

REGARD

REGARD 4-20 AND Ex CHANNEL CARDS INSTALLATION AND OPERATING MANUAL

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ABOUT THIS MANUAL

Scope of this manual

This manual describes how to install and set up Regard 4-20 and Ex channel cards. Some of the facilities and commands may only be available on recent versions of the cards. Where this is true, the relevant hardware and/or software release is stated.

Changes in this issue of the manual

- Commands in software versions 1.5 and 1.6 added.
- Dimensions of 7 channel cardframe added.
- Connection diagram for MTL 3041 safety barrier added.
- Description of Polytron Cl₂ and HF/HCl leak detection head test added.
- Explanation of HFLT and FSD error messages added.

Software version 1.5

- Automatic and manual testing of Polytron Cl₂ and HF/HCl leak detection heads, with new commands 04-7, 10-9 and 14-7.
- New command 60-9 to configure operation of analogue output during alarm inhibit.
- Lower limit of under-range fault alarm level (command 10-7, FLTU) reduced to -15% of range.
- Upper limit of over-range fault alarm level (command 10-8, FLTO) reduced to 115% of range.
- Flash rate during command 14-0 (TLED) reduced to 0.5Hz.
- New operational fault code FLTI.
- Operational fault FLTP now advisory.

Software version 1.6

- Commands 00-0 (QUIT) and 00-2 (SAVE) have a YES/NO selection, rather than having to press Reset for five seconds.
- Command 00-2 (SAVE) does not exit command mode.

Regard 4-20 issue 6

- Automatic and manual testing of Polytron Cl₂ and HF/HCl leak detection heads, with new commands 04-7, 10-9 and 14-7.
- New command 60-9 to configure operation of analogue output during alarm inhibit.
- Clearances of PCB tracks to relays increased to 3mm.
- External watchdog to ensure fail-safe operation under all conditions.

Issue 6 4-20 cards must be fitted with software version 1.5 or later. An optional relay must be fitted on the card to test Polytron Cl₂ and HF/HCl leak detection heads.

Regard Ex issue 4

- New command 60–9 to configure operation of analogue output during alarm inhibit.
- Additional gas names and ranges available in commands 04–2 and 04–3.
- Clearances of PCB tracks to relays increased to 3mm.
- External watchdog to ensure fail-safe operation under all conditions.

Issue 4 Ex cards must be fitted with software version 1.5 or later.

Other hardware changes:

- **DC fuse.** A soldered-in fuse is used in place of the 20mm replaceable fuse previously fitted. This fuse should only blow if there is a fault on the card, in which case the card should be replaced. The fuse rating is unchanged.
- **Reset push button.** Ex cards are now distinguished by a blue Reset push button. 4-20 and Master cards continue to have black and red Reset push buttons, respectively.

1 INTRODUCTION

1.1 Intended use

Regard is designed for the continuous monitoring of flammable, toxic and/or other gases and the control of alarms, indicators or other equipment via alarm relays.

Regard control cards and cardframe are designed for use in a control room environment. The atmosphere should be free of contaminants and pollutants which are known to be harmful to electronics equipment.

Regard control cards are not designed or certified for use in areas where combustible or explosive gas mixtures are likely to occur.

1.2 Description

Channel cards fit into a cardframe which provides screw terminals for all connections to the card. DC power to the cards is provided either by a mains power supply in the cardframe or through the dc input terminals.

Each channel card has connections for a measuring head, alarm relays, analogue output and remote reset. A four-character display shows the concentration of gas at the measuring head. Push buttons on the front panel allow gas name, measurement units and measurement range to be displayed.

Each channel card has three alarm relays which are normally configured as two gas alarms and a fault alarm. The fault alarm relay can be configured as a third gas alarm if required. The analogue output gives a 4–20mA, 0–20mA, 1–5V or 0–5V signal proportional to the reading on the display.

Full configuration, calibration and testing of cards is carried out using front panel controls only. There are no potentiometers. As well as zero, span and alarm level adjustments, the following operations can also be carried out:

- configure alarm relays to be latching or non-latching, manual reset or auto reset, normally energized or energized on alarm, rising or falling;
- set under-range and over-range fault levels;
- test relays and analogue output;
- set gas name, range and measurement unit;
- on Ex cards, set head current without using an external meter.

1.3 4–20 channel card

The 4–20 input card is used with two- or three-wire 4–20mA gas measuring heads or other transmitters, or can accept a 4–20mA signal from other equipment. The dc supply to the measuring head is taken directly from the dc supply to the channel card, nominally 24V. The maximum supply current to the head is 700mA, limited by a fuse.

Warning! Do not to plug a 4–20 channel card into a slot wired to an SE-Ex head: the higher voltage on the head supply terminals will permanently damage the pellistors.

1.4 Ex channel card

The Ex channel card is for use with an SE-Ex measuring head or other three-wire catalytic combustible gas sensor. The constant current head supply can be set between 100mA and 350mA. The maximum head supply voltage from the card is 9V, allowing cable lengths of up to 750m of 2.5mm² at 280mA. The minimum supply voltage is 1.5V.

1.5 Master card

The Regard Master card provides common and/or voted alarm outputs and advanced setup facilities. For more information refer to the *Regard Master Card Operating Manual*.

1.6 Modbus gateway card

The Regard Modbus gateway interface card provides a Modbus interface for Regard systems. For more information refer to the *Regard Modbus Gateway Card Operating Manual*.

2 COMMAND MODE

2.1 Introduction

All card settings, such as measurement range, zero, span, alarm levels, gas name and alarm operation, are set using the commands available in command mode.

There are three levels of access in command mode, two of which require the entry of a password:

- **Read** level, in which configuration settings can be read but not altered, and basic testing done (no password needed);
- **Maintenance** level, which allows access to commands used during regular calibration and maintenance (requires maintenance password);
- **Configuration** level, which allows access to all commands used to set up the card (requires configuration password).

2.2 Using command mode

To enter command mode press and hold down the Reset push button (marked **R**) for five seconds. Press \uparrow to change the display to 00-1, press Reset and enter the maintenance or configuration password. If you do not enter a password, you can still examine a limited number of settings.

Each command is accessed in the same way: use \uparrow and \downarrow to select the number of the command you want (e.g. 10-0) and press Reset. The command name ("ZERO" in this example) will be displayed for about one second, then the current setting is displayed. Most commands then use \uparrow and \downarrow to change the setting. Pressing Reset again returns to the command number. "Fix" the setting by pressing Reset again, and the display will return to the command number.

Save configuration settings using command 00-2. Exit command mode using command 00-0. Configuration settings are retained when there is no supply to the card.

In commands such as 04-6, where the command name ("F R" in this example) refers to the fault relay, the "F" will change to "A3" when relay 3 is configured as a gas alarm relay. In this example "F R" will become "A3 R".

The passwords are factory set to "MMMM" for maintenance level and "CCCC" for configuration level.

2.3 Alarm inhibit

When a card is put into command mode all its alarms are inhibited: the alarm relays will remain in their current state and will not change state unless changed manually. Any relay already in its alarm state when the card enters command mode 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 commands 14-4 (A1 relay), 14-5 (A2 relay) and 14-6 (Fault/A3 relay).

2.4 Example

- Press and hold down Reset (**R**) push button for five seconds.
Card shows software version and enters command mode V1.6 00-0
- Press \uparrow to select command 00-1 00-1
- Press Reset; card shows command name and is ready for password entry P.WD ????
- Press \uparrow three times to change first letter C???
- Press Reset to fix first letter. Second letter flashes CC??
- Press Reset three times to fix remaining letters of password.
Display shows access level then returns to command number CCCC CFG 00-1
- Press \uparrow three times to select command 04-0 04-0
- Press Reset. Display shows current gas name GAS CH4
- Press \uparrow to select new gas name H2S
- Press Reset to confirm new gas name 04-0
- Press \downarrow to select command 00-2 00-2
- Press Reset SAVE NO
- Press \uparrow to select YES YES
- Display shows OK when settings have been saved WAIT OK 00-2
- Press \downarrow twice 00-0
- Press Reset QUIT NO
- Press \uparrow to select YES YES
- Press Reset. Card exits command mode 0

2.5 Locking cards in command mode

Cards exit command mode automatically if no buttons are pressed for 10 minutes. To lock a card in command mode use command 60-0. Note that this command is not available in read mode.

3 FACILITIES AND CONFIGURATION

3.1 Indicators and controls

LED	Function during normal operation
A3 A2 A1	Flashing: alarm tripped Steady: alarm acknowledged but still tripped
Fault	Flashing: fault alarm tripped Steady: fault alarm acknowledged but still tripped
Power	Steady: dc supply on Flashing: operational fault—see Appendix A
Inhibit	Steady: all alarm relays inhibited Blinking: one or more alarm relays disabled

Push button	Function during normal operation
R	Acknowledge alarm Reset relay Enter command mode
↑	Display gas name
↓	Display units
Press both buttons to display range	

Display

The display normally shows the gas concentration.

- Flashing FSD indicates over-range.
- Flashing HFLT indicates a head fault.
- Flashing HCAL indicates that the measuring head is in calibration mode.

In command mode the display shows command options and configuration settings.

Alarm LEDs

LEDs A1, A2 and A3 indicate gas alarms.

- A flashing LED indicates that an alarm has been tripped and the corresponding alarm relay is in its alarm state (provided that the relay is not disabled). Pressing Reset will acknowledge the alarm;
- A steadily lit LED indicates that the alarm has been acknowledged but the display reading is still above the alarm level. The state of the alarm relay depends on its latching/acknowledge setting (see section 3.2.2);
- An unlit LED indicates that the alarm has been reset or that there is no alarm.

In command mode these LEDs indicate what the condition of the gas alarm would be in normal mode: tripped (LED on) or not tripped (LED off). Note that all relays are inhibited in command mode.

Fault LED

The Fault LED indicates a loop or measuring head fault:

- A flashing Fault LED indicates that the fault alarm has been tripped and the fault relay is in its alarm state (provided that the relay is not disabled). Pressing Reset will acknowledge the alarm;
- A steadily lit Fault LED indicates that the fault alarm has been acknowledged but the condition which caused the alarm to trip is still present. The state of the fault relay depends on its latching/acknowledge setting;
- An unlit Fault LED indicates that the fault alarm has been reset or that there is no alarm.

In command mode the Fault LED indicates what the condition of the fault alarm would be in normal mode: tripped (LED on) or not tripped (LED off).

Power LED The Power LED remains steadily lit when the dc supply to the card is on and the card is operating normally.

If the Power LED flashes, an operational fault has occurred—see Appendix A.

Inhibit LED The Inhibit LED lights to indicate that the alarm relays are inhibited. The alarm relays are inhibited when: the card is in command mode, there is a fault alarm, the card detects the 1Hz calibration signal from a Polytron head and during the first 30 seconds after power-on.

The Inhibit LED blinks **on** every two seconds to indicate that one or more alarm relays have been disabled. In command mode, when the Inhibit LED is normally lit, it will blink **off** every two seconds.

R (Reset) The Reset button is used:

- to acknowledge an alarm
- to reset an alarm relay
- to enter command mode and choose commands and configuration options while in command mode.

