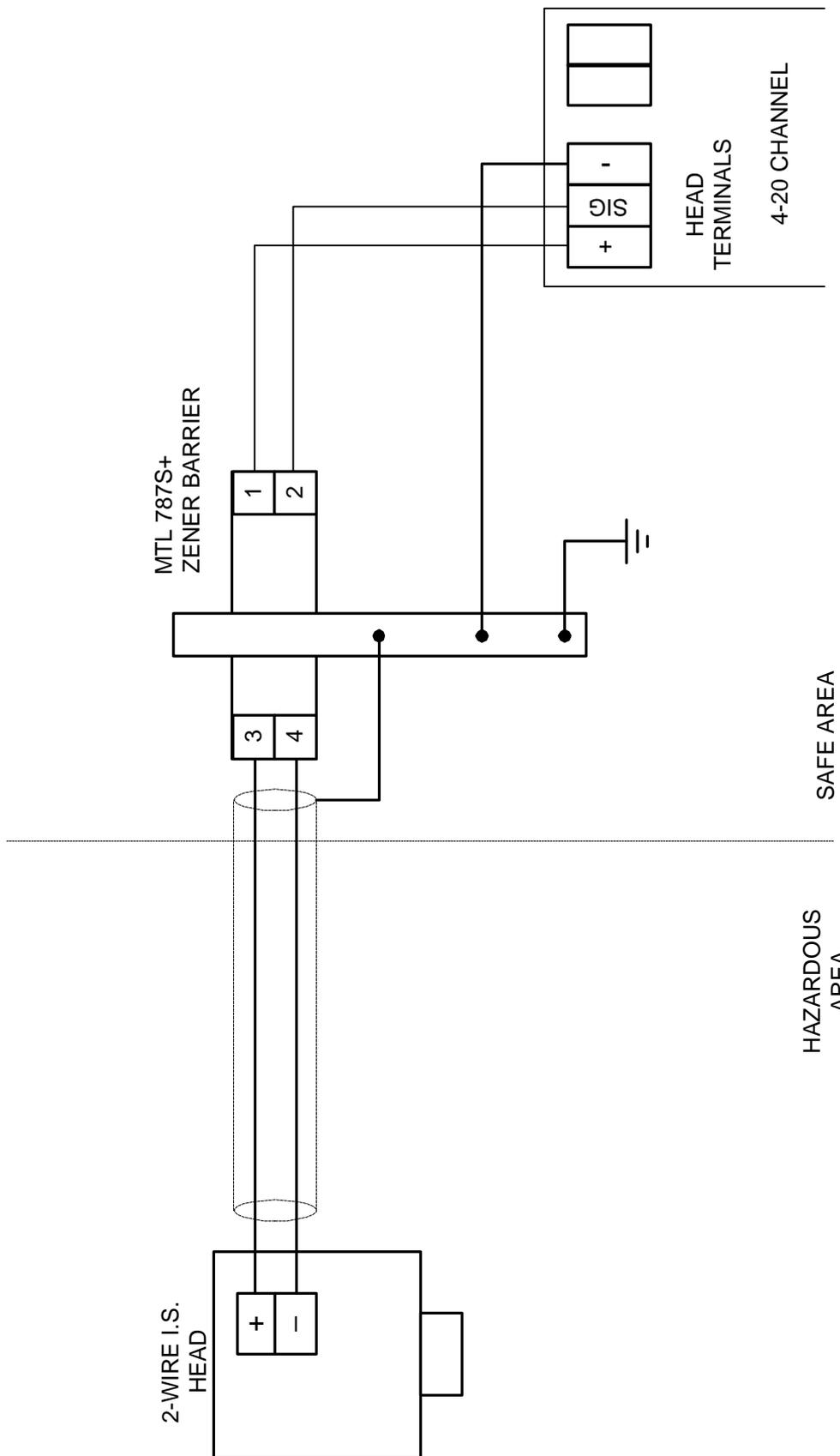
A6-6 Polytron Ex and IR Ex connections

A6-7 Polytron SE Ex pellistor head connections

A6-8   Two-wire 4–20mA measuring head connections via zener barrier

APPENDIX 7: COMMANDS SUMMARY

No.	PASSWORD R	M	C	SYSTEM command	CHANNEL command	MASTER command
00–0	●	●	●	QUIT (NO SAVE)		
00–1	●	●	●	ENTER PASSWORD		
00–2		●	●	SAVE CHANGES		
00–3		●	●	CHANGE PASSWORD		
00–4	●	●	●	CONFIGURE MODE	CONFIGURE MODE	CONFIGURE MODE
04–0	○	○	●		SELECT GAS NAME	
04–1	○	○	●		SELECT UNITS	
04–2	○	○	●		SELECT RANGE	
04–3		○	●		OVERRANGE LOCK	
04–4		○	●		A1 RLY ENERGIZE	M1 RLY ENERGIZE
04–5		○	●		A2 RLY ENERGIZE	M2 RLY ENERGIZE
04–6		○	●		R3 RLY ENERGIZE	M3 RLY ENERGIZE
04-7		○	●			MF RLY ENERGIZE
04–9		○	●		ANALOGUE OUTPUT	
10–0		●	●		SET ZERO	
10–1		●	●		SET SPAN	
10–2			●		ZERO DRIFT BAND	
10–3		●	●		TRIM 4mA O/P	
10–7	○	○	●		U/RANGE FAULT	
10–8	○	○	●		O/RANGE FAULT	
10–9	○	○	●		Ex SUPPLY FAULT	
11–0			●		HYSTERESIS BAND	
11–1	○	○	●		A1 TRIP LEVEL	M1 VOTE DATA
11–2	○	○	●		A2 TRIP LEVEL	M2 VOTE DATA
11–3	○	○	●			M3 VOTE DATA
11–4	○	○	●		A1 TRIP MODE	M1 MODE
11–5	○	○	●		A2 TRIP MODE	M2 MODE
11–6	○	○	●		R3 TRIP MODE	M3 MODE
11–7		○	●		A1 LATCH MODE	M1 LATCH MODE
11–8		○	●		A2 LATCH MODE	M2 LATCH MODE
11–9		○	●		R3 LATCH MODE	M3 LATCH MODE
12–0		○	●			MF LATCH MODE
14–0	●	●	●	TEST LEDs		
14–1	●	●	●	TEST REMOTE		
14–2	●	●	●	TEST SOUNDER	TEST O/P UNITS	
14–3	●	●	●	TEST CHANNELS	TEST O/P mA	
14–4		●	●		TEST A1 RLY	TEST M1 RLY
14–5		●	●		TEST A2 RLY	TEST M2 RLY
14–6		●	●		TEST R3 RLY	TEST M3 RLY
14–7		●	●			TEST MF RLY
52–0	○	○	●	SETUP CHANNELS	USER TEXT	
60–0		●	●	LOCK IN INHIBIT		
60–1			●	DISPLAY HEADING	DISPLAY	
60–2		●	●	DISABLE BEEPER		
60–3		●	●	DISABLE KEYBEEP		
60–4		●	●		DISABLE A1 RLY	DISABLE M1 RLY
60–5		●	●		DISABLE A2 RLY	DISABLE M2 RLY
60–6		●	●		DISABLE R3 RLY	DISABLE M3 RLY
60–7		●	●			DISABLE MF RLY
99–9	●	●	●	SELECT LANGUAGE		

PASSWORD column: R=Read, M=Maintenance, C=Configuration
  ○ command can be accessed (not changed)
  ● command fully accessible