RDP CUSTOMER DOCUMENT

Technical Manual
E725 Microprocessor Based
Transducer Indicator/Controller
DC INPUT VERSION

Doc. Ref CD1421S

This manual applies to units of mod status 6 ONWARDS

ISO 9001:2015 Quality Management

Affirmed by Declaration of Conformity

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1 INTRODUCTION

YOU DO NOT NEED TO READ THE ENTIRE MANUAL.
Read this section to find out which sections are important.

1.1 E725 DC Input Version

There are several types of unit in the E725 range. This manual is specifically for use with E725 units fitted with dc input board(s). Before proceeding, please check that the part number (located on a label on the E725 housing) has the following structure.

E725-XXX-DCX-X-X-X where X is unimportant for the purposes of this exercise.

The DC input version of the E725 is designed to work with a wide range of strain gauge, potentiometric and internally amplified transducers. It provides a display for DC type transducers. It has an analogue output (voltage and current) and four limits as standard. It has excellent dynamic performance and several sophisticated features. One of several option boards can be factory fitted.

1.2 How to Use This Manual

This manual contains all of the information needed to connect and calibrate your transducer. Please spend a little time to read and understand the relevant sections. It is not necessary to read all sections. Please use the index to select the sections relevant to your application.

It is possible that the unit is already calibrated with a transducer. If you have purchased the unit with a calibration then you can probably ignore all sections concerning programming and calibration.

If your unit is not calibrated then read Sections 3, 4, 5, 6 and 7 as a minimum.

1.3 Part Number Structure

SUPPLY	230	= 230V ac +5/-15%
	115	= 115 " "
	105	= 105 " "
	5	= 5V dc +50/-10%
	12	= 12 " + 50/-25%
	24	= 24 " + 50/-25%
INPUT BOARD (One must be chosen)	AC	= for LVDT/half-bridge etc.
	DC1	= for strain gauge and amplified transducers (±15V supply provided)
	DC2	= for amplified transducers (24V supply voltage provided)
	DC3	= for RDP D2 series transducers
OPTION BOARD (None or one may be chosen)	0	= none
	R	= four mechanical limit relays
	RS	= four solid state limit relays
	FR	= fast limits with two mechanical relays
	FRS	= fast limits with two solid state relays
	FM	= fast MAX/MIN board
	2AC	= Second LVDT/Half-bridge input
	2DC1	= Second DC1 input
	2DC2	= Second DC2 input
	2DC3	= Second DC3 input
SERIAL OUTPUT	0	= RS232
	1	= RS485
SPECIAL OPTION	0	= None
Example:- **E725 - 230 - AC - FR - 0 - 0**….		…has 230V ac supply, and AC input board, a fast limit card, RS232 output and no special options

2 EMC DECLARATION & SAFETY TEST INFORMATION

2.1 Electrical Safety Checks

This unit is designed to comply with EN 61010-1 "Safety requirements for electrical equipment for measurement, control and laboratory use". The specification complies with the EU Directive 2014/35/EU concerning low voltage electrical safety.

This unit was checked for electrical safety, using a portable appliance test unit, prior to despatch.

If the user wishes to carry out his own PAT tests, the following points must be followed.

1) This Safety Class 1 apparatus has a low fuse rating (<3A), and a low current rated power connection cable.

2) It is recommended that when carrying out an earth bond test (BS EN 61010-1, Section 6), the test current of 25A should not be applied for more than **six seconds**.

3) In general it is **not** recommended that high voltage (e.g. 1.5kV) insulation tests are carried out (BS EN 61010-1, Section 6). This could cause damage to suppressor components.

2.2 EMC Compliance

This unit is designed to comply with EN61326-1 "EMC requirements for electrical measurement equipment".

For full EMC compliance, only shielded multi-core cables should be used for connection to this unit; the cable shield to be terminated by means of a short "pig-tail" and connected as detailed in relevant sections of this manual.

The metal rear panel is used as a ground connection for all cable shields. The panel is internally connected to the supply earth wire that must be connected to a reliable ground.

Notes:

1) Cable shields to be earthed at only one end - the E725 end.

2) Ensure cables to and from the unit are routed away from any obviously powerful sources of electrical noise, e.g. electric motors, relays, solenoids and electrically noisy cables.

3) Ideally, the transducer body should not be connected to the cable shield, but should be separately earthed. If the transducer fixing attachments do not provide a good earth, then an earth strap should be used.

2.3 Certificate of EMC Conformity.

DECLARATION OF CONFORMITY

RDP ELECTRONICS LTD.
Grove Street Heath Town
Wolverhampton West Midlands
WV10 0PY
United Kingdom

We declare that the product described in this technical manual is manufactured by RDP Electronics Limited and performs in conformity to the following:

The Electromagnetic Compatibility Directive 2014/30/EU

The Low Voltage Safety Directive 2014/35/EU

The RoHS2 Directive 2011/65/EU

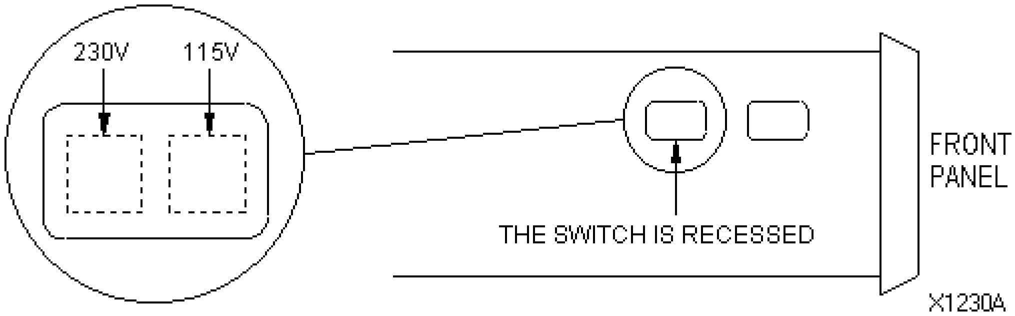
R D Garbett
Director
RDP Electronics Limited

3 INSTALLATION

3.1 Power Supply Voltage Selection and Connection

Check the supply requirement for the unit using the part number located on the outside of the unit housing:

E725-XXX (ignore the rest)					
If XXX =	**5**	then supply required is	**5V dc, 7W**	+50/-10%	
If XXX =	**12**	then supply required is	**12V dc, 7W**	+50/-25%	**dc Supply**
If XXX =	**24**	then supply required is	**24V dc, 7W**	+50/-25%	
If XXX =	***105**	then supply required is	**105V ac, 7VA**	+5/-15%	
If XXX =	***115**	then supply required is	**115V ac, 7VA**	+5/-15%	**ac Supply (50-60Hz)**
If XXX =	***230**	then supply required is	**230V ac, 7VA**	+5/-15%	
*In these cases check that the supply selection slider-switch is correctly set.					



The E725 is fused internally but it is recommended that the unit be externally fused also. We suggest a fuse of a slightly lower rating to the internal fuse (details in Section 3.3)
As this unit has no power switch, it is recommended that an external means of disconnection is fitted in a convenient location.

The **ac power supply** is connected to the three-core 2m long integral cable as follows:-

Cable Core	**Supply**
Brown	Live
Blue	Neutral
Green/yellow	Ground (Earth)

The **optional dc supply**, has integral 2m, two-core shielded cable as follows:-

Cable Core	**Supply**
Red	dc volts positive
Blue	dc volts negative
Shield (connect to good ground for optimum EMC)	0v/ground

3.2 Display During Power-Up

On power-up the display shows the following before assuming normal operating mode:-

Step	Display	Brief description.	Example
1	E725	The product model number	E725
2	X.XX	A number indicating the software version	1.00
3	AC-X	AC input. X =option card 1 to 4	AC-1
4	XX.Y.Z	The serial communication settings	00.0.4

3.3 Changing the Fuse

As the fuse is inside, it is necessary to open the unit in order to change the fuse. Firstly, please obtain the correct fuse as shown below. Section 3.1 details how to identify the power supply required by your unit.

230V ac, **115V ac** & **105V ac**	units require a	**250mA**	anti surge (A-S/T type) 20mm long, 5mm diameter
5V dc	unit requires a	**3.15A**	anti surge, 20mm long, 5mm dia.
12V dc	unit requires a	**1A**	anti surge, 20mm long, 5mm dia.
24V dc	unit requires a	**0.5A**	anti surge, 20mm long, 5mm dia.

DO NOT USE ANY OTHER VALUE OR TYPE OF FUSE. IT WILL INVALIDATE THE GUARANTEE, IT IS DANGEROUS AND IT MAY CAUSE A FIRE.

How to install the fuse.

1) DISCONNECT THE POWER AND ALL CONNECTORS FROM THE UNIT.
2) Place the unit on an anti-static mat and wear earth strap on wrist.
3) Remove the four screws, one at each corner of the rear panel.
4) Hold the power supply cable grommet and pull the rear panel and circuit boards gently from the unit.
5) Remove the two screws that hold the power supply board. The power supply board is on the top of the unit, at the front (near the display).
6) Lift the power supply board to reveal the fuse.
7) Replace the fuse and re-assemble the unit.

3.4 Panel Mounting

This unit may safely be used on a bench or as a portable unit providing that it is not mechanically damaged (by dropping etc) and providing that the supply cable is not damaged.

It may also be installed into a panel if desired.

Panel mounting procedure

The maximum acceptable panel thickness is 12mm. A hole must be cut in the panel 93mm wide and 45mm high. Pass the unit through the panel by firstly feeding the cables through the hole from the outside (front) of the panel and then inserting the unit rear end first.

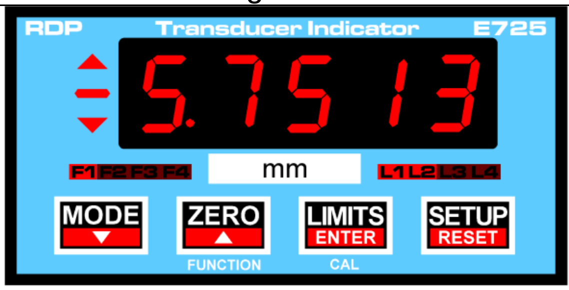
From the inside of the panel fit the panel-mount clips into the slots on the side of the housing and tighten until the unit is firmly fixed into the panel.

Sealing the front of the unit in a panel.

The membrane keypad of the E725 is sealed into its housing. In order to achieve a seal into the panel, silicone sealant should be applied liberally between the front of the panel and the rear of the unit bezel. This is best done prior to tightening the unit into its panel. The degree of protection is dependent upon how well this job is done but IP65 is possible.

4 Front panel DETAIL & external digital input controls

4.1 Display Features

The up arrow indicates that the display is showing the MAX value, the down arrow indicates that MIN is being displayed and both together indicate that the TIR is being displayed. (Section 10 refers). The horizontal bar between the up and down arrows provides the negative indication when all 5 digits are in use.		
Four control keys provide functions as described in section 4.2.		The E725 has 5 digits each 13.2mm in height.
Four LEDs (F1 to F4) show the display function MODE. These LEDs are not used on units with a single input unless calculated channels are assigned (Sections 11 and 12 refer).	The white area below the centre of the digits provides space for one of the legend labels (supplied) to be fixed.	Four LEDs indicate the status of the LIMITS. An illuminated LED indicates that a particular LIMIT has been triggered (Section 9 refers).

4.2 Control Key Functions

The E725 has four membrane keypads with tactile feedback. These keys select and control the functions of the E725. This section concerns itself only with the functions available in the E725's normal operating mode, it does not detail any of the programming or calibration functions.

Key functions. In order to...	**Press…**
Zero the display	ZERO
Return to calibration zero (clear Zero)	ZERO & RESET together
Change display (MAX *to* MIN to TIR to NORMAL)	MODE
Reset (MAX & MIN & TIR)	MODE & RESET together
Change function mode (if available)	MODE & FUNC. together
Display shunt cal reading (see section 7.6)	MODE & CAL together
Reset latched limits	LIMITS & RESET together

4.3 External Digital Input Controls

Two versions apply; one with opto-isolated inputs (labelled with a MOD number, e.g. MOD6, etc.), and one without isolated inputs, i.e. direct TTL inputs (labelled with a MOD number and a suffix A, e.g. MOD6A or 7A etc.).

Connections are made via the 15-way connector as shown in 4.3.1 and 4.3.2.