Alarms can also be acknowledged and reset by momentarily shorting the remote reset terminals together.

↑ and ↓ The ↑ and ↓ push buttons are used in command mode to select commands and configuration settings.

When the card is in normal measuring mode (i.e. not in command mode):

- press ↑ to display the gas being measured
- press ↓ to display the measurement units
- press ↑ and ↓ together to display the range.

3.2 Alarm relays

Each channel card has three single-pole changeover volt-free alarm relays. Relays 1 and 2 are controlled by gas alarms A1 and A2. Relay 3 is normally the fault relay but can be configured to be a third gas alarm relay.

3.2.1 Normally energized or energize on alarm operation

Each relay can be configured normally energized (fail-safe) or energized on alarm using commands 04-4 (A1 relay), 04-5 (A2 relay) and 04-6 (Fault/A3 relay).

3.2.2 Latch and acknowledge modes

Each relay can be configured to be

- **Latching and acknowledgeable.**
Relay must be reset manually and can be reset before the alarm clears.
- **Latching and non-acknowledgeable.**
Relay must be reset manually. Relay cannot be reset before the alarm clears.
- **Non-latching and acknowledgeable.**
Relay will reset automatically when the alarm clears or can be reset manually before the alarm clears.
- **Non-latching and non-acknowledgeable.**
Relay will reset automatically when the alarm clears. Relay cannot be reset manually before the alarm clears.
- **Delay-latching and non-acknowledgeable.**
Relay must be reset manually, but if the alarm is acknowledged while still tripped, the relay will reset automatically when the alarm clears.

Use commands 11-7 (A1 relay), 11-8 (A2 relay) and 11-9 (Fault/A3 relay) to set relay operation.

3.2.3 Alarm levels

Alarm levels can be set between 5% and 100% of full scale.

Use command 11-1 to set the A1 alarm level and 11-2 to set the A2 alarm level. Command 11-3 can be used to set the A3 alarm level if relay 3 is configured as a gas alarm relay.

3.2.4 Rising or falling alarms

Alarms A1 and A2 can each be set as a rising or falling alarm. (A rising alarm is tripped as the gas level increases; a falling alarm is tripped as the gas level decreases.)

Alarm A3 can be set as a rising or falling gas alarm, or as FLT. Setting A3 as FLT disables the A3 alarm and sets relay 3 as the fault alarm.

Use commands 11-4 and 11-5 to set A1 and A2 as rising or falling alarms, and 11-6 to select A3 as a rising or falling gas alarm or as FLT.

3.2.5 Alarm hysteresis

Alarm hysteresis¹ can be set between 0 and 5% in 0.5% steps and is pre-set to 1% of full scale. For example, on a 0 to 500 scale, a rising alarm set at 100 will reset at 1% of 500 below 100, i.e. at 95.

Use command 11-0 to set alarm hysteresis.

¹ The gap between an alarm trip level and alarm reset level. Sometimes called "dead-band".

3.2.6 Alarm inhibit

Alarms are inhibited

- for 30 seconds after the DC supply to the card is connected
- when the card is in command mode
- when there is a fault alarm
- when the 1Hz calibration signal is received from a Polytron head.

When alarms are inhibited all alarm relays are held in their non-alarm state. The alarm LEDs still indicate any alarm conditions.

3.2.7 Manual control of alarm relays

Each alarm relay can be manually controlled in command mode for testing or to override a latching/non-acknowledgeable alarm. Use commands 14-4, 14-5 and 14-6 to control relay 1, relay 2 and relay 3 respectively.

3.2.8 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 blinks every two seconds to indicate that an alarm relay is disabled.

Use commands 60-4, 60-5 and 60-6 to disable alarm relays.

Warning! A disabled relay will not operate if there is a gas alarm.

3.3 Fault alarms

The fault alarm is tripped by

- an under-range alarm
- an over-range alarm
- a head supply fault on an Ex card
- a Cl₂ or HF/HCl leak detection head test failure

3.3.1 Under-range and over-range 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.

3.3.1.1 Under-range alarm

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

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

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

3.3.1.2 Over-range alarm

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

On Ex cards 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 the LEL) 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 command 10–8 to set or disable the over-range alarm.

3.3.2 Pellistor head supply fault (Ex cards only)

A short circuit in the cable to a pellistor head will usually cause a gas alarm or a fault alarm. However a short circuit between the two head current carrying cores or between all three cores may not cause a sufficient change in signal to trip a gas alarm or fault alarm.

On Ex cards the supply voltage to the head is measured at the head supply terminal. Normally, this voltage should not change by more than a few hundred millivolts as the resistance of the head changes (remember that the head supply is constant current), but a wiring fault will cause this voltage to change by a volt or more. For example, if the supply voltage to the head is 5V at the card, and 2V at the head, a short circuit between the two current-carrying cores anywhere between the card and the head will cause the supply voltage to drop by at least 2V. Similarly, an open circuit will cause the supply voltage to the head to increase.

The supply fault will trip if the head supply voltage changes by more than the alarm level. The reference voltage from which changes in the supply are measured is the head supply voltage when command 10–0 (ZERO) was last used to zero the display. If a supply fault occurs, the display will flash HFLT and the fault alarm will trip.

Use command 10–9 to set the alarm level or to disable supply fault alarms. The supply fault level can be set between 0.5V and 2.0V.

Warning!

If the head voltage at the card is close to its 9V maximum, an open circuit may not be detected.

3.4 Analogue output

The analogue output can be configured as either a voltage output or a current output. Use switch SW1 to select current or voltage output and command 04–9 to select the range.

Output	SW1 position	Command 04–9 setting
4–20mA	DOWN	4–20
0–20mA	DOWN	0–20
1–5V	UP	4–20
0–5V	UP	0–20

The analogue output can drive a maximum load of 500Ω when used as a current output, or a minimum load of 1kΩ when used as a voltage output. The analogue output has a maximum output of 20mA (or 5V when set as a voltage output).

The analogue output return is to 0V.

3.4.1 Trimming analogue output

The analogue output can be trimmed using the front panel controls to be exactly 4mA ($\pm 0.02\text{mA}$) when the display reads zero (or 1V $\pm 0.05\text{mV}$ when set to a voltage output). This allows any offset in the analogue output to be corrected.

3.4.2 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 0 and 5V in 0.25V steps when set as a voltage output), or between zero and full scale in steps equivalent to the display resolution.

Use command 14–2 to control the output in display steps or 14–3 to control it in mA.

3.4.3 Analogue output operation during alarm inhibit

During normal operation, the analogue output gives a signal proportional to the measured gas level. During alarm inhibit, the analogue output can

1. Continue to indicate measured gas level,
2. Remain at the signal level immediately before alarm inhibit, or
3. Alternate between 3mA and 5mA at 1Hz (Polytron calibration signal).

For option 2 only:

- commands 14–2 and 14–3 can be used to manually vary the output.
- During the power-on inhibit period, the output is held at the level corresponding to zero gas.

Use command 60–9 to set the operation of the analogue output during alarm inhibit.

3.5 Gas names

4-20 cards The following pre-defined gas names can be selected, using command 04-0:

CH₄, H₂S, CO, O₂, Cl₂, SO₂, NO, NO₂, NH₃, O₃, CO₂, ClO₂, HCN, HCl, HBr, HF, H₂, Br₂, H₂O₂, EO, AsH₃, PH₃, B₂H₆, SiH₄.

An additional user-defined gas name can also be set using command 52-0.

Ex cards The gas name is set to 'Ex'. It can be changed by defining a user gas name with command 52-0 and selecting the USER option in command 04-1.

3.6 Measurement units

The following pre-defined measurement units can be selected: %LEL, %UEG, %LIE, %vol, %v/v, ppm, ppb, °C, %RH.

Use command 04-1 to define the measurement unit. An additional user-defined measurement unit can also be entered using command 52-0.

3.7 Measurement ranges

The following measurement ranges can be selected: 0-1, 0-2, 0-3, 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.

Use command 04-2 to define the range.

The resolution of the display varies according to the range (see Appendix C). Other ranges can be programmed by Draeger if required.

3.8 User defined gas name and measurement units

Command 52-0 allows the entry of a gas name or measurement unit other than those given above. The text entered becomes available in commands 04-0 and 04-1, so you cannot set a user-defined gas name **and** a user-defined measurement unit at the same time.

3.9 Zero and span adjustment

3.9.1 4-20 cards

The 4-20 card displays 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 the card displays zero can be adjusted by ±1mA from 4mA and the full-scale current by ±1mA from 20mA.

Use command 10-0 to set zero and 10-1 to set span.

3.9.2 Ex cards

The Ex card will display zero when the output of the detector bridge is zero and full scale at a pre-set bridge output between 50 and 350mV.

Command 10-0 balances the detector bridge to give a display of zero.

Command 10-1 allows the display to be set to the concentration of the calibration gas.

3.10 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 using command 10-2.

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

3.11 Over-range latching

The over-range latching feature can be used when a flammable gas detecting head is used. If the concentration of flammable gas present at the head exceeds the LEL, causing the output from the head to start falling again, over-range latching prevents the card from displaying this falling output, and instead holds the display and alarms as if the output from the head was still at full scale. Pressing Reset will un-latch the display. The analogue output will also remain at 20mA (or 5V) until Reset is pressed.

Use command 04-3 to enable or disable over-range latching.

3.12 Supply voltage monitoring

Each channel card monitors the supply voltage at its dc input. A supply voltage below 18V or above 30V will cause a critical operational fault (see Appendix A). If the supply exceeds 30V, normally energized relays will be de-energized to prevent over-heating the coils.

3.13 Remote reset

Each card has a remote reset input that allows alarms on that card to be acknowledged or reset by momentarily shorting the terminals together. The remote reset terminals can be commoned.

3.14 Turning off the display

The normal display of gas concentration can be turned off using command 60-1. The display will then read "----" when the card is in normal operation, but will respond to the \uparrow , \downarrow and R push buttons.

3.15 Polytron heads calibration signal

Regard cards will recognize the 1Hz calibration signal from Dräger Polytron heads. When the card detects the calibration signal it inhibits all alarms and displays HCAL.

3.16 Polytron Cl₂ leak detection head test

A relay² interrupts the 4-20mA loop for one second. The card then monitors the 4-20mA signal, which must reach a minimum value to pass the test.

Use the following:

- Command 10–9 to enable or disable testing, and set the level that the 4-20mA signal from the head must reach to pass the test. This pass level applies to both automatic and manual tests.
- Command 14–7 to do a manual test.
- Command 04–7 to programme an automatic daily, weekly or monthly test.

3.16.1 Automatic testing

At the intervals set in command 04–7, command 14–7 is executed automatically. Alarms are inhibited for the duration of the test and for 30 seconds afterwards. The analogue output will operate according to the setting of command 60–9.

If the test is successful, PASS will be displayed for 30 seconds and the card will return to normal operation.

If the test fails, FAIL will be displayed. After 30 seconds the fault alarm will trip and the card will continue normal operation, but the display will continue to show FAIL until the fault alarm is acknowledged. Gas alarms and all other functions of the card are unaffected.

² This optional relay must be fitted by Draeger to use the Cl₂ head test facility.

