TP488-IV
8 Channel Scanning Monitor
Operation and Instruction Manual

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1 Introduction

This manual contains information for the installation and operation of the TP488 eight input scanning monitor. The TP488 can accept up to eight analog inputs. Eight independently programmable relay outputs provide alarm or control for each input.

The TP488 monitors are designed for applications where good visibility is important. Large high intensity 20mm red LEDs provide a wide viewing angle and distance for the display. The display has been designed to be wall mounted and may be panel mounted if required. Each input may be independently calibrated/scaled to display directly in engineering units on the four digit display. An additional digit indicates which input is currently displayed. Large front panel pushbutton keypads are used to configure the operation of the instrument. Easy to follow “on display” messages assist in setting up of the instrument functions. Programmable functions include relay setpoint (high and or low), relay hysteresis, relay trip delay, relay normally open or normally closed operation, digital filter, display rounding, scanning rate and calibration.

Standard Features:

1. Accepts 4-20mA, 0-1V, LM335 and AD590 inputs in any combination.
2. 4 + 1 Digit 20mm high intensity LED Display.
3. Pushbutton programming and calibration.
4. Eight relay outputs with flexible operation modes.
5. Programmable beeper for each alarm.
6. Individual calibration for each input.
7. ^{o}C or ^{o}F selection (for temperature sensor inputs).
8. Programmable decimal point.
9. Weatherproof IP65 enclosure.
10. Alarm/relay annunciator LEDs.
11. Programmable digital filter.
12. Leading zero blanking.
13. On board power supply to power transmitters.
14. Programmable scan rate or may be locked to one input.
15. Alarm annunciator LEDs.
16. On board expansion connections for optional outputs and optional datalogger.
17. Auto display blanking timer.

Description:

The instrument is available to accept an input from various industrial sensors or input signals. These include temperature probes (types include AD590, LM335 etc.), 4 to 20mA or 0-1V scaleable in engineering units. The 4 to 20mA inputs may be configured to provide power to the transmitter (i.e. current sourcing) or measure directly from an independently powered transmitter (i.e. current sinking).

Options:

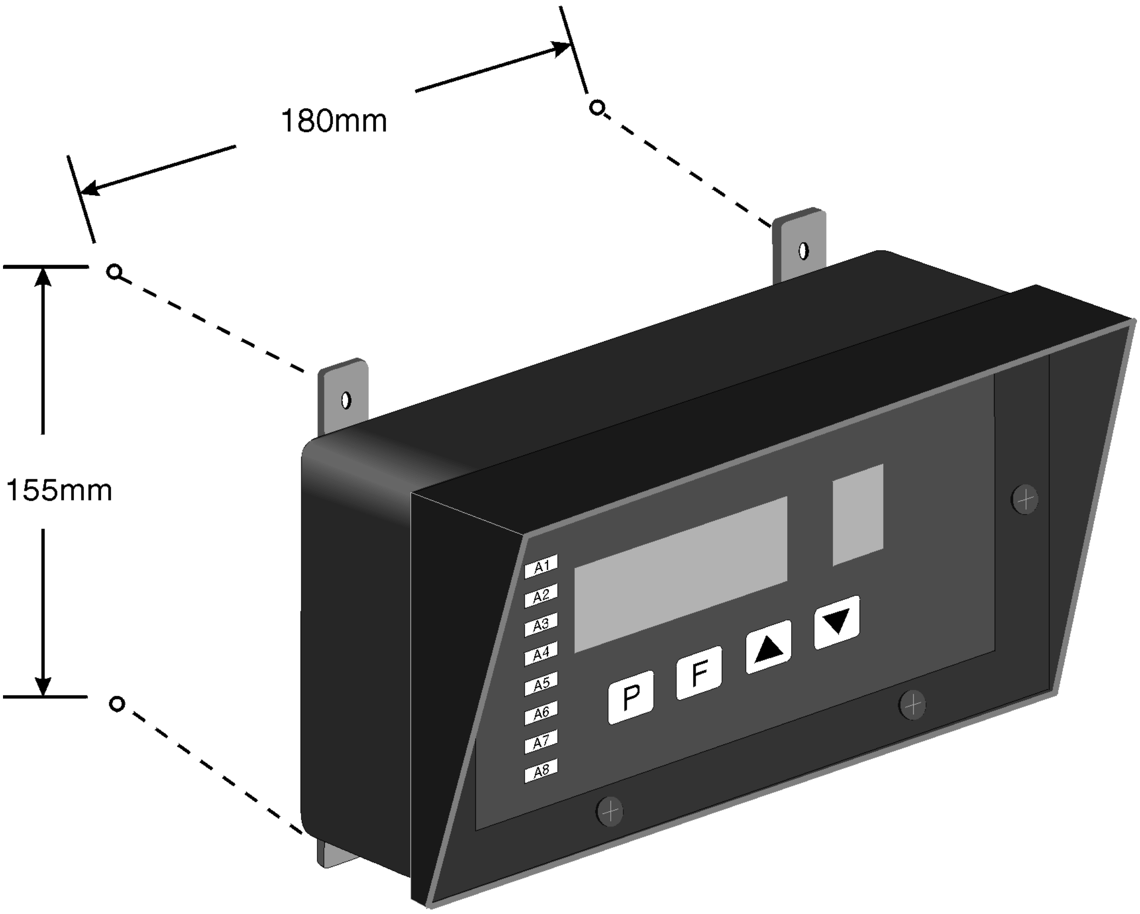
Options include:

1. Fully isolated retransmission (4-20mA, 0-1V or 0-10V), single channel.
2. RS232 or RS485 communications (ASCII, Modbus RTU protocol or special **A.buS** protocol for use with Windows compatible software option).
3. An optional in built data logger which uses the RS232 or RS485 output option to download information is available with a choice of memory sizes to suit various logging requirements. The data logger is supplied with Windows compatible software to allow data logging and live data download and viewing.
4. Windows compatible software for live data viewing and logging directly to the PC. This requires serial communication option to be fitted but does not require the in built data logger option.

Unless otherwise specified at the time of your order, your TP488 has been factory set to a standard configuration. Like all other TP488 series instruments the configuration and calibration is easily changed by the user. Initial changes may require dismantling the instrument to alter PCB links, other changes are made by pushbutton functions. If changes are required read section on input configuration.

2 Mechanical Installation

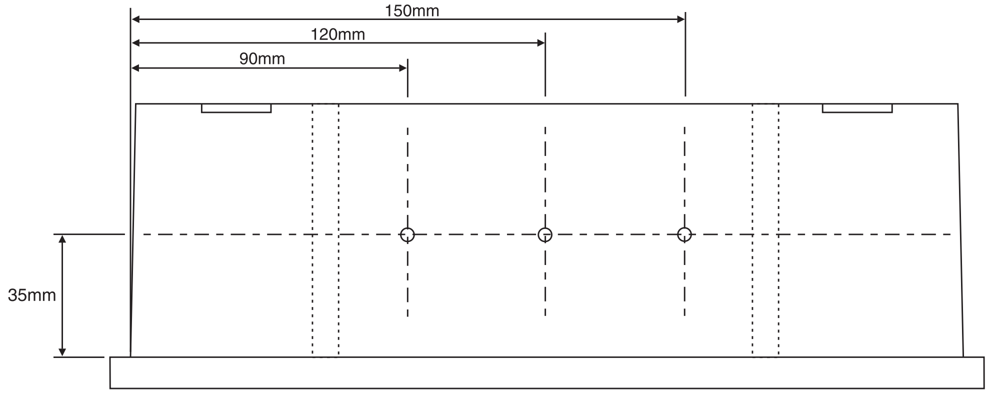
The instrument is designed to be wall mounted using the four mounting brackets provided. Carefully measure and drill four holes as shown below. An optional panel mount kit is available for use with this instrument see section 2.2. Overall enclosure dimensions are 255mm (w) x 145mm (h) x 125mm(max.) (d).



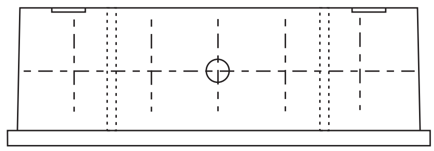
2.1 Fitting cable glands

The weatherproof enclosure has incorporated mounting pillars for securing boards, plates etc. on the base and immediately under the front panel. The case material is Black ASA. Cable glands are readily obtainable from electrical wholesalers and some hardware shops if required. Circuit boards should be removed prior to drilling. The hood is moulded to the case but cases without the hood are optionally available.

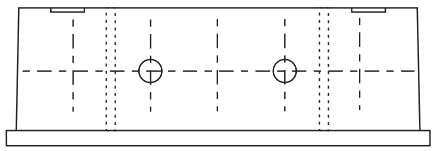
Suggested hole locations for up to 3 cable glands.



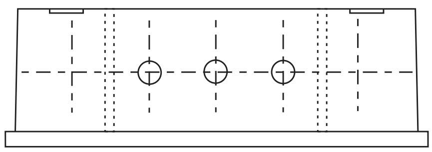
Suggested hole placement selection.