4.3.1 Opto-Isolated Inputs

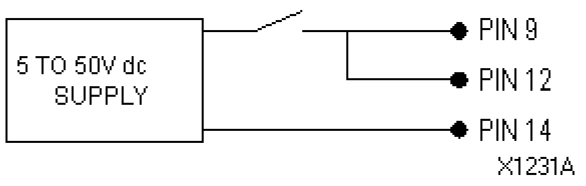
Digital Input functions. In order to...	**Apply 5-50V between pins…**
Zero the display	(14 and 10)
Return to calibration zero (clear Zero)	(14 and 10) AND (14 and 12)
Change display (MAX to MIN to TIR to NORMAL)	(14 and 9)
Reset (MAX & MIN & TIR)	(14 and 9) AND (14 and 12)
Change Function mode (if available)	(14 and 9) AND (14 and 10)
Shunt Calibration	(14 and 9) AND (14 and 11)
Reset latched limits	(14 and 11) AND (14 and 12)
Freeze Display (Digital HOLD)	(14 and 12)
Perform a fast analogue hold.	(14 and 13)

Connections are made via the 15 pin D type connector (labelled 'DIGITAL I/O') on the rear panel. In order to activate the functions a voltage of between 5 and 50V dc is applied between input com. (pin 14) and the required function pin. As the inputs are opto-isolated it is best to use an external supply as this gives the best protection for the unit against electrical interference. If this is not possible, a 5V output available from the same connector may be used, but opto isolation will be lost. If the 5V output from the E725 is used, the common (pin 14) must be grounded by connecting it to pin 8.

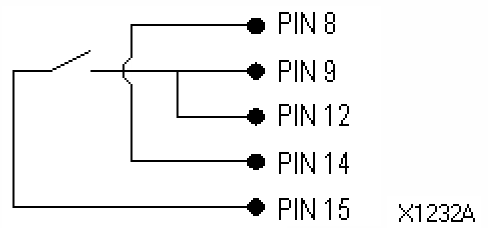
15 Pin DIGITAL I/O connector. Pins available for digital inputs.

Pin Description
8. Ground
9. Same as MODE key for these purposes
10. Same as ZERO key for these purposes
11. Same as LIMITS key for these purposes
12. Same as RESET key for these purposes and also digital HOLD.
13. Fast analogue HOLD.
14. Common for all digital inputs
15. +5V supply for digital i/p. If used, common (pin 14) must be linked to ground (pin 8).

Example of resetting MAX/MIN



Using an external power supply



Using the 5V supply output

4.3.2 TTL Inputs

Digital Input functions. In order to...	Apply TTL Low to Pin…
Zero the display	10
Return to calibration zero (clear Zero)	10 and 12
Change display (MAX to MIN to TIR to NORMAL)	9
Reset (MAX & MIN & TIR)	9 and 2
Change Function mode (if available)	9 and 10
Test amp circuits. Should display 1.100 APPROX.	9 and 11
Reset latched limits	11 and 12
Freeze Display (Digital HOLD)	12
Perform a fast analogue hold.	13

15 Pin DIGITAL I/O connector. Pins available for digital inputs.

Pin	Description
8 & 14	Ground (Common/0V)
9.	Same as MODE key for these purposes
10.	Same as ZERO key for these purposes
11.	Same as LIMITS key for these purposes
12.	Same as RESET key for these purposes and also digital HOLD.
13.	Fast analogue HOLD.

4.3.3 Digital Inputs – Specification (Both Versions)

Function	Min. pulse	Response	Droop
All digital inputs except hold	200ms	200ms max	N/A
Digital hold, remove signal to release	200ms	200ms max	None
Analogue fast hold, remove signal to release	0.1ms	0.1ms	1 digit/sec typ.

The fast analogue hold freezes both the display and the analogue output. Because it is held as an analogue voltage, it is prone to droop. For best results, Applying the hold to the digital hold 200ms after the analogue hold (a simultaneous hold may be acceptable) will eliminate display droop. However, the analogue output will still droop.

5 TRANSDUCER CONNECTION DETAILS

5.1 Transducer Connection Overview & Specification

The E725 provides input voltage (usually called excitation or supply voltage) for most types of DC transducer, as well as amplifying and displaying the output of the transducer. Please check the specific input card type (DC1, DC2 or DC3) from the part number label on the top of the E725 housing. Select which connection arrangement is appropriate from the following table.

Please note that there are voltages present in the connector which have the potential to destroy certain types of transducer, therefore please follow the instructions carefully. Check your wiring before connecting the transducer to the E725.

Transducer type or requirements	**Input card type**	**Connection arrangement**
Unamplified strain gauge bridge transducer.	Any DC version	Secton 5.2
3 to 10V and ±15V supplies and Voltage output.	DC1	Connections Table
23V supply and Voltage output	DC2	Connections Table
15V supply and Voltage output	DC1	Section 5.3
Potentiometric. (Pot)	Any DC version	Section 5.4
30V supply and 4-20mA output (3 wire type)	DC1	Section 5.5
23V supply and 4-20mA output (2 wire type)	DC2	Section 5.6

CONNECTIONS TABLE for 9 pin D type connector labelled 'TRANSDUCER'

<table>
<tr><th>PIN</th><th>Input card type DC1</th><th>Input card type DC2</th><th>Input card type DC3</th></tr>
<tr><td>1</td><td colspan="3" rowspan="2">1.5, 3, 5 and 10V (±5%) (Bipolar and selectable), 100mA max. E.g. for 3V selection, pin 1 has +1.5V and pin 2 has -1.5V. Section 7.2 has info. on setting the voltage.</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td><td>Signal +</td><td>Signal +</td><td>Signal +</td></tr>
<tr><td>4</td><td>Signal -</td><td>Signal -</td><td>Signal -</td></tr>
<tr><td>5</td><td>0v (Ground)</td><td>0v (Ground)</td><td>0v (Ground)</td></tr>
<tr><td>6</td><td>Shunt calibration (with 9)</td><td>N/C</td><td>N/C</td></tr>
<tr><td>7</td><td>+15V output, 100mA</td><td>+15V output,100mA</td><td>+15V output, 100mA</td></tr>
<tr><td>8*</td><td>-15V output*, 100mA</td><td>-8V output*, 100mA</td><td>-6V output*, 100mA</td></tr>
<tr><td>9</td><td>Shunt calibration (with 6)</td><td>N/C</td><td>N/C</td></tr>
<tr><td>Shell</td><td>Cable shield</td><td>Cable shield</td><td>Cable shield</td></tr>
</table>

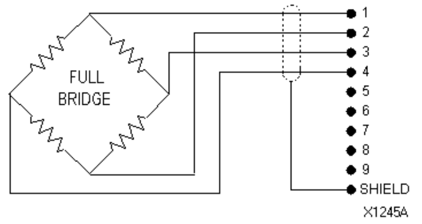
For example, to obtain a nominal 24V supply (actually 23V) from DC2, take the supply between pins 7 and 8 where there is a 23V potential difference.

*Due to the fact that this can be changed, it is recommended that the voltage between pins 8 and 5 be measured and checked prior to connecting the transducer.

5.2 Connections for Unamplified Strain Gauge Transducer

Section 7.2 contains additional information on excitation.
Section 7.5 (EXAMPLE M) and section 7.6 contain additional information on shunt calibration.

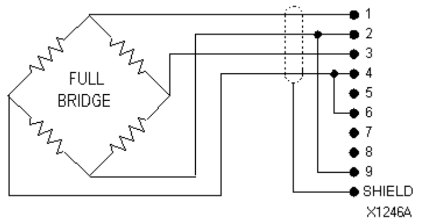
Without shunt calibration



1	Excitation +	Any DC input card
2	Exciation -	
3	Signal +	
4	Signal -	
5,6,7,8 & 9	No connection	
Shield	Connect to shell of connector	

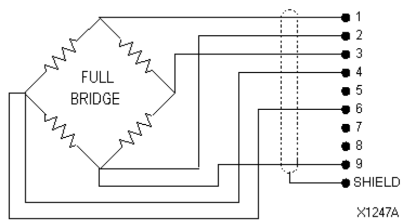
With shunt calibration- simple approach.

This approach is suitable for short cables typically <5m. For longer cables and for optimum accuracy use 'best approach' shown below.



1	Excitation +	Any DC input card
2	Exciation -	
3	Signal +	
4	Signal -	
5	No connection	
6	Shunt cal	
7 & 8	No connection	
9	Shunt cal	
Shield	Connect to shell of connector	

With shunt calibration- best approach



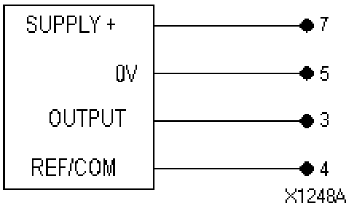
1	Excitation +	Any DC input card
2	Exciation -	
3	Signal +	
4	Signal -	
5	No connection	
6	Shunt cal	
7 & 8	No connection	
9	Shunt cal	
Shield	Connect to shell of connector	

5.3 Connections for Amplified Voltage Output Transducers

INPUT CARD TYPE DC1

The example shows a sensor that requires a 15V supply and has a voltage output. As the input to the E725 is floating, the common of the transducer need not be 0V.

Other supply arrangements may be required. Refer to CONNECTIONS TABLE for alternatives.

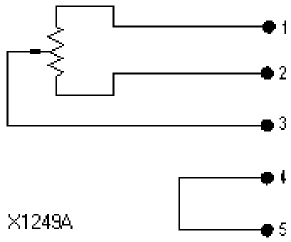


7 = +15V
5 = 0V
3 = Signal +
4 = Signal -

5.4 Connections for Potentiometric Transducers

ANY DC INPUT CARD

*The example shows a potentiometric transducer operating from a ±5V supply. In order to set the supply, the excitation must be changed as detailed in section 7.2.

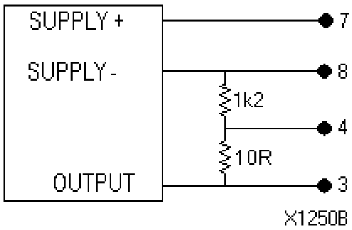


1 = +5V*
2 = -5V*
3 = Signal +
4 = Signal -
5 = 0V

5.5 Connections for 3 wire 4 to 20mA Transmitters

INPUT CARD TYPE DC1

The example shows a 3 wire 4-20mA transmitter with a 30V supply. Fit the resistors inside the connector.

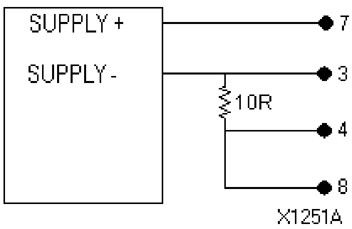


7 = +15V
8 = -15V
4 = Signal -
3 = Signal +

5.6 Connections for 2 wire 4 to 20mA Transmitters

INPUT CARD TYPE DC2

The example shows a 2 wire 4-20mA transmitter with a 23V supply. Fit the resistor inside the connector.



7 = +15V
3 = Signal +
4 = Signal -
8 = -8V

6 PROGRAMMING

6.1 Programming Overview

Various features of the E725 are user-programmable. This section of the manual outlines the general approach to programming and describes some specific programming steps.

Reading Section 6 should enable the user to access menus, enter numbers, select items and programme some specific features. Programming detail relating to calibration, limits and two channel operation are covered in Sections 7, 9 and 11 respectively.

SEVERAL EXAMPLES ARE GIVEN, THEY ARE HIGHLIGHTED IN BOXES AND BY THE USE OF THIS FONT. **THOSE IN BOLD PRINT ARE LIKELY TO BE PARTICULARLY USEFUL TO THE FIRST TIME USER.**

It is possible that the E725 has been supplied factory calibrated for use with a specific transducer. In this case, programming may be unnecessary. Care should be taken if programming is attempted as errors may cause the loss of calibration data.

6.2 Menu Access

The E725s programming procedure is based on a menu approach. There are three menus which are called the CONFIGURATION, CALIBRATION and USER SETUP menus.

Access to the menus is protected by three passwords. Each password is in fact a five digit number (i.e. five digits including leading zeros and sign). The passwords are called P1, P2 and P3.

The factory default values and access provided by each password are as follows:-

Password	Default	Access
P1	00001	USER SETUP menu
P2	00002	CALIBRATION and USER SETUP menus
P3	00003	CONFIGURATION, CALIBRATION and USER SETUP menus

It should be noted that the procedure for accessing the CONFIGURATION, CALIBRATION and USER SETUP menus is almost identical. The only difference is the user level which has to be selected and password which has to be entered.

Each menu offers several items, which allow particular features to be programmed. Once a menu has been accessed, the user can step forwards and backwards through that menu, making particular items appear on the display. Once an item is displayed it can be selected to allow a feature to be programmed.

The structure of CONFIGURATION, CALIBRATION and USER SETUP menus is shown in Section 6.9. The CONFIGURATION menu automatically leads in to the CALIBRATION menu which, in turn, automatically leads in to the USER SETUP menu. In this way the CONFIGURATION menu gives full access to all user-programmable features.