4 INSTALLATION

4.1 Safety earth

The mains connector earth terminal (E) on the backplane is not electrically connected to the metal of the subrack. An earth strap should be fitted from the subrack to earth. The L N and E terminals on the backplane connect to the DIN power supply connector only.

4.2 Power supplies

The cardframe has two DC connectors and a mains connector.

The dc supply can be connected to either or both of the DC connectors, but they should not be used to “daisy-chain” the supply through one rack to the next.

A rack-mounting power supply can be fitted in the left hand side of the card frame and may occupy one or more channel card positions. The specification for rack mounting power supplies is given in Appendix B. Use the figures for power consumption given in Appendix C to determine the power supply rating needed.

Where a three-wire head is used with a 4–20 card, the current taken by the head should be added to the current consumption for that channel. The maximum current that the 4–20 card can supply to a head is 700mA.

4.3 Cooling

Each channel card typically dissipates 3 – 4W of heat. If a large number of cards and racks are installed in a closed space use forced-air cooling where to prevent the cards becoming too hot. Use the figures for power dissipation below as a guide to how much cooling is required.

Channel card		Power dissipation
4-20	typical	3W
	maximum	7W
Ex	typical	4W
	maximum	11W

Power dissipation is quoted for 24V supply voltage. For higher or lower supply voltages increase or decrease the figures proportionally. The “typical” figure is for a card in normal operation with one relay energized and no alarms. The “maximum” figure applies to a card in alarm with all LEDs on and all relays energized.

4.4 Standby batteries

When an ac power supply is fitted in the cardframe, the dc input terminals can be used to connect a standby battery or standby dc input.

The dc input terminals do not have blocking diodes to prevent current flow from a rack-mounting power 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 power supply in the cardframe, it should always be connected to the dc terminal behind the power supply, to prevent excess current passing through the backplane PCB tracks when charging a fully discharged battery.

4.5 Connecting measuring heads

Connection diagrams for measuring heads are in Appendix E.

4.5.1 Cable types

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 RFI levels are low.

PVC/SWA/PVC cable without a screen or shield may not give adequate immunity against RFI. It should only be used if RFI is known to be unlikely for the lifetime of the installation or where the routing of the cables gives adequate protection against RFI.

4.5.2 Loop resistance and maximum cable length

The maximum permissible loop resistance for Ex cards is 20Ω (10Ω per core). Maximum cable lengths for 1.5mm^2 and 2.5mm^2 cable for the Draeger SE-Ex pellistor head running at 280mA are given below.

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

For 4-20mA heads refer to the heads operating manual to determine the maximum cable length.

4.5.3 Zener barriers and earthing

Because the 4-20mA signal from the head is measured by a resistor between terminal 11 on the backplane and 0V, a dual channel zener barrier is needed. The recommended zener barrier for the 4-20 card is the MTL787+. Single channel barriers such as the MTL728 short circuit the current sense resistor.

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 E.5 shows the 0V dc terminal on the backplane connected to the zener barrier earth busbar, effectively earthing all the channel cards in the card frame at the zener barrier earth. Alternatively, you can connect terminal 12 (0V) on each channel to the zener barrier earth.

4.6 Relays, remote reset and analogue output connections

The terminals for the relays, remote reset input and analogue output are shown in Appendix E.1. Use screened cable to connect to the remote reset input to minimize susceptibility to RFI.

4.7 Fuses and reverse polarity protection

A 1A quick blow fuse is fitted on the dc input on each card. A diode on each card prevents damage to the card if the supply is connected with incorrect polarity.

4.8 Plugging and unplugging cards with power on

All Regard cards will operate correctly if plugged in with power already connected to the cardframe. They can also be unplugged with power on without damage. However, **do not plug in or unplug cards which have mains voltage or an inductive load connected to any relay.**

5 SYSTEM SETUP AND CALIBRATION

5.1 4-20 cards

Apply power to the system and allow the measuring heads to settle for 24 hours before calibration. Some measuring heads may need more than 24 hours to settle fully.

Put each card into command mode, using the configuration level password. It is advisable to lock each card in command mode using command 60-0 to stop them automatically returning to normal mode during setup.

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

Set up and calibrate each 4-20 card in the system as follows:

5.1.1 Set range, gas name and measurement units

Set the name of the gas being measured using command 04-0.

Set the measurement unit using command 04-1.

Set the range using command 04-2.

5.1.2 Set alarm levels

Always set the alarm levels **after** the range has been changed, because changing the range resets the alarm levels to their default settings.

Set the A1 alarm level using command 11-1.

Set the A2 alarm level using command 11-2.

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

5.1.3 Set zero

1. Select command 10-0.
2. While there is no gas at the measuring head, use \uparrow and \downarrow to set the display to zero.
3. If the display is still above zero and pressing \downarrow displays END-, this indicates that signal from the measuring head is too high to set zero; if the display is negative and pressing \uparrow displays END+, this means that the output of the head is too low. Check the measuring head and re-calibrate if necessary.
4. When the display reads zero, press Reset.

5.1.4 Set span

1. Select command 10-1. If the measuring head has a "calibrate" switch, make sure it is in the OFF position.
2. Apply a known concentration of gas to the measuring head and allow the reading from the head to stabilize.

3. Use \uparrow and \downarrow to adjust the reading on the display until it is the same as the concentration of the calibration gas.
4. If you cannot set the display to read the same as the calibration gas concentration, the measuring head may be giving an incorrect output. The measuring head should be checked and, if necessary, re-calibrated.
6. When the display reading is correct, press Reset.

5.1.5 Trim analogue output

If necessary, trim the analogue output using command 10–3.

5.1.6 Save settings

Use command 00–2 to save configuration settings. Use command 00–0 to return the card to normal mode.

The card is now calibrated and set up for normal operation. If required, you can change other configuration settings such as normally energized alarm relays, over-range alarm or zero drift band without affecting the basic settings or calibration.

Once the settings have been saved, unplugging the card or turning off the power to the card will not lose the settings.

5.2 Ex cards

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

5.2.1 Set head current

As soon as the system is powered up, use command 04–8 to set the head current. If the head current is too low the head will not reach its correct operating temperature; too high and the pellistors may be damaged.

1. Select command 04–8. The display will show the measured head current.
2. Press \uparrow to increase the current or \downarrow to decrease it. A '+' after the number indicates that the current is slightly more than the number; a '-' means it is slightly less.

If the display shows MAX this means that the card has reached its maximum output voltage; MIN means it has reached its minimum output voltage.

If the display shows END+ this indicates that the maximum limit of the current adjustment range has been reached (about 350mA); END– indicates the minimum current.

3. Press Reset.

Allow the head to settle for at least one hour. Check the head current again before proceeding: it may have changed slightly as the card warmed up.³

5.2.2 Set range and alarm levels

Set the range using command 04–2.

Set the A1 alarm level using command 11–1.

Set the A2 alarm level using command 11–2.

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

Always set the alarm levels **after** the range has been changed, because changing the range resets the alarm levels to their default settings.

5.2.3 Set zero

1. Select command 10–0. The display will read NO.
2. While there is no flammable gas at the measuring head, use \uparrow or \downarrow to change the display to YES and press Reset.
3. Wait for the bridge balance point to be found, after which OK will be displayed.

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

A flashing FAIL on the display indicates that the signal from the head has changed during the zero routine. Allow the head to settle before trying to zero again.

4. After the card has zeroed, the display will return to 10–0.

5.2.4 Set span

1. Select command 10–1.
2. Apply a known concentration of gas to the measuring head and allow the reading from the head to stabilize.
3. Use \uparrow and \downarrow to adjust the reading on the display until it is the same as the concentration of the calibration gas. The display may occasionally show WAIT while the card adjusts the gain of the circuit to maintain optimum resolution.

If the display shows END+ or END– this indicates that the card has reached maximum or minimum gain: 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.

³ Once at operating temperature, changes in ambient temperature within the specified operating limits will not cause a change in head current.

5.2.5 Trim analogue output

If necessary, trim the analogue output using command 10-3.

5.2.6 Save settings

Use command 00-2 to save configuration settings. Use command 00-0 to return the card to normal mode.

Each card is now calibrated and set up for normal operation. If required, you can change other configuration settings such as normally energized alarm relays, over-range alarm or zero drift band without affecting the basic settings or calibration.

6 COMMANDS REFERENCE

00-0 QUIT Quit command mode

Exits command mode without saving configuration settings.

1. Select 00-0 and press Reset.
2. The display will show QUIT and then show NO.
3. Use ↑ or ↓ to change the display to YES and press Reset.

00-1 P.WD Enter password

1. Select 00-1 and press Reset.
2. The display will show "????".
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 MNT if the maintenance password was entered, CFG if the configuration password was entered, or BAD if an invalid password was entered.
8. The display returns to 00-1.

If an invalid password is entered, the card will remain at read level. Press Reset again to enter another password.

00-2 SAVE Save configuration settings

Writes the configuration settings to EEPROM.

1. Select 00-2 and press Reset.
2. The display will show SAVE and then show NO.
3. Use ↑ or ↓ to change the display to YES and press Reset.
4. The display will show WAIT while the settings are saved, then OK, confirming that the settings have been saved.

If there are no new configuration settings to save, the display will show NO! at step 2. Pressing ↑ or ↓ will have no effect. Press Reset to return to 00-2.

00-3 PCHG Change password

Allows you to change the password for the current access level—i.e. changes the maintenance password if the card is in command mode at maintenance level or the configuration password if at configuration level.

1. Select 00-3 and press Reset.
2. The display will change to "????". If you press Reset now the password remains unchanged.
3. Use ↑, ↓ and Reset to enter a new password in the same way as command 00-1.

The new password becomes effective immediately but only becomes permanent when you save the new settings using command 00-2.

04-0 GAS Set gas name

1. Select 04-0 and press Reset.
2. The display will show the current gas name.
3. Press ↑ or ↓ to select a new gas.
4. Press Reset.

04-1 UNIT Set measurement unit

1. Select 04-1 and press Reset.
2. The display will show the current measurement unit.
3. Press \uparrow or \downarrow to select a new unit.
4. Press Reset.

04-2 FSD Set range

1. Select 04-2 and press Reset.
2. The display will show the current range.
3. Press \uparrow or \downarrow to select a new range.
4. Press Reset.
5. The display will show NEW to indicate that a new range has been selected.

Note: Changing the range resets the alarm levels to 20% and 40% of full scale, both rising alarms.

04-3 FSDL Enable or disable over-range latching

1. Select 04-3 and press Reset.
2. The display will show YES if over-range latching is enabled, or NO if it is disabled.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

Note: If over-range latching is enabled, alarms will latch even if configured as non-latching in command 11-7, 11-8 or 11-9.

04-4 A1 R Set A1 relay normally energized or energized on alarm

1. Select 04-4 and press Reset.
2. The display will show ENER for energized on alarm or NORM for normally energized.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

04-5 A2 R Set A2 relay normally energized or energized on alarm

1. Select 04-5 and press Reset.
2. The display will show ENER for energized on alarm or NORM for normally energized.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

04-6 F R (A3 R) Set fault/A3 relay normally energized or energized on alarm

1. Select 04-6 and press Reset.
2. The display will show ENER for energized on alarm or NORM for normally energized.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

04-7 ACI2 Set Cl₂ leak head automatic test interval (4-20 cards only)

Sets the interval between automatic tests, or disables automatic tests. This command is only available in software version 1.5 or later.