One hole

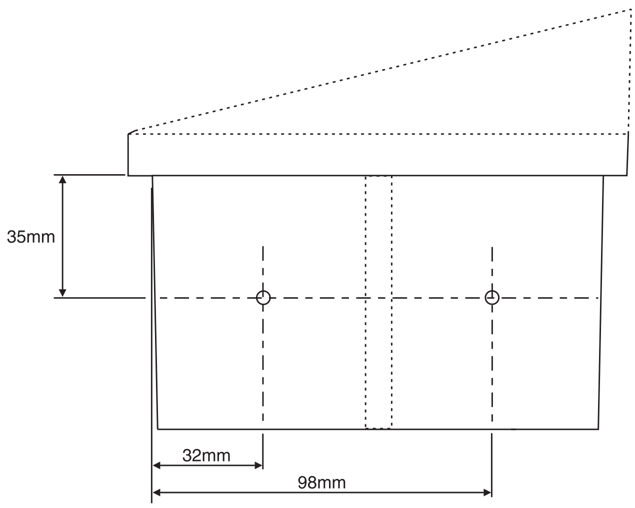


Two holes



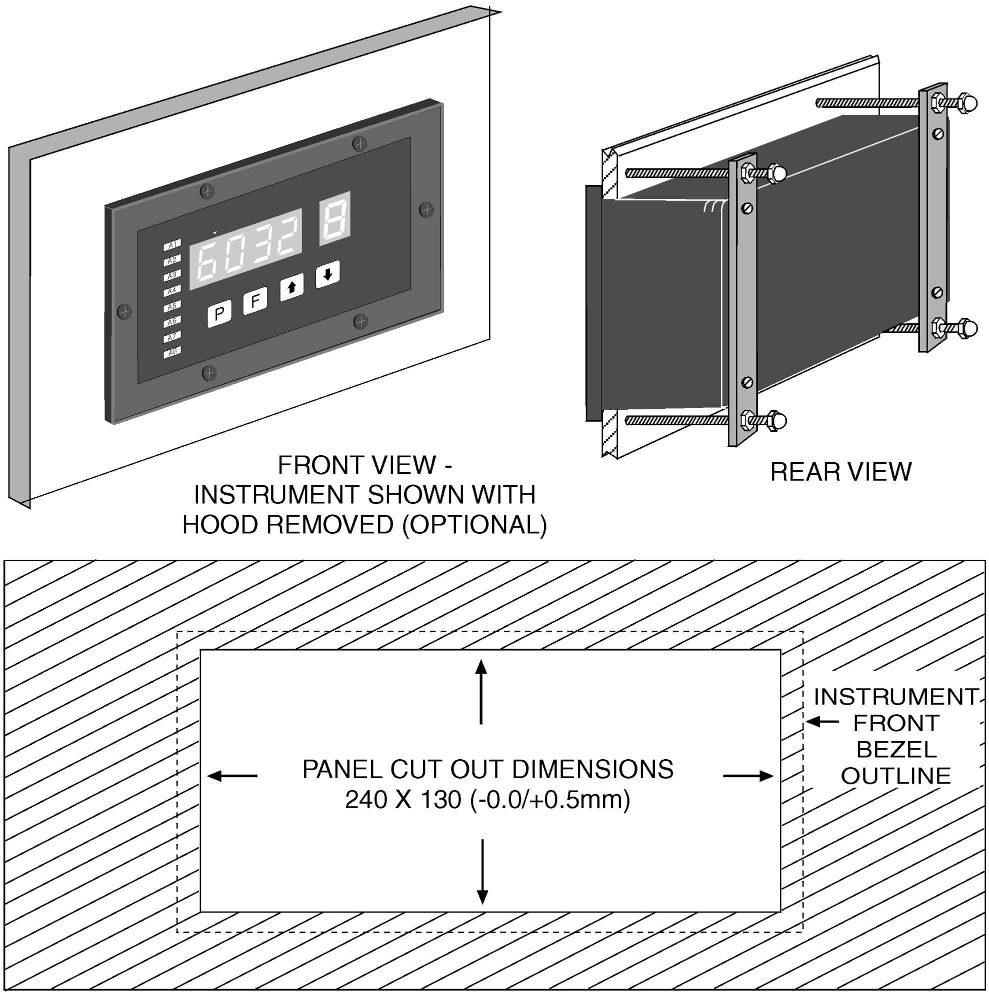
Three holes

Suggested hole locations for up to 2 cable glands with side entry



2.2 Panel mounting

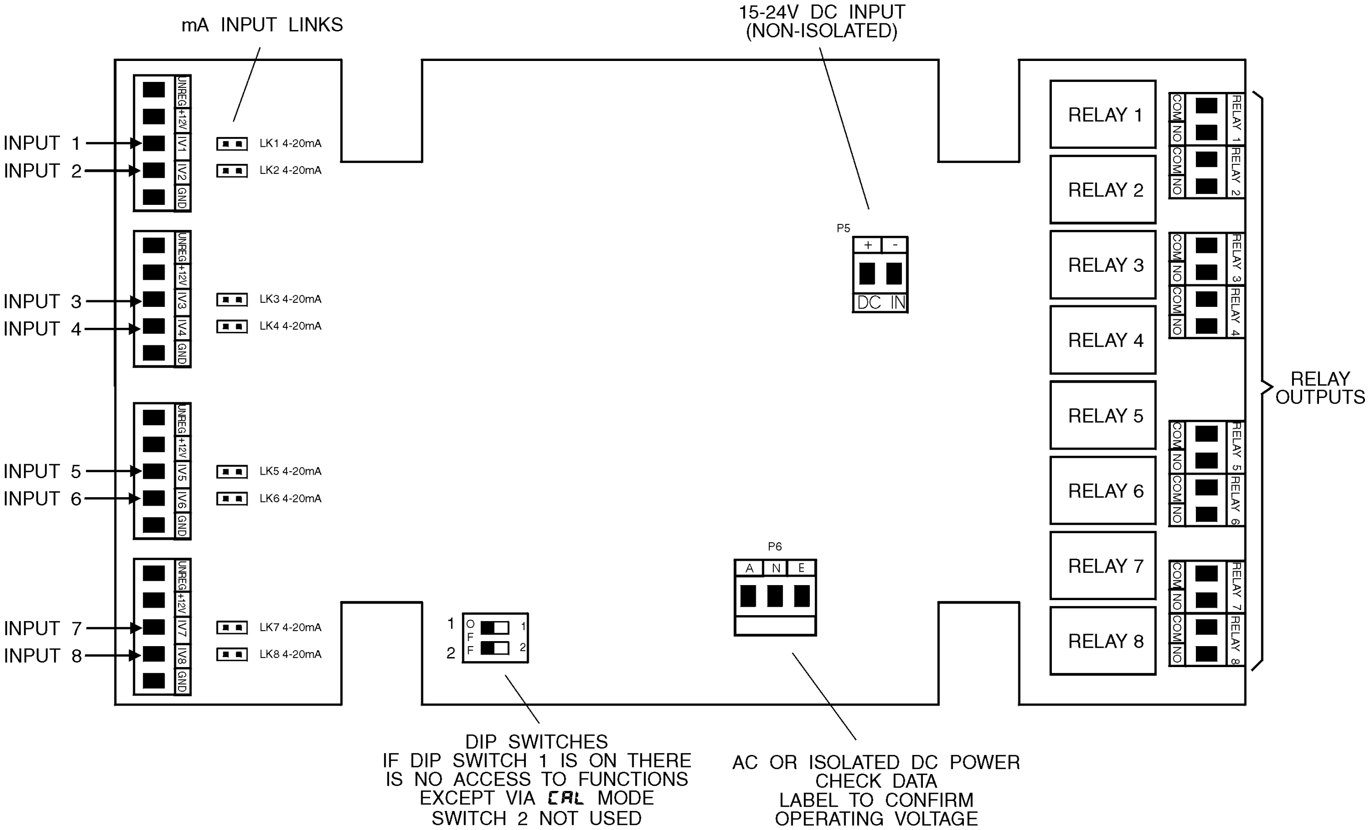
An optional panel mount kit is available. The kit comprises two adjustable bolts and two brackets. A case without the moulded hood is optionally available and is often used when panel mounting displays since it provides a mounting which projects less far the surface.



3 Electrical Installation

The display is designed for continuous operation and therefore no mains/power switch is fitted to the unit. It is recommended that an external switch and fuse be provided to allow the unit to be removed for servicing. To install cables remove six front panel retaining screws. Remove front panel taking care not to damage the ribbon cable (ribbon cable joins the front display circuit board to the main circuit board). Connect power and input cables to the plug in terminal blocks located within the enclosure. The terminals are clearly labeled and unplug for ease of installation, please take care to connect them correctly. The terminal blocks allow for wires of up to 2.5mm2 to be fitted. When power is applied the instrument will cycle through a display sequence, indicating the software version and other status information, this indicates that the instrument is functioning.

Input board layout



3.1 Power supply connections

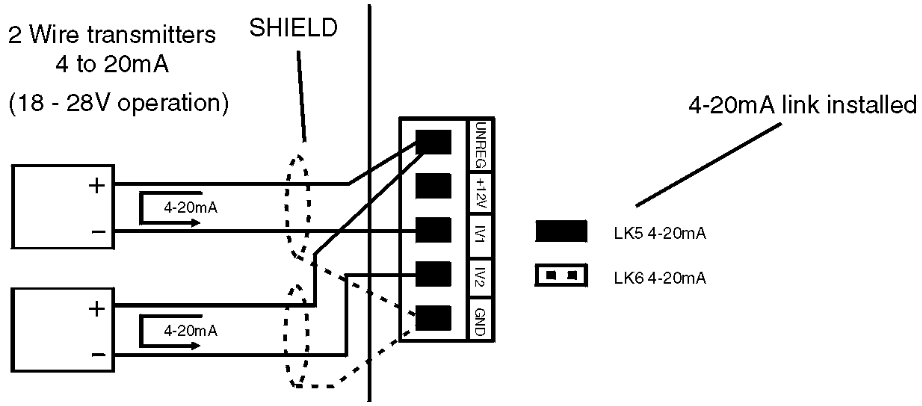
The power supply for the instrument is factory fitted and is of a fixed type. Check power supply type before connecting. Non isolated 15 to 24VDC supply instruments use the DC IN connector P5 shown on the diagram above. Isolated 12 to 48VDC supply instruments and AC supply instruments use connector P6 shown on the diagram above.

3.2 Input connections

The display may be configured to accept combinations of input types. To configure the input type for each input channel, select and fit the PCB link(s) as required (links are in for 4-20mA only) and select each input type in the programming mode. Some examples of input connections and PCB link selection follow. The instrument input ground terminal is common for all inputs. When using multiple transmitters, ensure transmitters can share a common ground. The input signal is placed between input terminals IV1 to IV8 and GND. Note: When using UNREG or +12V terminals to provide loop power check total current requirements do not exceed 200mA.

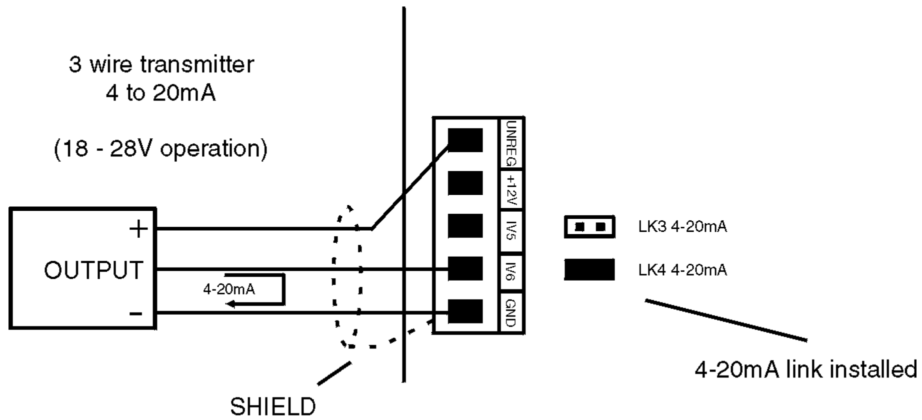
3.2.1 Two wire 4 to 20mA transmitter

2 sensors shown in this example, connected to inputs 1 and 2



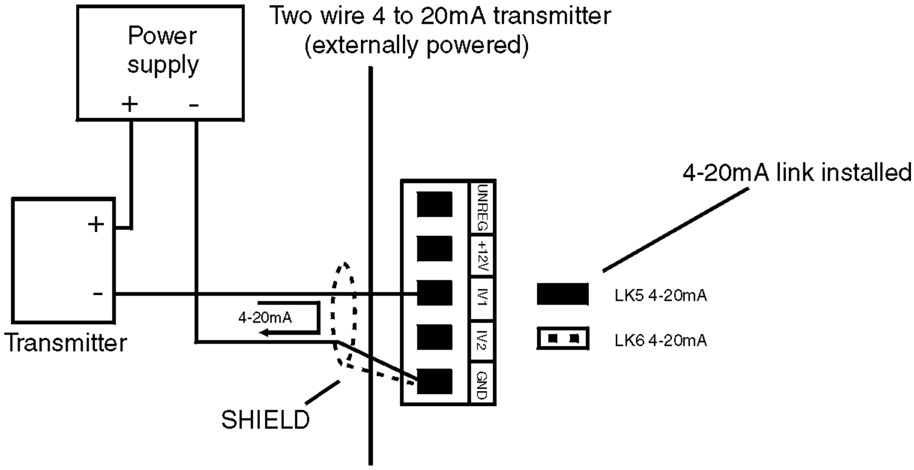
3.2.2 Three wire 4 to 20mA transmitter

Shown connected to input 6 in this example



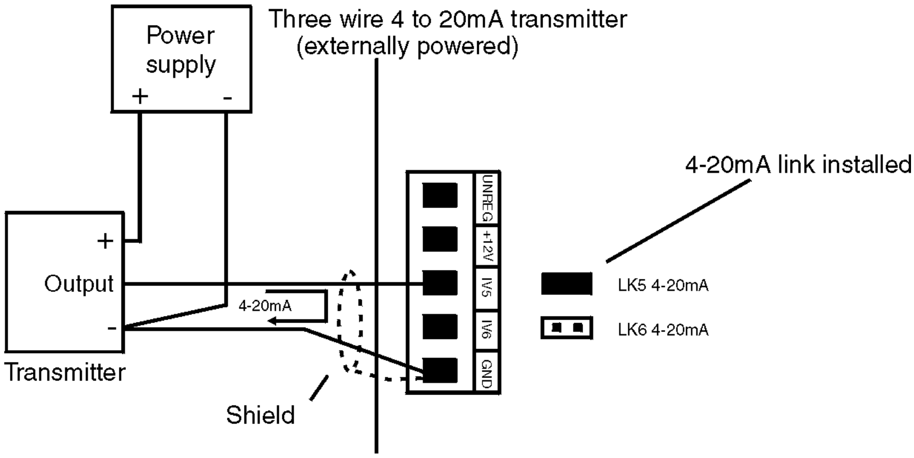
3.2.3 Two wire 4 to 20mA externally powered transmitter

Shown connected to input 1 in this example



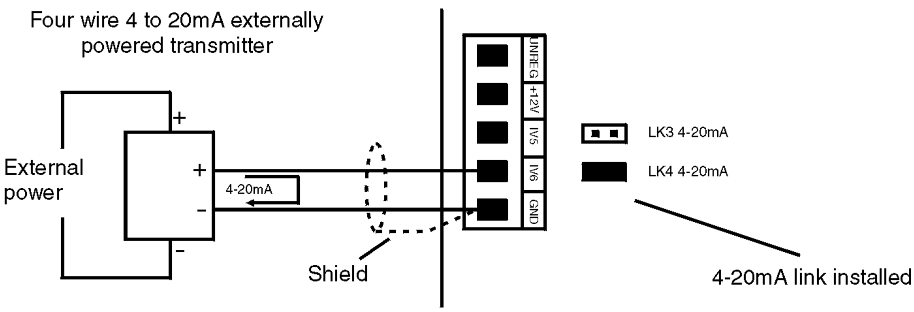
3.2.4 Three wire 4 to 20mA externally powered transmitter

Shown connected to input 5 in this example



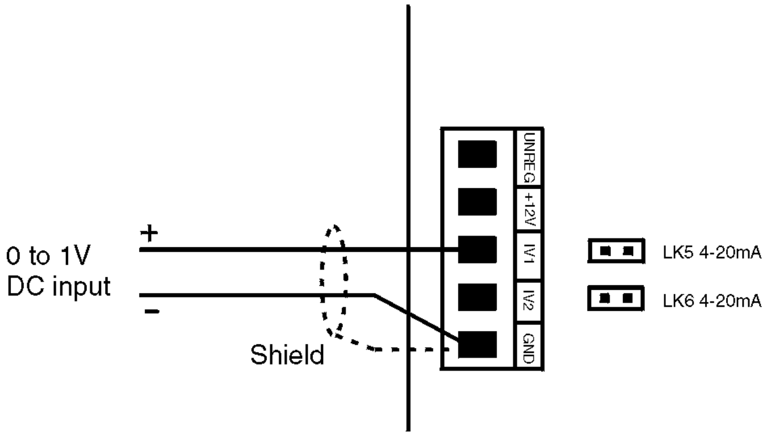
3.2.5 Four wire 4 to 20mA externally powered transmitter

