C8600 TEMPSCAN MODULAR PRECISION THERMOMETER OPERATOR MANUAL

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CONTENTS

PAGE

GENERAL INFORMATION 4

CALIBRATION, CERTIFICATION AND SERVICE 5

1. INTRODUCTION 6

2. DESCRIPTION 7
- 2.1 Instrument Layout 7
- 2.2 Connectors on Rear Panel 8
- 2.3 Power Supply and Back-up Battery 10
- 2.4 Keypad 11
- 2.5 The Display 12
- 2.6 Connection to External Equipment 12
  - 2.6.1 Analog output 12
  - 2.6.2 External high and low alarms 12
  - 2.6.3 RS-232C communications ports 13

3. SETTING PARAMETERS AND PROGRAMMING 14
- 3.1 Preparation on Delivery 14
- 3.2 Starting up and Self-check 14
- 3.3 Modes of Operation 14
- 3.4 Static Mode 15
- 3.5 Scan Mode 16
- 3.6 Programme Menu 17
  - 3.6.1 Channel ON/OFF selection 20
  - 3.6.2 Thermocouple material settings 20
  - 3.6.3 Temperature scale settings 21
  - 3.6.4 Numerical resolution settings 21
  - 3.6.5 Dwell and pause 22
  - 3.6.6 Date and time 23
  - 3.6.7 Individual channel recalibration 23
  - 3.6.8 High and low alarms 24
  - 3.6.9 Analog output 25

PAGE

3.6.10 Brightness of VF display 25
3.6.11 Communication baud rate 26
3.6.12 Daisy chain address 27
3.6.13 Language 27
3.7 Printer Menu 28
3.7.1 Selection of output format 29
3.7.2 Printing control 29

4. OPERATION 32
4.1 Preparation 32
4.2 Taking Measurements 32
4.3 Individual Channel Recalibrations 33
4.4 Use on Microvolt Range 33
4.5 PST Module Sensor Leads 33
4.6 High and Low Alarms 34
4.7 Out-of-Range Indications 35
4.8 Analog Output 35
4.9 Printing 36
4.10 Cleaning 36

5. SPECIFICATIONS 37
5.1 M8600/K Thermocouple Module 37
5.2 M8600/P Pt100 Module 40
5.3 M8600/X PST Module 42
5.4 Complete Instrument 44
5.5 Instrument Packs 47
5.6 Optional Equipment 47
5.7 External Communications Equipment 48

APPENDIX A — PRINTERS 49
A.1 — Epson LX-300 Printer 49
A.2 — Other Printers 50

APPENDIX B — PIN CONNECTIONS TO COMPUTER 53

PAGE

APPENDIX C — CONNECTIONS FOR ALARMS AND ANALOG O/P 56

FIGURES

Fig.1 — General View of C8600 7
Fig.2 — Rear Panel (from rear) 8
Fig.3 — Thermocouple Module 9
Fig.4 — Pt100 Module 9
Fig.5 — PST Module 9
Fig.6 — The Keypad 11
Fig.7 — The Display 12
Fig.8 — Typical Printout Run 30
Fig.9 — The Thermocouple Plug 37
Fig.10 — The Pt100 Sensor Connections 40
Fig.11 — The PST Sensor Connections 42
Fig.12 — Cable Connections for Daisy Chain Use 55

GENERAL INFORMATION

It is recommended that you read the safety and operation instructions before using this instrument.

WARNING

THIS INSTRUMENT REQUIRES A 230/110V a.c. POWER SUPPLY.

PLEASE READ PAGE 11 (SECTION 2.3) OF THIS MANUAL BEFORE SWITCHING ON INSTRUMENT OR CONNECTING THE EXTERNAL POWER SUPPLY.

TO AVOID ELECTRIC SHOCK DO NOT ALLOW ANY PROBE, SENSOR OR INTERFACE CABLE TO COME INTO CONTACT WITH LIVE ELECTRICAL POWER CONDUCTORS WITH VOLTAGES IN EXCESS OF 30 V r.m.s. OR 60 V d.c..

CAUTION

Temperature Measurement Probes
This precision instrument has been designed for use with the extensive range of Comark temperature probes. The use of other probes may impair the performance and accuracy of the instrument. Full details of Comark probes and sensors can be obtained from Comark Customer Support department or your local distributor.

Repeated sharp flexing can break thermocouple probe leads. To prolong lead life, avoid sharp bends or kinks in the leads, especially near the connector.

CERTIFICATE No. FM12129
ISO 9001

This instrument is manufactured in accordance with the Company's ISO 9001 Quality Approved System.

This instrument complies with the Electromagnetic Compatibility Directive 89/336/EEC and the Low Voltage Directive 93/68/EEC.

Declarations of Conformity available. Contact Comark Customer Support or your local Distributor.

In line with its policy of continuous development, Comark Limited reserves the right to alter the instrument specification without prior notice. Further information is available from Comark Limited or your distributor.

CALIBRATION, CERTIFICATION AND SERVICE

No. 0451

Certification
Comark can provide certificates of calibration for its whole product range, to suit ISO 9000 and other quality assurance procedures, food hygiene regulations, HACCPs and environmental regulations. Comark certificates are produced by independent quality controlled processes which compare product performance against agreed National Standards. For peace of mind and best practice Comark recommend annual certification/ recalibration.

Two levels of certification are available for infra-red temperature and non temperature instruments, excluding humidity:- UKAS certificates via an external accredited laboratory and NPL traceable certificates from the Comark calibration laboratory.

Three levels of certification are available for contact temperature products and these are detailed here:

a) UKAS Temperature Certification
The Comark UKAS (United Kingdom Accreditation Service) accredited temperature calibration laboratory is one of the finest in the UK. Comark UKAS certificates include 11 measurement points, the lowest uncertainty of 0.01°Cand provide independent proof of correct calibration using equipment and procedures audited by UKAS inspectors. The equipment used is fully traceable to the National Physical Laboratory.

b) UKAS Humidity Certification
In addition to the Comark temperature laboratory, the humidity laboratory continues the tradition of high accuracy certification and a wide range (25% to 90%RH) with uncertainties of 2.8% of reading. This range also includes Dew point measurements.

c) NPL Traceable Certification
Comark NPL certificates are traceable to the National Physical Laboratory and include 5 measurement points with uncertainty as low as 0.3°C.

Conformance
Certificates of conformance can be supplied for new, serviced and recalibrated instruments. These confirm that instruments are within their original manufactured specification.

Service/Repairs
Regular servicing and any required repairs, under warranty or after, are available from the Comark Service Department.

For more information on all Comark certification, calibration and service facilities please call Comark Customer Support or contact your local distributor.

1. INTRODUCTION

This operator manual includes the C8600 Modular Thermometer and the thermocouple, platinum resistance and PST modules designed for use with it. The separate manual, C8600 Relative Humidity and Temperature System (part number 17009), covers the H86 Wall mounted transmitter and the M8600/H Instrument Module. The instrument can accept up to three modules.

The **Thermocouple Module,** part number M8600/K, accepts four thermocouples for measuring temperature from thermocouple types K, N, T, J, R, S, E, B or uncompensated microvolts from an appropriate input. Channels are designated A, B, C and D.

The **Pt100 Module,** part number M8600/P, accepts two four-wire platinum resistance sensors with nominal resistance 100Ω at 0°C. Channels are designated A and B.

The **PST Module,** part number M8600/X, accepts four PST sensors with nominal resistance 10kΩ at 25°C. Channels are designated A, B, C and D.

The Humidity Module, part number M8600/H, accepts two H86 relative humidity and temperature transmitters, or four input currents in the range +1 to -1 milliamp. Channels are designated A, B, C and D. For complete details see the associated Manual 'C8600 Relative Humidity and Temperature System'.

The measured temperatures or signals may be displayed on the Vacuum Fluorescent Display of the C8600 or sent to an attached serial printer or personal computer.

Chapter 2 describes the instrument, and Chapter 3 deals with the setting of parameters. Operation, covered in Chapter 4, is simple once the preparation is complete. The instrument specifications are listed in Chapter 5. Appendix A describes printers, and Appendix B lists the pin connections at the rear panel, and the interface cables required.

2. DESCRIPTION

This chapter describes the instrument, its main components and their functions.

2.1 Instrument Layout — See Fig.1

The instrument is housed in a protective aluminium case and is operated via a keypad of 6 keys which completely control the equipment. The vacuum fluorescent display to the left of the keypad provides one line of 16 dot matrix characters for annunciation and messages and one line of 11 large numerals for measurements and parameter editing. All user connections are to the rear.