1. Select 04-7 and press Reset.
2. The display will show the current setting.
3. If the display shows a **flashing OFF**, this means that chlorine head testing is disabled in command 10-9. Press Reset to return to 04-7.
4. Otherwise, press \uparrow or \downarrow to select the required test interval:
 OFF: no automatic testing
 DAY: test daily
 WEEK: test weekly
 MNTH: test monthly
4. Press Reset

04-8 SETI Set head current (Ex cards only)

1. Select 04-8 and press Reset.
2. The display will show the measured head current. A '+' after the number indicates that the current is slightly higher than the number; a '-' means it is slightly lower.
3. Press \uparrow to increase the current or \downarrow to decrease it. (If the display shows MAX the card has reached its maximum output voltage; MIN means it has reached its minimum output voltage.)
4. Press Reset.

04-9 AOUT Set analogue output range

1. Select 04-9 and press Reset.
2. The display will show 4-20 or 0-20.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

If the analogue output is set to a voltage output, the 0-20 setting will give a 0-5V output, and the 4-20 setting a 1-5V output.

10-0 ZERO Set zero (4-20 cards)

1. Select 10-0 and press Reset.
2. The display will show the current gas reading.
3. Press \uparrow or \downarrow until the display shows 0.
4. Press Reset.

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

10-0 ZERO Set zero (Ex cards)

1. Select 10-0 and press Reset.
2. The display will show NO.
3. Press \uparrow to select YES and press Reset.
4. The display will show TEST and count up to the bridge balance point.
5. When the bridge is balanced the display will show OK and return to 10-0.
- If the detector bridge cannot be balanced the display will flash LOW or HIGH. Press Reset to return to 10-0. Check the head and wiring.
- FAIL flashing on the display indicates that the signal from the head has changed during the zero routine. Press Reset to return to 10-0 and allow the head to settle fully.

10-1 SPAN Set span (4-20 cards)

1. Select 10-1 and press Reset.
2. The display will show the current gas level.
3. Press \uparrow or \downarrow until the display shows the concentration of the calibration gas.
4. Press Reset.

Note: The span point can only be adjusted by $\pm 1\text{mA}$. If you cannot set the display to the correct reading the measuring head may need re-calibrating.

10-1 SPAN Set span (Ex cards)

1. Select 10-1 and press Reset.
2. The display will show the current gas level.
3. Press \uparrow or \downarrow until the display shows the concentration of the calibration gas.
4. Press Reset.

The display may occasionally show WAIT while the card adjusts the circuit gain to maintain optimum resolution. Wait for the display to return to the gas reading before pressing \uparrow or \downarrow again.

If the display shows END+ when you press \uparrow this means that the output of the head is too low for correct calibration. If the display shows END- when you press \downarrow this means that the output of the head is outside the maximum range of the card.

10-2 DRFT Set zero drift band

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

1. Select 10-2 and press Reset.
2. The display will show the current drift band setting.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

10-3 TRIM Trim analogue output

1. Connect a meter set to 0-20mA to the analogue output.
2. Select 10-3 and press Reset.
3. The display will show "4mA".
4. Press \uparrow or \downarrow to set the output to 4.0mA. Each press of \uparrow or \downarrow increases or decreases the output by 0.02mA. The maximum adjustment is approximately $\pm 0.4\text{mA}$. The display does not change.
5. Press Reset.

The signal is still trimmed to 4mA if the analogue output is set to 0-20.
If the analogue output is set as a voltage output, trim the output to 1.0V. The adjustment range is approximately $\pm 0.1\text{V}$ in steps of 5mV.

10-7 FLTU Set under-range fault level**4-20 cards** 0.5 to 3.5mA inclusive in 0.1mA steps, or OFF.**Ex cards** -15% to -5% of full scale in 1% steps, or OFF

1. Select 10-7 and press Reset.
2. The display will show the current under-range fault setting.
3. Press \uparrow or \downarrow to change the setting. OFF disables under-range faults.
4. Press Reset.

10-8 FLTO Set over-range fault level**4-20 cards** 20.5 to 23.5mA inclusive in 0.1mA steps, or OFF.**Ex cards** 105% to 115% of full scale in 1% steps, or OFF.

1. Select 10-8 and press Reset.
2. The display will show the current over-range fault setting.
3. Press \uparrow or \downarrow to change the setting. OFF disables over-range faults.
4. Press Reset.

10-9 LC12 Set C12 leak detection head test level (4-20 cards)

Sets the pass level or disables the test. The pass level is entered as a percentage of full-scale deflection. Minimum pass level is 20%; maximum is 100%. The OFF setting disables the test. This command is only available in software version 1.5 or later.

1. Select 10-9 and press Reset.
2. The display will show the current pass level, or OFF if the test is disabled.
3. Use \uparrow and \downarrow to change the setting. OFF is selected by pressing \uparrow when the display shows 100%, or \downarrow when the display shows 20%.
4. Press Reset.

10-9 FLTS Set head supply fault trip voltage (Ex cards)

Sets the voltage by which the head supply must change to trip a fault alarm. The fault trip voltage can be set between 0.5V and 2.0V in 0.1V steps, or set to OFF. The OFF setting disables the fault alarm being tripped by a head supply voltage change.

1. Select 10-9 and press Reset.
2. The display will show the current trip voltage.
3. Press \uparrow or \downarrow to change the setting. OFF is selected by pressing \uparrow when the display shows 2.0, or \downarrow when the display shows 0.5..
4. Press Reset.

11-0 HYST Set alarm hysteresis

Hysteresis can be set between 0% and 5% of full scale in 0.5% steps.

1. Select 11-0 and press Reset.
2. The display will show the current hysteresis setting.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

11-1 A1 T Set A1 trip level

1. Select 11-1 and press Reset.
2. The display will show the current alarm level.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

11-2 A2 T Set A2 trip level

1. Select 11-2 and press Reset.
2. The display will show the current alarm level.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

11-3 A3 T Set A3 trip level

The A3 alarm level can only be set if relay 3 has been configured as a gas alarm relay—see command 11-6.

1. Select 11-3 and press Reset.
2. The display will show the current alarm level, or FLT if relay 3 is configured as a fault alarm relay.
3. Press \uparrow or \downarrow to change the alarm level.
4. Press Reset.

11-4 A1 M Set A1 as a rising or falling alarm

1. Select 11-4 and press Reset.
2. The display will show the current setting: RISE for a rising alarm or FALL for a falling alarm.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

11-5 A2 M Set A2 as a rising or falling alarm

1. Select 11-5 and press Reset.
2. The display will show the current setting: RISE for a rising alarm or FALL for a falling alarm.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

11-6 A3 M Set A3 as a fault alarm or as a rising or falling gas alarm

1. Select 11-6 and press Reset.
2. The display will show the current setting: FLT for a fault alarm, RISE for a rising gas alarm or FALL for a falling gas alarm.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

11-7 A1 L Set A1 latch mode

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

1. Select 11-7 and press Reset.
2. The display will show the current setting.
3. Press \uparrow or \downarrow to select the mode: ACK, LACK, NAK, LNAK or DNAK.
4. Press Reset.

- ACK Non-latching and acknowledgeable.
Relay will reset automatically when the alarm clears or can be reset manually before the alarm clears.
- LACK Latching and acknowledgeable.
Relay must be reset manually and can be reset before the alarm clears.
- NAK Non-latching and non-acknowledgeable.
Relay will reset automatically when the alarm clears. Relay cannot be reset manually before the alarm clears.
- LNAK Latching and non-acknowledgeable.
Relay must be reset manually. Relay cannot be reset before the alarm clears.
- DNAK Delay-latching and non-acknowledgeable.
Relay must be reset manually, but if the alarm is acknowledged while still tripped, the relay will reset automatically when the alarm clears.

11-8 A2 L Set A2 latch mode

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

1. Select 11-8 and press Reset.
2. The display will show the current setting.
3. Press \uparrow or \downarrow to select the mode (see above).
4. Press Reset.

11-9 F L (A3 L) Set Fault/A3 latch mode

Set Fault/A3 to be latching, non-latching or delay-latching, acknowledgeable or non-acknowledgeable.

1. Select 11-9 and press Reset.
2. The display will show the current setting.
3. Press \uparrow or \downarrow to select the required mode (see above).
4. Press Reset.

14-0 TLED Test LEDs and display

1. Select 14-0 and press Reset.
2. The LEDs and display will flash. Pressing \uparrow or \downarrow has no effect.
3. Press Reset again to stop the LEDs and display flashing.

14-1 TRMT Test remote reset input

1. Select 14-1 and press Reset.
2. The display will show ON when the remote reset terminals are shorted and OFF when they are open circuit. If the remote reset terminals are held shorted for more than 10 seconds the display will show FLT. Pressing \uparrow or \downarrow has no effect.
3. Press Reset again to end testing.

14-2 OUT1 Test analogue output (display steps)

1. Select 14-2 and press Reset.
2. The display will show the current output signal.
3. Press \uparrow and \downarrow to increase or decrease the output.
4. Press Reset again to return the analogue output to normal.

14-3 OUT2 Test analogue output (mA)

1. Select 14-3 and press Reset.
2. The display will show the current output signal in mA. This will be the same as before the command was selected, rounded to the nearest mA.
3. Press \uparrow or \downarrow to increase or decrease the output.
4. Press Reset again to return the analogue output to normal.

If the analogue output is set to a voltage output, the output will change in 0.25V steps between 0V and 5V, but the display will still read 0 to 20. To calculate the voltage output, multiply the reading by 0.25.

14-4 T A1 Test A1 relay

1. Select 14-4 and press Reset.
2. The display will show ON if the relay is energized or OFF if it is de-energized.
3. Press \uparrow or \downarrow to toggle the relay.
4. Press Reset: the relay will remain in the state last shown.

14-5 T A2 Test A2 relay

1. Select 14-5 and press Reset.
2. The display will show ON if the relay is energized or OFF if it is de-energized.
3. Press \uparrow or \downarrow to toggle the relay.
4. Press Reset: the relay will remain in the state last shown.

14-6 T F (T A3) Test Fault/A3 relay

1. Select 14-6 and press Reset.
2. The display will show ON if the relay is energized or OFF if it is de-energized.
3. Press \uparrow or \downarrow to toggle the relay.
4. Press Reset: the relay will remain in the state last shown.

14-7 TCI2 Test Cl₂ leak detection head (4-20 cards only)

Performs a manual test of a Polytron Cl₂ or HF/HCl leak detection head. This command is only available in software version 1.5 or later.

1. Select 14-7 and press Reset.
2. The display will show NO or a flashing OFF.
3. If the display shows a flashing OFF, testing is disabled in command 10-9. Press Reset to return to 14-7.
4. Otherwise, press \uparrow or \downarrow to display YES and press Reset.
5. The display will show WAIT for one second, and then TEST.
6. If the signal from the head exceeds the test level (set using command 10-9) the display will show PASS briefly and then return to 14-7.
7. If the signal from the head does not reach the test level within 1 second, the display will flash FAIL. Press Reset.