Shown connected to input 6 in this example



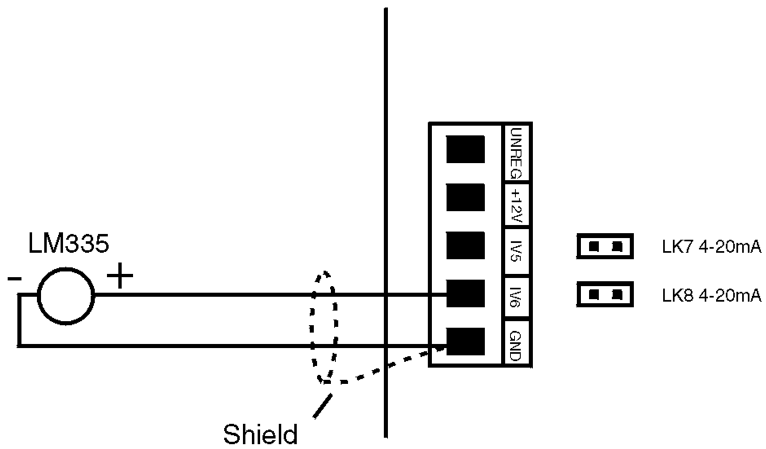
3.2.6 0-1VDC input

Shown connected to input 1 in this example



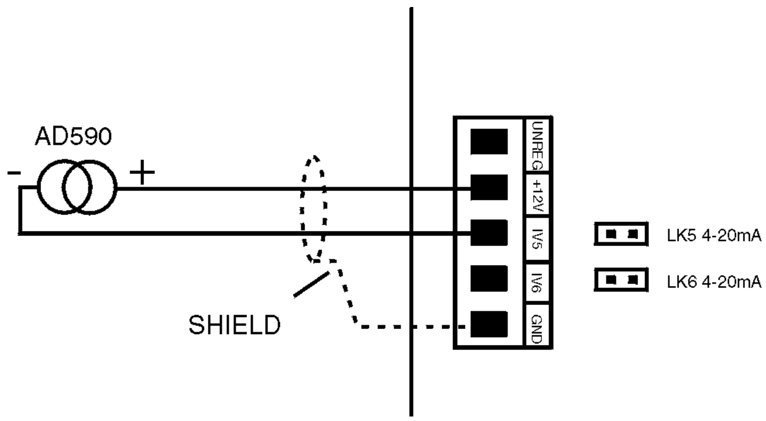
3.2.7 LM335 input

Shown connected to input 6 in this example



3.2.8 AD590 input

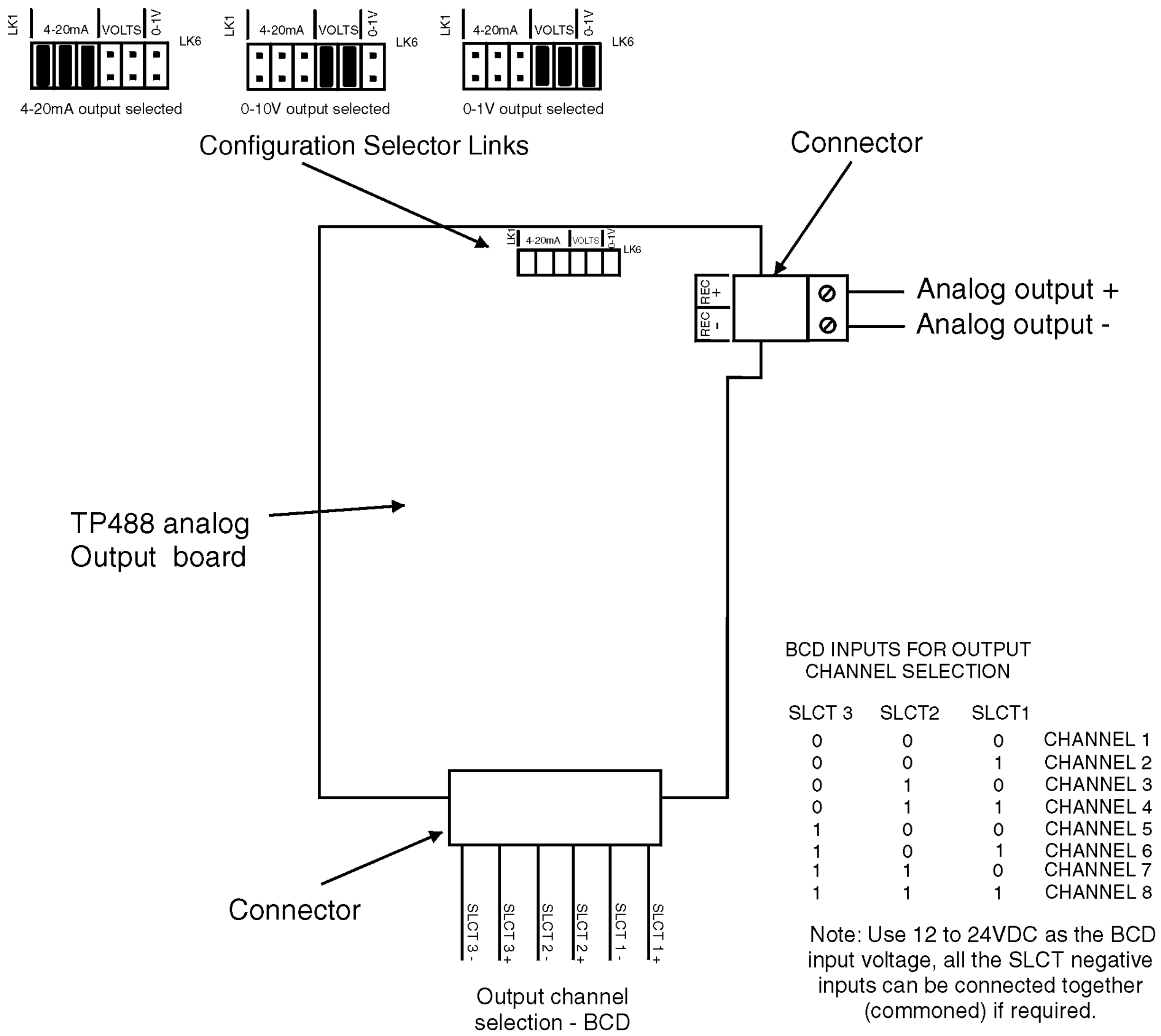
Shown connected to input 5 in this example



3.2.9 Optional analog output

The output board has facilities for 4-20mA, 0-1V or 0-10V retransmission and is factory supplied with all the necessary components for the output options required. PCB links are fitted to the circuit board to connect the electronic components for the correct output types. It may be necessary to alter the PCB links to change the output type (see link settings below). Two connectors allow for connection of analog output lines and BCD code channel selection lines. The optional output board piggy backs on top of the input board.

Setup functions associated with this output type are:
rEC_ function 5.11,
rEC‾ function 5.12,
r.tYP function 5.30,
r.Out function 5.31 and
ro.CH function 5.32.

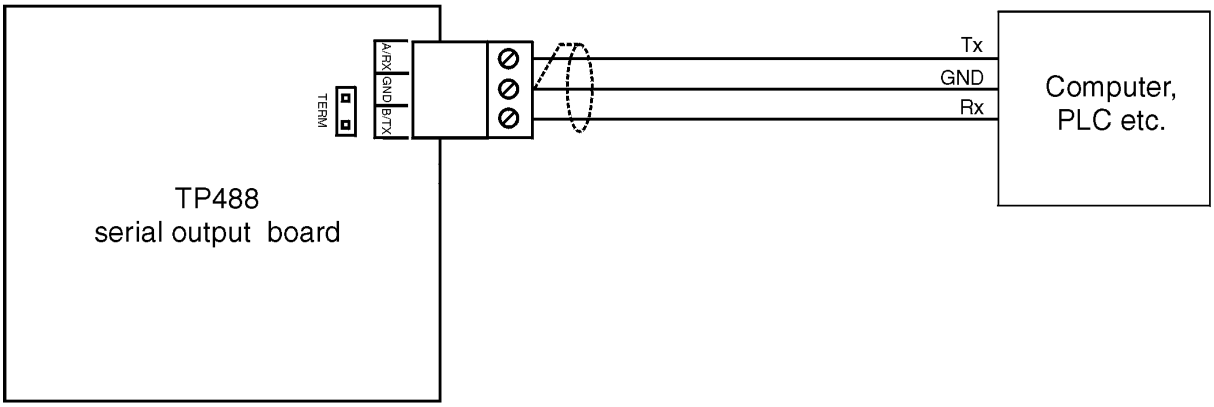


3.2.10 Optional serial output

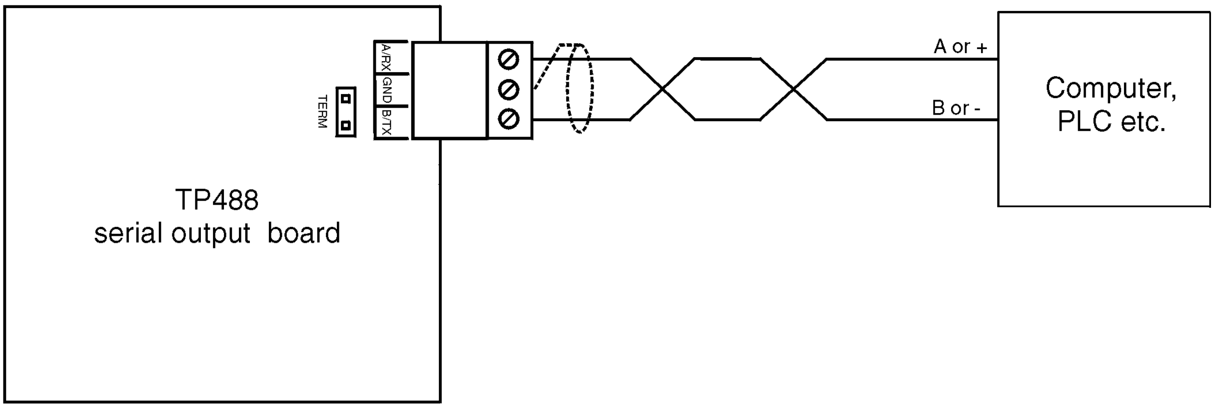
Electrical connections for the serial output option are as shown below. The option will be factory configured for either RS232 or RS485 output. The optional output board piggy backs on top of the input board. The link terminals marked “TERM” provides a terminating resistor to help prevent reflections on the data lines. It is used for RS485 only and is generally only required when communication problems exist over long data lines. Leave this link out unless such communication problems exist.

Refer to chapter 8 for details of setup functions associated with this output option.

RS232 connections (note Tx and Rx cross)



RS485 connections - use twisted pair shielded cable



4 Function table

The functions in the first table are accessible by either FUNC or CAL mode, see page 17.

Enter your settings for each channel in the spaces provided A single space for all channels indicates that the setting is common to all channels									
Display	Description/Range	1	2	3	4	5	6	7	8
ALLo	Alarm relay low value -1999 to 9999 or OFF								
ALHi	Alarm relay high value -1999 to 9999 or OFF								

The remaining functions below are accessible only by CAL mode, see page 17.

Enter your settings for each channel in the spaces provided A single space for all channels indicates that the setting is common to all channels									
Display	Description/Range	1	2	3	4	5	6	7	8
ALHY	Hysteresis value 0 to 9999								
ALtt	Alarm trip time 0 to 9999								
ALrt	Alarm reset time 0 to 9999								
AL.no or AL.nc	Alarm operation ALn.o or ALn.c								
Anb or Lnb or AbP or LbP	Auto no beeper Latch no beeper Auto with beeper Latch with beeper								
AL.CH	Allocate relay to input channel								
F.rLY	Manual relay override On or OFF								
d.OFF	Auto blanking 0 to 9999								
rEC_	Analog output low limit **(*Optional)**								

(*Optional) this function will only be accessible if the relevant option is fitted

Enter your settings for each channel in the spaces provided A single space for all channels indicates that the setting is common to all channels									
Display	Description/Range	1	2	3	4	5	6	7	8
rEC‾	Analog output high limit **(*Optional)**								
tYPE	Input type 4-20, 0-1.0 L335 or AS90								
dCPt	Decimal point 0 to 0.003								
FLtr	Digital filter 0 to 8								
CAL1	Calibration first point								
CAL2	Calibration second point								
OFSt	Calibration offset								
SCLE	Input scale								
UCAL	Uncalibrate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sign	Display polarity both, POS or NEG								
Unit	Temp. unit °C or °F								
SCAN	Scan time 0 to 60								
ChnL	Channels 1 to 8								
A.tYP	Relay operation SngL , SLCt or SEL.A								
bAUd	Baud rate 300 to 38.4 **(*Optional)**								
PrtY	Serial output Parity NONE, EVEN or odd **(*Optional)**								

(*Optional) this function will only be accessible if the relevant option is fitted

Enter your settings for each channel in the spaces provided A single space for all channels indicates that the setting is common to all channels									
Display	Description/Range	1	2	3	4	5	6	7	8
O.Put	Serial output mode dI SP, COnt, POLL A.buS or m.buS **(*Optional)**								
Addr	Serial output Address 0 to 31 **(*Optional)**								
r.tYP	Analog output mode SLCt, Hi , Lo or AUGE **(*Optional)**								
r.Out	Analog output type 4-20, 0-1.0 or 0-10 **(*Optional)**								
ro.CH	Analog output channels CXY or CXn **(*Optional)**								
dLAY	Log update 0.10 to 60.00 **(*Optional)**								
Hour	Set time 0.01 to 24.00 **(*Optional)**	n/a							
dAtE	Set date 01.01 to 31.12 **(*Optional)**	n/a							
YEAr	Set year 1970 to 2037 **(*Optional)**	n/a							
L.CI r	Clear log memory **(*Optional)**	n/a							

(*Optional) this function will only be accessible if the relevant option is fitted

5 Explanation of functions

The setup and calibration functions are configured through a push button sequence. The push buttons located at the front of the instrument are used to alter settings. Two basic access modes are available:

FUNC mode (simple push button sequence) allows access to commonly set up functions such as alarm setpoints.

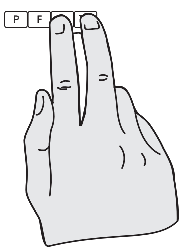
CAL mode (power up sequence plus push button sequence) allows access to all functions including calibration parameters.

Once CAL or FUNC mode has been entered you can step through the functions, by pressing and releasing the F push button, until the required function is reached. Changes to functions are made by pressing the ▲ or ▼ push button (in some cases both simultaneously) when the required function is reached.

Entering CAL Mode

1. Remove power from the instrument. Hold in the F button and reapply power. The display will briefly indicate CAL as part of the "wake up messages" when the CAL message is seen you can release the button. Move to step 2 below.