EXAMPLE A

TO ACCESS A MENU FROM THE UNIT'S NORMAL OPERATING MODE, PRESS THE SETUP KEY FOR AT LEAST ONE SECOND. THE DISPLAY WILL SHOW THE PROMPT **[UL 1]**. PRESS THE ▲OR ▼ KEY TO STEP THROUGH THE VARIOUS OPTIONS, WHICH ARE:-

DISPLAY	**ACCESS**
[UL 1]	USER SETUP MENU
[UL 2]	CALIBRATION AND USER SETUP MENU
[UL 3]	CONFIGURATION, CALIBRATION AND USER SETUP MENU

WHEN THE REQUIRED USER LEVEL IS DISPLAYED, PRESS THE LIMITS KEY TO SELECT THE DISPLAYED OPTION. THE DISPLAY WILL NOW SHOW A NUMBER ENTRY PROMPT **[00000]** WITH THE LAST DIGIT FLASHING. AT THIS POINT THE RELEVANT PASSWORD SHOULD BE ENTERED (SEE SECTION 6.3 FOR NUMBER ENTRY.)

6.3 Number Entry

Certain programming steps require number entry. When number entry is required, the display shows a five-digit number with the last digit flashing.

The password number entry prompt is [00000]

In other cases (for example ENGINEERING OFFSET) any existing value is shown. For example, if the existing value of ENGINEERING OFFSET is 1000, when ENGINEERING OFFSET is selected, the display shows [0 1000], and the last digit is flashing.

Pressing the UP-ARROW and DOWN-ARROW keys increases and decreases the flashing digit in the range 0 to 9.

Pressing the ENTER key accepts the current digit and causes the next (to the left) digit to flash. The user must enter the required number working from right-to-left across the display. The number contains five digits including leading zeros.

Pressing the RESET key at any stage in the number entry process discards changes and restarts the process. The original existing value is displayed with the last digit flashing. This is the only way of moving the flashing digit to the right.

A minus sign is entered with the most significant digit (i.e. the one to the left of the display). When the most significant digit is flashing, pressing the UP-ARROW and DOWN-ARROW keys increases and decreases the flashing digit in the range -9 to +9.

When the display shows the required new value, this number is entered in one of two ways.

1) If the most significant digit is flashing, pressing the ENTER key enters the new value.

2) If any other digit is flashing, pressing the ENTER and RESET keys together enters the new value. (This alternative simplifies the entry of low values such as 00003, the default value for password P3.)

   In both cases the unit accepts the new value and goes to the relevant menu. The display now shows the next item in the relevant menu. In the case of password number entry, if an incorrect password is entered, the unit returns to its normal operating mode.

EXAMPLE B (THIS IS INTENDED TO ILLUSTRATE GENERAL POINTS).
TO ENTER THE PASSWORD -00031 FROM THE PASSWORD NUMBER ENTRY PROMPT.

	DISPLAY SHOWS	ACTION
1	**00000**	PRESS UP-ARROW TO CHANGE DIGIT
2	**00001**	PRESS ENTER TO STEP TO NEXT DIGIT
3	**00001**	PRESS UP-ARROW THREE TIMES
4	**00031**	PRESS ENTER TO STEP TO NEXT DIGIT
5	**00031**	PRESS ENTER TO STEP TO NEXT DIGIT
6	**00031**	PRESS ENTER TO STEP TO NEXT DIGIT
7	**00031**	PRESS DOWN-ARROW FOR MINUS SIGN
8	**-00031**	PRESS ENTER TO ENTER PASSWORD

(AN UNDERLINED DIGIT REPRESENTS A FLASHING DIGIT)

EXAMPLE C

TO ENTER THE PASSWORD **00003** (FACTORY DEFAULT VALUE FOR PASSWORD P3) FROM THE NORMAL OPERATING MODE.

	DISPLAY SHOWS	ACTION
1	Numeric Data	PRESS SETUP FOR AT LEAST ONE SECOND
2	**[UL 1]**	PRESS UP-ARROW TWICE
3	**[UL 3]**	PRESS ENTER TO SELECT THE USER LEVEL 3
4	**00000**	PRESS UP-ARROW THREE TIMES
5	**00003**	PRESS ENTER & RESET TOGETHER TO ENTER PASSWORD AND GAIN ACCESS TO CONFIGURATION MENU

(AN UNDERLINED DIGIT REPRESENTS A FLASHING DIGIT)

6.4 Menu Item Selection

When a menu has been accessed the user can make available items appear on the display using the UP-ARROW and DOWN-ARROW.

EXAMPLE D (SEE ALSO MENU MAP, SECTION 6.10).

To step through the CONFIGURATION menu, having gained access as described in EXAMPLE C.

	DISPLAY SHOWS	ACTION
1	**[FP]**	PRESS DOWN-ARROW
2	**[Edit.P]**	PRESS DOWN-ARROW
3	**[Ecn]**	PRESS DOWN-ARROW
4	**[Gain]**	PRESS UP-ARROW
5	**[Ecn]**	PRESS UP-ARROW
6	**[Edit.P]**	PRESS UP-ARROW
7	**[FP]**	

To select a displayed item, press ENTER. The resulting display depends on which item has been selected. The action required once an item is selected depends on the item in question. Examples of selection of items EDIT PASSWORDS and FILTER are given in the following sections 6.6 and 6.7. Examples of selection of other items are given in Section 7, Calibration and Section 9, Limits.

6.5 Front Panel

The item FP allows the user to switch the front panel OFF or ON. Switching the front panel ON allows access to all the normal run-time push button functions (i.e. changing the display mode, zero etc.). Switching the front panel OFF disables all normal run-time push button functions except the SETUP key.

When this item is selected, the user enters a sub-menu comprising two possible options (ON and OFF), The UP-ARROW and DOWN-ARROW keys allow the user to step through this sub-menu. When the required status displayed, pressing the ENTER key selects the displayed status and exits the sub-menu. Alternatively, pressing the RESET key exits the sub-menu without changing the front panel status. In either case the display will then show [EDIT.P] (Edit Passwords), the next item in the CONFIGURATION menu.

6.6 Edit Passwords

<u>First time users should make themselves generally familiar with the unit before attempting to select the EDIT PASSWORDS item. Incorrect actions could result in the user being locked out of the CONFIGURATION menu.</u>

EDIT PASSWORDS allows the user to change the passwords from the default values noted in section 6.1. This allows programmed features to be protected by passwords that suit the user.

When this item is selected, the user enters a sub-menu with three items P1, P2 and P3. UP-ARROW and DOWN-ARROW allow the user to step through this sub-menu. When the required item is displayed, pressing ENTER selects that item. The display now shows a number entry prompt with the existing password value. The password can be changed to the required new value as described in general in Section 6.3.

<u>EXAMPLE E</u> (This is not recommended for first time users)		
To change the CALIBRATION menu password (P2) from 00002 to 00010, having gained access to the CONFIGURATION menu as previously described in EXAMPLE C.		
	DISPLAY SHOWS	**ACTION**
1	**[FP]**	Press DOWN-ARROW
2	**[Edit.P]**	Press ENTER to select EDIT PASSWORDS
3	**[P1]**	Press UP-ARROW
4	**[P2]**	Press ENTER to select Password 2
5	**0000<u>2</u>**	Press DOWN-ARROW twice
6	**0000<u>0</u>**	Press ENTER to step to next digit
7	**000<u>0</u>0**	Press UP-ARROW
8	**000<u>1</u>0**	Press ENTER & RESET simultaneously to enter new password value
9	**[P3]**	Press RESET to exit sub-menu
10	**[Ecn]**	
(An underlined digit represents a flashing digit)		

6.7 Filter

The item FILTER allows the user to adjust the –3db point of the digital low pass filter. The digital filtering acts on the display and serial output, but has no effect on the analogue output. The digital low pass filter has nine possible cut off frequencies (-3db point) as shown below.

FILTER VALUE	CUT OFF FREQUENCY (-3db)
1	100 Hz
2	75 Hz
3	50 Hz
4	25 Hz
5	10 Hz
6	7.5Hz
7	5.0Hz
8	2.5Hz
9	1.0Hz

Filter values 6-9 are only applicable to instrument mod. status 8 onwards

When this item is selected the user enters a sub-menu comprising the five possible filter values shown above. The UP-ARROW and DOWN-ARROW keys allow the user to step through this sub-menu. When the required value is displayed, pressing ENTER selects the displayed value and exits the sub-menu. Alternatively, pressing RESET exits the sub-menu without changing the filter value. In either case the display will then show [COUNT] (Count facility), the next item in the USER SETUP menu.

<u>EXAMPLE F</u>

TO CHANGE FILTER VALUE FROM 4 TO 5, HAVING GAINED ACCESS TO THE CONFIGURATION MENU AS DESCRIBED IN EXAMPLE C.

	DISPLAY SHOWS	ACTION
1	**[FP]**	**PRESS DOWN-ARROW UNTIL [FILT] IS DISPLAYED**
2	**[Filt]**	**PRESS ENTER TO SELECT FILTER**
3	**[Filt.4]**	**PRESS UP-ARROW TO CHANGE VALUE**
4	**[Filt.5]**	**PRESS ENTER TO SELECT VALUE 5**
5	**[Count]**	

6.8 Count Facility

(Only applicable to instruments mod. status 8 onwards)

This facility allows you to enter a number which will force the calibrated input signal to be displayed in the specified resolution. For example, if the display resolution is 2 decimal places and 25 is entered, then the calibrated input signal will be displayed in increments of 0.25 (e.g. 0.00, 0.25, 0.50, etc.). Example G details how to change the count value.

Notes – The count facility only applies to the displayed input signal and does not apply to:

1. The cal. signal (i.e. AC excitation voltage, displayed shunt cal. value)
2. Signal used for the software limits or the MAX/MIN/TIR values.
3. Data printed to the RS232/485 port.

Example G

Changing the number of counts having gained access to the CONFIGURATION menu as described in Example C

	Display Shows	Actions
1	**[FP]**	**Press DOWN-ARROW until [Filt] is displayed.**
2	**[Count]**	**Press ENTER to edit the number of counts**
3	**[00000]**	**Enter the required number of counts (see 6.3)**
5	**[L1-4]**	

6.9 Returning To Normal Operating Mode

When the display is showing any of the options in the first level of the CONFIGURATION, CALIBRATION or USER SETUP menus, it is possible to return to the normal operating mode by either of two actions.

1) Press RESET.
2) Press the DOWN-ARROW key until the display shows **[run] a**nd then press the ENTER key.

In both cases the display will be blanked and an increasing bar from left to right will be displayed to indicate that the E725 is saving the setup parameters.

6.10 Menu Map See Section 6.2 for menu access

EXAMPLE A - **REMINDER**

TO ACCESS A MENU FROM THE UNIT'S NORMAL OPERATING MODE, PRESS THE SETUP KEY FOR AT LEAST ONE SECOND. THE DISPLAY WILL SHOW THE PROMPT **[UL 1]**. PRESS THE ▲ **OR** ▼ KEY TO STEP THROUGH THE VARIOUS OPTIONS, WHICH ARE:-

DISPLAY	**ACCESS**
[UL 1]	USER SETUP MENU
[UL 2]	CALIBRATION AND USER SETUP MENU
[UL 3]	CONFIGURATION, CALIBRATION AND USER SETUP MENU

WHEN THE REQUIRED USER LEVEL IS DISPLAYED, PRESS THE LIMITS KEY TO SELECT THE DISPLAYED OPTION. THE DISPLAY WILL NOW SHOW A NUMBER ENTRY PROMPT **[00000]** WITH THE LAST DIGIT FLASHING. AT THIS POINT THE RELEVANT PASSWORD SHOULD BE ENTERED (SEE SECTION 6.3 FOR NUMBER ENTRY.)

PASSWORD	DISPLAY	MENU ITEM	MANUAL REFERENCE
P3	**[FP]**	Switch front panel ON/OFF	See Section 6.5
	[Edit.P]	Edit Passwords	See Section 6.6
	[Ecn]	Excitation Voltage	See Section 7.2
	[GAin]	Gain Range	See Section 7.3
P2	**[dP]**	Decimal Point	See Section 7.3
	[CAL.IP]	Calibrate Input	See Section 7.4
	[LIN.IP]	Linearise Input (If applicable)	See Section 7.5
	[E.OFF]	Engineering Offset	See Section 7.6
	[t.Pt]	Tare Point	See Section 7.7
P1	**[FILt]**	Filter	See Section 6.7
	[Count]	Count Facility	See Section 6.8
	[L 1-4]	Limits setup (standard)	See Section 9
	[L 1-2]	Limits setup (fast limit option	See Section 9
	[rUN]	Normal operating mode)	See Section 6.9

7 CALIBRATION

7.1 Calibration Overview

The E725 can operate with a wide range of transducers. Calibration is a procedure, involving an E725 and a transducer, to set up the E725 to read correctly in engineering units (e.g. bar) as required.

For example, when using an E725 with a pressure transducer, the user may want to see a display of 0 to 100.0 over a pressure range of 0 to 100 bar. This is achieved through calibration.

One of several possible approaches to the above example could be to apply 0 bar to the transducer and programme the E725 to display 0.0 at this pressure, then apply 100 bar to the transducer and programme the E725 to display 100.0 at this pressure.

This section describes procedures, including programming, for the calibration of a single transducer. If the E725 is fitted with Option 2DC1, 2DC2 or 2DC3 a second channel is available. Details for the calibration of the second channel are given in Section 11.