52-0 USER Set user text

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

1. Select 52-0 and press Reset.

2. The display will show the current user text. If has not been set before, it will default to "????".
3. Press Reset if you do not want to change the text. Otherwise, press \uparrow or \downarrow to change the first character. The character will flash as you change it.
4. Press Reset to "fix" the first character.
5. Enter the second, third and fourth letters in the same way.
6. When you press Reset to fix the fourth character, display will return to 52-0.

52-1 CARD Set card number

Sets the card number for communication with a Master card. For more information, refer to the *Regard Master Card Operating Manual*.

Do not change the card number from 0 unless a master card is fitted in the system.

1. Select 52-1 and press Reset.
2. The card will show the current card number.
3. Press \uparrow or \downarrow to change the number.
4. Press Reset.

60-0 LOCK Lock card in command mode

Locking the card in command mode prevents the card from automatically returning to normal mode if no buttons are pressed for ten minutes. Use command 00-0 (QUIT) to exit command mode.

1. Select 60-0 and press Reset.
2. The display will show NO.
3. Press \uparrow or \downarrow to change the display to YES.
4. Press Reset.

60-1 DISP Display on/off

Turns the normal gas level display on or off. The display will show "----" instead of the gas level during normal operation. The card will respond to the \uparrow , \downarrow and Reset buttons as normal.

1. Select 60-1 and press Reset.
2. The display will show the current setting: ON or OFF.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

60-4 A1 D Disable A1 relay

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

Warning! A disabled relay will not operate if there is a gas alarm.

1. Select 60-4 and press Reset.
2. The display will show NO if the relay is enabled or YES if it is disabled.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

Commands 04-4, 11-1, 11-4 and 11-7 display OFF when the A1 relay is disabled. The Inhibit LED will blink on (in normal mode) or off (in command mode) every two seconds to indicate that an alarm relay is disabled.

60-5 A2 D Disable A2 relay

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

Warning! A disabled relay will not operate if there is a gas alarm.

1. Select 60-5 and press Reset.
2. The display will show NO if the relay is enabled or YES if it is disabled.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

Commands 04-5, 11-2, 11-5 and 11-8 display OFF when the A2 relay is disabled.

The Inhibit LED will blink on (in normal mode) or off (in command mode) every two seconds to indicate that an alarm relay is disabled.

60-6 F D (A3 D) Disable Fault/A3 relay

Forces the Fault/A3 relay to remain in its non-alarm state when a fault/gas alarm is tripped.

Warning! A disabled relay will not operate if there is a gas alarm.

1. Select 60-6 and press Reset.
2. The display will show NO if the relay is enabled or YES if it is disabled.
3. Press \uparrow or \downarrow to change the setting.
4. Press Reset.

Commands 04-6, 11-3, 11-6 and 11-9 display OFF when the Fault/A3 relay is disabled. The Inhibit LED will blink on (in normal mode) or off (in command mode) every two seconds to indicate that an alarm relay is disabled.

60-9 AINH Set analogue output behaviour during alarm inhibit

This command is only available in software version 1.5 or later.

1. Select 60-9 and press Reset.
2. The display will show the current setting.
3. Press \uparrow or \downarrow to select:

OFF	Output continues to indicate measured gas level.
HOLD	Output will remain at signal level prior to inhibit.
3/5	Output alternates between 3mA and 5mA at 1Hz (Polytron calibration signal).
4. Press Reset

7 MAINTENANCE AND REPLACEABLE PARTS

7.1 Maintenance

Regard control systems do not require any maintenance but should be checked for correct operation at regular intervals.

Measuring heads should be checked and re-calibrated at the intervals specified in the measuring head instructions.

7.2 Replaceable parts

Description	Part No.
20mm (4HP) blank panel	4205711
25mm (5HP) blank panel	4205712
Backplane PCB assembly	4205715
Card guide, 160mm	4205760
4-20 channel card front panel	4205710
Ex channel card front panel	4205710

APPENDIX A: OPERATIONAL FAULTS

An operational fault is a fault in a cards operation, rather than a fault in the measuring head loop. They are classed as either **critical**, which may stop the card working, or **advisory**, when the card will continue to work safely, but its functions may be limited.

The Power LED will flash once a second and the display will alternate between normal and one of the fault codes in the following table. A critical fault is signalled by turning the fault relay on and off once a second.

If relay 3 has been configured as a gas alarm then it will not be turned on and off to indicate a critical operational fault. A microcontroller failure (FLTM) will always toggle relay 3, regardless of its configuration.

Operational faults are latching and non-acknowledgeable. Press Reset to clear the fault indication once the fault itself has cleared; if pressing Reset does not clear the fault indication then the fault is still present.

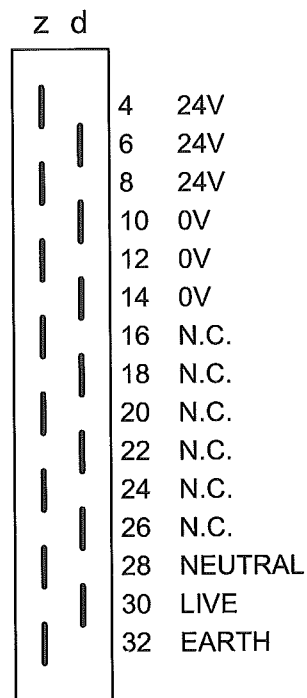
Fault code	Meaning	Remedy
FLTB	Button fault. Advisory . One of the front panel buttons appears to be continuously pressed. Operations which use the front panel controls may not be possible, but the card will otherwise work normally.	Check all front panel buttons.
FLTC	Communications error. Critical . Communication with the master card has failed. Functions controlled by the master card will not work, but the channel card will continue to operate.	Check card numbers (command 52-1), master card configuration and RS-485 connections.
FLTD	Data error. Critical . Configuration settings have been corrupted. Alarms may not operate reliably. Default configuration settings will be used.	Use command 00-2 to try to save new settings. If this does not clear the fault, replace the card.
FLTE	EEPROM failure. Critical . Configuration settings have been lost. Default configuration settings will be used.	Replace card.
FLTH	Supply voltage too high. Critical .	Check power supply.
FLTI	RAM data inconsistency. Advisory . An inconsistency has been found between the configuration data in EEPROM and RAM. The data in RAM has been corrected using the data in EEPROM.	If fault recurs, replace card.
FLTL	Supply voltage too low. Critical .	Check power supply.
FLTM	Microcontroller failure. Critical . FLTM alternates with fault code. Card should reset automatically within 2 secs.	If card does not reset, replace card.
FLTP	(Ex cards only.) EEPOT fault. Advisory . The electronic balance pot has changed position in error.	Press Reset to clear fault. Re-zero card if necessary.
FLTR	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.
FLTW	Watchdog reset. Advisory . An unknown program error has occurred and the card has automatically reset. The card will continue to operate normally, but any alarms may have been cleared.	If fault recurs, replace card.

APPENDIX B: POWER SUPPLIES

B.1 Power supply rating

Use the figures for power consumption given in Appendix C to calculate the power supply rating needed.

B.2 Backplane power supply connector



N.C. = NO CONNECTION

Note that pins 4, 6 and 8 are connected to each other on the backplane. The power supply therefore need not have an output on all these pins. For example, a power supply which has a 24V output on pin 4, +sense on pin 6, and no connection on pin 8 can be used. Similarly, it need not have 0V on all of pins 10, 12 and 14.

APPENDIX C: SPECIFICATIONS

C.1 Operating conditions

Supply voltage	18 – 30V DC, unregulated
Environmental	
Temperature	0 – 50°C
Humidity	0 – 90% RH, non-condensing
Vibration	To BS 2011 Part 2.1Fc
Current consumption at 24V	
4–20 card typical	125mA
(excl. head) maximum	300mA
Ex card typical	200mA
(including head) maximum	500mA
Analogue output	
Maximum load (current output)	500Ω
Minimum load (voltage output)	1kΩ

Weights	
Cardframe	2.1kg
Channel cards	220g

C.2 Alarm relays

Contact material	Silver alloy
Nominal switching capacity	5A 250VAC; 5A 30V DC
Max. switching power	1,250VA, 150W
Max. switching voltage	250VAC, 100V DC
Max. switching current	5A
Min. switching voltage	10V
Min. switching current	100mA