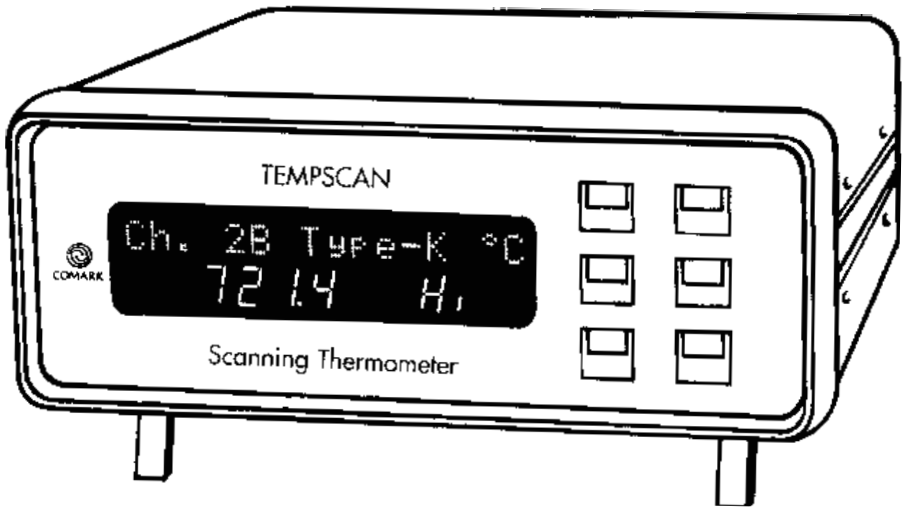

FIG.1 GENERAL VIEW OF C8600

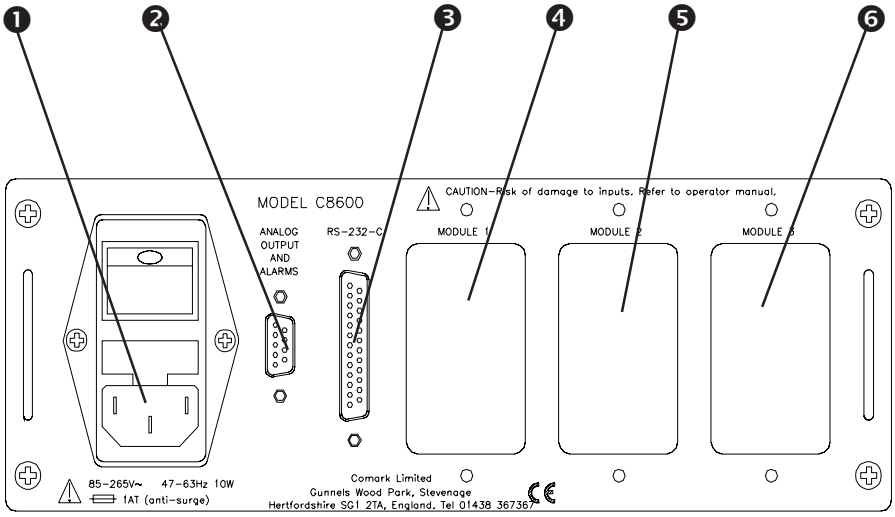

FIG. 2 REAR PANEL (FROM REAR)

2.2 Connectors on Rear Panel — See Fig. 2

The rear panel of the C8600 has connections for the following:

❶ 3-pin IEC plug for the external power supply (see Section 2.3)

❷ 9-pin 'D' socket for analog output and the high and low alarm output signals

❸ 25-pin 'D' socket for communications to a printer or with a personal computer

❹ Module 1 position

❺ Module 2 position

❻ Module 3 position

CAUTION: Signal isolation voltages from Mains Earth, and from each other are indicated in Chapter 5 sections relevant to each function.

Thermocouple Module — see Fig.3
4 x copper material sub-miniature thermocouple sockets thermally bonded to an isothermal block.

Pt100 Module — see Fig.4
2 x 6-pin Lumberg sockets for connection of Pt100 sensors.

PST Module — see Fig.5
4 x 3-pin headers and removable terminal blocks (screwblocks) for the connection of PST sensors.

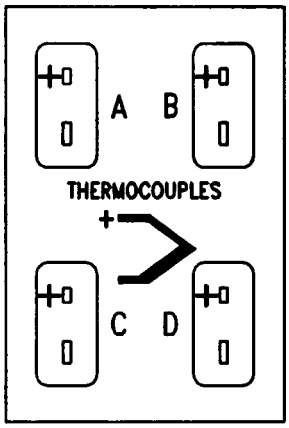

FIG.3 THERMOCOUPLE MODULE

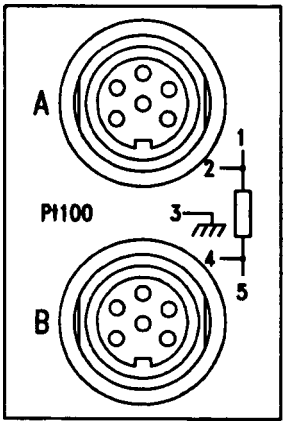

FIG.4 PT100 MODULE

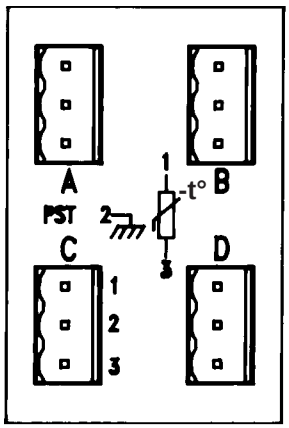

FIG.5 PST MODULE

2.3 Power Supply and Back-up Battery

The C8600 accepts a universal mains input of 85 to 265 V a.c. (or equivalent d.c.) via a 3-pin IEC socket on the rear panel, and does **NOT** require adaptation to different mains supplies.

The fuse required in the combination IEC holder for all supply voltages is 1 amp anti-surge 20 x 5mm, this is in circuit with the live conductor.

In the event that the moulded mains plug is cut off, the following colour coding is used for wires within the cable:

BLUE WIRE — Neutral — to plug pin N or NEUTRAL
BROWN WIRE — Live — to plug pin L or LIVE
GREEN/YELLOW WIRE — Earth — to plug pin E or EARTH
PLUG FUSE RATING: 3 amp (MAX).

CAUTION: This instrument must be earthed, it is the user's responsibility to ensure that their supply is properly earthed.

The double pole supply switch in the rear panel IEC socket may be used to switch the C8600 ON or OFF. The instrument is isolated from the supply in the OFF condition (0 visible on switch).

The C8600 uses a Lithium back-up cell to maintain a supply to the parameter configuration (non-volatile) memory and real-time clock. The low current drain is such that the life expectancy of this battery is greater than 10 years.

In the event of loss of the back-up function, the cell which clips into an AA-sized holder, may be exchanged with a new one with nominal voltage 3.0 to 3.7 volts. The back-up function will operate down to 1.1 volts.

2.4 Keypad

The Keypad has 6 push-button switches which emit a low level tone when pressed. See Fig.5. Their functions are:

SCAN changes the instrument status between static and scan modes.

PRINT takes the instrument through the Printer Menu (Section 3.7) to format the data output from the instrument to a printer. It can be used to return from the Programme Menu to the Static Mode (Section 3.4).

ENTER takes the instrument through the Programme Menu (Section 3.6) for setting the instrument and channel parameters. It can be used to return from the Printer Menu to the Static Mode.

SELECT within parameter editing in the Programme Menu (Section 3.6), is used to advance the display cursor to the next digit.

+ (plus arrow) and – (minus arrow) are used to increase or decrease numerical values in setting parameters, select the channel in Static Mode, or to move between groups of headings in the Programme Menu (Section 3.6).

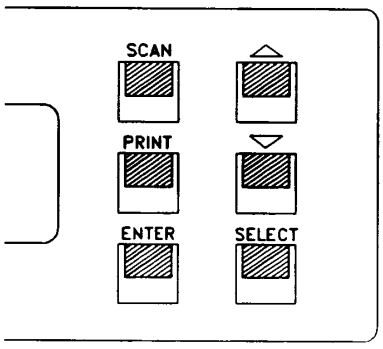

FIG.6 THE KEYPAD

2.5 The Display

The display has two lines to present channel status and reading value.

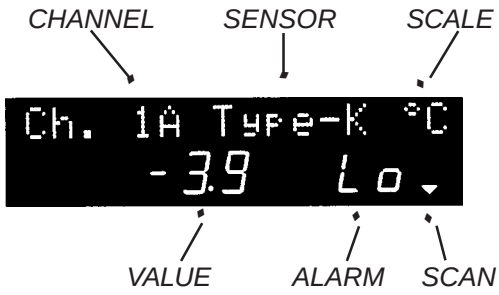

FIG.7 THE DISPLAY

In Static and Scan modes the top line has three fields showing channel, sensor type and scale. The numeric value appears on the lower line (preceded by '–' if negative), followed by the alarm status and scan indicator.