The E725 has an analogue output, calibration of this is dealt with in Section 8.

The E725 is capable of compensating for transducer non-linearity using either multi-point or polynomial techniques. It is anticipated that many users will not require these facilities, therefore they are covered in separate documentation.

<u>It is possible that the E725 has been supplied calibrated for use with a specific transducer. In this case calibration should not be necessary and care should be taken not to erase existing calibration data.</u>

7.2 Excitation Voltage

Almost all transducers require an input voltage. This is generally called "excitation" in the case of unamplified strain gauge transducers, and "supply voltage" in the case of amplified transducers. The E725 can work with a wide range of transducers. A variety of excitation and supply voltage arrangements are possible.

This section deals with excitation voltage available at pins 1 and 2 of the 9-pin D-type transducer connector (see Section 5). Excitation and supply voltage connections could involve other pins on this connector. This section is only relevant if pins 1 and/or 2 are to be used.

The excitation voltage on pins 1 and 2 is user selectable to 1.5, 3, 5 or 10 V nominal. This voltage is bipolar, e.g. if the excitation is set to 10 V, then pin 1 will be at +5 V and pin 2 will be at -5 V with respect to 0 V (ground).

For many re-calibrations or calibrations of replacement transducers, it may not be necessary to change the excitation voltage. The existing voltage level will probably apply in the new situation. For this reason the item EXCITATION is on the CONFIGURATION rather than the CALIBRATION menu.

However, in general, the excitation voltage will need to be set to suit the transducer being calibrated. This must be done before starting the main calibration procedure (see Section 7.5).

To establish the correct excitation voltage, refer to the transducer manufacturer's data-sheets or calibration sheets. In the case of unamplified strain gauge transducers it is usually best to set the excitation voltage to the maximum level allowed by the manufacturer.

IT IS VERY IMPORTANT THAT THE EXCITATION VOLTAGE PROVIDED BY THE E725 DOES NOT EXCEED THE MAXIMUM ALLOWED FOR THE TRANSDUCER. For this reason the default setting for EXCITATION VOLTAGE is 1.5 V, the minimum possible. Also, it is recommended that the transducer is disconnected before the item EXCITATION is selected, since the voltage displayed on the E725 during programming is actually present on the pins.

To change the excitation voltage it is necessary to understand E725 programming. The user should have read Section 6.

CHANGING EXCITATION WILL ERASE EXISTING CALIBRATION DATA.

When the item EXCITATION in the CONFIGURATION menu is selected, the user enters a sub-menu comprising the four possible excitation values shown in volts. UP-ARROW and DOWN-ARROW allow the user to step through this sub-menu. When the required voltage is displayed, pressing ENTER selects that voltage and exits the sub-menu. Alternatively, pressing RESET exits the sub-menu without changing the range. In either case the display will then show [GAIN], the next item in the CONFIGURATION menu.

EXAMPLE H

TO CHANGE THE EXCITATION FROM 1.5V TO 3V, HAVING GAINED ACCESS TO THE CONFIGURATION MENU AS DESCRIBED IN EXAMPLE C IN SECTION 6.3

	DISPLAY SHOWS	ACTION
1	[FP]	PRESS DOWN-ARROW TWICE
2	[Ecn]	PRESS ENTER TO SELECT EXCITATION
3	[Ecn.1.5]	PRESS UP-ARROW TO CHANGE VOLTAGE
4	[Ecn.3]	PRESS ENTER TO SELECT 3V.
5	[Gain]	

7.3 Gain Range

The E725 can accept a full-scale signal in a band from ±0.003 to ±10.0 V. This band is divided into eight ranges numbered 1 to 8.
For many re-calibrations or calibrations of replacement transducers, it may not be necessary to change the gain range. The existing gain range will probably apply in the new situation. For this reason the item GAIN is on the CONFIGURATION rather than the CALIBRATION menu.

However, in general, the gain range will need to be set to suit the transducer being calibrated. This must be done before starting the main calibration procedure (see Section 7.5).
The required gain range setting depends on the full-scale signal input to the E725 (i.e. the full-scale output from the transducer).

Typically, manufacturers' data sheets or calibration certificates state transducer full scale output (in V) or sensitivity (in mV/V). The sensitivity relates output at full scale to excitation voltage.

FOR EXAMPLE I THE CORRECT GAIN RANGE IS 6.It may be necessary to calculate the full-scale output from the sensitivity figure (sometimes referred to as the calibration factor on manufacturers' calibration sheets).

EXAMPLE I

TO CALCULATE TRANSDUCER FULL-SCALE OUTPUT FOR A TRANSDUCER, GIVEN A MANUFACTURER'S CALIBRATION FACTOR OF 2.9964MV/V & A MAX. ALLOWED EXCITATION OF 10V

FULL SCALE OUTPUT = CALIBRATION FACTOR X EXCITATION
= 2.9964 X 10
= 29.964MV

(IT IS ASSUMED HERE THAT E725 EXCITATION HAS BEEN SET TO 10V)

The transducer full scale output is the full scale input to the E725. The following table relates gain range to full scale input.

GAIN RANGE	FULL-SCALE INPUT (V)		
1	3.0	to	10.0
2	1.0	to	3.0
3	0.3	to	1.0
4	0.1	to	0.3
5	0.03	to	0.1
6	0.01	to	0.03
7	0.003	to	0.01
8	0.0025	to	0.003

For 4 to 20mA input signals using a 10 Ohm load resistor (see Sections 5.5 & 5.6) the correct gain range is 4.

FOR EXAMPLE I THE CORRECT GAIN RANGE IS 6.

To change the gain range it is necessary to understand E725 programming. The user should have read Section 6.

CHANGING GAIN RANGE WILL ERASE EXISTING CALIBRATION DATA.

When the item GAIN in the CONFIGURATION menu is selected, the user enters a sub-menu comprising the eight possible gain ranges. UP-ARROW and DOWN-ARROW allow the user to step through this sub-menu. When the required range is displayed, pressing ENTER selects that range and exits the sub-menu. Alternatively, pressing RESET exits the sub-menu without changing the range. In either case the display will then show [DP] (DECIMAL POINT), the first prompt in the CALIBRATION menu.

Exiting the sub-menu via the ENTER key (as opposed to the RESET key) will erase existing calibration data, even if the gain range has not been changed.

EXAMPLE J

To change the GAIN RANGE from 1 to 2, having gained access to the CONFIGURATION menu as described in Example C (Section 6.3)

	DISPLAY SHOWS	ACTION
1	**[FP]**	PRESS DOWN-ARROW THREE TIMES
2	**[GAin]**	PRESS ENTER TO SELECT GAIN
3	**[GAin.1]**	PRESS UP-ARROW TO CHANGE GAIN RANGE
4	**[GAin.2]**	PRESS ENTER TO SELECT RANGE 2
5	**[dP]**	

7.4 Decimal Point

Before starting the main calibration procedure (see Section 7.5) it is necessary to set the position of the decimal point. This will define the number of decimal places displayed when in normal operating mode.

To do this it is necessary to understand E725 programming. The user should have read Section 6.

CHANGING DECIMAL POINT WILL ERASE EXISTING CALIBRATION DATA AND LIMIT CONFIGURATION.

When the item DECIMAL POINT in the CALIBRATION menu is selected, the display shows 00000 with the decimal point in its existing position. Its position can be shifted to the left or right by pressing UP-ARROW or DOWN-ARROW respectively. When the decimal point is in the required position, pressing ENTER accepts that position. The user is returned to the CALIBRATION menu, the display shows the next item [CAL.IP] (CALIBRATE INPUT).

7.5 Calibrate Input

CALIBRATE INPUT is the menu item where the main calibration procedure must be carried out. Before this procedure is started, the transducer must be connected to the E725 (see Section 5), the excitation voltage must be programmed (if applicable, see Section 7.2), the gain range must be programmed (see Section 7.3) and the decimal point position must be programmed (see Section 7.4).

For optimum performance the E725 should be allowed to warm up (with excitation or supply voltage applied to the transducer) for at least twenty minutes before calibration.

The user must establish what display arrangement is required. For example, if the transducer in question is a ±250 lbs. tension/compression load cell, the E725 may be required to display ±250.0 lbs., ±113.5 kg, ±1112 N etc.

If a direct calibration is to be performed, the user must decide on the calibration point. This may be the same as the transducer full scale, but it may be less. For example, if a user plans to use a ±250 lbs. load cell over a range of ±150 lbs., never exceeding 150 lbs. in tension or compression, it would be reasonable to choose a calibration point of 150 lb.

If a shunt calibration is to be performed, the user must calculate a calibration point from data given on the transducer calibration sheet. This calculation is dealt with within EXAMPLE M.

Here is a checklist for what the user must decide.

Engineering units	e.g. Kg
Display full scale	e.g. 100 Kg
Display resolution	e.g. 100.0 Kg
Display polarity	e.g. ±100.0 Kg, positive in tension
Calibration zero point	e.g. 0 displayed at zero load.
Calibration point	(This is a user decision for direct calibrations, it must be calculated for shunt calibrations, see EXAMPLE M).

To perform a calibration it is necessary to understand E725 programming, The user should have read Section 6.

When the item CALIBRATE INPUT in the CALIBRATION menu is selected, the display shows a number entry prompt. This is the value of the calibration point and can be edited as described in general in Section 6.3. Pressing ENTER or ENTER and RESET together (as appropriate) selects the value displayed. The E725 enters CALIBRATION MODE, the display shows a transducer reading in counts or engineering units (depends on whether the E725 was already calibrated).

In CALIBRATION MODE, the front panel keys take on specific functions.

MODE and ZERO together	Clears any previous calibration.
ZERO	Fixes the calibration zero point.
ENTER	Takes a cal reading (positive or negative) for bipolar cal.
SETUP	Scales the transducer reading.
MODE and ENTER together	Performs a shunt calibration.
MODE and SETUP together	Accepts the calibration and exits CALIBRATION MODE. The display will then show E.OFF, the next relevant item in the CALIBRATION menu.

If it is necessary (e.g. due to an error) to exit CALIBRATION MODE and re-start the main calibration procedure, press MODE and SETUP together. The display shows [E.OFF] (ENGINEERING OFFSET). Press UP-ARROW as required to display item CALIBRATE INPUT, press ENTER to select CALIBRATE INPUT and proceed as before.

- NOTES REGARDING DISPLAY IN EXAMPLES K, L AND M

IN THE FOLLOWING EXAMPLES THE "DISPLAY SHOWS" COLUMN SHOWS THE ACTUAL CHARACTERS THAT WILL APPEAR EXCEPT WHERE MARKED AS FOLLOWS:-

*1 ANY NUMBER MAY APPEAR (IN COUNTS OR ENGINEERING UNITS).

*2 THE DISPLAY WILL READ TRANSDUCER OUTPUT IN UNCALIBRATED COUNTS. A DISPLAY GREATER THAN 55000 OR LESS THAN -55000 INDICATES A PROBLEM. CHECK CONNECTIONS AND GAIN SETTING.

*3 SYSTEM NOISE MAY CAUSE SLIGHT FLUCTUATION ABOUT THE READING SHOWN IN THE EXAMPLE

*4 A DISPLAY OF BETWEEN ±16666 AND ±55000 COUNTS CONFIRMS CORRECT GAIN RANGE SETTING.

*5 AT THIS STAGE THE ACTUAL APPLIED LOAD (OR PRESSURE ETC) IS DISPLAYED.

*6 RECOMMENDED FULL SCALE IS 50000 WITH OVERRANGE CAPABILITY OF 10% I.E. TO 55000.

EXAMPLE K – BIPOLAR DIRECT CALIBRATION

To calibrate a ±250 lb. tension/compression load cell to display ±100.0 kg using a bipolar direct load technique (±100 kg applied by universal testing machine).

1 Access CONFIGURATION menu (EXAMPLE C in Section 6.3).
2 Change EXCITATION if necessary (Section 7.2).
3 Change GAIN RANGE if necessary (Section 7.3).

Steps 1 to 3 are not necessary in some situations (e.g. re-calibrations). If steps 1 to 3 are taken, the user is automatically given access to the CALIBRATION menu. If not, access can be via password P2 (EXAMPLE C in Section 6.3 applies in general).

	DISPLAY SHOWS		ACTION
4	[dP]		Press ENTER to select item DECIMAL POINT.
5	[00000]		Press UP-ARROW to shift decimal point
6	[00000]		Press ENTER to accept decimal point position
7	[CAL.IP]		Press ENTER to select CALIBRATE INPUT
8	[00000]		Press ENTER 3 times (editing cal pt)
9	[00000]		Press UP-ARROW (editing cal pt)
10	[01000]		Press ENTER and RESET together (accepts cal pt)
11	[1234]	*[1]	Press MODE and ZERO together (clears previous cal)
12	[19]	*[2]	Apply zero load to the load cell and press ZERO
13	[0]	*[3]	Apply 100kg tension to the load cell
14	[34567]	*[4]	Press ENTER
15	[34567]	*[4]	Apply 100kg compression to the load cell
16	[-34678]	*[4]	Press ENTER
17	[-34678]	*[4]	Press SETUP (actual load not important here)
18	[- 100.0]	*[5]	Press MODE and SETUP together
19	[E.OFF]		If no other menu items are required, exit the CALIBRATION menu by pressing RESET. After a 2 second delay, the unit will go to normal operating mode. **SEE IMPORTANT NOTE AT END OF SECTION 7.5**

*[1], *[2] etc., see note above headed "NOTES REGARDING DISPLAY IN EXAMPLES K, L, AND M".