2. When the "wake up" messages have finished and the display has settled down to its normal reading press, then release the F button. Move to step 3 below.



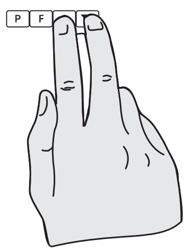
3. Within 2 seconds of releasing the F button press, then release the ▲ and ▼ buttons together. The display will now indicate FUNC followed by the first function.

Note: If step 1 above has been completed then the instrument will remain in this CAL mode state until power is removed. i.e. there is no need to repeat step 1 when accessing function unless power has been removed.

Entering FUNC Mode

No special power up procedure is required to enter FUNC mode.

1. When the "wake up" messages have finished and the display has settled down to its normal reading press, then release the F button.



2. Within 2 seconds of releasing the F button press, then release the ▲ and ▼ buttons together. The display will now indicate FUNC followed by the first function.

Explanation of Functions

5.1 Alarm relay low setpoint

Display:	ALLo
Range:	Any display value or OFF
Default Value:	OFF

Displays and sets the low setpoint value for the selected alarm relay. Use this low setpoint function if a relay operation is required when the display value becomes equal to or less than the low setpoint value. To set a low alarm value go to the AxLo function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value. The low alarm setpoint may be disabled by pressing the ▲ and ▼ push buttons simultaneously. When the alarm is disabled the display will indicate OFF. If the relay is allocated both a low and high setpoint then the relay will activate when the value displayed moves outside the band set by the low and high setpoints. The value at which the relay will reset is controlled by the ALHY function.

Example:
If ALLo is set to 10 then the relay will activate when the display value is 10 or less for the allocated channel.

5.2 Alarm relay high setpoint

Display:	ALHi
Range:	Any display value or OFF
Default Value:	OFF

Displays and sets the high setpoint value for the selected alarm relay. Use this high setpoint function if a relay operation is required when the display value becomes equal to or greater than the high setpoint value. To set a high alarm value go to the AxHi function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value. The high alarm setpoint may be disabled by pressing the ▲ and ▼ push buttons simultaneously. When the alarm is disabled the display will indicate OFF. If the relay is allocated both a low and high setpoint then the relay will activate when the value displayed moves outside the band set by the low and high setpoints. The value at which the relay will reset is controlled by the ALHY function.

Example:
If ALHi is set to 100 then the relay will activate when the display value is 100 or more for the allocated channel.

5.3 Alarm relay hysteresis (deadband)

Display:	ALHY
Range:	0 to 9999
Default Value:	10

Displays and sets the alarm relay hysteresis limit for the selected channel. To set a relay hysteresis value go to the function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value. The hysteresis value is common to Fault, Low and High setpoint values. The hysteresis value may be used to prevent too frequent operation of the relay when the measured value is rising and falling around setpoint value. See "Alarm Relays" chapter for further details of alarm operation.

5.4 Alarm relay trip time delay

Display:	ALtt
Range:	0 to 9999
Default Value:	0

Displays and sets the alarm trip time and is common for both high and low setpoint values. The trip time is the delay before the alarm will trip. The alarm condition must be present continuously for the trip time period before the alarm will trip. This function is useful for preventing an alarm trip due to short non critical deviations from setpoint. The trip time is selectable over 0 to 9999 seconds. See "Alarm Relays" chapter for further details of alarm operation.

5.5 Alarm relay reset time delay

Display:	ALrt
Range:	0 to 9999
Default Value:	0

Displays and sets the alarm reset time and is common for both high and low setpoint values. The reset time is the delay before the alarm will de-active after the display value returns to a non alarm value. The trip time is selectable over 0 to 9999 seconds. See "Alarm Relays" chapter for further details of alarm operation.

5.6 Alarm relay normally open/closed

Display:	ALn.o or ALn.c
Range:	ALn.o or ALn.c
Default Value:	ALn.o

Displays and sets the selected alarm relay action to normally open (de-energised) or normally closed (energised), when no alarm condition is present. See "Alarm Relays" chapter for further details of alarm operation.

5.7 Alarm relay operation mode

Display: Anb, Lnb, AbP or LbP

Range: Anb, Lnb, AbP or LbP

Default Value: Anb

Displays and sets the alarm relay action to normally open (de-energised) or normally closed (energised), when no alarm condition is present. See "Alarm Relays" chapter for further details.

5.8 Allocate relay to input channel

Display: AL.CH

Range: CXY or CXN

Default Value: n/a

The AL.CH function allows each alarm relay to be allocated to one or more input channels. This function will only be seen if the A.tYP function is set to SLCt or SEL.A. See "Alarm Relays" chapter for further details of alarm operation and for an example of AL.CH operation.

5.9 Manual relay override

Display: F.rLY

Range: OFF or ON

Default Value: OFF

Allows the F button to be used to reset a relay alarm operation. See "Alarm Relays" chapter for further details.

5.10 Auto display blanking

Display: d.OFF

Range: 0 to 9999

Default Value: 0

The function d.OFF can be used to select the number of minutes for the automatic display blanking. Settings from 0 to 9999 minutes can be made. If set to 0 the auto display blanking is disabled and the display will remain on. If set to a number other than 0 then the display will switch off in the number of minutes set. When the display blanks the alarm annunciators, the input reading and the channel number will all be blanked. Timing for the auto blanking starts from the last keypad operation i.e. from the last time the P, F, ▲ or ▼ button was pressed. To turn the display back on or to restart the timing process simply press any of these buttons. The instrument will continue to measure input, operate alarms etc. even if the display is blank. The display blanking is provided primarily to reduce power consumption in battery powered applications .

5.11 Analog output option low value

Display: rEC_

Range: Any display value

Default Value: 0

Seen only when analog retransmission option fitted. Displays and sets the analog retransmission (4–20mA) output low value (4mA) in displayed engineering units. To set the analog output low value go to the rEC_ function and use the ▲ or ▼ push buttons to set the required value then press F to accept this selection. See also r.tYP, r.Out and ro.CH functions.

Example: If it is required to retransmit 4mA when the display indicates 0 then select 0 in this function using the ▲ or ▼ button.

5.12 Analog output option high value

Display: rEC‾

Range: Any display value

Default Value: 1000

Seen only when analog retransmission option fitted. Displays and sets the analog retransmission (4–20mA) output high display value (20mA) in displayed engineering units. To set the analog output high value go to the rEC‾ function and use the ▲ or ▼ push buttons to set the required value then press F to accept this selection. See also r.tYP, r.Out and ro.CH functions.

Example;If it is required to retransmit 20mA when the display indicates 50 then select 50 in this function using the ▲ or ▼ button.

5.13 Input type for selected channel

Display: tYPE

Range: 4-20, 0- 1.0, L335 or A590

Default Value: 4-20

Selects the input or temperature sensor type to be used with the selected channel. The selections are 4-20 selects 4-20mA, 0- 1.0 selects 0-1V, L335 selects LM335 semiconductor temperature transducer and A590 selects AD590 semiconductor temperature transducer. See also the "Electrical Installation" chapter for 4-20mA input link locations.

5.14 Decimal point for selected channel

Display: dCPt

Range: 0 to 0.003

Default Value: 0

Displays and sets the decimal point position for the selected channel.

5.15 Digital filter

Display: FLtr
Range: 0 to 8
Default Value: 2

Displays and sets the digital filter value. Digital filtering uses a weighted average method of determining the display value and is used for reducing display value variation due to short term interference. The digital filter range is selectable from 0 to 8, where 0 = none and 8 = most filtering. Use ▲ or ▼ at the FLtr function to alter the filter level if required. Note that the higher the filter setting the longer the display may take to reach its final value when the input is changed, similarly the relay operation and any output options will be slowed down when the filter setting is increased. To set the digital filter value go to the FLtr function and use the ▲ or ▼ push buttons to set the required value then press F to accept this selection.

5.16 First calibration scaling point

Display: CAL 1
Range: Any display value
Default Value: n/a

First scaling point for 2 point calibration scaling - See "Calibration" chapter, section 7.1.

5.17 Second calibration scaling point

Display: CAL2
Range: Any display value
Default Value: n/a

Second scaling point for 2 point calibration scaling - See "Calibration" chapter, section 7.1. This function will not be seen if LM335 or AD590 input is selected.

5.18 Calibration offset

Display: OFSt
Range: Any display value
Default Value: n/a

Calibration offset - See section 7.2.

5.19 Input scaling without live input

Display: SCLE
Range: n/a
Default Value: n/a

Scaling function - See section 7.3.

5.20 Uncalibrate

Display: UCAL
Range: n/a
Default Value: n/a

Uncalibrate, resets calibration See "Calibration" chapter, section 7.4

5.21 Display polarity

Display: Si gn
Range: both, POS or nEg
Default Value: both

Display polarity for selected channel. both means that positive and negative values can be displayed. POS means that only positive values will be displayed, any value below zero will be rounded to zero, nEg means that only negative values will be displayed, any value above zero will be rounded to zero.

5.22 Temperature units

Display: Uni t
Range: °C or °F
Default Value: °C

Selects temperature units for use when a temperature sensor input is used. Select °C or °F for a display in Celsius or Fahrenheit.

5.23 Scanning time per channel

Display: SCAn
Range: 0 to 60
Default Value: 0

Sets display automatic scanning display time from 0 (off) to 60 seconds.

5.24 Number of active channels

Display: Chn1

Range: 1 to 8

Default Value: 8

Selects the number of active channels from 1 to 8. This can be used to prevent unused channels from being displayed.

5.25 Relay operation type

Display: A.tYP

Range: Sn91 , SLCt or SEL.A

Default Value: Sn91

Allows selection of single mode (Sn91) or select mode (SLCt or SEL.A) operation. See "Alarm Relays" chapter for further details.

5.26 Baud rate for serial communications

Display: bAUd

Range: 300 .600 . 1200 .2400 .4800 .9600 . 19.2 or 38.4

Default Value: 9600

Select from 300 .600 . 1200 .2400 .4800 .9600 . 19.2k or 38.4k baud. Refer to Chapter 8, page 39 for further details.

5.27 Parity for serial communications

Display: PrtY

Range: NONE .EVEN or odd

Default Value: NONE

Select parity check to either NONE, EVEN or odd. Refer to Chapter 8, page 39 for further details.

5.28 Output mode for optional serial communications

Display: O.Put

Range: di SP .Cont .POLL .A.buS or M.buS

Default Value: Cont

Set serial interface mode - seen only with serial output option. Allows user to select the serial interface operation as follows:

di SP - sends image data from the display without conversion to ASCII.
Cont - sends ASCII form of display data at a rate typically 90% of the sample rate.
POLL - controlled by computer or PLC as host. Host sends command via RS232/485 and instrument responds as requested.
A.buS - is a special communications mode used with Windows compatible optional PC download software. Refer to the user manual supplied with this optional software.
m.buS - Modbus RTU protocol.

5.29 Instrument address for serial communications

Display:	**Addr**
Range:	**0** to **31**
Default Value:	**0**

Set unit address for polled (**POLL**) mode (**0** to **31**). Allows several units to operate on the same RS485 interface reporting on different areas etc. The host computer or PLC may poll each unit in turn supplying the appropriate address. The unit address ranges from 0 to 31 (DEC) but is offset by 32 (DEC) to avoid clashing with ASCII special function characters (such as <STX> and <CR>). Therefore 32 (DEC) or 20 (HEX) is address 0, 42 (DEC) or 2A (HEX) is address 10. Refer to Chapter 8, page 39 for further details.

5.30 Analog output mode

Display:	**r.tYP**
Range:	**SLCt**, **HI** , **LO** or **AUGE**
Default Value:	**SLCt**

The optional analog) output can be made to operate in one of four ways indicated by **SLCt**, **HI** , **LO** or **AUG**. If **SLCt** is selected within this function then the channel whose input will be output via the recorder output is selected by an external BCD input (SLCT1, SLCT2 and SLCT3) on the circuit board). If **HI** is selected then the highest input value from any input channel selected in **ro.CH** will be output. If **LO** is selected then the lowest value from any channel selected in **ro.CH** will be output. If **AUG** is selected then the average values of all active channels will be output.

5.31 Analog output signal type

Display:	**r.Out**
Range:	**4-20**, **0-1.0** or **0-10**
Default Value:	**4-20**

Displays and sets the output type for the analog output. For 4-20mA output select **4-20**. For 0-1V output select **0-1.0**. For 0-10V output select **0-10**. Note; ensure that correct links are set on the analog output board when selecting output mode.

5.32 Analog output channels

Display: ro.CH

Range: Y or n

Default Value: Y

Displays and sets the active channels for the analog output in HI or LO mode. Use ▲ and ▼ to select required channel. Select Y (yes) or n (no), toggled via the P button e.g. C2 Y means that channel 2 is selected to operate the recorder output (i.e. channel 2 will now affect the recorder output), C2 n means that channel 2 will not affect the recorder output. Setting all channels to n will make the recorder output inactive regardless of the rEC_ and rEC‾ settings. The r.tYP function must be set to either HI or LO for the ro.CH function to be seen.

5.33 Data logger logging period

Display: dLAY

Range: 0.10 to 60.00

Default Value: 1.00

Select log update time - seen only with data logger option. Refer to section 10, page 48. Displays and sets the time period between each log sample. Available selections are:

0.10 (10 seconds), 0.20 (20 seconds), 0.30 (30 seconds), 1.00 (1 minute), 2.00 (2 minutes), 3.00 (3 minutes), 4.00 (4 minutes), 5.00 (5 minutes), 6.00 (6 minutes), 10.00 (10 minutes), 15.00 (15 minutes), 20.00 (20 minutes), 30.00 (30 minutes) and 60.00 (60 minutes).

Note: The data log memory (see L.CLr below) must be cleared whenever the log update time is changed or the date and time is changed.