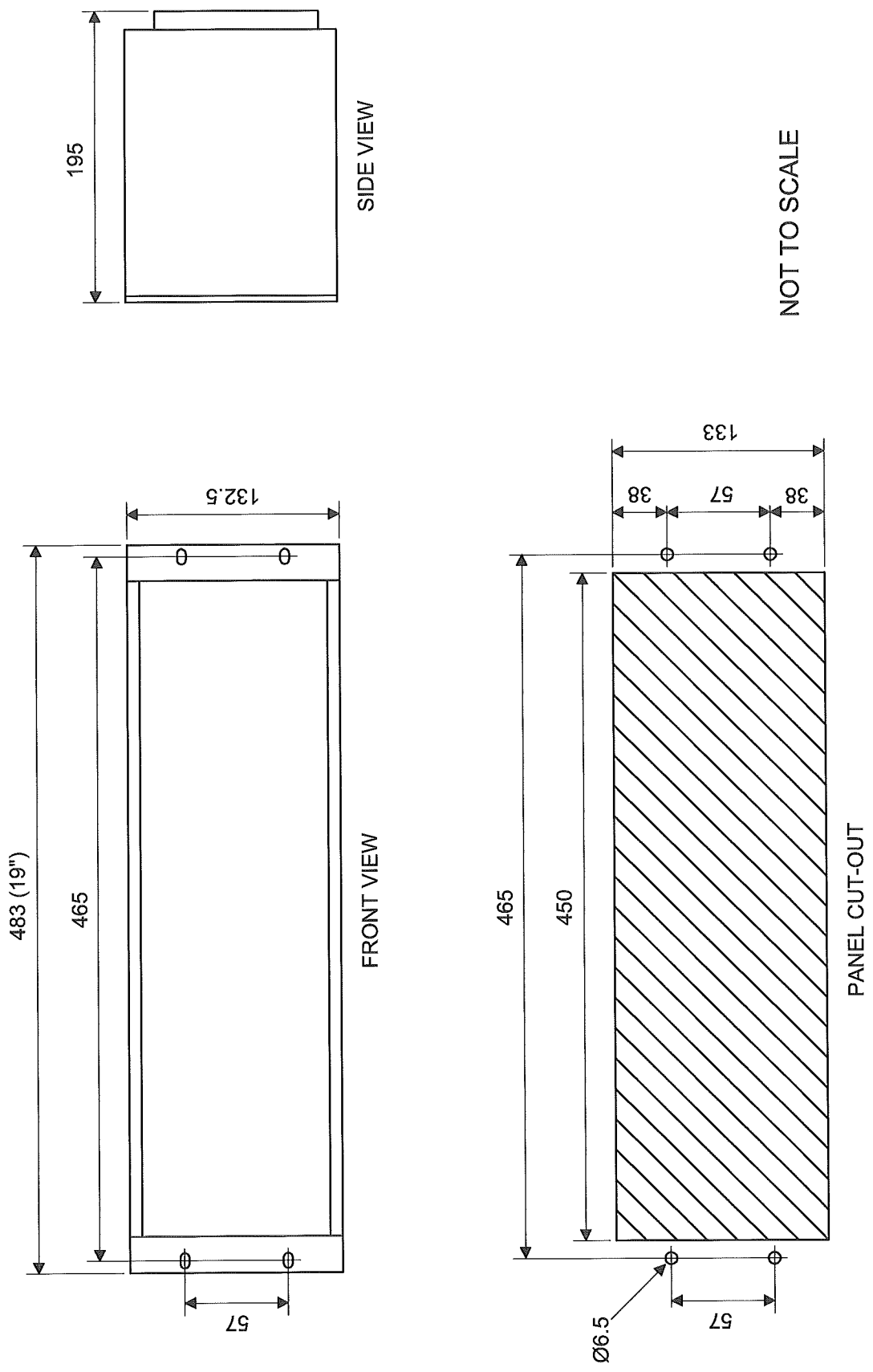
C.3 Display resolution

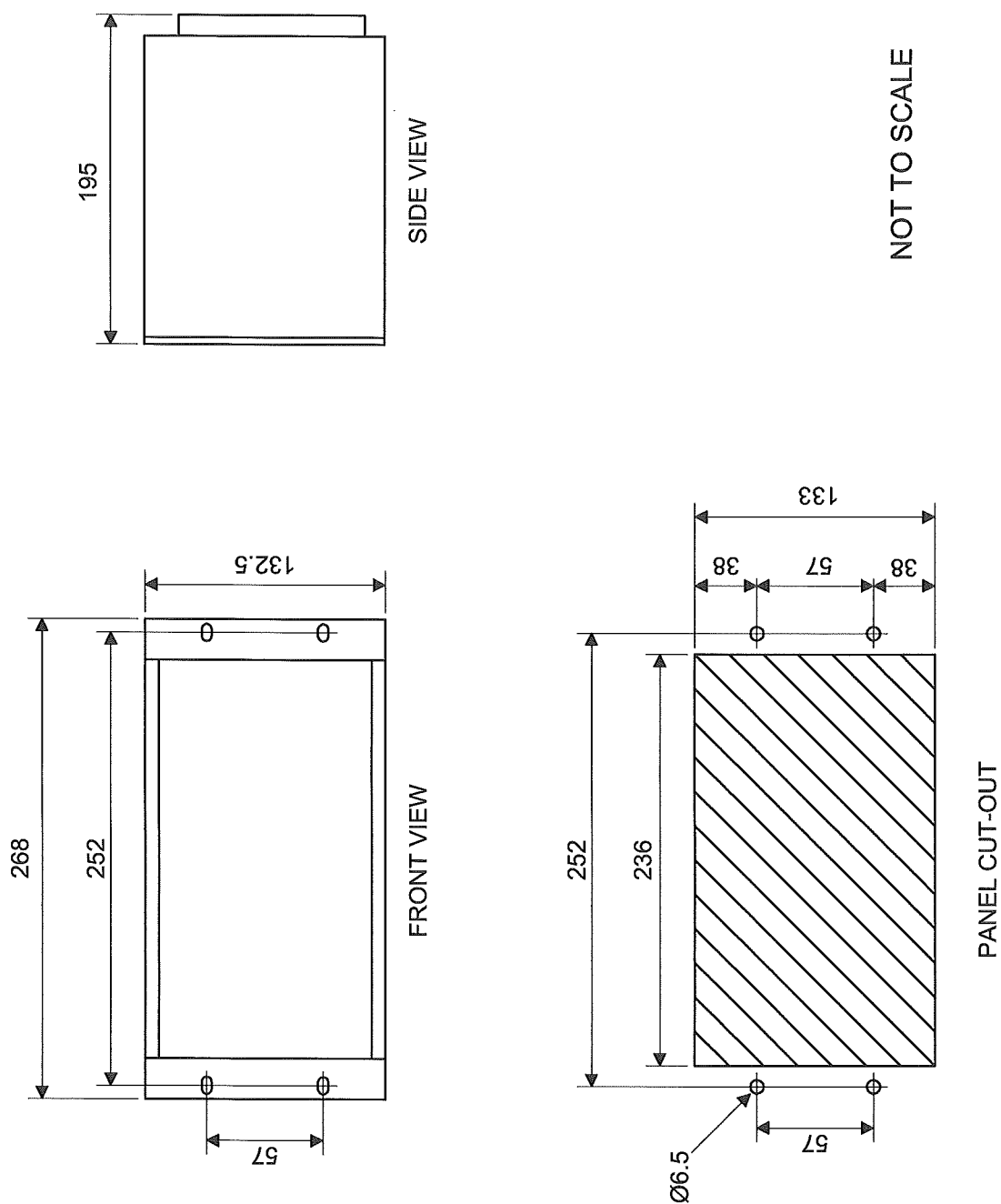
The resolution of the display depends on the selected range. The following table gives the resolution and the number of decimal places displayed for a positive reading on each range.

Range	Resolution	Dec. places	Range	Resolution	Dec. places
0 – 1	0.01	2	0 – 100	1	0
0 – 2	0.01	2	0 – 200	1	0
0 – 3	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
0 – 50	0.1	1			