EXAMPLE L – UNIPOLAR DIRECT CALIBRATION

TO CALIBRATE A 3000 PSIG PRESSURE TRANSDUCER TO DISPLAY 0 TO 3000 PSIG USING A UNIPOLAR DIRECT PRESSURE TECHNIQUE (3000 PSIG APPLIED BY DEAD-WEIGHT TESTER). STEPS 1, 2 AND 3 PLUS ASSOCIATED COMMENT ARE AS ABOVE EXAMPLE K.

	DISPLAY SHOWS	**ACTION**
4	**[dP]**	PRESS DOWN-ARROW (SKIP DECIMAL POINT)
5	**[CAL.IP]**	PRESS ENTER TO SELECT CALIBRATE INPUT
6	**0000<u>0</u>**	PRESS ENTER THREE TIMES (EDITING CAL.PT)
7	**0<u>0</u>000**	PRESS UP-ARROW THREE TIMES (EDITING CAL.PT)
8	**0<u>3</u>000**	PRESS ENTER & RESET SIMULTANEOUSLY (ACCEPTS CAL.PT)
9	**[2345]**	PRESS MODE & ZERO TOGETHER (CLEARS PREVIOUS CAL) *1
10	**[21]**	APPLY ZERO PRESSURE, PRESS ZERO *2
11	**[0]**	APPLY 3000 PSIG *3
12	**[43210]**	PRESS SETUP *4
13	**[3000]**	PRESS MODE & SETUP SIMULTANEOUSLY *5
14	**[E.OFF]**	IF NO OTHER MENU ITEMS ARE REQUIRED, EXIT THE CALIBRATION MENU BY PRESSING RESET. AFTER A 2 SECOND DELAY, THE UNIT WILL GO TO NORMAL OPERATING MODE. **SEE IMPORTANT NOTE AT END OF EXAMPLE I.**

*1, *2, ETC.-SEE NOTE ABOVE HEADED "NOTES REGARDING DISPLAY IN EXAMPLES K, L AND M."

EXAMPLE M - SHUNT CALIBRATION

POINTS TO NOTE REGARDING SHUNT CALIBRATION.

1) SHUNT CALIBRATIONS ARE APPLICABLE TO MOST (BUT NOT ALL) TYPES OF UNAMPLIFIED STRAIN GAUGE TRANSDUCERS. THEY ARE NOT APPROPRIATE FOR OTHER TYPES OF TRANSDUCER USED WITH THE E725.
2) THE TECHNIQUE INVOLVES THE E725 INTERNALLY CONNECTING A SHUNT RESISTOR ACROSS ONE ARM OF THE TRANSDUCER'S STRAIN GAUGE BRIDGE. THIS PRODUCES A TRANSDUCER OUTPUT THAT CAN BE USED AS A CALIBRATION REFERENCE.
3) THE INTERNAL RESISTOR VALUE IS 59K OHM. IN SOME CASES IT MAY BE NECESSARY TO CHANGE THIS RESISTOR TO ACHIEVE AN APPROPRIATE TRANSDUCER OUTPUT. INSTRUCTIONS FOR THIS PROCEDURE ARE AVAILABLE ON REQUEST
4) A PARTICULAR TRANSDUCER CONNECTION ARRANGEMENT IS NECESSARY IF A SHUNT CALIBRATION IS TO BE USED (SEE SECTION 5.2).

TO CALIBRATE A 3000 PSIG PRESSURE TRANSDUCER TO DISPLAY 0 TO 200.0 BAR G USING A SHUNT CALIBRATION TECHNIQUE, WHERE THE MANUFACTURER'S CALIBRATION CERTIFICATE FOR THE TRANSDUCER STATES THE FOLLOWING.

CAPACITY	3000 PSIG	SHUNT CAL FACTOR	1.4385 MV/V
CALIBRATION FACTOR	2.9964 MV/V	SHUNT RESISTOR	59K OHM

CALCULATION OF CALIBRATION POINT

$$CP = \frac{SCOP}{FSOP} \times TFS$$

WHERE

CP	=	CALIBRATION POINT
SCOP	=	SHUNT CAL. OUTPUT
FSOP	=	FULL SCALE OUTPUT
TFS	=	TRANSDUCER FULL SCALE

The Shunt Cal. Output is given on the transducer calibration certificate, it is sometimes referred to as "Shunt Cal Factor". (usually expressed in mV or mV/V)

THE FULL SCALE OUTPUT IS GIVEN ON THE TRANSDUCER CALIBRATION CERTIFICATE, IT IS SOMETIMES REFERRED TO AS "CALIBRATION FACTOR". IT IS USUALLY EXPRESSED IN MV OR MV/V. IN THE ABOVE EQUATION, SHUNT CAL. OUTPUT AND FULL SCALE OUTPUT MUST BE IN THE SAME ENGINEERING UNITS (E.G. BOTH BE IN MV/V).

THE TRANSDUCER FULL SCALE IS GIVEN ON THE TRANSDUCER CALIBRATION CERTIFICATE, IT IS SOMETIMES REFERRED TO AS "CAPACITY". IT MAY BE NECESSARY TO CONVERT THE ENGINEERING UNITS OF THIS VALUE. IN FACT THIS IS THE CASE IN OUR EXAMPLE. THE TRANSDUCER FULL SCALE IS 3000 PSIG, SINCE THE E725 IS REQUIRED TO DISPLAY IN BAR G, 3000 PSIG MUST BE CONVERTED TO BAR G. COMMON CONVERSION FACTORS ARE GIVEN IN SECTION 15. THE TRANSDUCER FULL SCALE BECOMES 206.84 BAR G.

THE SHUNT RESISTOR VALUE IS NOT USED IN THE EXAMPLE CALCULATION, BUT IT MUST BE 59K OHM FOR THE CALCULATION TO BE VALID.

RETURNING TO THE PREVIOUS EQUATION.

$$CP = \frac{1.4385}{2.9964} \times 206.84 = 99.3 \text{ BAR G}$$

EXAMPLE M CONTINUES ON NEXT PAGE

EXAMPLE M - SHUNT CALIBRATION **CONTINUED**

Programming steps.

Steps 1, 2 and 3 plus associated comment are as above example K.

	DISPLAY SHOWS		ACTION
4	[DP]		Press ENTER to select item DECIMAL POINT
5	[00000]		Press UP-ARROW to shift decimal point
6	[0000.0]		Press ENTER to accept DECIMAL POINT position
7	[CAL.IP]		Press ENTER to select CAL.IP
8	[0000.0]		Press UP-ARROW three times (editing cal pt)
9	[0000.3]		Press ENTER (editing cal pt)
10	[0000.3]		Press UP-ARROW nine times (editing cal pt)
11	[0009.3]		Press ENTER (editing cal pt)
12	[0009.3]		Press UP-ARROW nine times (editing cal pt)
13	[0099.3]		Press ENTER & RESET together (accepts cal pt)
14	[345]	*1	Press MODE & ZERO together (clears previous cal)
15	[23]	*2	Apply zero pressure, press ZERO
16	[0]	*3	Maintain zero pressure, press MODE & ENTER together to perform shunt calibration
17	[99.3]	*3	For approximately five seconds, the display reads the transducer output while the shunt resistor is in circuit. No action is required for the display to revert to normal.
18	[0.0]	*5	Press MODE & SETUP together
19	[E.OFF]		If no other menu items are required, exit the CALIBRATION menu by pressing RESET. After a 2 second delay, the unit will go to normal operating mode. **SEE IMPORTANT NOTE AT END OF SECTION 7.5**

*1, *2 etc., see note above headed "NOTES REGARDING DISPLAY IN EXAMPLES K, L, AND M".

IMPORTANT NOTE

Calibration menus should only be re-accessed by appropriate personnel. Subsequent errors in these menus could lead to a need for re-calibration.

7.6 Shunt Calibration as A Calibration Check

Whether the original calibration is performed using a direct or shunt technique, the shunt calibration feature can often be used as post calibration check. This applies to most types of unamplified strain gauge transducer, connected as "With Shunt Calibration" in Section 5.2.

Any display offset that has previously been applied (via ZERO key or digital input) will confuse the shunt function so press RESET and ZERO to remove any display offset.

When the E725 is in normal operating mode, pressing MODE and LIMITS together brings the shunt resistor into circuit for about five seconds, the number displayed will increase by an amount called the shunt calibration reading. Therefore the shunt cal reading is equal to the display with shunt cal, minus the display without the shunt cal. After five seconds, the display reverts to normal reading.

This operation should be performed when the transducer is measuring a static quantity (most conveniently, zero but do not press ZERO as this may confuse the calculation).

The shunt calibration value should change very little over time. If the value differs largely from the expected value, the system should be checked.

7.7 Linearise Input

This item is not present in all versions of the E725, i.e. if Lin IP not displayed.

The E725 is capable of compensating for transducer non-linearity using either multi-point or polynomial techniques. The item [LIN.IP] (LINEARISE INPUT) relates to multi-point linearisation. It is anticipated that many users will not require this facility, therefore it is covered in separate documentation (RDP Reference CD1426).

If [LIN.IP] (LINEARISE INPUT) is selected accidentally the display shows the transducer signal in counts or engineering units (depends on calibration status of E725). The user should exit by pressing the MODE and SETUP keys together. The display will then show[E.OFF], the next item in the CALIBRATION menu.

7.8 Engineering Offset

The item [E.OFF] (ENGINEERING OFFSET) in the CALIBRATION menu allows an engineering offset to be added to the calibrated transducer signal. For example, if a transducer has been calibrated to read ±1000 g and the ENGINEERING OFFSET is set to +100, in normal operating mode the display will read -900 to +1100 g.

The ENGINEERING OFFSET is not the same as the CALIBRATION OFFSET, which is fixed during the main calibration procedure (see Section 7.5).

The ENGINEERING OFFSET is not the same as the ZERO DISPLAY function, which is applied via the ZERO key or equivalent digital input (see Sections 4.2 and 4.3).
If an ENGINEERING OFFSET has been programmed, when in normal operating mode the function of the ZERO key (or equivalent digital input) will be to set the display to the value

of the ENGINEERING OFFSET (assuming the tare point has not been used to override this, see Section 7.9).

To change the engineering offset it is necessary to understand E725 programming. The user should have read Section 6.

When the item [E.OFF] (ENGINEERING OFFSET) in the CALIBRATION menu is selected, the display shows a number entry prompt. The value is edited as described in general in Section 6.3. Pressing ENTER or ENTER and RESET together (as appropriate) selects the value displayed. The user is returned to the CALIBRATION menu, the display shows the next item, [t.Pt] (TARE POINT).

7.9 Tare Point

The item [t.Pt] (TARE POINT) in the CALIBRATION menu allows a tare point to be defined. The tare point is the reading obtained in normal operating mode when the ZERO key is pressed (or the equivalent digital input is applied).

The default value for the tare point is 0, i.e. when in normal operating mode, pressing the ZERO key sets the display to 0. If an engineering offset is programmed, the tare point is automatically set to the value of the engineering offset.

For example, if a transducer has been calibrated to read ±1000 g and the ENGINEERING OFFSET is set to +100, in normal operating mode the display will read -900 to +1100 g. The tare point is automatically set to +100, so pressing the ZERO key sets the display to +100.

It may be necessary to override the arrangement described above. For example, if it is required that a ZERO key operation sets the display to 0 rather than +100, this can be achieved by changing the tare point value to 0.

To change the TARE POINT it is necessary to understand E725 programming. The user should have read Section 6.

When the item [t.Pt] (TARE POINT) in the CALIBRATION menu is selected, the display shows a number entry prompt. The value is edited as described in general in Section 6.3. Pressing ENTER or ENTER and RESET together (as appropriate) selects the value displayed. The display shows [L 1-4] which is the first item in the LIMITS menu.

8 ANALOGUE OUTPUT

8.1 Analogue Output Description

The E725 has an analogue output of both voltage (up to ±10V) and current (4-20mA). The output is independent of the microprocessor controller and therefore is unaffected by ZERO commands.

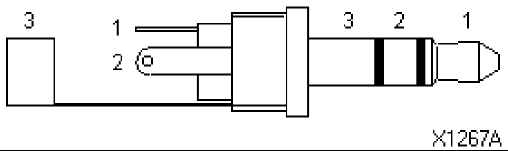
The 4 to 20mA output is set up to give 4mA at a transducer signal of zero. Therefore it is not appropriate to use 4 to 20mA output for bipolar applications (e.g. tension/compression load cells and bipolar pressure transducers). It is recommended that a ±10V output is used for bipolar applications.