In the Programme and Printer Menus the top line text indicates which parameter is being modified, and the parameter value may appear on either the text or numeric lines.

2.6 Connection to External Equipment

2.6.1 Analog output

To enable chart recorders, flat bed recorder, etc., to be used with the C8600 an analog representation of a specified channel is provided as an output. The specification gives the interface parameters of this output. Connection is by means of the 9-way D-connector on the rear panel. The Analog output facility is bipolar.

2.6.2 External high and low alarms

External alarms may be signalled via connections available at the 9-way D-connector on the rear panel. Outputs are isolated and consist of one high and one low signal from open-collector transistors. The specification gives the interface parameters of this output.

Accessory AL1, containing signal and power relays, may be connected to the C8600 alarm output(s) to operate external loads. See section 5.6 for details.

2.6.3 RS-232C communications ports

The C8600 has two RS-232C communications ports, one primary and one secondary, both available through the 25-pin 'D' connector on the rear panel. The primary port can be connected for transfer of data to:

a) Epson LX-300 dot matrix printer or other compatible serial printer.

b) IBM compatible personal computer.

In the case of (a), the data is text printed in tabular form. See Appendix A for connection and setting up with a printer.

The secondary RS-232C communication port is used to permit the connection of more than one C8600 to a computer in a daisy chain, for the purpose of channel expansion through a single computer port. A daisy chain adaptor, ADP19, is required to separate the ports when using the secondary port (See Appendix B). When using only the primary port, connection cables plug directly into the rear panel 25-way connector.

Comark supply a Windows™ software kit, C8600S1, for use when a C8600, or several C8600 instruments in a daisy chain, is connected to a P.C. This programme allows data capture and display, and allows the C8600 to be configured from the computer. A separate software manual is supplied with the C8600S1 kit.

3. SETTING PARAMETERS AND PROGRAMMING

3.1 Preparation on Delivery

The C8600 is designed for bench operation, and sufficient ventilation is provided when free standing on a solid flat surface.

The C8600 is supplied with a power cable to connect mains to the IEC connector at the rear panel. Above the IEC socket the double pole mains switch may be used to turn the instrument ON or OFF.

The fold-out feet at the front of the instrument may be used to tilt the case upwards if desired.

3.2 Starting up and Self-Check

When the Mains ON/OFF switch has been turned on, the instrument displays a standard message which includes the firmware revision:

Comark Limited
C8600 X.YZ

As soon as measurements are ready the instrument moves to the Static Mode on the first selected channel.

Inputs are referred to by a module number and channel letter, e.g. 1C, 2A, and regardless of mode of operation, the instrument continuously measures all selected inputs in sequence from 1A onwards, at a rate of 4 channels per second. Displayed data depends upon the mode of operation.

3.3 Modes of Operation

The C8600 has the following modes of operation, and these are described in subsequent Sections of this Chapter:

STATIC MODE The instrument displays the value of a single channel selected by scrolling with the up and down keys.

SCAN MODE	The instrument displays the value of all selected channels in sequence, advancing according to Pause and Dwell settings. See Section 3.5 and Para.3.6.5.
PROGRAMME MENU	Operational parameters are entered in this mode.
PRINTER MENU	Printing parameters are entered in this mode.

Note: If the instrument is turned OFF, operational parameters are retained in the non-volatile memory, and date and time are maintained.

To change between Static and Scan Modes, press the Scan key. A triangular symbol flashes at the bottom right of the display to indicate Scan mode.

3.4 Static Mode

The Static Mode is used to view the value of a single channel at a time. When the self-check has been successfully completed, the display shows the current reading from the first selected channel, for example:

```
Ch. 1A Type-K °C
   023.1    Hi                    (See Section 4.3)
```

If – is pressed, the display depends on which channels are selected. Channels may be selected or deselected in the Programme Menu (See Para.3.6.1). The advantage of deselecting unused channels is that the rate at which the remaining selected channels are measured is increased.

Press – to move the display to the next selected channel in the sequence 1A, 1B, 1C, 1D, 2A, 2B, 2C, 2D, 3A, 3B (and 3C, 3D if all modules are thermocouple).

After the last selected channel, pressing – will display time and date:

15:24:35
22–05–96

Pressing + takes the display through the cycle in the reverse order.

The thermocouple type and temperature scale can be altered channel by channel in the Programme Menu. For thermocouples, Type-U refers to uncompensated microvolts.

3.5 Scan Mode

In Scan Mode the display steps automatically along all of the selected channels from the sequence 1A, 1B, 1C, 1D, 2A, 2B, 2C, 2D, 3A, 3B (and 3C, 3D if all modules are thermocouple).

The rate of stepping is defined by the settings of Pause and Dwell times. Pause refers to the time spent measuring each input, and Dwell refers to the time the instrument waits between scans of all of the inputs.

Pause and Dwell times may be set to the nearest second.

Typically the Pause time might be set to one second, or a value long enough to observe the reading. If output to a printer has been selected, the channel value is sent just before the next channel becomes displayed, i.e. the end of the Pause period. If Pause is set to zero then the actual pause is the time the C8600 takes to make a fresh reading which may vary between 0 and $^1/_4$ second.

Typically the Dwell time might be set to zero to allow a steady update rate for all channels. If monitoring and printing out at set intervals of T, then the Dwell setting should be

T – (P * C)

Where P is the Pause setting, and C is the number of channels selected.

Scan Mode (and any printing) may be halted at any time by pressing the Scan key. It may be restarted by pressing Scan again, however this will repeat the header and the scan will be resynchronised to start from this new time.

3.6 Programme Menu

The Programme Menu is used for setting the parameters for measurement, and is reached from the Static Mode (time & date or reading) by pressing ENTER. The sequence of displays in this menu, shown in the example below, assumes module 1 is thermocouple, 2 is PST and 3 is Pt100.

Display		Group	Comment	
PROGRAMME MENU				
SET CHANNEL		1	See Para.3.6.1	
Ch.1A Select	ON		OFF or ON	
Ch.1B Select	ON		OFF or ON	
Ch.1C Select	OFF		OFF or ON	
Ch.1D Select	OFF		OFF or ON	
Ch.2A Select	ON		OFF or ON	
Ch.2B Select	ON		OFF or ON	
Ch.2C Select	OFF		OFF or ON	
Ch.2D Select	OFF		OFF or ON	
Ch.3A Select	ON		OFF or ON	
Ch.3B Select	OFF		OFF or ON	
SET MATERIAL		2	See Para.3.6.2	
Ch.1A Matl.	K		KNTJRSEB	
Ch.1B Matl.	T		KNTJRSEB	Deselected
Ch.2A Matl.	PST		PST only	channels are
Ch.2B Matl.	PST		PST only	not offered
Ch.3A Matl.	Pt100		Pt100 only	
SET SCALE		3	See Para.3.6.3	
Ch.1A Scale	°C		°C °F K voltage	
Ch.1B Scale	µV		"	Deselected
Ch.2A Scale	°C		°C °F K	channels are
Ch.2B Scale	°F		"	not offered
Ch.3A Scale	K		°C °F K Ω	

Display	Group	Comment
SET RESOLUTION	4	See Para.3.6.4
Ch.1A d.places 2 Ch.1B d.places 0 Ch.2A d.places 1 Ch.2B d.places 2 Ch.3A d.places 2		0,1,2 temperature and Ω µV = 0 or voltage d.p. position 0 to 6 Deselected channels are not offered
SET FOR SCANNING	5	See Para.3.6.5
Pause time H,M,S 00–00–01		on numeric display
Dwell time H,M,S 00–00–00		
SET TIMEKEEPING	6	See Para.3.6.6
Date DD–MM–YY 01–11–96		on numeric display
Time HH–MM–SS 19–36–04		24 hour clock
SET SCALING Ch.1A SPAN Ch.1A °C ZERO Ch.1B SPAN Ch.1B °C ZERO continues for all channels	7	See Para.3.6.7 01.0000 (on numeric –0000.00 display) 01.0000 –0000.00
SET ALARM LIMITS Ch.1A °C HIGH Ch.1A °C LOW Ch.1B °C HIGH Ch.1B °C LOW continues for all channels	8	See Para.3.6.8 _0030.00 (on numeric _0020.00 display) _0006.00 _0002.00
SET ALARM HYST. °, Ω, %, µV (1A)	9	See Para.3.6.8 0000.00 (on numeric display)