5.34 Set datalogger clock

Display: Hour

Range: 0.01 to 24.00

Default Value: n/a

Set time - seen only with data logger option. Refer to section 10.
Displays and sets the current time in hours and minutes (24 hour format HH.MM) e.g. set as 17.20 for 5:20 pm.

5.35 Set datalogger date

Display: dAtE

Range: 01.01 to 31.12

Default Value: Date

Set date - seen only with data logger option. Refer to section 10.

Displays and sets the current date in days and months (DD.MM format). The months will roll over automatically (up at the end of the month, down at the beginning of the month) as the day is scrolled up or down.

5.36 Set datalogger year

Display:	YEAr
Range:	1970 to 2037
Default Value:	n/a

Set year - seen only with data logger option. Refer to section 10.
Displays and sets the current year (YYYY format). Valid years settings are from 1970 to 2037 (valid Julian time format years).

5.37 Clear data logger memory

Display:	L.CLr
Range:	n/a
Default Value:	n/a

Clear data log memory - seen only with data logger option. Refer to section 10.
This function clears the data log memory, to clear the memory press then release ▲ and ▼ simultaneously, the display will show CLrP asking if you really want to clear the memory. If you wish to clear memory then press then release ▲ and ▼ simultaneously again. The log memory will then be cleared and the log period reset, the display will indicate ProG LoG to confirm this. Once the memory is cleared all previously logged records will be lost from the instruments memory, if the CLrP message is reached and it is not wished to clear the log memory then pressing and releasing either F or P will abort the function.

5.38 Returning to normal measure mode

When the calibration has been completed it is advisable to return the instrument to the normal mode (where calibration functions are less likely to be tampered with). To return to normal mode, turn off power to the instrument, wait a few seconds and then restore power.

5.39 Error messages

Startup errors

- **CnFgErr** (configuration error). Microcontroller has not been configured at the factory or has been damaged. Return to the supplier for service.
- **ProgEPrO** (program eprom). New software version installed or eprom error. It is normal to see this message once when a new EPROM software version is installed. If this message is seen it will normally last only a few seconds. Unless this problem persists do not switch off until the message has cleared. If the message persists then return the instrument to the supplier for service.

Measurement Errors

- **- - - -** (overrange input error). This message indicates that the input is higher than the instrument expects. Check that the **tYPE** function is set correctly for the input present and that the input links (if required) are set correctly.
- **-or -** (display overrange error). This message indicates that the number is too large to display i.e. the display value has gone beyond the 4 digit display limits of **9999** or below **- 1999**. It may be necessary to revise the scaling and/or the number of decimal points and recalibrate.

Calibration Errors **SPAnErr** Temperature calibration too close to 0^{o}C or two point calibration inputs too close together. Increase the temperature for calibration if a temperature sensor input is used or for 4-20mA or 0-1V inputs check that there is a minimum of 20% of range change between calibration points.

6 Alarm relay operation

The TP488 is provided with 8 alarm/setpoint relays, each is rated at 5A, 240VAC into a resistive load. The relays can be set to operate in one of three basic modes, namely "single" (**SnGL**) mode and "select" (**SLCt** or **SEL.A**) modes. In single mode each relay is assigned to its corresponding channel i.e. relay 1 is assigned to input 1, relay 2 to input 2 etc. In select mode **SLCt** relays may be assigned to any channel, in **SEL.A** mode the channel itself is allocated the setpoint and then the relay is allocated to the channel.

Each relay has the following parameters which may be set by the user:

1. Low setpoint, adjustable in measurement units.
2. High setpoint, adjustable in measurement units.
3. Relay hysteresis, adjustable in measurement units.
4. Relay trip time, adjustable in seconds.
5. Relay reset time, adjustable in seconds.
6. Relay action N/O or N/C.
7. Setpoint relay mode, auto or latching - with or without beeper.
8. Allocate alarm to input channel, allows channels in use to be allocated to any alarm relay when in select mode operation.
9. Alarm mode selection, allows selection of single or select (multi) mode operation.
10. Alarm manual override enable/disable function.

Notes:

- The required relay must be selected using the ▲ or ▼ buttons, prior to making changes to the relay functions. In **SnGL** and **SLCt** modes the right hand display digit which normally shows the channel number actually represents the relay number for alarm setup purposes e.g. if **ALLo 2** is seen on the display then the low alarm setpoint for relay 2 is being viewed. In **SEL.A** mode the same display of would mean that the low alarm setpoint for channel 2 is being viewed.
- In applications where less than eight channels are used, the unused relays are assigned to the highest channel if in **SnGL** mode.
- The **F** button is used as an alarm reset (see **F.rLY** function) or alarm acknowledge button.
- When alarm selection is in **SLCt** or **SEL.A** mode the decimal point places must be the same for each channel, the decimal points for each channel will automatically be made the same when "select" alarm mode **SLCt** or **SEL.A** is used.
- In **SnGL** and **SLCt** alarm modes the alarm annunciator LEDs on the front panel indicate which alarm relay is activated, not which channel caused the activation. In **SEL.A** mode the annunciator indicates which channel has caused the alarm relay operation.

The setpoint relays operate in the following way:

If the measured value is above the high setpoint (**ALHi**) or below the low setpoint (**ALLo**) the alarm trip timer (set via **ALtt**) starts. This timer is reset if the measured value drops below the high setpoint or above the low setpoint. When the duration of the alarm condition exceeds the trip delay time, the alarm is operated. The alarm LED flashes, the setpoint relay is activated, and optionally the beeper sounds. When the alarm has tripped, the measured value is compared to the high setpoint less the hysteresis value and the low setpoint plus the hysteresis value. If it is less than the high setpoint less the hysteresis value and greater than the low setpoint plus the hysteresis value the setpoint reset relay timer (set via **ALrt**) is started. This timer is reset if the displayed value exceeds the high setpoint less the hysteresis value or drops below the low setpoint plus the hysteresis value. When the time the input has been out of alarm condition exceeds the reset delay time the relay is de-activated. If the setpoint is in automatic mode the LED is extinguished and the relay returns to its position, and the Beeper is silenced. If the setpoint is in latched mode, press the **F** Button to reset the alarm. By pressing the **F** button the alarm is acknowledged. This silences the beeper, and stops the LED flashing. When the alarm is reset the LED extinguishes and the relay returns to its position. The **F.rLY** function can be individually set for each relay. This function allows the relay to be reset by pressing the **F** button even if an alarm condition still exists.

The alarm programmable functions operate as follows:

6.1 Relay Low Setpoint ALLO

The low setpoint for the selected relay or channel may be programmed to operate the alarm relay when the measured value falls below the set value. If the low setpoint is not required, it may be set to **OFF** in the setup mode (press ▲ and ▼ simultaneously to set the alarm to **OFF**). The instrument is configurable for each relay to have a low and a high setpoint, so the relay may be triggered if the reading deviates outside of the setpoint limits. If the relay is allocated both a low and high setpoint then the relay will activate when the value displayed moves outside the band set by the low and high setpoints. The value at which the relay will reset is controlled by the **ALHY** function.

Example: If **ALLO 1** is set to **0.0** then the relay will activate if its associated channel goes to **0.0** or below.

6.2 Relay High Setpoint ALHi

The high setpoint for the selected relay or channel may be programmed to operate the alarm relay when the measured value exceeds the set value. If the high setpoint is not required, it may be set to **OFF** in the setup mode (press ▲ and ▼ simultaneously to set the alarm to **OFF**). The value at which the relay will reset is controlled by the **ALHY** function.

Example: If **ALHi 1** is set to **30.0** then the relay will activate if its associated channel goes to **30.0** or above.

6.3 Relay Hysteresis ALHY

The hysteresis value is used to prevent too frequent operation of the alarm relay when the measured value stays close to the setpoint. The hysteresis value is common to the high and low relay action for each alarm. Without a hysteresis setting (hysteresis value set to zero) the alarm will activate when the display value goes above the alarm setpoint (for high alarm) and will reset when the display value falls below the setpoint, this can result in repeated on/off switching of the relay at around the setpoint value. The hysteresis setting operates as follows: In the high alarm mode, once the alarm is activated the input must fall below the setpoint value minus the hysteresis value to reset the alarm. e.g. if alarm high value is set to 50.0 and the hysteresis is set to 3.0 then the setpoint output relay will activate once the display value goes above 50.0 and will reset when the display value goes below 47.0 (50.0 minus 3.0). In the low alarm mode, once the alarm is activated the input must rise above the setpoint value plus the hysteresis value to reset the alarm. e.g. if alarm low value is set to 20.0 and the hysteresis is set to 10.0 then the alarm output relay will activate when the display value falls below 20.0 and will reset when the display value goes above 30.0 (20.0 plus 10.0). The hysteresis units are expressed in displayed engineering units.

6.4 Relay Trip Time ALtt

The alarm trip time determines how long the measured value has to be above the high trip point or below the low trip point before an alarm is given. This can be used to prevent false alarms on noisy inputs. The value is set in seconds, with a range of 0 - 9999 seconds.

6.5 Relay Reset Time ALrt

The alarm reset time determines how long the measured value has to be below the high trip point and above the low trip point before the alarm is reset. This value is set in seconds, with a range of 0 - 9999 seconds. For operation a reset delay of zero is suitable.

6.6 Relay N/O or N/C operation (ALn.o/n.c)

Each alarm may be programmed to operate as a normally open (N/O) or normally closed (N/C) device. A N/O relay is de-energised when no alarm condition is present and is energised when an alarm condition is present. A N/C relay is normally energised and is de-energised when an alarm condition is present. The N/C mode is useful for power failure detection.

6.7 Setpoint Relay Mode

The alarm has four modes of operation:

Anb: Automatic reset, no beeper.

Lnb: Latched alarm, manual reset, no beeper.

AbP: Automatic reset, beeper.

LbP: Latched alarm, manual reset, beeper.

Automatic Reset, with Beeper:

When automatic mode is selected, the relay will automatically reset when the measured input falls within the alarm threshold limits as described above. The beeper is silenced and the LED stops flashing. If the F button is pressed before the measured input falls within the alarm threshold limits, the beeper will be silenced, and the LED will stop flashing, and become constantly illuminated.

Automatic Reset, no Beeper:

This mode is the same as above, except the beeper is not activated. This mode is ideal for control applications.

Latched Alarm, Manual Reset, with beeper:

When latched mode is selected the alarm is latched until the F button is pressed. If the F button is pressed before the measured input has returned to values, the LED stops flashing, staying on steadily, the beeper is silenced. When the measured input has returned to the LED is extinguished and resets the relay. If the measure input has returned to level before the alarm is reset, pressing the alarm reset button immediately extinguished the LED, silences the beeper and resets the relay.

Latched Reset, no Beeper:

This mode is the same as above, except the beeper is not activated.

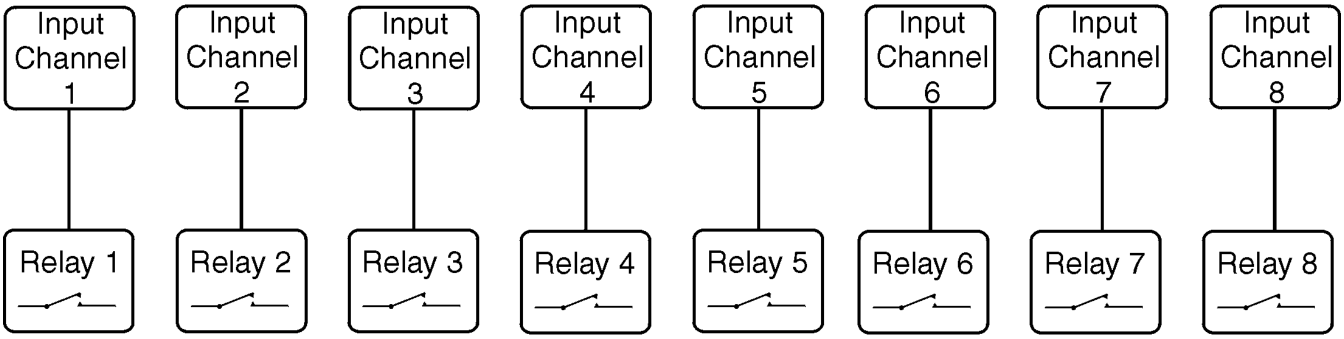
6.8 Relay manual override F.rLY

When setup to operate in this mode any relay which is activated can be de-activated manually, i.e. the alarm condition overridden, simply by pressing the F button. The front panel annunciator LED will indicate which channel (not necessarily the relay number) which has caused the relay activation. Prior to being reset the annunciator LED for the channel which caused the relay activation will flash, when reset then annunciator LED will extinguish even if this channel is still in an alarm condition. To allow operation in this mode the F.rLY function must be set to on for the relays required. Any relays with F.rLY set to OFF cannot be reset via the F button. If the F button is pressed to acknowledge an alarm condition on a relay with F.rLY set to OFF then the annunciator LED for that relay will change from a flashing LED to a solidly lit LED. The LED will remain lit whilst an alarm condition exists for that relay.

6.9 Alarm Relay Operating Modes A.tYP

Single Mode

In single mode each alarm relay is activated by the input at its corresponding channel, thus alarm relay 1 is assigned to input channel 1 etc. To choose single mode select SnGl at the A.tYP function. The A.tYP function is accessible only when the functions are entered via CAL mode. To set up the alarm setpoints and other functions simply select the required relay (selected at the channel number display) and step to the required function using the F button, then alter the alarm setting required using the ▲ or ▼ button. Press the F button to accept the changes.



Select Mode

When select mode is used any relay may be allocated to any one or number of input channels. This means that each relay can be set to operate from one set of setpoint values only. To choose select mode choose **SLCt** or **SEL.A** at the **A.tYP** function. In **SLCt** mode the alarm setpoint is assigned to the relay selected, in **SEL.A** mode the alarm setpoint is assigned to the channel selected.