Where the E725 has two input channels, the analogue output represents whichever channel or function has been selected for display (see Section 11).

The analogue output is adjusted using the zero and gain screwdriver potentiometers on the rear panel. These are located at the bottom left of the rear panel and are marked 'Z' and 'G'. The zero and gain potentiometers are common to both the voltage and the 4-20mA output. Therefore, although both may be connected and used, only one can be accurately set up. The zero and gain potentiometers only affect the analogue output, they have no effect on the display.

8.2 Analogue Output Connections & Specification

The analogue output mating connector is a 3.5mm diameter, 19mm long stereo jack-plug. The socket is located at the bottom left of the rear panel. The connections are as follows:



CONTACT	FUNCTION
1	4-20mA
2	±10V
3	0V (COMMON) & Shield

Specification	
Analogue output (short circuit proof)	0 to ±10V (at 5mA max) AND 4-20mA into 0 to 500 Ohms
Analogue output bandwidth	0 to 300Hz
Analogue output ripple (P-P typical)	Voltage: 2µV (RTI) + 2mV (RTO) 4-20mA: 3nA (RTI) + 30µA (RTO)
Zero pot range	±1.5v or ±2mA
Gain pot range	4:1

General specification may also be relevant. See Section 13. This is an active output that should not be connected to any external power supply, as this will damage unit.

8.3 Analogue Output Calibration

The reason for calibrating the analogue output is to ensure that the relationship between the force/pressure etc applied to the transducer and the analogue voltage or current output is as required. (E.g. 0 to 10V for zero to full scale on the transducer). The E725 must be calibrated as described in Section 7 (this may have been done by RDP) before the analogue output is calibrated. The E725 display can then be used in the process of calibrating the analogue output.

In order to calibrate the analogue output either a physical input or a bridge shunt must be applied to the transducer connected to the E725. The analogue output must be monitored using a voltmeter or milliammeter depending on the required output (volts or 4-20mA).

The process described in Section 7.3 will have set the gain range for the analogue output. If the
gain range value has not been correctly entered, the analogue output may not operate over the full ±10V or 4-20mA range.

To calibrate the analogue output first ensure there is zero load/pressure etc applied to the transducer and adjust the zero (Z) control until the output is measured at 0V (or 4mA for 4-20mA output).

Then EITHER

1) Apply a known force/pressure etc. to the transducer and adjust the gain (G) control until the output is as required. It is appropriate to use the value displayed on the E725 to establish the force/pressure etc. applied to the transducer. The applied force/pressure etc. should ideally be between 50% and 100% of full-scale

OR

2) FOR CERTAIN UNAMPLIFIED STRAIN GAUGE TRANSDUCERS ONLY.

   Check the transducer is appropriately connected as shown in "With shunt calibration" in Section 5.2

   Activate the CAL function (by pressing MODE & CAL together). Adjust the analogue output required for the momentary display achieved. (The CAL function automatically switches off after a few seconds so it will need to be repeatedly activated).

EXAMPLE 1, VOLTAGE OUTPUT

If the following were true.

Transducer full scale:-	500 units
Analogue output required at full scale:-	10V
Momentary shunt cal value displayed:-	237.3

Then the voltage output during the cal operation should be (237.3/500) x 10V = 4.75V

EXAMPLE 2, 4 to 20 mA OUTPUT (other detail as for example 1)

For the same transducer, a 4-20mA output is required then the output is

((237.3/500) X 16mA) + 4mA = 11.6mA.

4 to 20mA output is only suitable for unipolar transducers, or bipolar transducers used in unipolar mode.

Note: Reversing transducer connections will reverse analogue outputs irrespective of display programming.

9 LIMITS

9.1 Limits Description

The E725 has as standard four Limits. A limit (sometimes referred to as a trip limit or set point) is a facility to indicate when the signal is above or below a certain value. On the standard unit, the indication takes the form of a front panel LED and a TTL output signal available from a rear panel connector.

There are several relay options available and your use of this section will depend on whether you have any of the relay options fitted. Please check the part number of your E725, it is located on a label on the top of the housing.

E725-NNN-NNN-XXX-N-N where XXX is important and NNN is not important here.

If XXX = R,	then the unit has 4 mechanical relays	= Option R
If XXX = RS,	then the unit has 4 solid state relays	= Option RS
If XXX = FR,	then the unit has 2 fast mechanical relays	= Option FR
If XXX = FRS,	then the unit has 2 fast solid state relays	= Option FRS

Any other value of XXX is not relevant to the LIMITS section and indicates that the E725 does not have any LIMIT options fitted, however, TTL outputs are available.

9.2 Connections and Specification

Connections for TTL outputs, i.e. no limit option fitted. TTL outputs are available via the connector labelled DIGITAL I/O. Pin numbers are as follows: -

PIN	Description
4	Limit 1 TTL output (Low when front panel LED is OFF)
5	Limit 2 TTL output (Low when front panel LED is OFF)
6	Limit 3 TTL output (Low when front panel LED is OFF)
7	Limit 4 TTL output (Low when front panel LED is OFF)
8	Common for TTL outputs

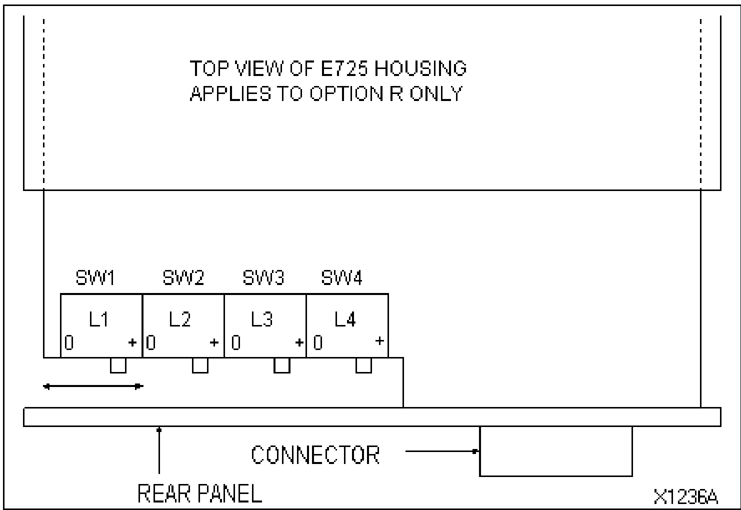
Connections for the R, RS, FR and FRS options (9 pin D type marked OPTION)

PIN	**Mechanical relays (* see following)**		**Solid state relays**	
	Opt **R**	Opt **FR**	Opt **RS**	Opt **FRS**
1	Relay 1 pole*	Relay 1 (normally open)	Relay 1	Relay 1
2	Relay 1 common	Relay 1 common	Relay 1	Relay 1
3	Relay 2 pole*	Relay 1 (normally closed)	Relay 2	N/A
4	Relay 2 common	Relay 2 (normally open)	Relay 2	Relay 2
5	Relay 3 pole*	Relay 2 common	Relay 3	Relay 2
6	Relay 3 common	Relay 2 (normally closed)	Relay 3	N/A
7	Relay 4 pole*	L1 logic	Relay 4	L1 logic
8	Relay 4 common	L2 logic	Relay 4	L2 logic
9	N/A	Logic common (0V)	N/A	Logic common (0V)
Shell	Cable shield / shield			

* For option R only, it is possible to select (see below) whether the relay is normally open or normally closed. The default setting is normally open.
In NORMALLY OPEN operation, the relay contacts are OPEN CIRCUIT whilst the front panel LIMIT light is OFF.
In NORMALLY CLOSED operation, the relay contacts are CLOSED CIRCUIT whilst the front panel LIMIT light is OFF.

If you need to change the operation of the relays, it is necessary to change some switches on the option card circuit board. This involves opening the case of the E725. Please follow these instructions carefully.

Isolate the power to the E725. Remove all connectors from the rear panel. Undo the 4 screws on the rear panel (black crosshead located in each corner). Observe the necessary precautions for handling static sensitive devices. Holding the power cable grommet, pull until the circuit boards have withdrawn by about 75mm (3"). The switches are now in view (looking from the top of the unit). Their function and position is shown below.



For NORMALLY OPEN relay operation, the slider switch should be in the right-hand position (marked +)

For NORMALLY CLOSED relay operation, the slider switch should be in the left-hand position (marked 0)

Specification of LIMITS for all versions.

	TTL output	Option R	Option RS	Option FR	Option FRS
Number of relays	None	4	4	2	2
Response time	15ms	20ms	20ms	5ms	5ms
Max voltage (dc)	Zero	150V	200V	150V	200V
Max voltage (ac)	Zero	125V	130V	125V	130V
Max switching	25mA*	30W/60VA	200mA	30W/60VA	200mA
On resistance	-	<1 Ohm	10 Ohms	<1 Ohm	10 Ohms
Off resistance	-	Open circuit	10^{12} Ohms	Open circuit	10^{12} Ohms
Accuracy	±1 digit			±0.2% F.S. typical	
Hysteresis	Programmable			±0.2% F.S. typical, fixed**	

* The total source/sink current for the TTL outputs must not exceed 50mA.

** Ensure optimum gain range is selected in order to minimise the effects of this (analogue) hysteresis on the overall accuracy of Options FR/FRS.

9.3 Programming Limits

In order for the limits to function, it is necessary to programme the limit values and some other factors associated with their operation.

Please read Sections 6.1, 6.2, 6.3, & 6.4. This will give essential information on accessing the menu, entering numbers and selecting items from the programming menus. The Menu Map (Section 6.10) may also be useful. Once you have read Sections 6.1 to 6.4, return to this section.

When the Limits menu is accessed, the display reads [l 1-4], denoting Limits 1 to 4. This will read [l 1-2] if you have option FR or FRS fitted as there are 2 limits available with the fast limit option.

Press ENTER.

Press the UP ARROW or DOWN arrow until the display shows the limit you wish to change. For example [l 2]. Press ENTER to select your chosen item.

Again using the UP ARROW and DOWN ARROW keys, choose the operation mode of the limit. The choices and their description are as follows:

[OFF]	OFF. The limit is turned OFF which is the DEFAULT CONDITION. Selecting OFF exits the set up of the current limit. If the current limit is the last limit (L2 for option FR and FRS, L4 for all other cases), the unit will exit the limits menu.
[HI]	HIGH. The limit activates when the input signal is higher than the set point.
[LO]	LOW. The limit activates when the input signal is lower than the set point.
[d.tion]	DEVIATION. The limit activates when the input signal deviated from the set point by more than a specified amount. For example, a set point of 100 with a deviation of 10 would be activated below 90 and above 110. Deviation is not available with Options FR/FRS.

Press ENTER to make your selection.

The display will briefly show [Funct].

Using the UP ARROW and DOWN ARROW keys, view the six LIMIT INPUTS available to be monitired. For most applications the [n-IP] will be appropriate. Full details are as follows:

[n-IP]	NET INPUT is the value seen on the display of the unit in normal operational mode.		
[G-IP]	GROSS INPUT disregards any zero offsets introduced (eg by pressing the ZERO key) since calibration.		
[t-IP]	TARE INPUT is the zero offset introduced by the ZERO function.		
[n-IP]	WITH MAX INDICATOR.	MAX INPUT is monitored.	Section 10 gives further details.
[n-IP]	WITH MIN INDICATOR.	MIN INPUT is monitored..	
[n-IP]	WITH TIR INDICATOR.	TIR INPUT is monitored.	

Press ENTER to make your selection.

Number entry, quick refresher!

Increment/decrement a digit using the UP ARROW or DOWN ARROW key.
Step digits using the ENTER key
Enter the value using the ENTER and SETUP keys together or if the left-hand digit is flashing, by pressing ENTER.
In order to correct an error, press RESET to return to the original value.
Negative numbers are entered using the left-hand digit.

The display will briefly show [SetPt] (SET POINT) and then show a number. Enter the required value of the set point. It can be any value between minus 99999 and plus 99999. Section 6.3 deals with number entry if you're not sure.

If you have selected [d.tion] (DEVIATION) as the operation mode, the unit will at this point request the level of deviation allowed. ([d.tion] will appear on the display briefly). Input this value. THIS STEP WILL BE OMITTED IF THE OPERATION MODE IS NOT [d.tion].

Next the unit will momentarily display [HYS] (HYSTERESIS). Hysteresis provides a dead band around the limit value. If for example, the signal from the sensor has a lot of fluctuation, as the average signal approaches the set point, the limit will be rapidly triggered on and off. The hysteresis value allows a dead band to be configured. If for example the limit is a high limit with a set point of 100 and hysteresis of 10, the limit will trigger at 100 but not go off until 90.
Hysteresis is not programmable with Options FR/FRS.