Display	Group	Comment
SET ALARM OUTPUT	10	
Ch.1A Alarm ON		OFF or ON
Ch.1B Alarm ON		OFF or ON
Ch.2A Alarm ON		OFF or ON
Ch.2B Alarm OFF		OFF or ON
Ch.3A Alarm OFF		OFF or ON
SET ALARM FORM	11	CLOSED or OPEN
Normally CLOSED		
SET ANALOG O/P	12	See Para.3.6.9
Analog output 1A		any 1 selected channel
Gain 1mV/° x		01.0000 (on numeric
Zero scale		–0000.00 display)
SET BRIGHTNESS	13	See Para.3.6.10
Brightness 5		from 0 to 9
SET INTERFACE	14	See Para.3.6.11 & 12
Baud rate 9600		from 150 to 19200
Comms. address 1		from 1 to 9
SET LANGUAGE	15	See Para.3.6.13
English ?		or Francais ? etc.
Day/Month/Year ?		or Month/Day/Year ?
END OF MENU	16	

From the first display press ENTER once to move down one step and so on to the end. A final pressing of ENTER returns the display to the Static Mode. The table shows the sequence divided into 14 groups of displays, or “stepping stones”. Press – to move down through the 14 groups in order. The steps within a group can then be reached by pressing ENTER, as above. A final pressing of – returns the display to the Static Mode. From the first entry in one group pressing + moves back to the start of the preceding group.

The form or value of each parameter can be altered as required by using the + and – keys. Long multi-digit parameters are adjusted by entering an edit feature with the Select key, whereby

each digit is adjustable with the + and – keys. The Select key advances the edit cursor to the next digit. Press ENTER to accept the edited value and view the value which the C8600 will use.

At any stage in the cycle, press PRINT to return to the Static Mode. Thus if only one parameter needs editing, it can be selected and altered in the Programme Menu and then the Static Mode reached by pressing PRINT.

3.6.1 Channel ON/OFF selection

When ENTER is pressed the first time to reach the Programme Menu, the display shows:

PROGRAMME MENU
SET CHANNEL
Ch.1A Select OFF (or ON)

The answer OFF can be changed to ON by pressing +, and back to OFF by pressing –. The benefit of deselecting unused channels is simply that the instrument will have more time available to read the wanted channels, and so they will be updated more frequently.

Move to the selection for the next channel by pressing Enter. Continue with this process until the selection for all channels is correct.

3.6.2 Thermocouple material settings

The next displays are:

SET MATERIAL
Ch.1A Matl. K (or N, T, J, R, S, E, B)

This is for the benefit of thermocouple modules only, as there is only one type of Pt100 sensor and only one type of PST sensor. Press + or – to move through the list of types until the required one is displayed. Press Enter to set the material for each of the remaining channels. Note that on Pt100 module channels the material displayed is Pt100 and on PST module channels the material displayed is PST.

3.6.3 Temperature scale settings

The next displays are:

SET SCALE
Ch.1A Scale °C (or °F, K, voltage)

The scales available to Thermocouple Modules are °C, °F, K and voltage. When voltage is selected no CJC compensation is done, and the thermocouple material is displayed in Static and Scan Modes as Type-U where U means Uncompensated.

Note: During Scan and Static modes the scale units for voltage will only be displayed as µV when the channel resolution is set to 0 decimal places.

The scales available to Pt100 Modules are °C, °F, K and Ω. The scales available to PST Modules are °C, °F and K.

Press + or – to move through the list of scales until the required one is displayed.

Press Enter to set the scale for each of the remaining channels.

Note: When altering the scale for a particular channel, it is necessary to ensure that the scale dependant parameters on that channel are re-entered to match that scale. e.g. Alarm High and Low, Zero constant and Analog Output Zero.

3.6.4 Numerical resolution settings

The next displays are:

SET RESOLUTION

Ch.1A d.places 2	options: 0 to 2
Ch.1B d.places 0	temperature and ohms
Ch.2A d.places 1	µV = 0 or voltage
Ch.2B d.places 2	d.p. position 0 to 6
Ch.3A d.places 2	

The resolutions available for temperature on the display and the printout are 1°, 0.1° or 0.01° (whatever the temperature scale is in). For uncompensated voltage on thermocouple modules there are 7 settings under resolution corresponding to the 7 possible positions for the decimal point. This does not imply resolution of voltage finer than 1µV, but is simply a means of obtaining special scaling for adaptation of the C8600 to customer provided linear sensors. The scale units displayed are controlled by the resolution setting to µV for 0, mV for 3, V for 6 and !V for 1, 2, 4 or 5. The ability to position the decimal point, coupled with the variable channel span and zero settings should permit numerical adaptation for any linear voltage output sensor.

3.6.5 Dwell and pause

The next displays are:

SET FOR SCANNING

Pause time H,M,S
0–00–01

Pause time is defined as the time for which the instrument measures each channel before moving to the next (See Para.3.5).

To avoid editing Pause Time press Enter. To produce and advance the edit cursor press Select. To change an individual digit press + or –. Press Enter at any stage to view the edited result which the C8600 will accept. Press ENTER again for the next display:

Dwell time H,M,S
0–00–00

Dwell time is defined as the dead time the instrument waits between scans through the selected channels. It would usually be set to 0.

Dwell Time is edited (or not) in the same way as Pause Time.

3.6.6 Date and time

The next displays are:

SET TIMEKEEPING

Date DD–MM–YY
01–11–96 on numeric display

Time HH–MM–SS
19–36–04 24 hour clock

Edit the numeric value using the same procedure as described in Para.3.6.5 using the +, – and Select keys.

The sequence DD-MM-YY for entering a new date is fixed. The day/month order will display as required in Static Mode and on printouts.

When the C8600 is connected to a printer, the date and time may be printed at the beginning of the line.

The date / time system does not take account of daylight saving, but does take account of leap years.

CAUTION: The time and date as displayed from the Programme Menu do not update themselves, thus if the time setting is merely being checked, it must be done in the Static Mode. See Para.3.4.

3.6.7 Individual channel recalibration (see also Section 4.3)

The next displays are:

SET SCALING

Ch.1A SPAN
01.0000

Ch.1A °C ZERO
–0000.00

Span and Zero may be individually set for each and every channel. Edit the numeric value using the same procedure as described in Para.3.6.5 using the +, – and Select keys.

Span may be adjusted between 0.0001 and 99.9999.

Zero may be adjusted between +9999.99 and –9999.99

3.6.8 High and low alarms

The next displays are:

```
SET ALARMS
Ch.1A  °C      HIGH
_0030.00

Ch.1A  °C      LOW
_0020.00
```

High and Low alarms may be individually set for each and every channel.

The alarms set the trip points for alarm messages on the display, and this cannot be suppressed.

To adjust them, edit the numeric value using the same procedure as described in Para.3.6.5 using the +, – and Select keys. The adjustment range covers the measurement range.

The alarm trip point will occur at the high and low alarm settings only when the alarm hysteresis parameter is set to Ø. A small amount of hysteresis may be set to avoid alarm chatter where measurements hover at the limit, with hysteresis the trip point is displaced + or – one half of the hysteresis value about the alarm setting, according to whether the value has exceeded or gone under it. E.g. if you want a high alarm at 100°C and set a hysteresis of 2° the alarm will go high at 101° on increase of temperature, and return in-band at 99° on decrease.

There is only one hysteresis setting for the alarms of the whole instrument, and the scale units employed by hysteresis are locked to those used on channel 1A.

Selected channels may have their alarm status influence the alarm output signals.

```
SET ALARM OUTPUT
Ch.1A Alarm      ON
Ch.1B Alarm      ON
Ch.2A Alarm      ON
Ch.2B Alarm     OFF
Ch.3A Alarm     OFF
```

If more than one channel is assigned to the alarm output then the appropriate alarm is OFF if ALL assigned channels are out of that alarm condition.

The conducting or insulating state of the alarm outputs, when not in the alarm condition, may be controlled by setting FORM to CLOSED or OPEN respectively.

3.6.9 Analog output

The Analog Output may be assigned to a chosen channel, and may be scaled and offset to cope with inputs over a wide range. The associated displays are:

```
SET ANALOG O/P

Analog output   1A      (channel assignment)

Gain 1mV/° x            (scaling factor)
01.0000

Zero scale              (offset constant)
–0000.00
```

3.6.10 Brightness of vacuum fluorescent display

The brightness level of the vacuum fluorescent display is set next:

```
SET BRIGHTNESS
Brightness        5
```

The brightness scale runs from 0 to 9 representing minimum to maximum drive to suit various ambient lighting conditions. The drive is deliberately prevented from being completely blanked.