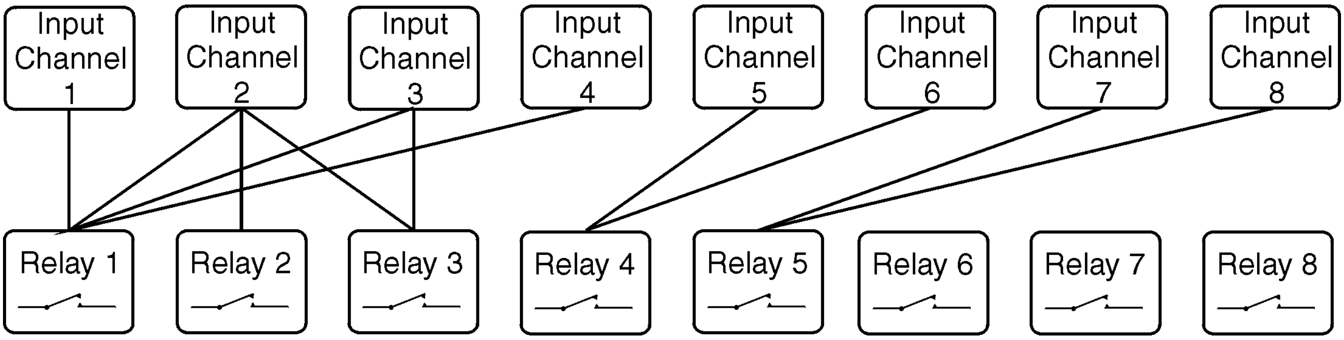
For **SLCt** mode set up the alarm functions as you would for single mode but this time when a channel is selected the channel number refers to the alarm number as far as the alarm functions are concerned. For example if channel 3 is selected when function mode is entered and **ALHi** is set to 50 then relay 3 will activate whenever any input channel allocated to relay 3 (via the **AL.CH** function) goes to 100 or above. In **SLCt** mode the alarm annunciators will show which relays have been activated.

In **SEL.A** mode the user can program setpoint values for input channels rather than relays. This allows the relays selected to operate from multiple setpoints since each channel can be given different setpoint values. e.g. if the display is showing channel 2 then any high or low setpoint made whilst channel 2 is displayed will apply to channel 2 rather than relay 2. This mode allows more than one setpoint to operate a single relay. For example if channel 1 is selected and **ALHi 1** set to 100 then the relays allocated to channel 1 via the **AL.CH** function will all activate when channel 1 has an input which would cause a display of 100 or above. In **SEL.A** mode the alarm annunciator LEDs show which channel has caused the alarm condition. Example - if **AL.CH** function for channel 3 is set to **A 1Y** and **A3Y** with all other channels set to **n** then relays 1 and 3 will activate if the input on channel 3 is outside the alarm setting for that channel.

Note: If more than one input channel is assigned to a relay then the decimal point positions must be the same for each of those channels. The TP488 will automatically assign the same decimal point position to each channel. Any further changes to one channel will automatically cause a change to the other channels allocated to the same relay. When the alarm setpoints etc. for the chosen alarm have been set continue through the functions by pressing and releasing **F** until the **AL.CH** (allocate relay to input channel) function is reached.

6.10 Allocate relays to channel function AL.CH

The **AL.CH** function is only seen when in either **SLCt** or **SEL.A** select mode. This function allows the grouping of inputs to alarm relays. When you reach this function you will already have selected a channel, the LED digit in the right hand window indicates the relay (or channel number in **SEL.A** mode) selected. Each of the channels will flash (use ▲ or ▼ to change channels) with the option to allocate this channel to the relay. For example in **SLCt** mode if the digit in the right hand window indicates **3** then the **AL.CH** function will allow the user to allocate any one or a number of channels to relay 3. The first channel will show up as **C 1Y** or **C 1N** (channel 1 yes or no), use the **P** button to toggle between yes and no. If **C 1Y** is selected then relay 3 will operate from channel 1 input. If **C 1N** is chosen then relay 3 will ignore any inputs on channel 1. Step through each channel and select either yes or no. If a relay is not used it is advisable to select **OFF** for the alarm high and low settings or select "no" for each input channel, this will prevent unwanted operation of the relay and its alarm light/buzzer.



To illustrate select mode operation the table below shows the **AL.CH** selection to obtain the connections shown in the diagram above.

	Alarm relay number							
	1	2	3	4	5	6	7	8
Channel 1	C 1Y	C 1N	C 1N	C 1N	C 1N	C 1N	C 1N	C 1N
Channel 2	C2Y	C2Y	C2Y	C2N	C2N	C2N	C2N	C2N
Channel 3	C3Y	C3N	C3Y	C3N	C3N	C3N	C3N	C3N
Channel 4	C4Y	C4N	C4N	C4N	C4N	C4N	C4N	C4N
Channel 5	C5N	C5N	C5N	C5Y	C4N	C5N	C5N	C5N
Channel 6	C6N	C6N	C6N	C6Y	C4N	C6N	C6N	C6N
Channel 7	C7N	C7N	C7N	C4N	C7Y	C7N	C7N	C7N
Channel 8	C8N	C8N	C8N	C4N	C8Y	C8N	C8N	C8N

If **SLCt** mode were used then the setpoints are assigned to the relays, not the input channels. e.g. if **ALHI** is set for relays 1, 2, 3, 4 and 5 then for the table above:

Relay 1 will activate if channel 1, 2, 3 or 4 go above the relay 1 setpoint.

Relay 2 will activate if channel 2 goes above the relay 2 setpoint.

Relay 3 will activate if channel 2 or 3 go above the relay 3 setpoint.

Relay 4 will activate if channel 5 or 6 go above the relay 4 setpoint.

Relay 5 will activate if channel 7 or 8 go above the relay 5 setpoint.

Example: In **SLCt** mode operation using settings in the table above if **ALHI 1** is set to **20.0** then relay 1 will activate if either channel 1, 2 or 3 inputs go to **20.0** or above.

If **SEL.A** mode were used then individual setpoints can be assigned to each input channel e.g. if **ALHI** is set for channels 1 to 8 then for the table above:

Relay 1 will activate if channel 1, 2, 3 or 4 goes above the channel setpoint.

Relay 2 will activate if channel 2 goes above the channel setpoint.

Relay 3 will activate if channel 2 or 3 goes above the channel setpoint.

Relay 4 will activate if channel 5 or 6 goes above the channel setpoint.

Relay 5 will activate if channel 7 or 8 goes above the channel setpoint.

e.g. in **SEL.A** mode at the **AL.CH** function for channel 2 the setting to allocate relays 1, 2 and 3 to channel 2 are **C 1Y**, **C2Y**, **C3Y**, **C4N**, **C5N**, **C6N**, **C7N**, **C8N** i.e. **C 1Y** actually means Relay 1 Yes, **C2Y** actually means Relay 2 Yes etc.

Example: In **SEL.A** mode operation using settings in the table above if **ALHI 1** is set to **20.0** and **ALHI 2** is set to **30.0** and then relay 1 will activate if channel 1 input goes to **20.0** or above or if channel 2 input goes to **30.0** or above.

Record your own settings in the table below.

	Alarm relay number							
	1	2	3	4	5	6	7	8
Channel 1								
Channel 2								
Channel 3								
Channel 4								
Channel 5								
Channel 6								
Channel 7								
Channel 8								

7 Calibration

7.1 Live signal input calibration

4-20mA or 0-1V calibration by applying live input signals.

This method uses the CAL 1 to enter the calibration scaling point for the first calibration scaling point for 4-20mA and 0-1V inputs and uses function CAL2 as the second calibration scaling point for 4-20mA and 0-1V inputs. The procedure is as follows:

1. Select the channel required then enter setup functions via CAL mode, see page 17 for procedure.
2. Go to the CAL 1 function and press the ▲ and ▼ buttons simultaneously to enter the calibration mode. The display will now indicate LIVE followed by the "live" reading.
3. Apply a known input to the instrument of nominally 0% (this value is not critical and may be anywhere within the measuring range of the instrument). When the reading has stabilised press the F button.
4. The display will indicate SCL 1 (scale 1) followed by the scale value in memory. Now press the ▲ or ▼ button to obtain the required scale (calibration) value. Press the F button, the display will now indicate CAL End indicating that calibration of the first point is complete.
5. The display will now indicate CAL2 (2nd calibration point). Either step through the functions using the F button (to bypass the second calibration point) or enter the 2nd calibration mode as above by pressing the ▲ and ▼ buttons simultaneously.
6. Apply an input of 100% (again this value is not critical, for best accuracy should not be too close to the previous value). When the reading has stabilised, press the F button, the display will now read SCL2 (scale 2) followed by the second scale value in memory.
7. Press the ▲ or ▼ button to obtain the required scale value. Press the F button the display will now read CAL End (indicating that calibration of the second point is complete). The display will return to the measure mode (with calibration access).

Note: When entering the second point independently, the first calibration point may be bypassed simply by pressing the F button instead of the ▲ and ▼ buttons simultaneously.

Temperature calibration.

This method uses the CAL 1 to enter a single point calibration for temperature sensors AD590 or LM335. The procedure is as follows:

1. Connect a temperature sensor and place it in a known temperature environment. Ideally the temperature should be at the maximum end of measurement range for the application. e.g. if the maximum expected temperature for the installation is 50^{o}C then place the sensor at around this temperature.
2. Select the channel required then enter setup functions via CAL mode, see page 17 for procedure.

3. Go to the CAL 1 function and press the ▲ and ▼ buttons simultaneously to enter the calibration mode. The display will now indicate LIVE followed by the "live" reading.

4. When the live reading has stabilised press the F button.

5. The display will indicate SCL 1 (scale 1) followed by the scale value in memory. Now press the ▲ or ▼ button to obtain the required scale (calibration) value. Press the F button, the display will now indicate CAL End indicating that calibration is complete.

7.2 Offset calibration

OFSt - Calibration offset - the calibration offset is a single point adjustment which can be used to alter the calibration scaling values across the entire measuring range without affecting the calibration slope. This method can be used instead of performing a two point calibration when a constant measurement error is found to exist across the entire range. To perform a calibration offset press the ▲ and ▼ buttons simultaneously at the OFSt function. A "live" reading from the input will be seen and the display will briefly flash the message LIVE, make a note of this reading. Press the F button, the message SCLE will now be seen followed by the last scale value in memory. Use the ▲ or ▼ button to adjust the scale value to the required display value for that input. For example if the "live" input reading was 50 and the required display value for this input was 70 then adjust the SCLE value to 70. Press the F button to accept changes or the P button to abort the scaling.

7.3 4–20mA or 0–1V input scaling without live input

This method of scaling can be used with 4-20mA or 0-1V inputs as an alternative to the CAL 1 and CAL2 calibration. This method does not require a live input. After scaling any offsets in the display reading can be adjusted at the OFSt function.

4-20mA input scaling

Enter via CAL mode and go to the SCLE function the press the ▲ and ▼ buttons simultaneously. The display will now indicate En 4 (enter 4mA scaling value) followed by the last scaling value in memory. Using the ▲ or ▼ button set the display to the required reading for 4mA. Now press the F button. The display will indicate En20 (enter 20mA scaling value) followed by the last scale value in memory. Now press the ▲ or ▼ button to obtain the required reading for 20 mA. Press the F button the display will now read CAL End indicating that the calibration/scaling is complete. The display will return to the measure mode (with calibration access).

0-1V input scaling

Enter via CAL mode and go to the SCLE function the press the ▲ and ▼ buttons simultaneously. The display will now indicate En 0.0 (enter 0V scaling value) followed by the last scaling value in memory. Using the ▲ or ▼ button set the display to the required reading for 0V. Now press the F button. The display will indicate En 1.0 (enter 1V scaling value) followed by the last scale value in memory. Now press the ▲ or ▼ button to obtain the required reading for 1V. Press the F button the display will now read CAL End indicating that the calibration/scaling is complete. The display will return to the measure mode (with calibration access).

7.4 Uncalibration

UCAL - Uncalibrate - used to set the instrument back to the factory calibration values. This function should only be used when calibration problems exist and it is necessary to clear the calibration memory. To clear the calibration memory press the ▲ and ▼ buttons simultaneously at the UCAL function. The message CAL CLr will be seen to indicate that the memory has cleared.

8 Serial output option

RS232/RS485 Functions:

bAud - Set baud rate. Select the baud rate from **300**, **600**, **1200**, **2400**, **4800**, **9600**, **19.2** or **38.4**

Prty - Set parity. Select either **NONE**, **EVEN** or **Odd**

O.Put - Select serial output mode. Select **diSP**, **Cont**, **POLL**, **A.buS** or **m.buS**. The **diSP**, **Cont** and **POLL** modes are described in more detail in this chapter. **A.buS** is used when communicating with the Windows compatible download software supplied with the optional data logger, refer to the handbook supplied with the software. See the "Modbus Communications" chapter for details of the **m.buS** option.

- **diSP** - Sends image data from the display without conversion to ASCII
- **Cont** - Sends ASCII form of display data every time display is updated
- **POLL** - Controlled by computer or PLC as host. Host sends command via RS232/RS485 and instrument responds as requested.

Addr - Set unit address for polled (POLL) mode (1 to 31). Allows several units to operate on the same RS485 interface reporting on different areas etc. The host computer or PLC may poll each unit in turn by supplying the appropriate address. The unit address ranges from 1 to 31 (DEC) but is offset by 32 (DEC) to avoid clashing with ASCII special function characters such as $< STX >$ and $< CR >$. Therefore 32 (DEC) or 20 (HEX) is address 0, 42 (DEC) or 2A (HEX) addresses unit 10.