Finally, the display will show [Lat.N] (LATCHING NO). This sets the limits to be non-latching. If this is set to [Lat.Y] (LATCHING YES) using the UP ARROW key, once the limit is triggered, it will stay triggered even if the signal falls below the set point. The limit must be reset before it will go off. See Section 4 for details of how latched limits are reset. Press ENTER once the required selection is made.
Note: latching LOW limits are inoperable.

The display will now prompt entry of the next limit unless this was the last limit (L4 for R and RS, and L2 for FR and FRS). If it was the last limit, the display will show RUN. Press enter (and wait for 2 seconds). The unit has now left set-up mode and is in normal operating mode.

To make a quick exit from the limits menu, whilst the display is showing [L1], [L2, L3] or {L4] press RESET. The display will then show [run]. Press ENTER and after a 2 second delay, the unit will return to normal operating mode.

10 MAX /MIN (PEAK CATCHER)

10.1 How to Identify if Your E725 Has an Option FM Card Fitted

Please compare the part number of your E725 (located on a label on top of the housing) with the following:

E725-NNN-NNN-XXX-N-N where XXX is important and NNN is not important here.

If XXX = FM, then the unit has option FM (also referred to as fast MAX/MIN or Peak catcher) fitted.

Any other value of XXX is not relevant to this section and indicates that the E725 does not have option FM. However, the standard MAX/MIN features are still available.

10.2 MAX/MIN Description (E725 Without Option FM)

The standard E725 monitors the transducer signal and stores the maximum (MAX), minimum (MIN), and the total indicated range (TIR). The total indicated range is the difference between the maximum and the minimum.

To the left of the display, the up arrow (triangle) indicates that the display is showing the MAX value, the down arrow indicates that MIN is being displayed and both together indicate that the TIR is being displayed. Pressing the MODE key rotates the display NORMAL to MAX to MIN to TIR to NORMAL etc. An external device may also switch modes using the digital inputs. Section 4.3 gives further information.

Pressing MODE and RESET together resets the MAX/MIN value.

10.3 MAX/MIN Description (E725 With Option FM)

Please use Section 10.1 to check if your unit has Option FM fitted.

To the left of the display, the up arrow (triangle) indicates that the display is showing the MAX value, the down arrow indicates that MIN is being displayed and both together indicate that the TIR is being displayed. Pressing the MODE key rotates the display NORMAL to MAX to MIN to TIR to NORMAL etc. An external device may also switch modes using the digital inputs. Section 4.3 gives further information.

The MAX/MIN value is reset by pressing MODE and RESET together or by using the RESET input on the FM option board connector.

Option FM provides a fast analogue peak catcher which uses analogue comparators to catch the MAX (peak) and MIN (trough or valley) of the input signal. The peak catcher is suited to very rapidly changing signals. Please note that the MAX and MIN signals are stored as analogue values and so may flicker slightly due to electrical interference. Also, there will be a signal droop that is normally negative-going.

In addition to the standard analogue output (see Section 8), there is an analogue output available from the FM option board connector. The FM analogue output is a non-scaled version of the stored value. If the coarse gain range is correctly set for the transducer, the output of the peak for example, should be between 5V and 10V for a peak value equal to the full-scale range of the transducer.

In order accurately to identify the relationship between the FM analogue output and the displayed peak value, measure the FM analogue output voltage and then compare it with the peak value shown on the E725 display.

The TIR (difference between MAX & MIN) has the possibility of being twice the F.S. value of the transducer. For this reason the analogue output of TIR is halved.

10.4 MAX/MIN Connections and Specification (E725 Without Option FM)

The standard E725 connections for externally changing display mode and resetting MAX / MIN and TIR are given in section 4.3.

Specification for MAX/MIN (E725 Without Option FM).

Range of capture.	**Any value between -99999 and +99999.**
Min pulse width for ±1 digit accuracy.	**Guideline figures:- 40ms at filter value 1, 100ms at filter value 5.**

10.5 MAX/MIN Connections and Specification (E725 With Option FM)

The FM board can be fully controlled from the front panel. However, if external control is required or an analogue output of the MAX or MIN value is required, connections can be made to the card.

The connections are made using the 9 pin D plug (supplied) to the connector marked OPTION on the rear of the E725. The connections and their descriptions are as follows:-

PIN	Function	Description
1	MAX output	Voltage between pin 1 and 4 proportional to MAX
2	MIN output	Voltage between pin 2 and 4 proportional to MIN
3	TIR output	Voltage between pin 3 and 4 proportional to TIR/2
4	Analogue common	Common for above analogue outputs
5	Reset	Resets stored MAX and MIN when linked to pin 6
6	+5V	5V output for above.
7	MAX comparator O/P	Logic O/P. Goes low when input sig. > current MAX.
8	MIN comparator O/P	Logic O/P. Goes low when input sig. < current MIN.
9	Digital common	Common for Pins 7 & 8
Shield	Cable shield	Cable Shield.

Option FM can be reset using the connector labelled DIGITAL I/O (see section 4.3) or by using the pin 5 of connector marked OPTION.

Specification for OPTION FM

Range of capture	Any value between -99999 and +99999
Accuracy for 0 to FS step.	Change in 10ms = 0.1% FS Change in 1ms = 0.2% FS
Drift (droop)	Typically 1 digit per 3 seconds, normally negative going, even if the signal is negative.

Notes

1) The E725 FM has a very rapid response to transient signals. Ensure that the E725 has adequate supply-noise suppression otherwise erroneous MAX/MIN values may be stored.

When the MAX/MIN is RESET, there will nearly always be some residual value (i.e. not exactly zero). This is due to the small amount of noise inherent on the signal. The display may appear stable due to the digital filtering.

Remember that the FM board is designed to store fast peaks. If there is a fast transient information on your signal due to mechanical or electrical noise, the FM board will catch it. The FM board is not able to discriminate between desirable and undesirable MAX or MIN values.

If you do encounter problems with unexpected peak values, monitor the signal with an oscilloscope in order to see what is causing them. They are almost always due to noise induced into cabling from motors, solenoids or other electrically noisy equipment.

If you wish to display or store a fast MAX or MIN value for a long time, use the digital HOLD function (see Section 4.3 for details).

11 TWO CHANNEL VERSIONS

11.1 Description

There are 3 dual options available and your use of this section will depend on which option is fitted. Please check the part number located on a label on the top of the housing.

E725-NNN-NNN-XXX-N-N where XXX is important and NNN is not important here.

If XXX = 2DC1, then the unit has two DC1 input boards fitted
If XXX = 2DC2, then the unit has two DC2 input boards fitted
If XXX = 2DC3, then the unit has two DC3 input boards fitted

Any other value of XXX is not relevant to this section.

The dual inputs are of the same type. That is, if the first input is a DC1, the second is also a DC1. In addition to this, as the two input cards share the gain range, the transducers must have a similar sensitivity ±15%, and they must display the same full-scale value.

The second channel is connected via a 9 pin D type the OPTION.

When an E725 is fitted with a second input card, four display functions are activated.
To move between functions, press MODE and FUNCTION together. The 4 LEDs marked F1, F2, F3 and F4 located just above the MODE key indicate the function that is selected. The functions are as follows:-

<table>
<tr><td>F1</td><td>A</td><td>Transducer A input</td><td rowspan="4">Limit & MAX/MIN monitor selected function. MAX/MIN and any latched limits are reset when the function mode is changed.</td></tr>
<tr><td>F2</td><td>B</td><td>Transducer B input</td></tr>
<tr><td>F3</td><td>(A+B)/2</td><td>Average of A and B input</td></tr>
<tr><td>F4</td><td>A-B</td><td>Difference between A and B</td></tr>
</table>

ZERO FUNCTION. Each of the modes has a separate zero point. Therefore, pressing ZERO whilst in mode F1 (transducer A) will have no effect on the calculation of A-B (mode F4) for example. If modes F3 or F4 appear to be incorrect, RESET ZERO on all four modes to ensure that all modes have the zero offset removed. Calculations should now be correct.

ANALOGUE OUTPUT. The analogue output is proportional to the currently selected mode. Mode F4 is halved because when the outputs of A & B are -10V & +10V respectively, the output would otherwise be (-10)-(+10) = -20V which is not possible. The output is therefore (A-B)/2.

11.2 Connections for Second DC Input Channel

The connections to the second DC input are IDENTICAL to the first. Refer to section 5 for transducer connections.

11.3 Calibrating the Second Transducer

This section assumes that the first transducer is calibrated. If not, see Section 7.

Select F2 (Transducer B input). See above for how to do this.

Ensure that zero load/pressure etc. is applied to the transducer and press the ZERO key.

Apply a known load/pressure etc. to the transducer (or operate the CAL function from run mode) and adjust the input balance potentiometer (just above the power input lead on the rear panel and labeled 'X') until the required display is obtained. Please note that there is a 15% F.S. adjustment on this potentiometer so if the sensitivity of the transducers differs by more than this, it will not be possible to match the two channels.

12 RS232/RS485 OUTPUTS

The E725 is fitted with an RS232 output as standard, or an RS485 output as an option.

The last-but-one digit of the part number indicates whether the RS485 option is fitted. If it is a '0' the output is RS232, if it is a '1' the output is RS485.

The serial outputs enable the user to connect one E725 using RS232, or up to 256 E725 units using RS485, to a computer. This allows the display reading for example to be directly transferred to a PC.

In addition to this, a PC may take operational control of the unit, enabling actioning of all front panel (and other) functions.

Calculated channels may be defined, allowing for example the display to read different engineering units (user selectable) for the same transducer input.

Recognising that only a small number of customers use RS232 and in an attempt to save paper, there are no further details of the RS232 or RS485 output in this manual.

Please contact RDP or your distributor to order a copy of the full Serial Communications Manual, part number CD1423.

13 SPECIFICATION

The specification for the E725 DC input versions is as follows:-

Power supply	For supply identification, connections, tolerance and fuse values see Section 3.1 and 3.3.
Operating temperature.	Ac supply, -10 to +45°C, (14 to 113°F) Dc supply, -10 to +55°C, (14 to 131°F)
Dimensions	DIN437000. Width 92, height 44, depth 180 (inc. connectors)
Case material	Aluminium anodised black.
Weight	Ac supply. 0.51kg (excluding connectors) Dc supply. 0.43kg (excluding connectors)
Controls	Four membrane keys with tactile feedback Potentiometers for analogue output zero and gain.
Indicators.	5 digits, 13.2mm high. 4 LEDs for limits & 4 LEDs for function
Display resolution	1 in ±99999
Display update rate	3Hz
A to D resolution	1 in ±99999
Digital inputs	HOLD, ZERO, RESET, opto isolated, 5 to 50V into 2k Ohms or TTL. (See also section 4.3).
Digital outputs	TTL for limits (see Section 9.2)
RS232/485	See section 12.
Connectors	Transducer 9 pin D type male, Option 9 pin D type female (male if dual input) Digital I/O 15 pin D type male
Limits	See section 9.2
Transducer input and excitation	See section 5.1
Shunt Resistor Value	59k Ohms (0.1%) fitted as standard by RDP
Amplifier input range	3mV to 10v
Amplifier gain	X1 to x 3000
Amplifier Input Resistance	100M Ohms min
Amplifier Linearity	0.02% F.S.
Amplifier CMRR	110dB typical. Dc to 50Hz
Amplifier CMVR	±12.5V typical
Amplifier Temp. Coefficient	Zero; 0.3µV/°C RTI Typical. Gain; 0.003% F.S./°C Typical optimum at ± full scale
Analogue output	See section 8.2

EMC

The unit passed the following standards.

a) EN55022. : Conducted and radiated emissions.
b) EN61000-4 -2 : Electrostatic discharge
-3 : Radiated immunity
-4 : Fast transient bursts
-6 : Conducted immunity
-11 : Supply voltage dip

Note: Because of the high gains involved when low output transducers are used, spurious display/analogue outputs may be seen in the presence of strong RF fields at certain frequencies. These frequencies will depend on:

a) The cable length, especially the transducer's cable.
b) Type of cable. (Quality of shield etc.)
c) Cabling and grounding point Layout.