APPENDIX D: CARDFRAME DIMENSIONS

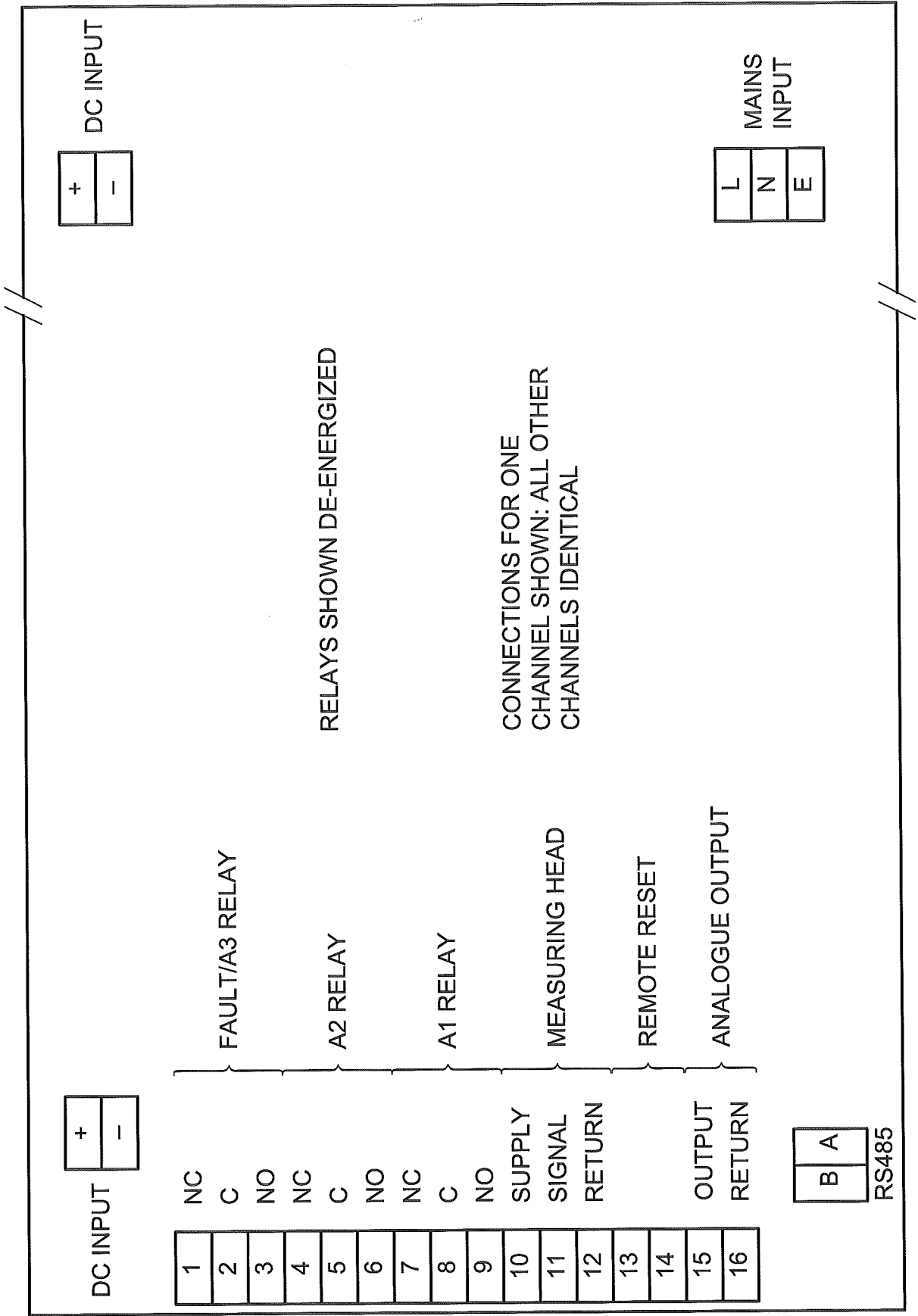
D.1 19" (16 channel) cardframe



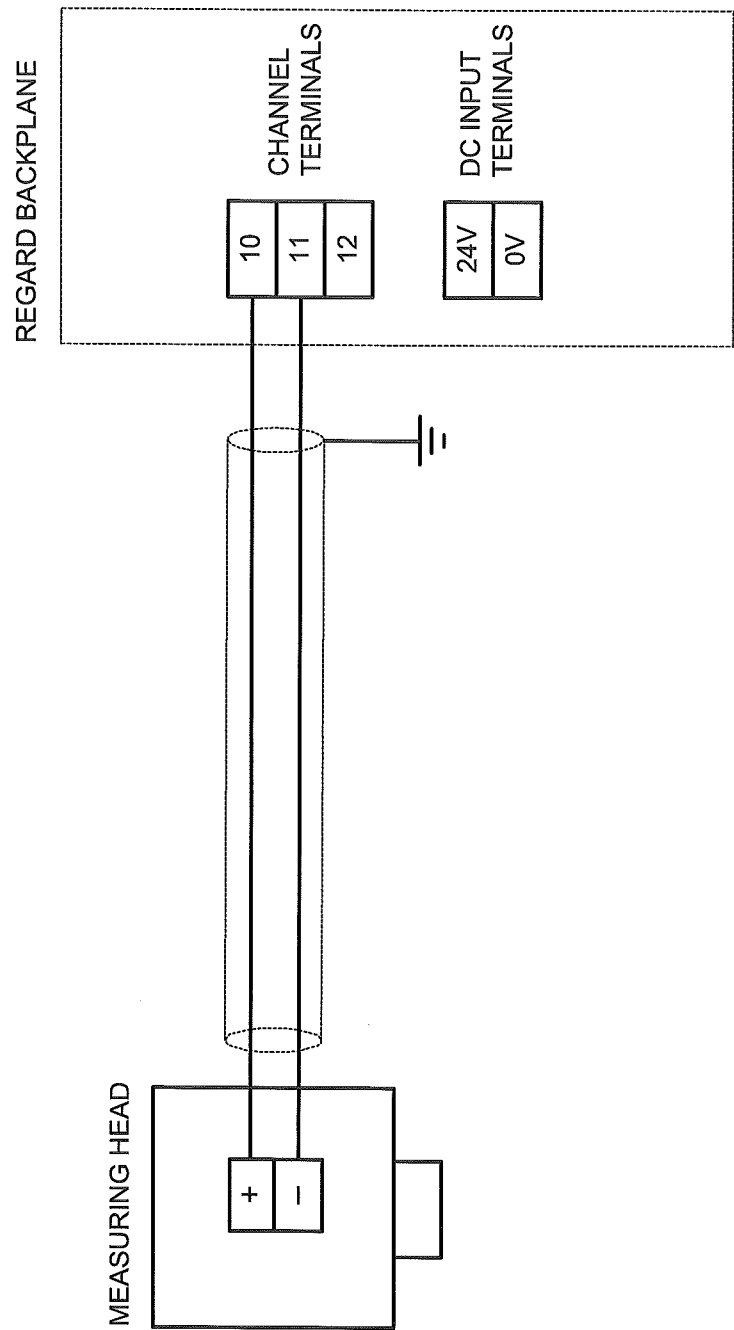


APPENDIX E: CONNECTION DIAGRAMS

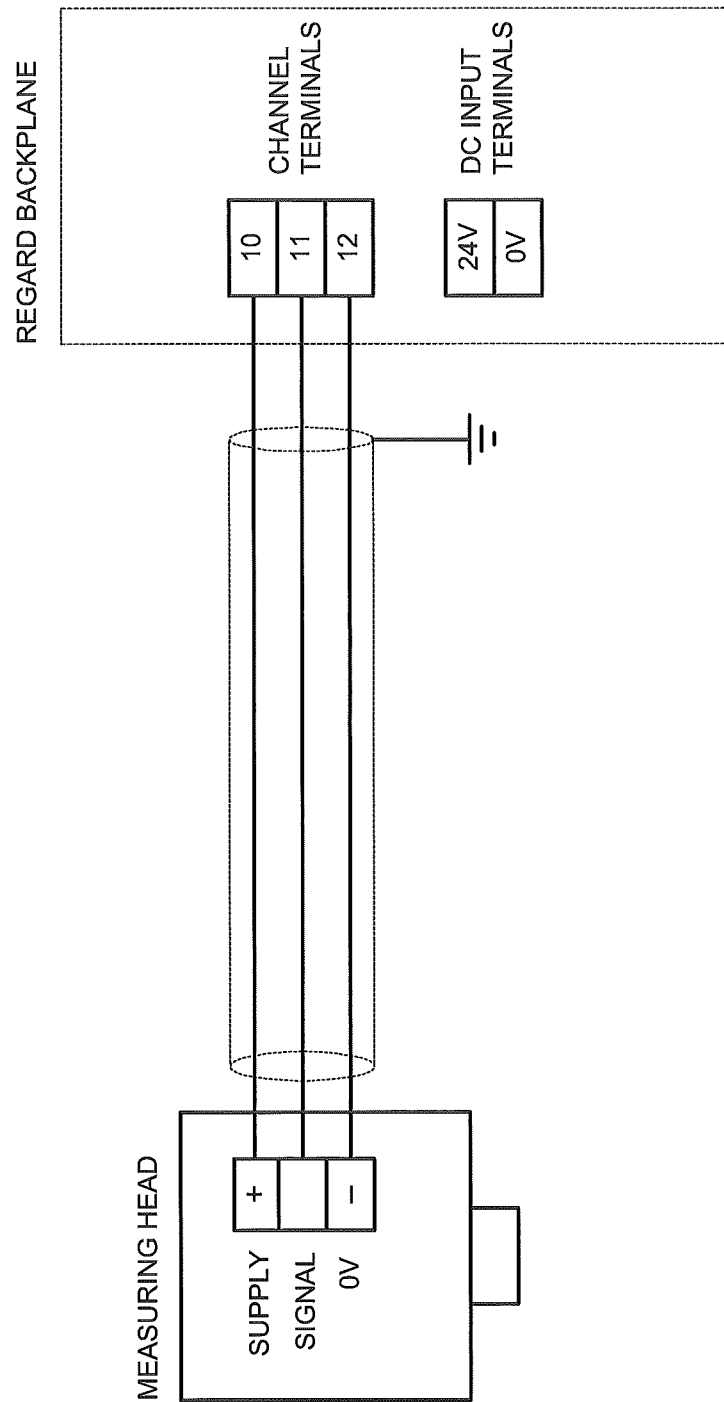
E.1 Backplane terminals



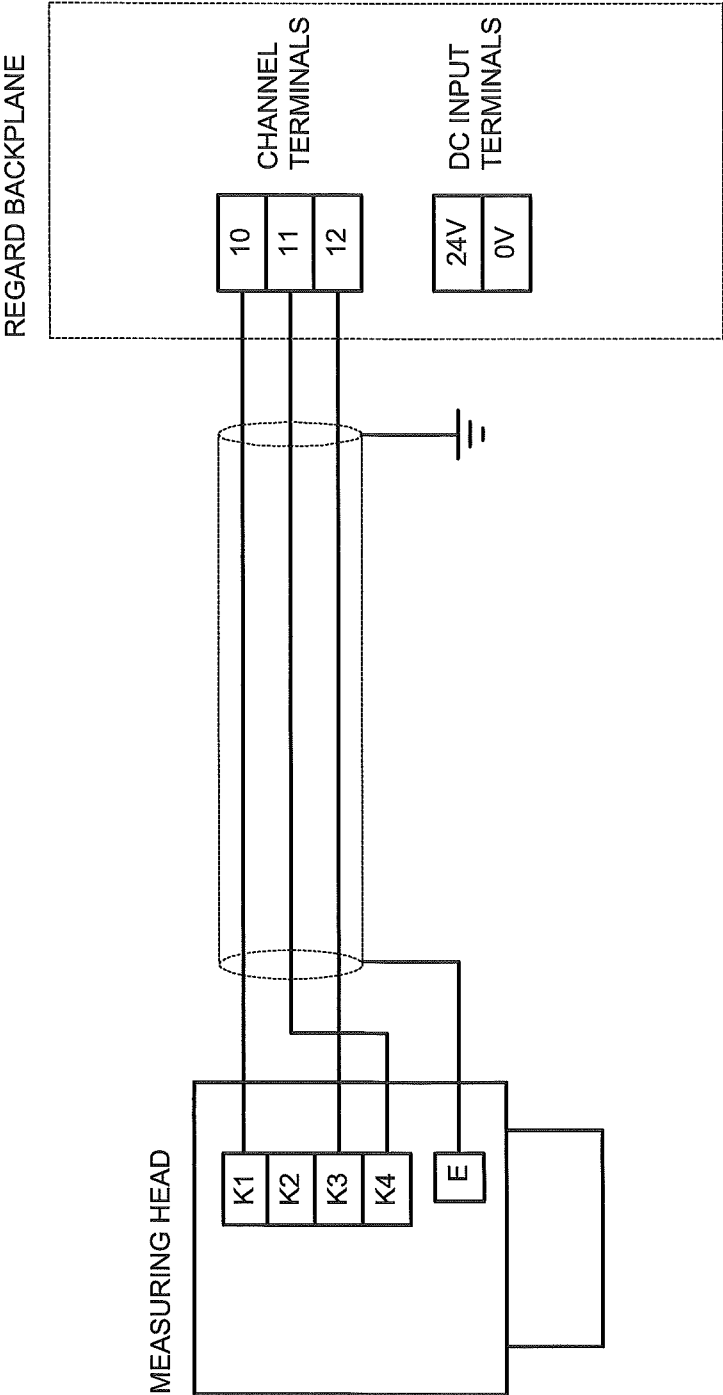
E.2 Two-wire 4–20mA measuring head connections



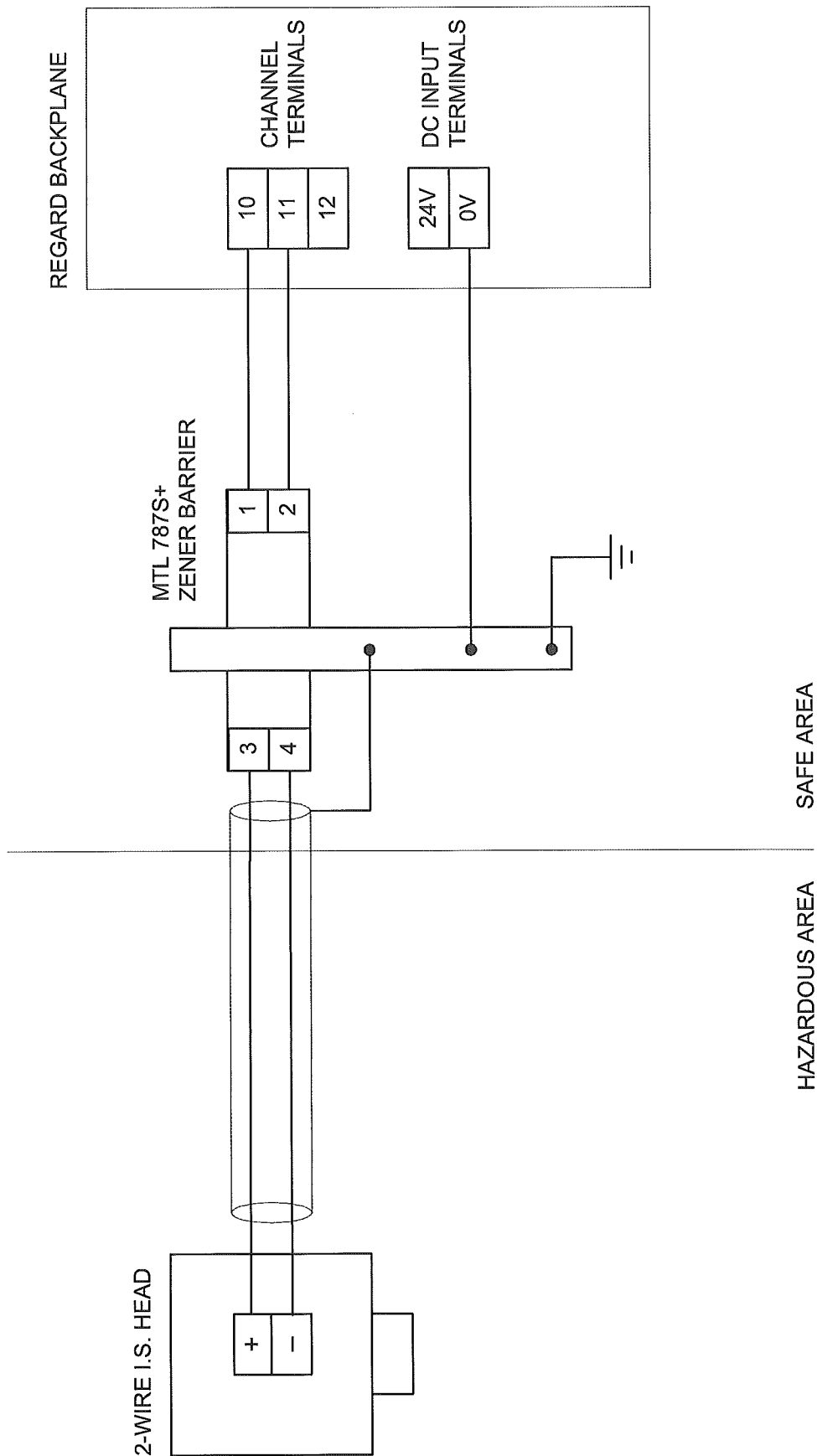
E.3 Three-wire 4–20mA measuring head connections