Notes: Multi drop operation is only valid for instruments fitted with the RS485 output option.

8.1 Serial operation and commands

When sending commands to make changes to function settings such as alarm setpoints the TP488 should be in normal measure mode when the command is sent i.e. display has been powered up without any pushbuttons being pressed and **FUNC** mode not entered.

diSP - Image Display Mode:

In image display mode the display value is sent via RS232/RS485 as raw data in the format:

$< ESC >$ IXYYYY

Where:	$< ESC >$	is the ESCAPE character (27 Dec, 1B Hex, ∧[ASCII)
	I	is the character "I" (73 Dec, 49 Hex)
	X	is the number of image bytes in ASCII (31 to 38 Hex)
	$YYYY$	is the raw, 8 bit display data.

This information is output at the same rate as the sample rate. The number of image bytes sent depends on the number of display digits present. This mode is suitable only when the receiving unit is produced by the same manufacturer as the TP488. The data sent is seven segment display image i.e. Bit 0 is segment A, Bit 1 is segment B etc.

Cont - Continuous Transmit Mode:

In this mode the display value is continually transmitted out via the RS232/485 interface in ASCII format with 8 data bits + 1 stop bit. Data will be updated at approximately the same rate as the sample rate.

The format for this mode is:

$$< STX > XAAAA, XBBBB, XCCCC, ...XHHHH < CR >$$

Where:	$< STX >$	is start of text character (2 Dec, 02 Hex, ∧B ASCII)
	X	SPACE (32 Dec, 20 Hex) for a positive value or
	X	"-" (45 Dec, 2D Hex) for a negative value
	$AAAA$	is the display value for Channel 1 in ASCII
	$BBBB$	is the display value for Channel 2 in ASCII
	$CCCC$	is the display value for Channel 3 in ASCII
	$HHHH$	is the display value for Channel 8 in ASCII
	$< CR >$	is a Carriage Return (13 Dec, 0D Hex, ∧M ASCII)

Notes: Display values will only be sent for active channels i.e. the channels selected at the **Chnl** function. Leading spaces (32 Dec, 20 Hex) will be transmitted if the display value is less than 4 digits long. If the decimal point is non zero then it will be sent in the appropriate place as "." (46 Dec, 2E Hex) and will use the space normally set for positive numbers ("X" value above) if the number has 4 digits plus a decimal point.

POLL - Host Controlled Transmit Mode:

This mode requires a host computer, PLC or other device to poll the instrument to obtain display or other information or reset various setpoint parameters. Communications software is required when using **POLL** mode. Data is in ASCII format with 8 data bits + 1 stop bit. When polling the TP4888 it is essential that the command characters are sent with less than a 10mS delay between them. This normally means that each command line must be sent as a whole string e.g. $< STX > PA < CR > 1 < CR >$ is sent as one string rather than $< STX >$ on one line followed by P etc. Whenever the function key is operated the whole string is sent. The format used is ASCII (8 data bits + 1 stop bit).

The format for the command requesting a value from the TP488 is:

$$< STX > CA < CR > D < CR >$$

Where:	$< STX >$	is the start of text ASCII character (∧B, 02 Dec, 02 Hex)
	C	is the command character (see following poll commands available)
	A	is the unit address (Range: 32 to 63 Dec, 20 to 3F Hex, "SPACE" to ? ASCII the address is offset by 32 Dec, 20 Hex)
	$< CR >$	is the ASCII character for CR (∧M, 13 Dec, 0D Hex)
	D	is the Channel number required e.g. 1 (49 Dec, 31 Hex) for Channel 1

The format for data returned from the TP488 is:

$$< ACK > CANXYYYY < CR >$$

Where:	$< ACK >$	is the Acknowledge c haracter (6 Dec, 06 Hex, ∧B ASCII)
	C	is the command character (see following poll commands available)
	A	is the unit address (Range: 32 to 63 Dec, 20 to 3F Hex, "SPACE"

		to ? ASCII the address is offset by 32 Dec, 20 Hex)
	N	is the Channel number in ASCII
	X	SPACE for positive or “-” for negative
	$YYYY$	is the value requested in ASCII

Notes: Leading spaces (32 Dec, 20 Hex) will be transmitted if the display value is less than 4 digits long. If the decimal point is non zero then it will be sent in the appropriate place as “.” (46 Dec, 2E Hex) and will use the space normally set for positive numbers (“X” value above) if the number has 4 digits plus a decimal point.

The format for the host in sending a relay setting to the TP488 is:

$$< STX > CA < CR > N < CR > XYYYY < CR >$$

Where:	$< STX >$	is Start of Text Character (2 Dec, 02 Hex, ∧B ASCII)
	C	is the command character (see following poll commands available)
	A	is the unit address (Range: 32 to 63 Dec, 20 to 3F Hex, “SPACE” to ? ASCII the address is offset by 32 Dec, 20 Hex)
	$< CR >$	is Carriage Return (13 Dec, 0D Hex, ∧M ASCII)
	N	is the relay number in ASCII e.g.: 1 for alarm 1 etc.
	X	SPACE for positive or “-” for negative
	$YYYY$	is the sent relay value in ASCII

The format for the returned data for a relay setting to the TP488 is:

$$< ACK > CANXYYYY < CR >$$

Where:	$< ACK >$	is the Acknowledge c haracter (6 Dec, 06 Hex, ∧B ASCII)
	C	is the command character (see following poll commands available)
	A	is the unit address (Range: 32 to 63 Dec, 20 to 3F Hex, “SPACE” to ? ASCII the address is offset by 32 Dec, 20 Hex)
	$< CR >$	is Carriage Return (13 Dec, 0D Hex, ∧M ASCII)
	N	is the relay number in ASCII e.g.: 1 for alarm 1 etc.
	X	SPACE for positive or “-” for negative
	$YYYY$	is the returned relay value in ASCII

Notes: Leading spaces (32 Dec, 20 Hex) will be transmitted if the display value is less than 4 digits long. If the decimal point is non zero then it will be sent in the appropriate place as “.” (46 Dec, 2E Hex) and will use the space normally set for positive numbers (“X” value above) if the number has 4 digits plus a decimal point.

The POLL commands available and instrument responses are as follows:

1. **Transmit Primary display value:** $< STX > PA < CR > D < CR >$
   e.g. ∧BP!∧M2∧M using a terminal program (channel 2, address 1). Instructs unit to return the primary display value for the selected channel. Format of returned data is:

   $$< ACK > PAXYYYY < CR >$$

Where:	$< ACK >$	is Acknowledge (6 Dec, 06 Hex)
	P	echo command received “P” (80 Dec, 50 Hex)
	A	is the responding units address

X SPACE for positive or "-" for negative
$YYYY$ is the value in ASCII
$< CR >$ is a Carriage Return (13 Dec, 0D Hex)

2. **Transmit secondary display value:** $< STX > SA < CR > D < CR >$
e.g. ∧BS!∧M2∧M using a terminal program (channel 2, address 1). Instructs unit to return the secondary display value for the selected channel e.g. the secondary display value for model TP488-TC is the cold junction temperature. If the display has no secondary display value then a "?" will be returned. Format of returned data is:

$< ACK > SAXYYYY < CR >$

Where:
$< ACK >$ is Acknowledge (6 Dec, 06 Hex)
S echo command received "S" (83 Dec, 53 Hex)
A is the responding units address
X SPACE for positive or "-" for negative
$YYYY$ is the value in ASCII
$< CR >$ is a Carriage Return (13 Dec, 0D Hex)

3. **Transmit all active channel display values:** $< STX > QA < CR >$
e.g. ∧BQ!∧M using a terminal program (address 1). Instructs unit to return the display values for all active channels i.e. the channels selected a the Chn1 function. Format of returned data is:

$< ACK > QAXBBB, ...XIIII < CR >$

Where:
$< ACK >$ is Acknowledge (6 Dec, 06 Hex)
X SPACE (32 Dec, 20 Hex) for a positive value or
X "-" (45 Dec, 2D Hex) for a negative value
$BBBB$ is the display value for Channel 1 in ASCII etc.
$IIII$ is the display value for the highest active channel in ASCII
$< CR >$ is a Carriage Return (13 Dec, 0D Hex, ∧M ASCII)

Example: If all 8 channels are active then the returned data format would be:
$< ACK > QAXBBBB, XCCCC, XDDDD, XEEEE, XFFFF, XGGGG, XHHHH,$
$XIIII < CR >$

4. **Read low alarm setpoint:** $< STX > LA < CR > N < CR >$
e.g. ∧BN!∧M2∧M to read alarm 2 low setpoint using a terminal program (address 1). Instructs unit to return the low alarm setpoint value. Format of returned data is:

$< ACK > LANXYYYY < CR >$

Where:
$< ACK >$ is Acknowledge (6 Dec, 06 Hex, ∧F ASCII)
L echo command received "L" (76 Dec, 4C Hex)
A is the responding units address
N is the relay number in ASCII
X SPACE for positive and "-" for negative
$YYYY$ is the setpoint value in ASCII
$< CR >$ is a Carriage Return (13 Dec, 0D Hex, ∧M ASCII)

5. **Read high alarm setpoint:** $< STX > HA < CR > N < CR >$

   e.g. ∧HN!∧M2∧M to read alarm 2 high setpoint using a terminal program (address 1). Instructs unit to return the high alarm setpoint value. Format of returned data is:

	$< ACK > HANXYYYY < CR >$	
Where:	$< ACK >$	is Acknowledge (6 Dec, 06 Hex, ∧F ASCII)
	H	echo command received “H” (72 Dec, 48 Hex)
	A	is the responding units address
	N	is the relay number in ASCII
	X	SPACE for positive and “-” for negative
	$YYYY$	is the setpoint value in ASCII
	$< CR >$	is a Carriage Return (13 Dec, 0D Hex, ∧M ASCII)

6. **Set low alarm setpoint:** $< STX > lA < CR > N < CR > XYYYY < CR >$
   e.g. ∧lN!∧M1∧M1000∧ to set alarm 1 low setpoint to 1000 using a terminal program (address 1). Instructs unit to set the low alarm setpoint value.
   Format of returned data is:

	$< ACK > lANXYYYY < CR >$	
Where:	$< ACK >$	is Acknowledge (6 Dec, 06 Hex, ∧F ASCII)
	l	echo command received “l” (108 Dec, 6C Hex)
	A	is the responding units address
	N	is the relay number in ASCII
	X	SPACE for positive and “-” for negative
	$YYYY$	is the setpoint value in ASCII
	$< CR >$ is a Carriage Return (13 Dec, 0D Hex, ∧M ASCII)	

7. **Set high alarm setpoint:** $< STX > hA < CR > N < CR > XYYYY < CR >$
   e.g. ∧hN!∧M1∧M5000∧ to set alarm 1 low setpoint to 5000 using a terminal program (address 1). Instructs unit to set the high alarm setpoint value. Format of returned data is:

	$< ACK > hANXYYYY < CR >$	
Where:	$< ACK >$	is Acknowledge (6 Dec, 06 Hex, ∧F ASCII)
	h	echo command received “h” (104 Dec, 68 Hex)
	A	is the responding units address
	N	is the relay number in ASCII
	X	SPACE for positive and “-” for negative
	$YYYY$	is the setpoint value in ASCII
	$< CR >$	is a Carriage Return (13 Dec, 0D Hex, ∧M ASCII)

8. **Transmit instrument model and software version:** $< STX > IA < CR >$ e.g. ∧BI!∧M using a terminal program (address 1). Instructs unit to return the instrument model and software version.
   Format of returned data is: $< ACK > IACCX.X < CR >$

Where:	$< ACK >$	is Acknowledge (6 Dec, 06 Hex, ∧F ASCII)
	I	echo command received "I" (73 Dec, 49 Hex)
	A	is the responding units address (offset by 32 Dec e.g. "!" is address 1)
	CC	a 2 character identifier e.g. LC means loadcell input
	$X.X$	is the software version number e.g. 4.6
	$< CR >$	is a Carriage Return (13 Dec, 0D Hex, ∧M ASCII)

9. **Invalid command:** If the command received from the host is invalid the unit will return the following: $< ACK >?A < CR >$, where:

Where:	$< ACK >$	is Acknowledge (6 Dec, 06 Hex, ∧F ASCII)
	?	echo command received "?" (63 Dec, 3F Hex)
	A	is the responding units address (offset by 32 Dec e.g. "!" is address 1)
	$< CR >$	is a Carriage Return (13 Dec, 0D Hex, ∧M ASCII)

9 Modbus RTU functions

When using Modbus RTU communications the instrument must be set up electrically for RS232 or RS485 communications and the **O.Put** function must be set to **m.buS**. The maximum recommended baud rate for Modbus operation is 9600. The following commands are available:

Modbus Function 1 - Read coil status
Reads the ON/OFF status of the relay coils. Broadcast is not supported. Relay addresses are offset by 1 e.g. relay 1 is addressed as 0, relay 2 is addressed as 1 etc. Logic 1 = ON, Logic 0 = OFF. To read the coil status a query is sent to the instrument, the instrument then responds to the query. An example of a query to read coils 1 to 4 from the instrument at address 2 is given below.

Field name	**Example(Hex)**
Unit address	02
Function	01
Starting address Hi	00
Starting address Lo	00
Number of points Hi	00
Number of points Lo	08
Error check (LRC or CRC)	–

An example of a response is given below:

Field name	**Example(Hex)**
Unit address	02
Function	01
Byte count	01
Data (coils 8 to 1)	B6
Error check (LRC or CRC)	–

The status of the relay coils is shown in the Data B6 (hex) or binary 10110110. Relay 1 is indicated by the least significant binary bit. The status of the relays is therefore:

Relay 1 - OFF, Relay 2 - ON, Relay 3 - ON, Relay 4 - OFF, Relay 5 - ON, Relay 6 - ON, Relay 7 - OFF and Relay 8 - ON.