3.6.11 Communication baud rate

The RS-232C interface to the external equipment (printer or computer) is set next:

SET INTERFACE
Baud rate 9600

The baud rate at which information is transmitted from and received by the C8600 is set using + and –, and it must be the same in all items of interconnected equipment. The values available for selection in the C8600 are:

150
300
600
1200
2400
4800
9600
19200

Subject to adequate data throughput, any rate may be used. A rate of 9600 is recommended for general use. Always check the selected baud rates before connecting the C8600 to external equipment to ensure they are the same.

The other parameters for the RS-232C interface are fixed:

1 start bit
8 data bits of ASCII
No Parity
1 stop bit

3.6.12 Daisy chain address

The C8600 may be connected in line with one or more other C8600 instruments in line to a computer. In order for the computer to distinguish between instruments they are each given a unique address. The computer is always given address 0, and the first or only C8600 connected should be set to address 1. Further instruments must be given unique numbers.

Comms. address 1

Press + or – to adjust the address in the range 1 to 9. With only one C8600 the address must be set to 1.

3.6.13 Language

The next displays are:

SET LANGUAGE
English ?

The C8600 is programmed for 5 different languages:
English
Français
Español
Italiano
Deutsch

From the English ? display, press + or – keys to move through the available languages. When the desired language is displayed, press ENTER and all displays are translated into this language.

The next display is:

Day/Month/Year ? or Month/Day/Year

Use the + or – key to reverse the order for display on the C8600 display or on the printed tables.

Press ENTER to leave the Programme Menu and return to the Static Mode.

3.7 Printer Menu

The Printer Menu is used to enter the parameters for the required formatting of measurement data to the RS-232C output port. The data formatting for a printer is quite different to that for a computer, depending on type of printer and paper size. The printer is used for tabular presentation, whereas the computer may be used for real time data capture or data logging.

The Printer Menu is reached from the Static Mode by pressing PRINT, and the sequence of displays are given below.

Display	Group	Comment
PRINTER MENU		
SET FOR OUTPUT Format PRINTER	1	 or COMPUTER or NONE
SET FOR PRINTER Type DOT MATRIX	2	 or INKJET
Stamp line NONE		or TIME, DATE, BOTH
Font size NORMAL		or COMP.
Line length 80		30–132
Page length 66		0–99
END OF MENU	3	

Similarly to the Programme Menu, press PRINT to move down one step and so on to the end.

The table shows the sequence divided into groups. Press – to move down the groups in order. The steps within a group can be obtained by pressing PRINT, as above. From the first entry in one group pressing + returns the display to the start of the preceding group.

The form or value of each parameter can be set as required using the + and – keys.

At any stage in the cycle, press ENTER to return to the Static Mode.

3.7.1 Selection of output format

This selects between output formats for Printer, Computer or None. The selection is made by the + and – keys.

SET FOR OUTPUT	
Format PRINTER	or COMPUTER or NONE

When printer is selected, all tabular formatting is done by the C8600. When Computer is selected the formatting includes address routing characters to permit the connection of multiple C8600 instruments in a daisy chain. When None is selected, the C8600 will still communicate with a computer, but the computer must request data each time it is required. The setting required to work with the Windows™ software kit C8600S1 is NONE.

3.7.2 Printing control

The next display is:

SET FOR PRINTER	
Type DOT MATRIX	or INKJET

The selection from these is made with + or – keys. Drivers are not available for every available printer, but some printers require specific initialisation to print correctly.

The next display is:

Stamp line NONE	or TIME, DATE or BOTH

The C8600 prints the results from each Scan on a fresh line. The line will be started with the time of day, the date, both or neither as required. Fig.7 shows timestamping in use.

The next display is:

Font size NORMAL	or COMP.

Normal printed characters may be pitched at 10 or 12 per horizontal inch, and compressed pitched at 16 or 17. By selecting compressed mode in the printer it is possible to get more channel columns on a single line across the width of the page. Measurements are printed in a fixed field width of 10 characters.

The next display is:

Line length 80 range 30–132.

The C8600 keeps track of the number of characters printed on each line. If the next result column will not fit at the end of the line the printer will advance to the next line and print underneath the first measurement column, tabbing in past any date or time stamp that has been selected.

Date 24–01–96 Time 12:23:56

	1A°C	1B°C	2A°F	2B°C	3A°C
12:23:56	23.5	156.4L	74.3	815	–0.13L
12:24:56	23.8	285.8L	74.8	1108	–0.06L
12:25:56	24.1	325.4	75.4	1283	0.01
12:26:56	24.4	341.4H	75.9	1312	0.08H
12:27:56	24.7	336.6H	76.5	1350	0.11H
12:28:56	25.0	330.7	77.0	1337	0.07H
12:29:56	25.2	324.8	77.4	1321	0.03
12:30:56	25.5	319.2L	77.9	1315	0.00
12:31:56	25.7	334.3	78.3	1298	–0.09L

FIG.8 TYPICAL PRINTOUT RUN

The next display is:

Page length 66 range 0–99

The C8600 keeps track of the number of lines printed on each page. It is assumed that the printer has been set to top of form before the C8600 is put into Scan Mode. After the C8600 has sent the set number of lines it will issue a Form Feed command to advance to the next paper sheet.

At the beginning of each print run, and at the top of each page a standard header is printed showing Date, Time, Channel columns and scale settings. See Fig 8.

A page length setting of 0 should be used with continuous forms and/or to suppress headers subsequent to the initial one.

After setting the parameters, and before leaving the Printer Menu, it is now necessary to ensure that the appropriate printer is connected to the C8600, switched on and set on-line. When the Printer Menu, is left by pressing Enter, the C8600 returns to Static Mode, and no printing will occur. To start printing it is necessary to have selected FORMAT — PRINTER in the Printer Menu, and to switch the C8600 to Scan Mode. If the C8600 fails to detect the presence of the printer at this stage, the message:

Connect printer!

is shown. If the printer is not connected within 10 seconds the instrument returns to Static Mode.

While printing is in progress, it may be stopped at any time by pressing Scan to return to Static Mode.

4. OPERATION

4.1 Preparation

Check that the sensor probe(s) is (are) correctly positioned for the required readings and that plugs are firmly connected to the sockets on the rear panel.

In exceptional circumstances sensor cables may be prone to the pickup of electrical interference. The C8600 Watchdog will restore the mode of operation in the event of electrical interference or power loss, however pagination on printed scans may require adjustment.

4.2 Taking Measurements

Connect the C8600 to the mains power supply, switch on, and use Static Mode to ensure the instrument configuration matches the probes connected at the rear panel, and the measurement needs. Any of the 8 thermocouple types may be selected, and may be mixed amongst the channels. All thermocouples must have compatible or compensating materials for leads and plug components. If an extension lead is used this must also be made of compatible or compensating components.

Use Static Mode to observe the measurement from a single channel at a time, or Scan Mode to automatically step around the selected channels. Typically Scan Mode is used when sending output to an attached printer.

Should a temperature sensor become broken or disconnected during measurements, the instrument detects this and displays an error indication during the period of the input fault. On the printer this produces the message ‘Error’.

4.3 Individual Channel Recalibrations

The C8600 permits a Span factor and a Zero constant to be entered for each and every channel. In normal use all span factors should be set to 1 and all zero constants to 0 in order to use the full accuracy of the C8600 calibration, however there may be occasions when a particular probe is known to require a trim to the calibration of the channel it is connected to, or it is possible that a linear voltage output sensor is being measured on the voltage scale, and Span and Zero are required to obtain the desired scaling.

Span will always be processed before the Zero because of the strict order in which they are applied by the machine.

As an example a channel reading is +10.07 when the probe is at +10, and +101.00 at +100, this is corrected for by means of:-

Span = (100–10)/(101–10.07) = 0.9898
Zero = 10 – (10.07 * 0.9898) = +000.03

4.4 Use on Microvolt Range

The measurement range is from –10,000 to +80,000 µV. The material used for the connecting leads must be a non-thermic type such as copper. One copper/copper miniature plug is supplied for connecting the user's leads to the instrument. Thermal effects will be indicated as an offset reading on the display. The measurement circuit may be short-circuited at the measurement point to determine the magnitude of any such offset.

4.5 PST Module Sensor Leads

It is anticipated that the user may wish to install or extend their own PST sensor leads, and four removable screwblock connectors are supplied with each PST Module for this purpose.

The central pin of the PST Module connector is connected to instrument chassis earth, and does not need to be used. If reading variations occur with long runs of sensor lead a screen may be used and terminated to either the central pin or the lower pin (signal common).