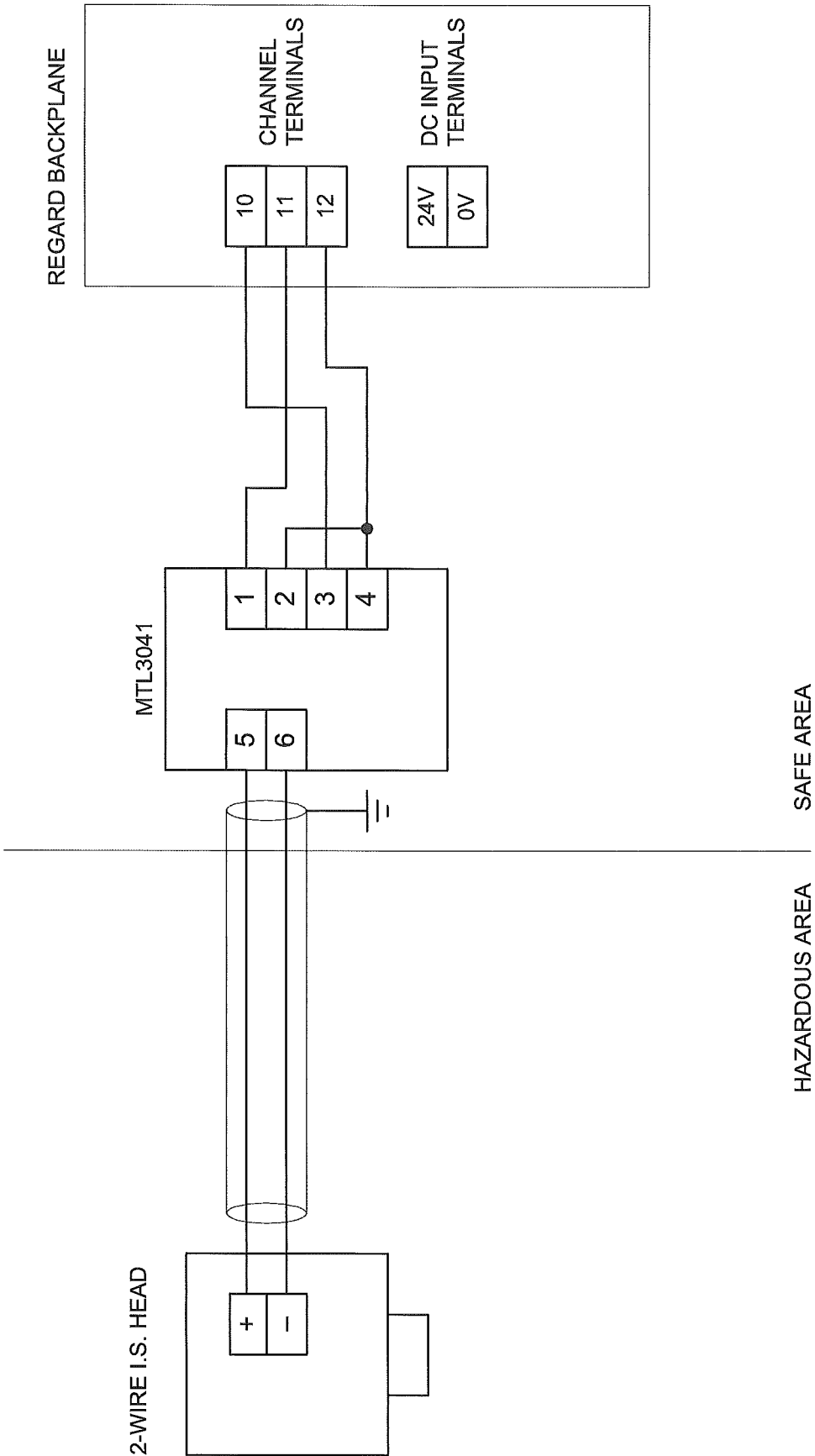
E.4 Polytron Ex and IR Ex connections



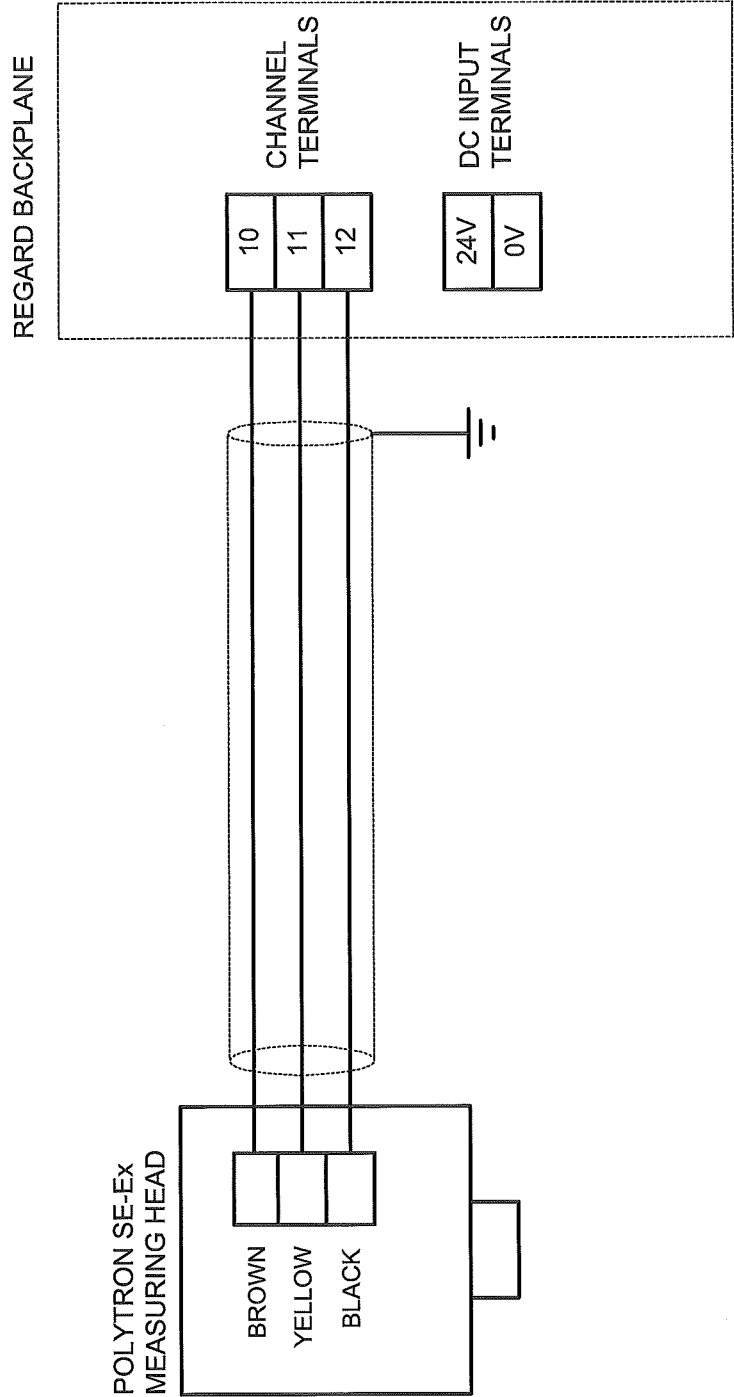
E.5 Two-wire 4–20mA measuring head connections via zener barrier



E.6 Two-wire measuring head connections via MTL3041 isolating barrier



E.7 Polytron SE Ex pellistor head connections



APPENDIX F: COMMANDS SUMMARY

Cmd. No.	Command Name	Function	Command mode level			Default setting
			Read	Maint.	Config.	
00-0	QUIT	Quit command mode	•	•	•	
00-1	P.WD	Enter password	•	•	•	
00-2	SAVE	Save settings		•	•	
00-3	PCHG	Change password		•	•	
04-0	GAS	Set gas name	o	o	•	CH4/Ex
04-1	UNIT	Set units	o	o	•	%LEL
04-2	FSD	Set full-scale deflection	o	o	•	100
04-3	FSDL	Set over-range latching		o	•	YES
04-4	A1 R	Set relays normally energized or energize on alarm		o	•	ENER
04-5	A2 R			o	•	ENER
04-6	F R or A3 R			o	•	NORM
04-7	ACI2*	Set CI2 head test period	o	o	•	
04-8	SETI (Ex)	Set/measure head current	o	•	•	280
04-9	AOUT	Configure analogue output		o	•	4-20
10-0	ZERO	Set zero		•	•	
10-1	SPAN	Set span		•	•	
10-2	DRFT	Set zero drift band			•	0.0%
10-3	TRIM	Trim analogue output		•	•	
10-7	FLTU	Set under-range fault level	o	o	•	2.0/-12%
10-8	FLTO	Set over-range fault level	o	o	•	OFF
10-9	LCI2* (4-20)	Set CI2 head test level	o	•	•	OFF
10-9	FLTS (Ex)	Set supply fault level	o	o	•	1.5V
11-0	HYST	Set alarm hysteresis			•	1.0%
11-1	A1 T	Set A1 alarm level	o	o	•	20
11-2	A2 T	Set A2 alarm level	o	o	•	40
11-3	A3 T	Set A3 alarm level (if not FLT)	o	o	•	FLT
11-4	A1 M	Set A1 rising/falling	o	o	•	RISE
11-5	A2 M	Set A2 rising/falling	o	o	•	RISE
11-6	A3 M	Set A3 rising/falling/fault	o	o	•	FLT
11-7	A1 L	Set relays latching, non-latching, delay-latching, acknowledgeable, non-acknowledgeable		o	•	DNAK
11-8	A2 L			o	•	DNAK
11-9	F L or A3 L			o	•	LACK
14-0	TLED	Test display & LEDs	•	•	•	
14-1	TRMT	Test remote reset	•	•	•	
14-2	OUT1	Test analogue output (units)		•	•	
14-3	OUT2	Test analogue output (mA)		•	•	
14-4	T A1	Test A1 relay		•	•	
14-5	T A2	Test A2 relay		•	•	
14-6	T F or T A3	Test fault/A3 relay		•	•	
14-7	TCI2*	Test CI2 head		•	•	
52-0	USER	Enter user gas name or units			•	????
52-1	CARD	Set card channel number	o	o	•	0
60-0	LOCK	Lock card in command mode		•	•	
60-1	DISP	Turn normal display on or off			•	ON
60-4	A1 D	Disable A1 relay		•	•	NO
60-5	A2 D	Disable A2 relay		•	•	NO
60-6	F D or A3 D	Disable fault/A3 relay		•	•	NO
60-9	AINH*	Set analogue o/p mode in inhibit		o	•	OFF

• Command can be accessed and setting changed

o Command can be accessed but setting cannot be changed

* Command only available in v1.5 or later

Default passwords: Maintenance level-MMMM, Configuration level-CCCC.