Function 3 - Read holding registers

This function reads the binary contents of the holding registers in the instrument being addressed. The value for this function is stored as a 32 but two's compliment number in two 16 bit registers per channel. Note; a value of 32000 represents a positive overrange and -32000 a negative overrange.

Registers 1 to 8 are addressed as 0X00 to 0X07.

Registers 9 to 16 hold the alarm high values for relays 1 to 8. Note a value of 0X8000 means that the relay is set to OFF and has no high value. Registers 9 to 16 are addressed as 0X08 to 0X0F.

Registers 17 to 24 hold the alarm low values for relays 1 to 8. Note a value of 0X8000 means that the relay is set to OFF and has no low value. Registers 17 to 24 are addressed as 0X10 to 0X17.

Registers 25 to 32 represent the decimal point settings for channels 1 to 8. Registers 25 to 32 are addressed as 0X18 to 0X1E.

An example of a query to read input channels 1 to 3 from an instrument at address 5 is given below.

Field name	**Example(Hex)**
Unit address	05
Function	03
Starting address Hi	00
Number of points Hi	00
Number of points Lo	03
Error check (LRC or CRC)	–

An example of a response is given below:

Field name	**Example(Hex)**
Unit address	05
Function	03
Byte count	06
Data Hi(register 1)	00
Data Lo(register 1)	33
Data Hi(register 2)	00
Data Lo(register 2)	25
Data Hi(register 3)	00
Data Lo(register 3)	17
Error check (LRC or CRC)	–

The value of register 1 is 0033 Hex which is 51 Dec. The value of register 2 is 0025 Hex which is 37 Dec. The value of register 3 is 0017 Hex which is 23 Dec.

Register table for TP488 displays using Modbus RTU function 3

Address	Register	Description
0X00	1	Channel 1 display value
0X01	2	Channel 3 display value
0X02	3	Channel 3 display value
0X03	4	Channel 4 display value
0X04	5	Channel 5 display value
0X05	6	Channel 6 display value
0X06	7	Channel 7 display value
0X07	8	Channel 8 display value
0X08	9	Relay 1 high setpoint
0X09	10	Relay 2 high setpoint
0X0A	11	Relay 3 high setpoint
0X0B	12	Relay 4 high setpoint
0X0C	13	Relay 5 high setpoint
0X0D	14	Relay 6 high setpoint
0X0E	15	Relay 7 high setpoint
0X0F	16	Relay 8 high setpoint
0X10	17	Relay 1 low setpoint
0X11	18	Relay 2 low setpoint
0X12	19	Relay 3 low setpoint
0X13	20	Relay 4 low setpoint
0X14	21	Relay 5 low setpoint
0X15	22	Relay 6 low setpoint
0X16	23	Relay 7 low setpoint
0X17	24	Relay 8 low setpoint
0X19	26	Channel 1 decimal point
0X1A	27	Channel 2 decimal point
0X1B	28	Channel 3 decimal point
0X1C	29	Channel 4 decimal point
0X1D	30	Channel 5 decimal point
0X1E	31	Channel 6 decimal point
0X1F	32	Channel 7 decimal point
0X20	33	Channel 8 decimal point

10 Data logger

The data logger is an optional addition to the instrument. This section applies only to instruments fitted with the data logger option. If the data logger is being used with the Windows compatible software provided then refer to the separate "Download Software User Guide" booklet.

Operation of the data logger

The data logger memory will store the hours:mins:secs, day:month and year together with the display readings at the time of log update. The log update time may be set at the dLAY function. The data logger automatically logs inputs to all eight TP488 channels. For TP488 channels not selected (see Chnl function) the overrange value (- - - -) will be logged for each sample. The logging rate is set separately and is independent from the instruments scan rate setting (SCAN).

If an input is overranged when logged then the overrange value (- - - -) will be logged for that channel for as long as the overrange value is present. Readings taken during power failure will not be logged. The log memory is set up in a circular format. Once the top of memory is reached the log data will overwrite the start of memory (overwriting the oldest record). The recording time available will vary depending on the memory size fitted and the update time selected. The table below shows maximum recording times.
Data is transmitted in comma separated format making it compatible with many commercially available databases/spreadsheets. Time information is downloaded in Julian time format which is again compatible with many databases/spreadsheets. The internal clock is battery backed. Downloaded log records are in the form of the time followed by the logged record for each channel at that time.
Downloaded information is transmitted via the serial output option board in RS232 or RS485 format, thus a serial output option must be fitted on all instruments with data logging software.

Data logger Windows software

Data logger software compatible with Windows 95, 98, 2000, NT and XP is provided for use with the data logger (not tested and may not be compatible with Vista). A separate user booklet for the software is also provided. Consult this user manual for details of software setup. The data logger can also communicate using standard serial polling commands, these are listed under the heading "Serial Command Format" in this chapter.

TP488 datalogger table - maximum logging times (approximate)

Time between logs	**32k memory** days:hours:min	**128k memory** days:hours:min
10 seconds	0:04:26	0:17:46
20 seconds	0:08:53	1:11:33
30 seconds	0:13:20	2:05:20
1 minute	1:02:40	4:10:40
2 minutes	2:05:20	8:21:20
3 minutes	3:08:00	13:08:00
4 minutes	4:10:40	17:18:00
5 minutes	5:13:20	22:05:20
6 minutes	6:16:00	26:16:00
10 minutes	11:02:40	44:10:40
15 minutes	16:16:00	66:16:00
20 minutes	22:05:20	88:21:20
30 minutes	33:08:00	133:08:00
60 minutes	66:16:00	266:16:00

Data logger polling functions

Usually data is downloaded using the Windows program supplied with the data logger but the data logger can be also polled via a PC etc. using the commands below. Functions which are used when the data logger option is fitted are accessible only via **CAL** mode.

dLAY- Select log update time. Displays and sets the time period between each log sample. Available selections are: **0. 10** (10 seconds), **0.20** (20 seconds), **0.30** (30 seconds), **1.00** (1 minute), **2.00** (2 minutes), **3.00** (3 minutes), **4.00** (4 minutes), **5.00** (5 minutes), **6.00** (6 minutes), **10.00** (10 minutes), **15.00** (15 minutes), **20.00** (20 minutes), **30.00** (30 minutes) or **60.00** (60 minutes). Note: The data log memory (see **L.CLr** below) must be cleared whenever the log update time is changed or the date and time is changed.

Hour - Set time. Displays and sets the current time in hours and minutes (24 hour format HH.MM) e.g. set as **1720** for 5:20 pm.

dAtE - Set date. Displays and sets the current date in days and months (DD.MM format). The months will roll over automatically (up at the end of the month, down at the beginning of the month) as the day is scrolled up or down.

YEAr - Set year. Displays and sets the current year (YYYY format). Valid years settings go up to 2037 (valid Julian time format years).

L.CLr - Clear data log memory. This function clears the data log memory, to clear the memory press then release ▲ and ▼ simultaneously, the display will show **CLr?** asking if you really want to clear the memory. If you wish to clear memory then press then release ▲ and ▼ simultaneously again. The log memory will then be cleared and the log period reset, the display will indicate **ProG LoG** to confirm this. Once the memory is cleared all previously logged records will be lost from the instruments memory, if the **CLr?** message is reached and it is not wished to clear the log memory then pressing and releasing either **F** or **P** will abort the function.

Serial Command Format

Instruments using the data logger option are provided with extra software functions to the standard instrument. This section describes these extra functions. Note that the information below is not required if the TP488 is used with the download PC software provided when the datalogger option is purchased, the commands below are intended to be used as an alternative method of communication to the download PC software.

Initial Setup

Select the baud rate, parity and address as required. The serial output mode function (**O.Put**) must be set to **POLL** when using the data logger using the commands below. Note: if comminincating using the PC download software provided then the (**O.Put**) can be set to **POLL** if required but setting this function to **A.buS** will make initial setup easier.

Transmit Record Block: <STX>DA<CR>D<CR>TTTTTTTTTT<CR>NNNN<CR>

Where: TTTTTTTTTT is the start time of the block (in Julian time format). NNNN is the number of records to be sent. Instructs the unit to send a block of logged data via the serial interface. The returned data format is: <ACK>DAD<CR> followed by NNNN records in the format:-
TTTTTTTTTT,S1111,S2222,S3333,S4444,S5555,S6666,S7777,S8888<CR> where:

TTTTTTTTTT is the start time for each record (in Julian time format). If TTTTTTTTTT (time in "Transmit Record Block" request) is sent as 0 then the records will start at the earliest time in log memory.

S is the sign (<SPACE> for positive values and "-" for negative.)

1111, 2222 etc. are the values for each channel.

Values will only be transmitted for active channels. Invalid readings from any channel will be received as the overrange value (**- - - -**) for that channel. If the start time requested is not present in the log then <ACK>DA?<CR> will be returned.

Transmit All Logged Data: <STX>DA<CR>A<CR>

Instructs the unit to transmit the entire data log. All log records since the last log memory reset will be sent to the host. The unit will respond with <ACK>DAA<CR> followed by all log record sent in the same format as above (Transmit Record Block)

Transmit System Time: <STX>DA<CR>T<CR>

Instructs the instrument to transmit the current time in Julian time format as follows:-
<ACK>DAT TTTTTTTTTT<CR>

Transmit the Log Start Time: <STX>DA<CR>S<CR>

Instructs the instrument to transmit the log start time i.e. the time stamp on the first record in the log. Note that if the memory has "wrapped around", i.e. has started to overwrite existing logged records, that the log start time will not be the original time the log started (since this time stamp and associated log record has been overwritten). The returned data format is: <ACK>DAS TTTTTTTTTT<CR>

Transmit the Log Update Time: <STX>DA<CR>U<CR>

Returns the current log update time as set in the log memory. The returned time may be different to the **dLAY** time if there has been no log reset since the **dLAY** function was changed. The returned data format is: <ACK>DAU NNNN<CR>, where NNNN is the update time in seconds.

Transmit the Log Memory Size: <STX>DA<CR>M<CR> Returns the size of the log memory in records. The returned data format is: <ACK>DAM NNNN<CR>, where NNNN is the number of records for that memory size e.g. an 8K memory will return 508.

Set the System Time: <STX>DA<CR>t<CR>TTTTTTTTTT<CR>
Set the instrument system clock to Julian time TTTTTTTTTT. If the command is successful then <ACK>DAt<CR> will be returned. If the Julian time is invalid then <ACK>DA?<CR> will be returned.

Set the Log Update Time: <STX>DA<CR>u<CR>NNNN<CR>
Set the log update time to NNNN seconds. Note that the new time will not apply until a log reset is performed. If the command is successful then <ACK>DAu<CR> will be returned. If the update time is invalid then <ACK>DA?<CR> will be returned. Valid times are as shown in the **dLAY** function explanation.

Reset the Log Memory: <STX>DA<CR>R<CR>RESET<CR>
This command will reset the log memory. This will erase all current records and reset the log update time if it has changed. As this will result in a loss of data the command must be sent exactly as it appears or the memory will not be reset. If the command is successful then <ACK>DAR<CR> will be returned to indicate that the memory has been reset. If the command is invalid then <ACK>DA?<CR> will be returned.

11 Specifications

11.1 Technical specifications

Input type:	Up to 8 channels each selectable as either 4-20mA, 0-1V, LM335 or AD590
Display range:	4-20mA = -1999 to 9999
	0-1V = -1999 to 9999
	LM335 = -50 to 150^{o}C
	AD590 = -50 to 150^{o}C
Accuracy:	0.1% of full scale when calibrated
Sample rate:	0.5 seconds per channel approx.
ADC resolution:	1 in 20,000
Ambient temperature:	-10 to 60^o C
Humidity:	5 to 95% non condensing
Display:	4 digit (value) + 1 digit (channel number) 20mm red LED
	8 off annunciator LEDs
Power Supply:	AC 240V or 110V 50/60Hz
	or DC isolated wide range 12 to 48V
	or DC non isolated 15 to 24V
	Note: supply type is factory configured.
Power Consumption:	AC supply 15 VA max,
	DC supply typically 100mA with no transmitter supply used,
	add 15mA per relay activated
Output (standard):	8 x relay, Form A, rated 5A resistive 240VAC

11.2 Optional outputs

Analog retransmission:	Single 4–20mA, 0–1VDC or 0–10VDC, type is link selectable.
Serial communications:	RS232 or RS485 (ASCII or ModbusRTU)
Datalogger:	32k or 128k internal datalogger memory

11.3 Physical Characteristics

Case Size:	255mm x 145mm x 125mm
Panel Cut Out:	If using this method of mounting the panel cut out size is 240 x 130mm -0.0mm/+0.5mm
Connections:	Plug in screw terminals (max 1.5mm wire, 2.5mm for relays and power supply).
Weight:	1.3kgs

12 Guarantee and service

The product supplied with this manual is guaranteed against faulty workmanship for a period of two years from the date of dispatch.

Our obligation assumed under this guarantee is limited to the replacement of parts which, by our examination, are proved to be defective and have not been misused, carelessly handled, defaced or damaged due to incorrect installation. This guarantee is VOID where the unit has been opened, tampered with or if repairs have been made or attempted by anyone except an authorised representative of the manufacturing company.

Products for attention under guarantee (unless otherwise agreed) must be returned to the manufacturer freight paid and, if accepted for free repair, will be returned to the customers address in Australia free of charge.

When returning the product for service or repair a full description of the fault and the mode of operation used when the product failed must be given. In any event the manufacturer has no other obligation or liability beyond replacement or repair of this product.

Modifications may be made to any existing or future models of the unit as it may deem necessary without incurring any obligation to incorporate such modifications in units previously sold or to which this guarantee may relate.

This product is designed and manufactured in Australia.