The Comark PST sensor has a relatively high resistance compared to Pt100 sensors, and a simple 2-wire connection provides adequate measurement accuracy. The instrument PST calibration assumes zero lead length. The effect of lead resistance on measurement accuracy doubles for every increase in measurement temperature of 20°C, and the following table indicates the length of standard PST sensor cable (with 2 x 7/0.2mm wires) for –0.1°C error.

Measurement temperature, °C	Length 7/0.2mm lead for –0.1°C error, metres
0	988
20	467
40	127
60	53
80	24
100	12
120	6.1

4.6 High and Low Alarms

The C8600 displays alarm status for each of the channels at the right hand end of the numeric display line. This feature cannot be turned off, and the message is **Hi** when the measurement is greater than the High alarm limit, **Lo** when the measurement is less than the Low alarm limit, and blank in between.

Chosen channels may influence the state of the external alarm signals available at the instrument rear panel. The Programme Menu should be used to select which channels are able to affect the outputs. When only one channel is used it will be clear that the output signals will directly follow the displayed Hi or Lo condition. When more than one channel is used, then the respective output condition will occur if any one of the inputs triggers the alarm. It is possible with multiple channels set for alarm indication that both high and low outputs could become asserted.

When printing, the symbol H or L will accompany the measurement when in alarm as appropriate.

Both alarm facilities will cover the entire measurement range and are applied after multiplying factor and constant term.

4.7 Out-of-Range Indications

Two conditions which would give incorrect readings will be indicated by the display. The first condition is either too positive or too negative an input due to the probe being outside its characterising range (Overrange). The second condition is where the probe becomes broken.

Both conditions produce dashes on the display, four for positive overrange, and five dashes for negative overrange. If a thermocouple probe or a PST probe breaks, becomes open-circuit, or is unplugged, negative overrange will occur. If the Pt100 probe is unplugged a similar condition will arise, but if the Pt100 sensor becomes broken, or one wire becomes open-circuit the result depends on the location of the fault.

4.8 Analog Output

Connection is by means of a 9-pin 'D' connector, and Appendix C indicates the pins used.

The Analog output may be assigned to any one of the measurement channels, see Para.3.6.9.

The standardised scalings with Gain = 1 are:

1 millivolt per degree for temperature
1 millivolt per ohm for Pt100 ohms
1 millivolt per 10 µV for Voltage scale.

A separate pair of analog output gain and zero settings permit the sensitivity and offset to be altered over a wide range.

If the required signal exceeds the range (a little over ±1 volt) it will limit at that value.

4.9 Printing

Ensure that the baud rate selected on the C8600 is the same as that of the printer. See Appendix A.

In the Printer Menu, ensure that the PRINTER format is on, and that correct printer type is chosen (Dot Matrix/Inkjet).

Select the appropriate line and page length settings to suit the print paper. See Section 3.7.

Connect the printer via the cable to the 25-pin 'D' socket on the rear panel and check that the printer is turned ON and on-line.

Select Scan Mode to commence printing.

If at any time it is required to stop the printout, press Scan to return to Static Mode.

Note: It is not possible to daisy chain more than one C8600 to a single printer, and because the daisy chain omits the pin 11 connection, it should not be used in circuit with the ADP17 printer cable.

4.10 Cleaning

Before cleaning the C8600 disconnect the mains supply and all connectors. Wipe with a soft damp cloth. To avoid affecting plastics and finishes use only water as the solvent, with mild detergent if necessary.

5. SPECIFICATIONS

Sections 5.1, 5.2 and 5.3 give the specifications for the Thermocouple Module, Pt100 Module and PST Modules respectively. Section 5.4 covers the specifications for the complete instrument. Section 5.5 lists the contents of each instrument pack, and Section 5.6 the optional items. Section 5.7 lists the external communications equipment which can be used.

5.1 M8600/K Thermocouple Module

Four Channel Thermocouple or µV input.

Scales	°C, °F, K and µV
Thermocouple Types	Type-K, N, T, J, R, S, E, B, characterising to EN 60584-1 : 1995
Measurement Ranges	K... –200°C to +1372°C N... –200°C to +1300°C T... –200°C to +400°C J... –200°C to +1200°C R... –50°C to +1767°C S... –50°C to +1767°C E... –200°C to +1000°C B... +100°C to +1820°C

Thermocouple Characterising Accuracy — See table below.

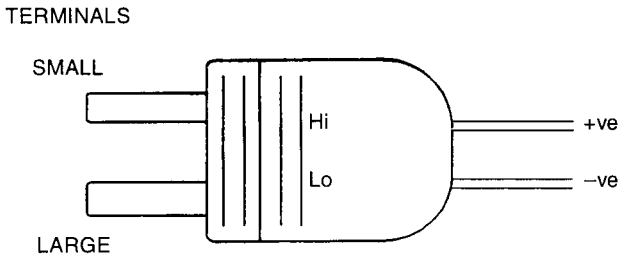

FIG.9 THE THERMOCOUPLE PLUG

Microvolt Input Range	–10,000 to +80,000µV
Resolution	
Temperature	1°, 0.1°, 0.01° (C, F or K) full range
Microvolts	1µV
Accuracy at 23°C	Better than ±0.05% of reading ±0.2°C (0.4°F) (Type-K thermocouple).
Temperature coefficient	less than ±0.01% of reading per °C change from 23°C.
Cold junction stability	better than ±0.05°C/°C away from 23°C
Input Resistance	High impedance with pulse open-circuit detection system.
Series Mode Rejection	60dB at 50 or 60Hz
Common Mode Rejection	110dB at 50 or 60Hz
Interchannel isolation and Fault Protection	30 V peak, non-cumulative
Common Mode Voltage from Mains Earth	100 V peak
Electrical noise	On µV range the display will not normally deviate by more than ±4µV and will not deviate by more than ±7µV in the worst case.

THERMOCOUPLE CHARACTERISING ACCURACY TO EN 60584-1 : 1995, ACCORDING TO ITS-90

Thermocouple Type	Range °C From	To	Maximum Error ±°C
K	–200	+1372	<0.03
N	–200	+1300	<0.03
T	–200	+400	<0.03
J	–200	+1200	<0.03
R	–50	0	<0.06
	0	100	<0.04
	100	1767.7	<0.03
S	–50	1767.7	<0.035
E	–200	1000	<0.03
B	+100	1000	<0.06
	+1000	+1820	<0.11

5.2 M8600/P Pt100 Module

Two Channel, Platinum Resistance or ohm Input.

Scales	°C, °F, K and Ω
Temperature	Platinum Resistance sensor Pt100, characterising to EN 60751 : 1995

Four terminal connection

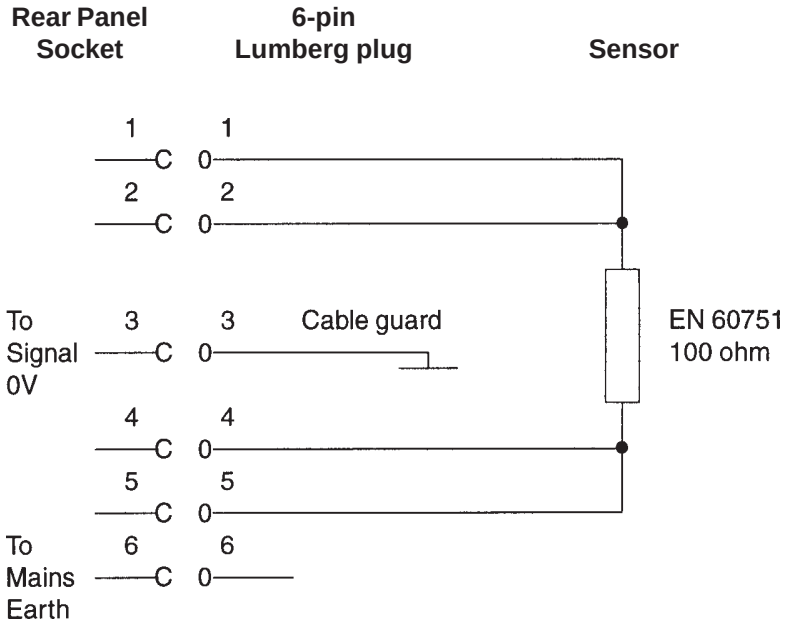

FIG.10 THE PT100 SENSOR CONNECTIONS

Measurement Range	–200 to 850 °C or –328 to 1562 °F
Ohm Input Range	0 to 550 Ω
Resolution	
Temperature	1°, 0.1°, 0.01° (C, F or K) full range
Ohms	0.01Ω

Accuracy at 23°C	better than ±0.03% of reading ±0.1°C(0.2°F)
Temperature coefficient	less than ±0.0015% of Kelvin reading per °C change from 23°C.
Input Resistance	10MΩ missing probe detection system
 Interchannel isolation	12 V peak
 Common Mode Voltage from Mains Earth	100 V peak

Pt100 CHARACTERISING ACCURACY TO EN 60751 : 1995, ACCORDING TO ITS-90

Range °C		Maximum
From	**To**	**Error ±°C**
–200	850	<0.01

5.3 M8600/X PST Module

Four Channel, Thermistor (PST) Input.