14 GLOSSARY OF TERMS

Analogue output	A continuously variable voltage or current signal proportional to a measured quantity.
Bar	An engineering unit for pressure measurement.
Bar g	An abbreviation of bar gauge. The addition of the word gauge states that the measurement is relative to atmospheric pressure (as is usually the case).
Bipolar	Working in a range from a negative value, through zero, to a positive value.
Bridge shunt	Alternative to shunt resistor.
Calculated channels	On 2-channel E725's where the channels are labelled A and B, the Calculated channels are A-B and (A+B)/2.
Calibration	Setting equipment (e.g. an E725 and a transducer) to give a known display or output for a particular measured quantity or range of quantities.
Calibration factor	Alternative to full-scale output referred to excitation voltage.
Calibration point	A point chosen for correlation between the physical quantity applied to a transducer and transducer output, E725 display or E725 output.
Calibration zero	The zero point defined during the main calibration procedure
Capacity	Alternative to full-scale.
Counts	Uncalibrated value displayed by E725.
D2-Series	A series of RDP manufactured LVDTS with integral signal conditioning providing dc-in/dc-out operation.
Displacement	General technical word for quantities such as distance, height, length, diameter etc.,
Engineering unit	A unit of measure of a physical quantity (e.g. In the case of displacement, mm).
Excitation (voltage)	The voltage applied to an unamplified (typically strain gauge) transducer to make it work.
Full-scale	The total specified measurement range of a transducer or instrument.
Function mode	In some cases the E725 can display A, B, A-B, (A+B)/2 or alternative Engineering units (lbs., kg etc.,).These display modes are called Function modes
Half bridge transducer	A transducer (usually strain gauge or inductive) requiring bridge completion components to operate with an E725
Hysteresis	(In the context of limits) A means of avoiding repeated re-triggering of a limit when the input signal dwells close to the set point.
Hysteresis	(In the context of transducers) An undesirable characteristic, the difference between the rising signal and the falling signal for the same physical quantity (similar to backlash in a machine).
IP65	A reference to a generally recognised Ingress Protection index. IP65 defines total protection against dust and low-pressure water jets from any direction.
Limit	A facility to indicate if a signal is above or below a particular level
Low pass	Term applied to electronic filters, which remove high frequencies and does not affect low frequencies.
LVDT	Linear Variable Differential Transformer, a type of transducer technology, particularly well suited to displacement measurement.

Max	The maximum transducer reading stored since last reset.
Mechanical relay	Electronically operated switch with mechanical parts.
Min	The minimum transducer reading stored since last reset
Normal operating mode	The status of the E725 on power-up (after a short power-up sequence) where a calibrated E725 displays a measured quantity.
Opto-isolated	A means of protecting a digital input via an optical device, removing conventional electrical continuity.
Peak	Alternative for max
Polarity	Whether a quantity is positive or negative
Potentiometer	A variable resistor often used for making adjustments
Potentiometric transducer	A transducer employing potentiometric (varying electrical resistance) technology.
PSI	Pounds (per) Square Inch. An engineering unit for pressure measurement
PSIG	An abbreviation of psi gauge. The addition etc., (as bar g).
RS232	A particular type of serial communication
RS485	A particular type of serial communication
Sensitivity	The relationship between transducer output, applied physical quantity and (in some cases excitation voltage)
Serial output	A means of transferring information or instruction in a digitally coded form.
Set point	The level at which a limit is triggered
Shunt calibration	A means of calibrating certain strain gauge transducers where a shunt resistor is used to produce a transducer output without applying a physical quantity (e.g. pressure) to the transducer
Shunt calibration factor	Alternative to shunt calibration output referred to excitation voltage.
Shunt calibration output	The output obtained when a shunt resistor is applied to a strain gauge transducer.
Shunt calibration reading	A reading obtained when a shunt resistor is applied to a strain gauge transducer.
Shunt resistor	The resistor used for shunt calibration.
Solid-state relays	An electronic device with similar features to a mechanical relay, but with no moving parts.
Strain gauge transducer	A transducer employing strain gauge technology
Supply voltage	The voltage applied to an amplified transducer to make it work.
TIR	Total indicated reading, the difference between max and min
Transducer	An electronic measuring device which converts a physical quantity (e.g. pressure) into an electronic signal (e.g. voltage).
Transmitter	A widely used term for an amplified transducer with a 4 to 20mA Output
Trough	Alternative for min
TTL	Transistor Transistor Logic, the output of an IC.
Unipolar	Working in a range 0 to a positive value
Valley	Alternative for min

15 Common conversion factors

Pressure

	Psi	Bar	in. of H_2O at 4°C	in. of Hg	mm. of Hg (Torr)	Pascals
Psi	1	14.504	3.6127×10^{-2}	0.4912	1.934×10^{-2}	1.4503×10^{-4}
Bar	6.8948×10^{-2}	1	2.491×10^{-3}	3.3864×10^{-2}	1.333×10^{-3}	10^{-5}
In. of H_2O at 4°C	27.68	401.48	1	13.60	0.5354	4.014×10^{-3}
In. of Hg	2.036	29.53	7.355×10^{-2}	1	3.937×10^{2}	2.953×10^{-4}
mm. of Hg (Torr)	51.715	750.06	1.868	25.4	1	7.502×10^{-3}
Pascals	6.8948×10^{3}	1×10^{5}	2.491×10^{2}	3.386×10^{3}	1.333×10^{2}	1

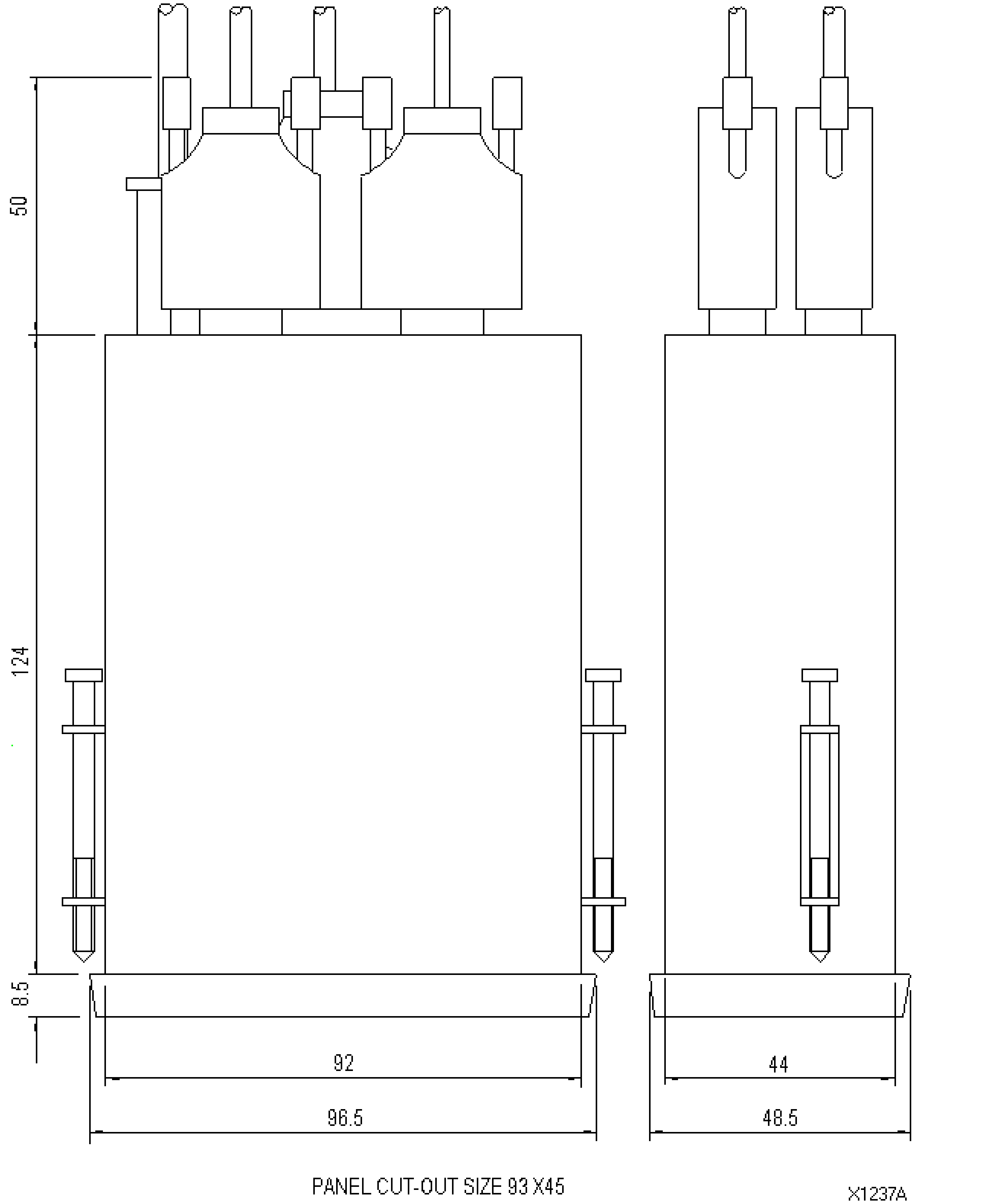
Load

	Pound (lb.)	Kg	Newton
Pound	1	2.205	.2248
Kg	0.4536	1	0.102
Newton	4.448	9.807	1

Torque

	Nm
1 oz-in	7.06×10^{-3}
1 lb.-in	0.113
1 lb.-ft	1.3558
1 kg/m	9.80665

16 APPENDIX 1 DIMENSIONAL DETAILS



17 APPENDIX 2 – COMPLETE CONNECTION LISTING

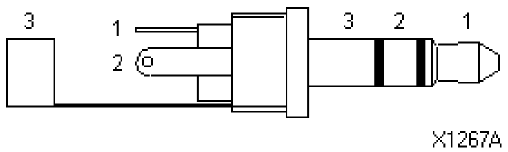
E725 9-WAY CONNECTIONS (TRANSDUCERS AND OPTIONS)							
PIN	AC TRANSDUCER	DC TRANS (ALL VERSIONS)	OPT R	OPT RS	OPT FR	OPT FRS	OPT FM
1	Exc. High	Excitation +	RL1 N.O./N.C	RL1	RL1 N.O.	RL1	Max Out
2	Exc. Low (0V)	Excitation -	RL1 Com	RL1	RL1 Com	RL1	Min Out
3	Signal Low*	Signal +	RL2 N.O./N.C.	RL2	RL1 N.C.	No Con	TIR Out
4	Signal Hi*	Signal -	RL2 Com	RL2	RL2 N.O.	RL2	AN.Com (0V)
5	0V (Ground)	0V (Ground)	RL3 N.O./N.C.	RL3	RL2 Com	RL2	Reset
6	M/S	Sh.Cal.1	RL3 Com	RL3	RL2 N.C.	No Con	5V Out
7	½ BR.R Hi	+15V Out	RL4 N.O./N.C.	RL4	L1 Logic	L1 Logic	Max CMP Out
8	½ BR.Com	-15/-8/-6V Out (DC1/DC2/DC3)	RL4 Com	RL4	L2 Logic	L2 Logic	Min CMP Out
9	½ BR.R Low	Sh.Cal.2	No Con	No Con	Logic Com	Logic Com	Dig.Com (0V)

* Reverse for 2AC Option

Transducer connectors are sockets
Options are plugs except 2AC/DC

15-WAY CONNECTIONS (DIGITAL I/O)			
PIN	DIGITAL I/O	PIN	INPUTS
1	Rs232 rx	9	Reset/Mode
2	Rs232 tx	10	Reset/Zero
3	Rs232 Com.(Ground)	11	Reset/Limits
4	Limit 1 Out	12	Hold/Reset
5	Limit 2 Out	13	Fast Hold
6	Limit 3 Out	14	Com.
7	Limit 4 Out	15	(+5V Out)
8	Limit Com (Ground)		

On 9-15 way connect shields/shields to shells



ANALOGUE JACK	
CONTACT	FUNCTION
1	4-20mA
2	±10V
3	0V (Com)

SUPPLY AC/DC	
Brown	100-230V ac
Blue	Neutral
Green/Yellow	Ground
Red	V+ DC
Blue	V- DC
Shield	Ground

18 WARRANTY AND SERVICE

WARRANTY.

R.D.P. Electronics products are warranted against defects in materials or workmanship. This warranty applies for one year from the date of delivery. We will repair or replace products that prove to be defective during the warranty period provided they are returned to R.D.P. Electronics.

This warranty is in lieu of all other warranties, expressed or implied, including the implied warranty of fitness for a particular purpose to the original purchaser or to any other person. R.D.P. Electronics shall not be liable for consequential damages of any kind.

If the instrument is to be returned to R.D.P. Electronics for repair under warranty, it is essential that the type and serial number be quoted, together with full details of any fault.

SERVICE.

We maintain comprehensive after-sales facilities and the instrument can, if necessary be returned to our factory for servicing.

Equipment returned to us for servicing, other than under warranty, must be accompanied by an official order as all repairs and investigations are subject to at least the minimum charge prevailing at the date of return.

The type and serial number of the instrument should always be quoted, together with full details of any fault and services required.

IMPORTANT NOTES.

1. No service work should be undertaken by the customer while the unit is under warranty except with the authorisation of RDP Electronics.

2. If the instrument is to be returned to R.D.P. Electronics for repair, (including repair under warranty) it is essential that it is suitably packed and that carriage is insured and prepaid. R.D.P. Electronics can accept no liability whatsoever for damage sustained during transit.

3. It is regretted that the above warranty only covers repairs carried out at our factory. Should the instrument have been incorporated into other equipment that requires our engineers to perform the repair on site, a charge will be made for the engineer's time to and from the site, plus any expenses incurred.

The aforementioned provisions do not extend the original warranty period of any product that has been either repaired or replaced by R.D.P. Electronics.

THIS WARRANTY MAY BE NULL AND VOID SHOULD THE CUSTOMER FAIL TO MEET OUR TERMS OF PAYMENT.