Scales °C, °F and K

Temperature Sensor Type
Negative Temperature Coefficient Thermistor, 10kΩ @ 25°C
Two terminal connection by means of three way screwblock.

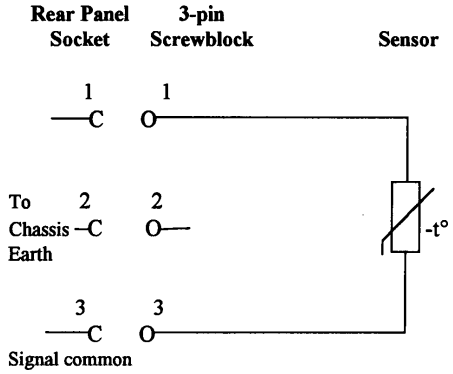

FIG.11 THE PST SENSOR CONNECTIONS

Measurement Range	–80 to +150°C or –112 to +302°F
Resolution	
Display	1°, 0.1°, 0.01° (C, F or K) full range
Measurement	0.01° (C or K) –50 to +120°C 0.01°F –40 to +230°F
Instrument Accuracy –5 to +50°C	better than ±0.1°C (0.2°F) –40 to +130°C better than ±0.5°C (0.9°F) full range
System Accuracy using Comark PST probe	better than ±0.5°C (0.9°F) –40 to +110°C

Interchannel isolation — Pin 3 is common to all channels

Common Mode Voltage from Mains Earth — 100 V peak

CHARACTERISING ACCURACY TO FENWAL UUA41J1

Range °C		Maximum
From	**To**	**Error ±°C**
–80	–40	0.05
–40	+60	0.02
+60	+100	0.03
+100	+150	0.05

5.4 Specifications for the Complete Instrument

	Environmental Conditions
Operating temperature	–5 to 50°C 23 to 122°F
Storage temperature	–25 to 70°C –13 to 158°F
Relative Humidity	0 to 93 % non-condensing
Channel reading rate	4 per second
Open circuit sensor indication	– – – – –
Outside range indication	(–) – – – –
Warm-up	Negligible effect
High and Low Alarms	One pair per input, always active to display
Alarm Settability	0.01°, 0.01Ω or 1µV depending on scale and sensor
Alarm outputs	Open collector TTL and CMOS compatible. When FORM is CLOSED, outputs are conducting (Logic Ø) in-band, and vice-versa. Vmax = +70V, Imax = 50mA, Pmax = 150mW. One high and one low output via 9-way 'D' connector.  100 V peak isolation from measurement ground.
Factor	One per channel, settable from 0.0001 to 99.9999, applied prior to constant and alarms.
Constant	One per channel, settable from –9999.99 to 9999.99 (–160000 to 160000 voltage scale), added to measured value after applying factor but before alarms.

Pause (time each input)	Programmable from 00:00:00 to 23:59:59 in increments of 1 second.
Dwell (time between scans)	Programmable from 00:00:00 to 23:59:59 in increments of 1 second.
Channel Selection	Each channel may be individually selected or deselected
Scan Mode	Stop/Start from keyboard. Scan always starts from first selected channel.
Static Mode	Manual selection of input from keypad.
RS-232C Outputs	One master and one slave port, each with TXD, RXD, RTS, CTS and Signal ground, wired as DCE. Baud rate selectable from 150, 300, 600, 1200, 2400, 4800, 9600, 19200. Full galvanic isolation from measurement and sensor circuit (100 V peak)

Analog Output Specification

DC Output, ±1 volt	1mV per degree with settable zero and span factors.
Resolution	12-bit for ±1 volt range
Linearity	Monotonic
Accuracy	±0.1% of full scale
Temperature coefficient	±0.05% per °C
Output Resistance	1 ohm
Output current	From –8mA to + 8mA
Termination	9-pin 'D' socket on back panel
Isolation	Output Ground is common to measurement ground.

Timekeeping Accuracy

at reference temperature	±20ppm
over range –10 to 60°C	±55ppm

Mains Supply
Universal input 85-265 V a.c., 47-63Hz or d.c. equivalent
Consumption 10 Watts
Installation Category (Overvoltage Category) II
Connection by IEC combination inlet
Mains fuse 1AT (anti-surge) 20 x 5mm.

Physical Specification

Overall dimensions	Width 257mm, Height 118mm including feet, Depth 263mm
Weight	3.2Kg
EMC	Emission — Radiated or Mains conducted No emissions above EN 55 022 Class B limits Immunity — IEC 1000-4-3 for light industrial equipment Performance to Criterion B, deviation < 6°C See Section 4.1 ESD — IEC 1000-4-2 for light industrial equipment
Other Specifications	Conforms to BS EN 61010-1: 1993

5.5 C8600 Instrument Packs

Each instrument is supplied with the specified modules fitted and:-

1 x C8600 Modular Thermometer Operating Manual

1 x IEC supply cable with moulded mains plug

1 x Subminiature Thermocouple plug for type-B (copper, copper)

1 x Lumberg Plug

1 x 3-way removable screwblock connector

1 x 9-pin 'D' plug and housing.

5.6 Optional Equipment

C8600S1
Windows™ software kit with 1 x 3½" disc, 1 x Software Operator Manual for C8600 Modular Thermometer, 1 x ADP18 RS-232C communication cable for connection of C8600 to a computer (25-pin to 9-pin).

See Appendix B for the pin connections on the communication cable.

Probes and Sensors
These are not supplied with the instrument, and can be ordered from the wide range available from Comark Limited.

ADP17
3m RS-232C communication cable for connection of C8600 to a serial printer (25-pin to 25-pin).

ADP18
2m RS-232C communication cable for connection of C8600 to a computer (25-pin to 9-pin).

ADP19
1m Daisy chain adaptor cable to split out the two communications ports from the single 25-way 'D' connector at the instrument rear panel (3 x 25-pin).

Note: Daisy chain adaptors have tail lengths of 1 metre and may be chained directly for side by side C8600 instruments, or extended with a customer supplied 25-pin 1:1 plug-socket extension cable.

ADP20
0.3m Adaptor to connect thermistor probes with Lumberg type connectors to the M8600/X 3 pin input.

ADP21
0.3m Adaptor to connect thermistor probes with sub-miniature connectors to the M8600/X 3 pin input.

C4503
Epson LX-300 printer with mains cable and 1 x ADP17 communication cable.

AL1
Alarm module (single channel) for use with autodialler or alarm systems. One or both of the C8600 alarm outputs can be used to control both signal and power relays, each with changeover contacts. The power contacts are rated 250 V a.c. and fused 2 amps. Complete with battery charger to maintain the internal backup battery.

5.7 External Communications Equipment

IBM compatible PC.

Other compatible serial printer.

APPENDIX A — PRINTERS

If a printer is used with the C8600, the connections between the two must be correctly made and the parameters must be compatible. This section gives the necessary information for the Epson LX-300.

A.1 Epson LX-300 Printer

The Epson LX-300 printer may be set up for serial printing. It is important to read the Epson LX-300 User's Guide.

Communication Cable and Pin Connections
The communication cable is supplied by Comark Limited ready wired with the appropriate 25-pin plugs.

The pin connections on the plugs are as follows:

C8600 end 25-Pin 'D' Plug pin No.	LX-300 end 25-pin 'D' Plug pin No.	LX-300 Signal
1	1	Power ground
2 in	2	TXD
3 out	3	RXD
4 in	4	RTS
5 out	5	CTS
7	7	Signal Ground
11	11	Reverse channel
–	20	Reverse channel

Before use, the LX-300 must be set up with the correct parameters with reference to Table B at page 2–21 in the Epson User's Guide, and tables C to O which may be printed out by holding down the FONT button when switching ON.

Communication parameters are mandatory, others are optional. A suggested configuration is:-

Character spacing	10cpi
Shape of zero	optional
Skip over perforation	OFF
Character Table	PC437
Auto Line Feed	OFF
Page Length	11 inches
Auto tear off	optional
Tractor	Single
Interface	Auto selection (30 sec.)
Bit rate	9600 baud, or same as C8600
Parity	None
Data length	8 bit
ETX/ACK	optional

Connecting C8600 and Printer
The C8600 should be in Static Mode, and the printer should be turned off before connecting up.

Paper Supply
Suitable paper, e.g. tractor feed type 241 mm (9½") wide, should be used with the printer.

A.2 Other Printers

Any other serial dot matrix printer should be able to work with the C8600 for printing tabular data as long as the DOT MATRIX selection is made, and communication parameters are made compatible. An 80 or 132 column printer should be used with a serial RS-232C link.

The following printers are suitable, all require switch settings.

HP Deskjet 500	(select C8600 INKJET mode)
Panasonic KX-P1081	(select C8600 DOT MATRIX mode)
Panasonic KX-P1170	(select C8600 DOT MATRIX mode)
Panasonic KX-P1180	(select C8600 DOT MATRIX mode)
EPSON LX-800	(select C8600 DOT MATRIX mode)

Setting of Printer DIP Switches
Few printers share the same pattern of settings for their DIP switches, the parameters important for the C8600 are as follows:-

Character table	IBM Graphics Characters (for µ, Ω, °)
Handshake	DTR (hardware)
Auto Line Feed	OFF
Parity	NONE
Data length	8-bit
Baud Rate	9600 baud, or same as C8600

In the tables below, parenthesised entries depend on user preference, otherwise the settings are mandatory.

Settings for SW1, Main board or left hand Bank A switch

SW1	DJ-500	KX-P1081	KX-P1170	KX-P1180	LX-800
1	DOWN	OFF	ON	ON	(OFF)
2	DOWN	OFF	(OFF)	(OFF)	(OFF)
3	DOWN	OFF	OFF	OFF	ON
4	DOWN	(OFF)	(OFF)	(OFF)	OFF
5	(DOWN)	OFF	OFF	OFF	(OFF)
6	(UP)	OFF	OFF	OFF	(ON)
7	DOWN	ON	OFF	OFF	(OFF)
8	(DOWN)	OFF	OFF	OFF	(OFF)

Settings for SW2 or right hand Bank B switch

SW2	DJ-500	KX-P1081	KX-P1170	KX-P1180	LX-800
1	(DOWN)				(OFF)
2	(UP)				(OFF)
3	(DOWN)				(OFF)
4	DOWN				OFF
5	DOWN				
6	DOWN				
7	DOWN				
8	(UP)				

Settings for Serial option board

SW1	DJ-500	KX-PS10	KX-PS10	KX-PS10	8143
1		ON	ON	ON	ON
2		OFF	OFF	OFF	OFF
3		OFF	OFF	OFF	OFF
4		OFF	OFF	OFF	OFF
5		ON	ON	ON	(ON)
6		(ON)	(ON)	(ON)	OFF
7		ON	ON	ON	OFF
8		OFF	OFF	OFF	ON

APPENDIX B — PIN CONNECTIONS TO COMPUTER

When connecting a single C8600 to an IBM compatible computer, a standard communication cable is required. When there is more than one C8600 connected in a daisy chain with the computer, intermediate C8600 instruments require a daisy chain adaptor cable.

Both of these cables are available from Comark ready wired with the appropriate plugs.

The C8600 has two RS-232C communication ports on a 25-pin socket at its rear panel. The primary communication port is used in applications with a single C8600. The secondary port is used where there is more than one C8600 to connect with instruments next up the chain away from the computer. The computer communication port is assumed to be at a 9-pin 'D' plug. For computers with only a 25-pin RS-232C plug an adaptor is required.

Standard Computer Communications Cable

C8600 end 25-pin 'D' Plug pin No.	Computer end 9-pin 'D' Skt pin No.	Direction wrt Computer	Computer Signal
1	1	–	Pwr Ground
2	3	out	TXD
3	2	in	RXD
4	7	out	RTS
5	8	in	CTS
6	6	in	DSR
7	5	–	Signal 0v

Extension Communications Cable

Any of the communication cables for use with C8600 may be extended with a customer-supplied cable. This extension cable would consist of a 25-pin 'D' plug at one end and a 25-pin 'D' socket at the other, with the following minimum interconnections: 2–2, 3–3, 4–4, 5–5, 7–7. To cater for all situations add 1–1, 6–6, 11–11. Extensions with all pins connected may be used.

Interface Adaptor for Computers with 25-pin D-connectors:

25-way D-socket Pin No.	9-way D-plug Pin No.	Computer Signal Name
1	–	
2	3	TXD
3	2	RXD
4	7	RTS
5	8	CTS
6	6	DSR
7	5	Sig 0v.
8	1	–
20	4	–
22	9	–

Daisy Chain Adaptor Cable to Split the Ports

To Computer 25-pin socket D-Connector Pin No.	To pri C8600 25-pin plug D-Connector Pin No.	To sec C8600 25-pin plug D-Connector Pin No.	Computer Signal Name
1	1	1	PG (Braid)
2	2		TXD
3	3		RXD
4	4		RTS
5	5		CTS
6	6		DSR
7	7	7	Ground
	14	2	TXD
	16	3	RXD
	19	4	RTS
	13	5	CTS

In daisy chain applications the cable requirements are as described here and shown in Fig. 12.

PC to First C8600

Use an ADP18 cable with the 9-pin socket connected to the PC (an adaptor cable, not supplied by Comark, will be required for PCs with 25-pin connectors) and the 25-pin plug connected to the 25-pin socket of an ADP19 cable. The ADP19 cable is connected to the C8600 using the 25-pin plug with the twin cables attached.

First C8600 to Intermediate C8600 Instruments

The ADP19 cable is connected to a second ADP19 using the remaining 25-pin plug, either direct or via an extension cable (not supplied by Comark) made up to suit the application. The second ADP19 cable is connected to the second C8600 instrument and to the cables for the third instrument. ADP19 (and extension cable) connections are repeated for each intermediate C8600 until the last instrument in the chain.

Intermediate C8600 to Final Instrument

The remaining 25-pin plug on the last ADP19 cable is connected to the final C8600, either direct or via a 25-pin socket to 25-pin plug extension cable (not supplied by Comark).

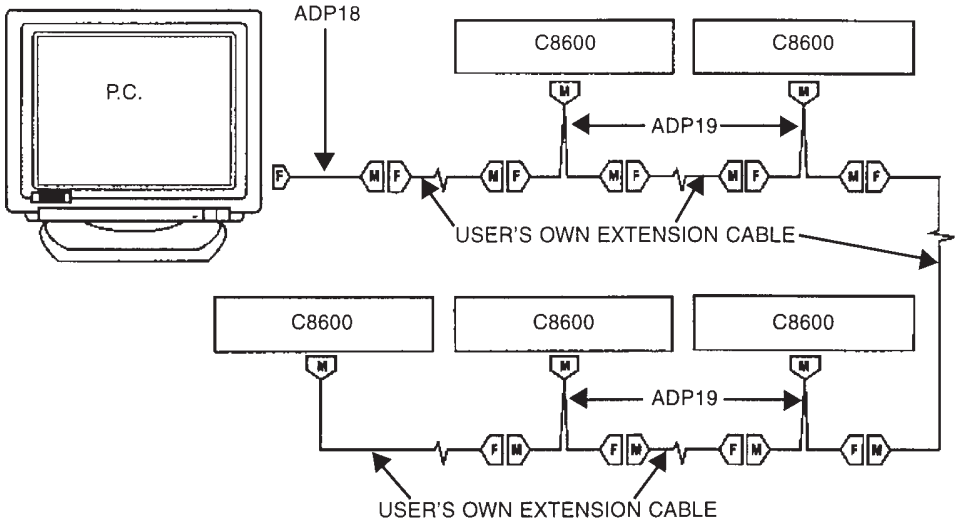

FIG.12 CABLE CONNECTIONS FOR DAISY CHAIN USE

APPENDIX C — CONNECTIONS FOR ALARMS AND ANALOG OUTPUT

Connection to the C8600 analog output signal and to the high and low alarms is provided at the 9-pin 'D' socket on the rear panel. A matching plug is supplied with the C8600 to make connection with these signals.

The analog output ground is not isolated from the C8600 signal ground, and will be at the same potential.

The alarm outputs are open collector opto-isolator transistors with a shunt connected diode for reverse polarity protection. The output when ON will sink a current of 12 milliamps, and the voltage applied when OFF should not exceed 70 volts.

Signal connections:

9-way 'D' Pin No.	**Signal Name**
1	Analog Output Signal
2	Analog Output Ground
3	Not connected
4	Low Alarm Positive
5	Low Alarm Negative
6	Not connected
7	Not connected
8	High Alarm Positive
9	High Alarm Negative